No. 654,716. Patented July 31, 1900.

E. P. COWLES.

MOTOR VEHICLE.

(Application filed Aug. 25, 1899.)

(No Model.) 5 Sheets—Sheet 1.

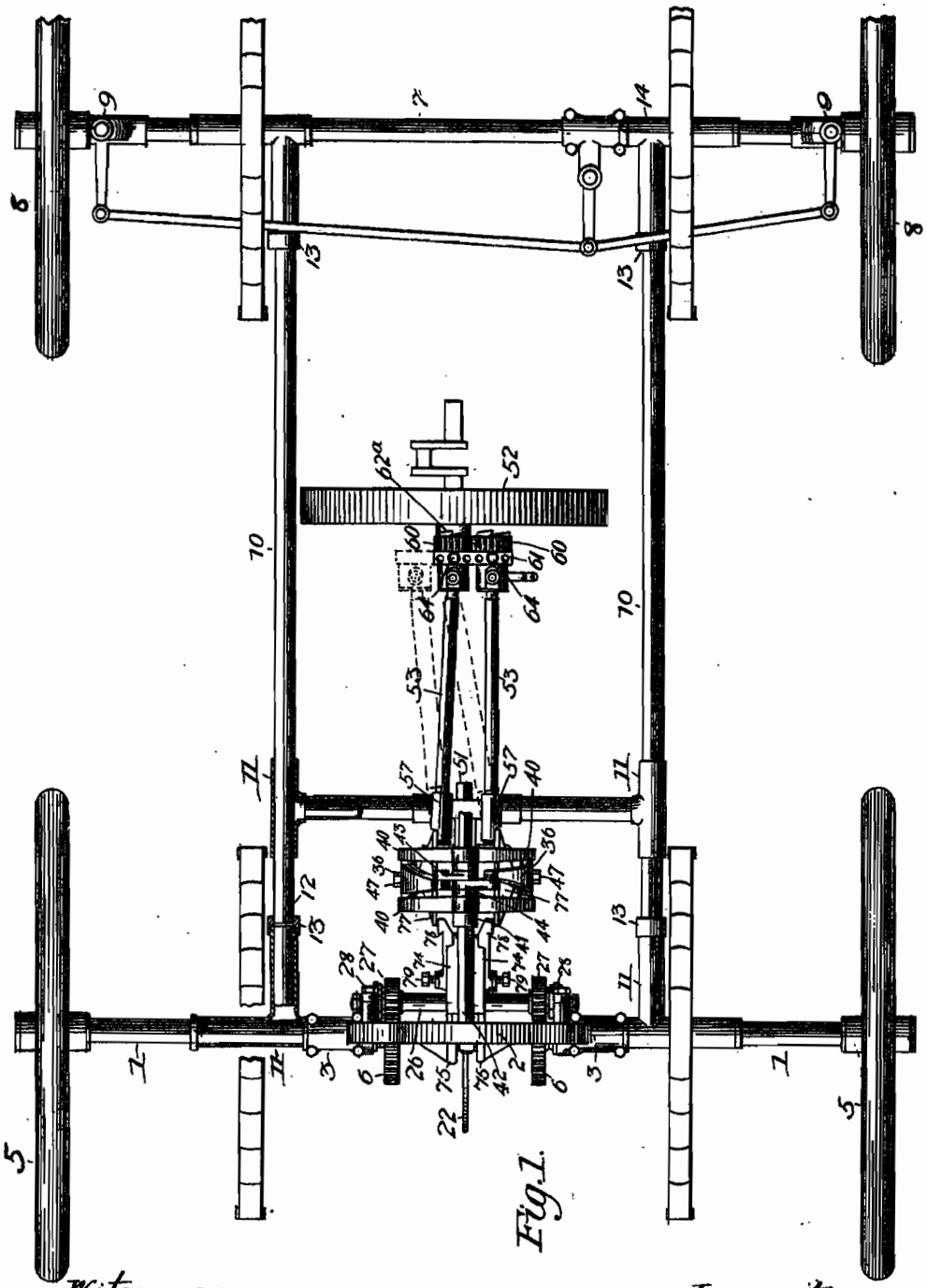

Fig. 1.

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(No Model.) 5 Sheets—Sheet 2.

Fig. 3.

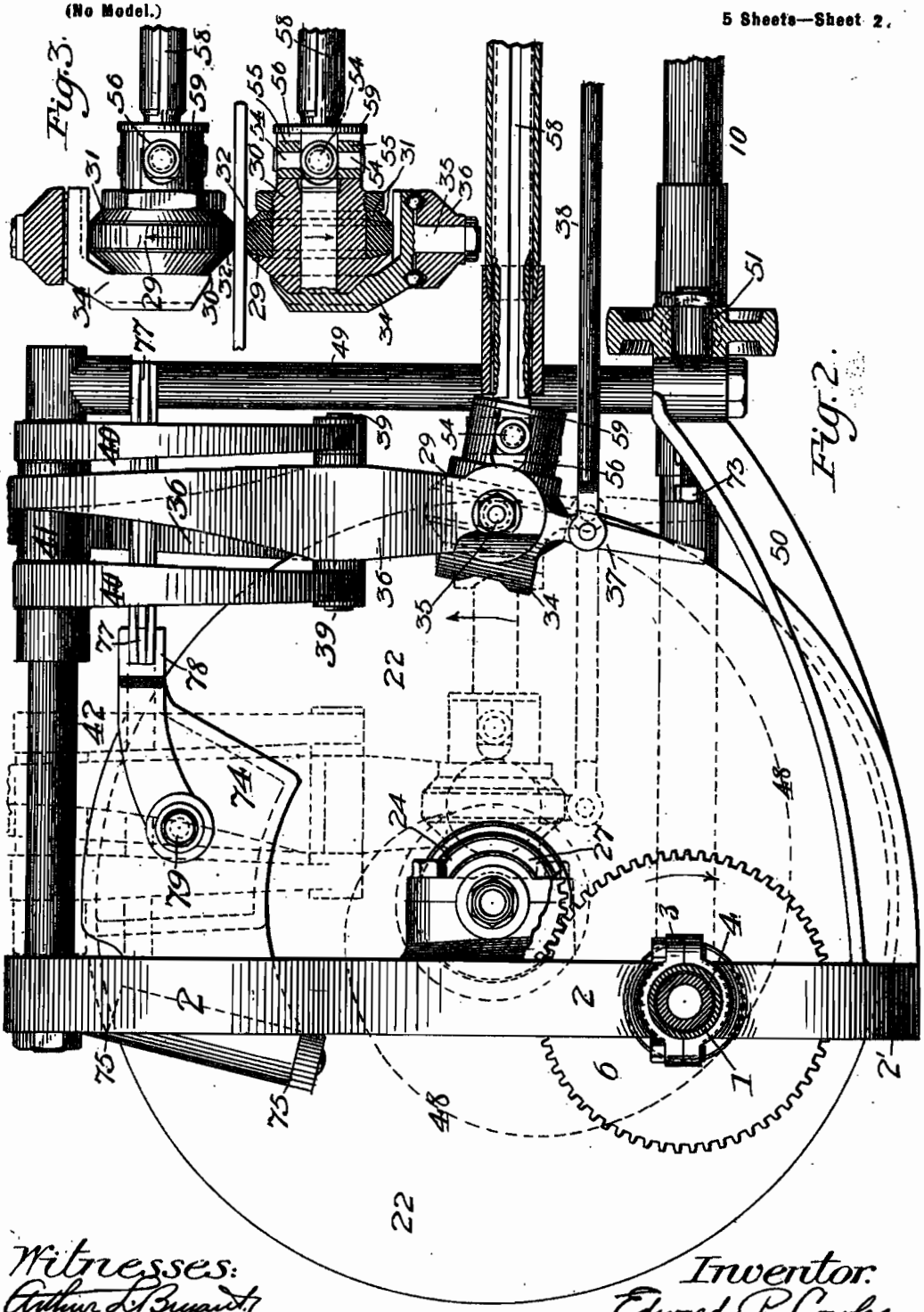

Fig. 2.

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(No Model.) 5 Sheets—Sheet 3.

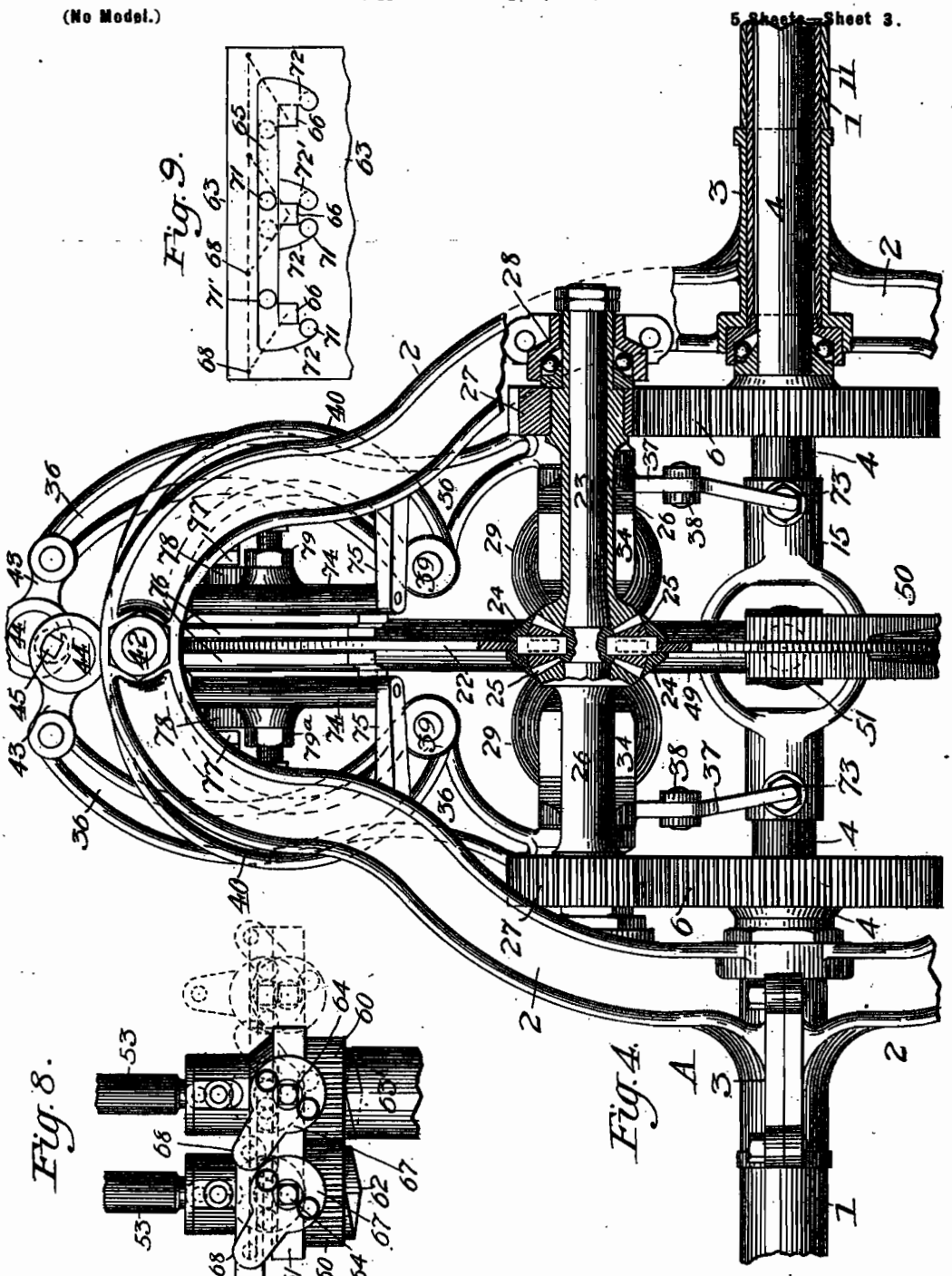

Fig. 9.

Fig. 8.

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(Application filed Aug. 25, 1899.)

(No Model.) 5 Sheets—Sheet 4.

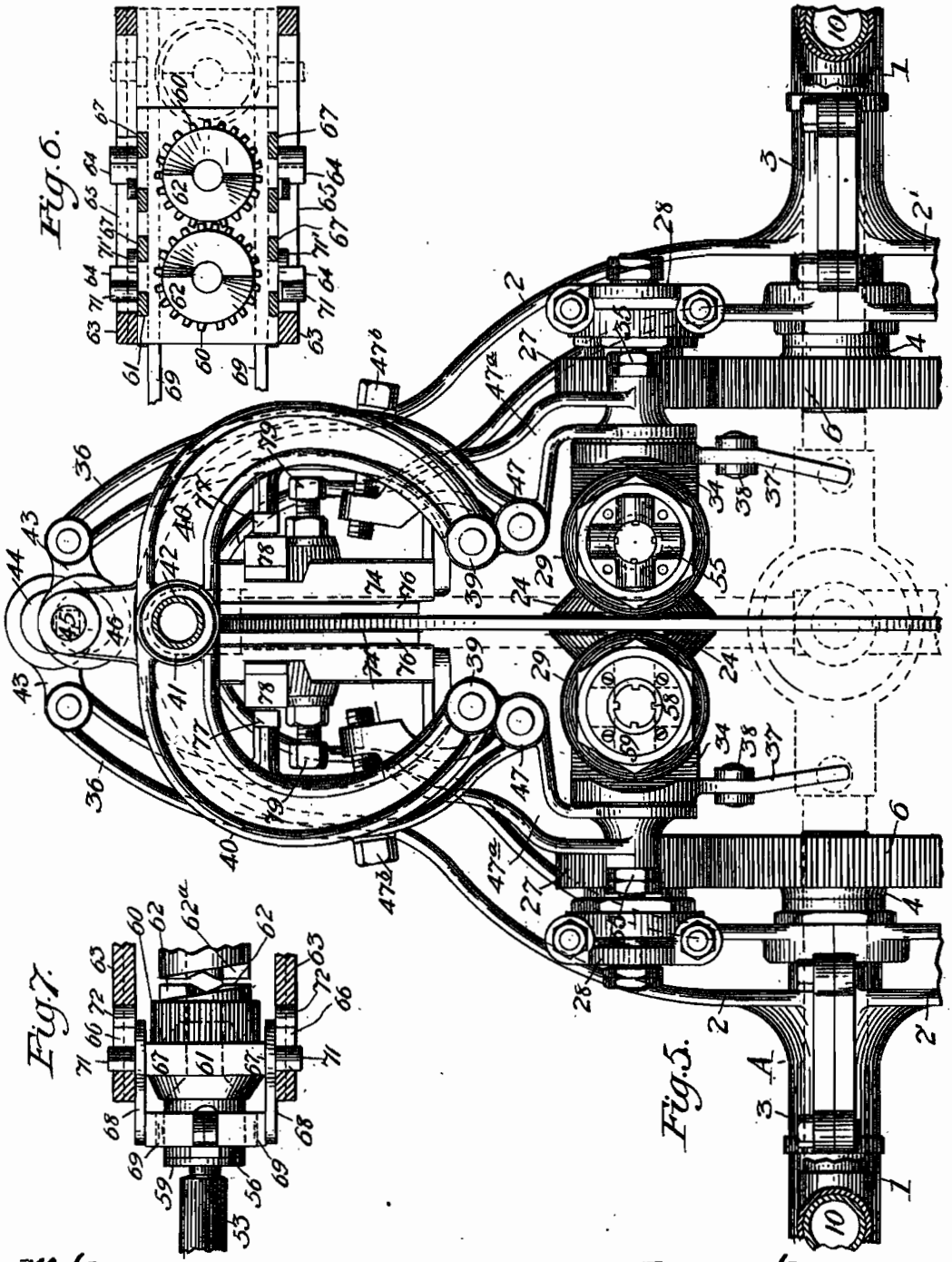

Fig. 6.

Fig. 7.

Fig. 5.

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MOTOR VEHICLE.

(Application filed Aug. 25, 1899.)

(No Model.) 5 Sheets—Sheet 5.

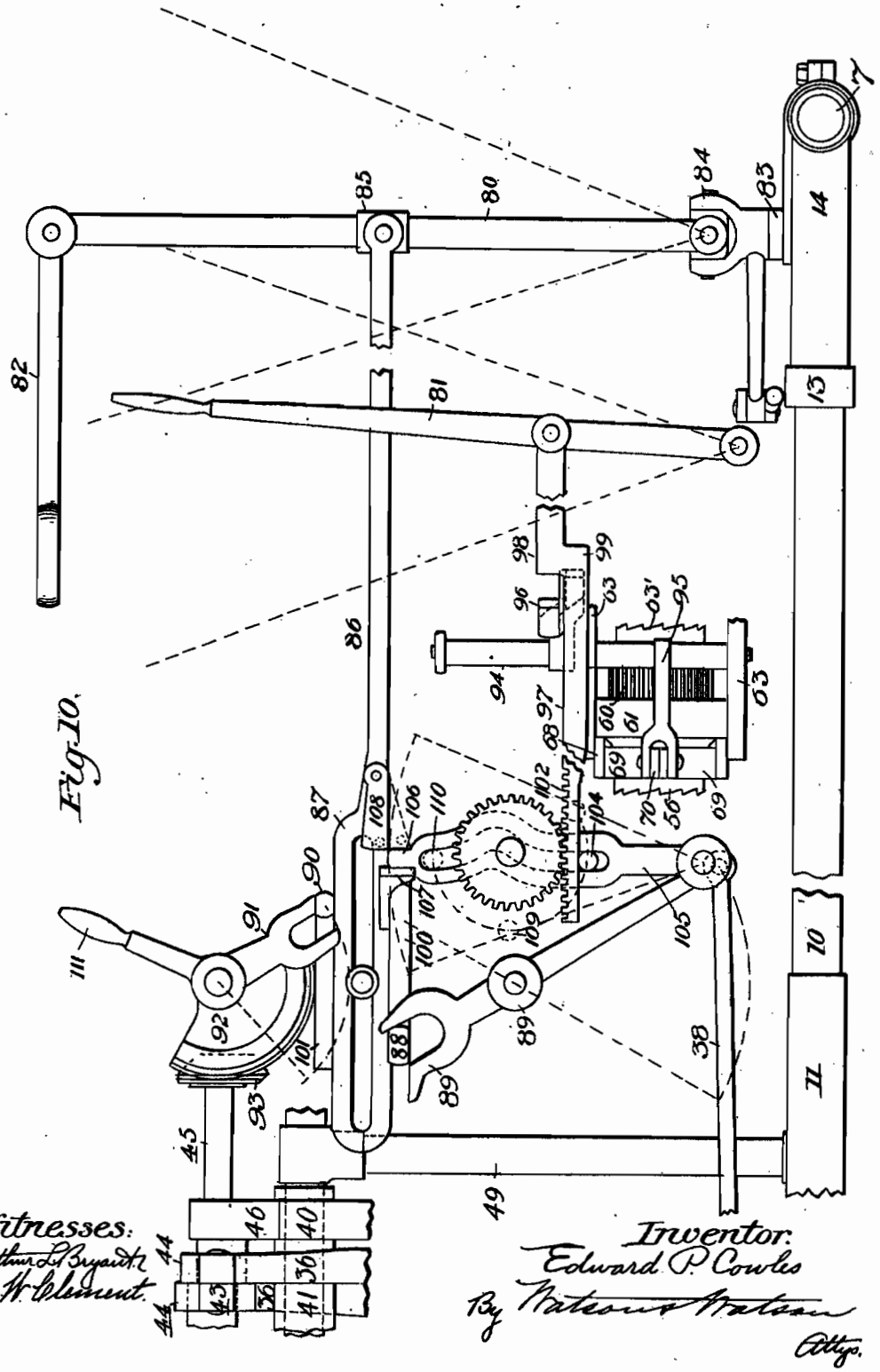

Fig. 10.

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UNITED STATES PATENT OFFICE.

EDWARD P. COWLES, OF WARREN, OHIO.

MOTOR-VEHICLE.

SPECIFICATION forming part of Letters Patent No. 654,716, dated July 31, 1900.

Application filed August 25, 1899. Serial No. 728,502. (No model.)

To all whom it may concern:

Be it known that I, EDWARD P. COWLES, a citizen of the United States, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Motor-Vehicles, of which the following is a specification.

My invention consists in improvements in the driving-gear of motor-vehicles, and has for its objects, first, to provide a driving-gear that will work perfectly smooth and noiseless and adapted to vary the speed or leverage between motor and driving-wheels conveniently and without shock; second, to provide a reversing-coupling for motors that revolve but one way, my invention being adapted to any kind of motor in use, and, third, a brake of peculiar construction.

The invention consists, further, in various improvements in construction and arrangement of parts and in specific devices for effecting the various movements, all of which will be fully described in the following specification, reference being had to the accompanying drawings, in which—

Figure 1 is a plan or top view of the running-gear of an automobile embodying my improvements. Fig. 2 is a side view of the driving-gear. Fig. 3 is a plan view and section of the friction-rollers. Fig. 4 is a rear view of the driving-gear partly in section. Fig. 5 is a front view of the driving-gear. Figs. 6, 7, 8, and 9 are views showing details of the reversing-coupling; and Fig. 10 is a diagrammatical view of the operating mechanism.

Referring to the drawings, A indicates the rear axle, which comprises tubular portions 1 and yokes 2, the yokes being provided with semihubs 3, in which the tubes 1 are securely clamped. Through the tubes 1 extend the driving-axles 4, which are provided on their outer ends with the driving-wheels 5 and on their inner ends, inside of the yokes 2, with spur-gears 6. The front axle 7 is a single straight tube connected to the steering-wheels 8 by the usual hinge-joints 9. The axles are connected by two reach-bars 10, the connections between these bars and the axles being made by long bearing-T's 11, in which the reach-bars and axles are free to turn. The reach-bars are prevented from longitudinal movement in the T's by means of collars 12, fast in the reach-bars and screw-caps 13, which are screwed over them and onto the ends of the T's, leaving the reach-bars free to turn, but confining them longitudinally by means of the collars 12. A cross-bar 15 is provided between the reach-bars a short distance in front of the rear axle, and to this cross-bar the yokes 2 are connected by braces to prevent them from turning under the reaction of the driving mechanism.

The driving mechanism consists of a thin disk 22 of suitable material, preferably hardened steel or "saw-steel," about sixteen inches or eighteen inches in diameter, mounted on a shaft 23, Fig. 2, by nut and collared hub 24, much in the same manner that a circular saw is mounted. Inside of hub 24 are the usual differential gears 25, which transmit the rotation power of disk 22 equally to two sleeves 26, turning loosely on shaft 23 and having pinions 27 secured near their outer ends, which intermesh with the gears 6, secured to the inner ends of the driving-axles 4. These gears can be of any proportion. In the present instance they are as two is to one. Shaft 23 is suitably mounted in bearings 28, extending from yoke 2.

Engaging frictionally with opposite sides of disk 22 are two driven friction-rollers 29, with their points of contact opposite, so that the contact-pressure of one balances or counteracts that of the other, and thus relieves disk 22 and its bearings wholly from the strain of this pressure. By reason of both rollers being driven, the frictional efficiency is doubled. These friction-rollers consist of a hub 30, carrying a flange, and a nut and washer 31, a ring of suitable friction material 32, preferably indurated paper fiber, being clamped between their slightly-beveled inside surfaces. Friction-rollers 29 turn on studs 33, extending from angular blocks 34, their axes being preferably parallel with the surface of disk 22. Extending from the other arm of the angular block 34 is a stud 35, preferably with its center line intersecting center line of 33 and passing through point of contact of roller with disk 22 perpendicular with surface of said disk. Pivot 35 serves to connect block 34 and its friction-roller to the lower arm of a lever 36, permitting a slight rotation or oscillation of friction-roller 29 to

be effected and controlled by an arm 37, depending from block 34 and connected by a link 38 to mechanism to be hereinafter described. By this means the plane of revolution of friction-rollers can be shifted in either direction from a position at right angles to a plane containing the axis of disk 22 and a radius passing through point of contact, as shown by full lines in Fig. 2.

The levers 36 are pivoted at 39 between the arms of a yoke 40, extending down on both sides of disk 22 from a hub 41, sliding freely on a horizontal bar 42, extending from yoke 2. The upper ends of levers 36 are connected by links 43 to eccentrics 44, having their centers on opposite sides of their axis 45, forming a toggle-joint, by which levers 36 are made to vibrate on their pivots 39 and cause friction-rollers 29 to "bite" or relax their hold on disk 22 like a vise. It will be observed that yoke 40 is self-contained and sustains pressure of friction-wheels with the thrust and pull of eccentrics 44 independently of any other part. The hub of eccentrics 44 has its bearing on an arm 46, projecting from yoke 40. A square hole or socket in this hub admits a square rod 45, by turning which with suitable mechanism hereinafter described eccentrics 44 and levers 36 are manipulated.

In Fig. 5 I have shown means for adjusting the levers 36 to take the wear of the friction-rollers 29. In this figure the levers 36 terminate in hubs 47, in which are pivoted secondary levers 47^a. The lower ends of levers 47^a carry the friction-rollers 29, and their upper ends are connected to the levers 36 by means of bolts 47^b. By means of these bolts the lower ends of levers 47^a may be adjusted relatively to the levers 36, and the rollers 29 thus made to grip the disk 22 more or less firmly. This adjustment also is used to compensate for wear, as above stated. It is obvious that when the rollers are biting the disk 22 it would require great power to slide them to and from its center; but when their plane of revolution is shifted from right angles to a radius of the disk passing through the point of contact, as hereinbefore described and as shown in Fig. 2, they will traverse automatically toward the center of the disk following the broken spiral line 48, and when the plane of revolution is shifted in the opposite direction they will traverse toward the periphery in the same manner. A slight force will cause the friction-wheels when under their greatest load to traverse back and forth from center to circumference, and vice versa, changing the speed of the driving-wheels and the leverage of the motor, as desired. As the friction-wheels 29 traverse to and from the center of the disks 22 they force the levers 36 and yoke 40 along with them, the sleeve 41 of yoke 40 being free to slide along horizontal bar 42 and the hub of eccentrics 44 being free to slide along square rod 45. The thrust and pull of friction-wheels 29 is transmitted by levers 36, yoke 40, and sleeve 41 to the horizontal bar 42, the front end of which is supported by a vertical bar 49, the lower end of which is secured to a forward extension 50 from lower part 2′ of yoke 2, which in turn is pivoted at 51 to cross-piece 15, Figs. 1 and 2. In this manner the reaction from turning the driving-wheels is sustained by the perch-bars 10 10.

The friction-wheels 29 are preferably driven directly from the motor 52 by means of extensible rods 53, connected at both ends by flexible or universal joints, which may be of any suitable form, although I prefer the form shown, consisting of four pins 54, extending radially from the ends of the rods 53, on which are rollers 55, Fig. 3, fitting into slots 56 cut in the hubs 30, permitting free motion in every direction. Rollers 55 are retained in slots 56 by a washer 59, secured to the ends of the hubs 30. The outer parts of rods 53 are tubular, and each has a sleeve 57 on one end provided with feathers formed on its inside surface and fitting into grooves in a rod 58, which telescopes within the tube. In this manner rods 53 are adapted to extend as the friction-wheels 29 traverse toward the center of the disks 22. The ends of rods 53 toward the motor are coupled by joints similar to those above described to pinions 60, Figs. 6, 7, 8, and 9, having bearings in a block 61. These pinions intermesh and cause the rods 53 and friction-wheels 29 to revolve in opposite directions and to transmit the power of the motor to both friction-wheels. The sides of pinions 60 toward the motor have clutch members 62, either one of which will fit a similar clutch member 62^a on the motor-shaft. A block 61 slides between guides 63, attached to the motor-frame. It is guided by square pins 64, projecting from its upper and lower surfaces and sliding in slots 65 cut in the guides 63. When sliding in these slots, clutches 62 are maintained just far enough away to clear the motor-clutch 62^a. Pins 64 are preferably placed the same distance apart as the axes of pinions 60 and with their center lines intersecting them. In the side of slot 65 toward the motor are cut three square recesses 66, Fig. 7, of the same size as pins 64 and the same distance apart, the axis of the center recess 66 intersecting the axis of the motor-shaft clutch. Obviously when block 61 is moved along until pins 64 register with the center recess and one of the outer ones block 61 can be pushed toward the motor, and the clutch 62, which is opposite, will engage with the motor-clutch, and the rod 53 in line with the motor-shaft will be rotated with it, the other rod being rotated in the opposite direction. When they are moved so that the other clutch 62 is engaged, they will rotate in the opposite direction or the rotary motion of rods 53 will be reversed. This movement of block 61 is effected by means of four cams 67, which turn on round portions of the pins 64. They are all moved simul-

taneously by arms 68, connected by links 69, which are brought together at 70 and manipulated by suitable levers hereinafter described. Cams 67 each have two pins 71 71′ on opposite sides of the center projecting outwardly and sliding in slot 65.

By referring to Fig. 9, which shows the upper side of lower guide 63, it will be seen that recesses 72 72′ are cut in the side of slot 65 for pins 71 to swing into. In the position shown in Fig. 8 the right-hand gear 60 is engaged with motor. If rod 69 is pushed to the right, cams 67 will be turned, pins 71′ and 71 will bear against the side of slot 65, and block 61 will be drawn away from motor and couplings 62 and 62ª disengaged. When pins 71 71′ in recess 72 72′ reach the straight slot 65, cams 67 can turn no farther and block 61 is moved to the right. When the pins come opposite their respective recesses, cams 67 continue to turn, pins 71 71′ act against the outside of slot 65, and the other two pins swing into recesses 72 72′, and block 61 is forced toward motor, and left-hand coupling 62 engages motor-coupling 62ª and is locked in this position. When link 69 is drawn in the opposite direction, the same operations take place in reverse order. The inside pins 71′ are made shorter, extending only half-way through guide 63, and recesses 72′ in center are cut only half-way through; otherwise, as will be seen in Fig. 9, the long pins 71 would have no bearing to withdraw block 61 at this point.

As hereinbefore stated, this invention is adapted to all forms of motors. The foregoing reversing device is particularly designed for hydrocarbon-motors and the like which revolve but one way, making it necessary to provide for reversing in the driving-gear. For pressure-motors, such as steam, compressed-air, and the like, which can be conveniently reversed, this reversing device would be uncalled for and would of course be left out. In such cases I would preferably have two motor-shafts connected by gears 60, with rods 53 coupled directly and permanently but flexibly thereto. For obvious reasons it would be objectionable to reverse while friction-rollers 29 were in contact or "biting" the disk 22, as it would subject all parts to great strain and wear. As will be hereinafter explained, reversing can take place only when friction-rollers are free. In this condition, the parts being of small diameter and very light weight, the inertia to be overcome is a negligible quantity, and the coupling can be safely made while motor-shaft is at full speed of six hundred revolutions per minute, the impact of coupling-teeth under these circumstances being equivalent to a body falling only eight inches.

Referring again to the friction-wheels 29, Fig. 2, arm 37 is purposely placed and link 38 pivoted to it on the side of friction-roller 29 from which the periphery at point of contact with disk 22 is moving. This causes friction-roller 29 in traversing to and from center of disk 22 to follow the lead of link 38, like a common "caster-wheel," and when the movement of link 38 stops from either direction wheel 29 automatically moves into position with its plane of revolution at right angles to a radius of disk 22, passing through point of contact with wheel 29 and remains in this position until link 38 is moved again. If, however, pivots 35 are placed at one side of radius of disk passing through point of contact, as hereinbefore mentioned, friction-roller 29 will act wholly like a caster-wheel, and its plane of revolution could be shifted from perpendicular to radius of disk passing through point of contact and traversed over the disk by pushing block 34 or yoke 40. I prefer, however, the arrangement shown. It will be understood that the foregoing description of movements for driving-gear are for a forward movement of the vehicle. In a backward movement involving a reverse movement of the driving-gear it would be difficult or impossible to cause wheel 29 to traverse to and from center of disk 22, from the fact that it would lead the movement of link 38, and when this movement stopped would not come into right angular position, but have a tendency to turn around on pivot 37; but in backing it is never practicable to use anything but the slowest speed, and traversing wheel 29 away from periphery of disk 22 is therefore not desirable. For this reason arm 37 is extended down and in backing is brought against a stop 73, which brings wheel 29 into proper position to act on disk 22 and holds it there during the reverse movement of the driving-gear. The movement of angular block 34 about its pivot 35 is restricted within certain limits, about ten or fifteen degrees either way, so that when for any reason it is desired to move yoke 40 without traversing wheels 29 to and from center of disk 22 wheels 29 can be released from disk and the whole device slid along the bar 42 and wheels 29 clamped at any point.

The brake consists of two swinging blocks 74, one on each side of disk 22, hinged to the yoke 2 at 75. When brought together, they clamp the disk like a vice. Each piece 74 is in the form of a box adapted to hold a block 76, of suitable friction material, which is adjustable to swinging piece 74 to take up wear by means of set-screw 79 and lock-nut 79ª. Levers 36 are provided with horizontal bars 77 on their upper ends, the inside faces of which are straight and parallel with sides of disk 22. They bear against lugs 78 on swinging pieces 74, and when eccentrics 44 are turned in the direction to release friction-wheels 29 or to draw the upper ends of levers 36 together they cause the brake 74 to clamp disk 22. By this means the brake can be applied in any position of yoke 40 between center and circumference of disk 22. The thrust of brakes 74 is received directly by yoke 2 and is transmitted to perch-bars 10 by means hereinbefore described. It will be observed

that notwithstanding the action of the brakes is practically instantaneous they can never be applied when friction-wheels 29 are engaged with disk; neither can wheel 29 be applied when brakes are on. All strain and wear that would result from this source are therefore avoided.

In the arrangement of levers to bring about the several changes and operations if each change were made separately it would require a number of levers that would be very confusing and offer great liability to accident. I prefer the general arrangement shown in Fig. 10, where all the operations are brought about by manipulating two levers, a steering-lever 80 and a reversing-lever 81, the various changes being divided between them in the following order: For a steering-lever I prefer a horizontally-swinging lever 82, like the tiller of a boat, and I preferably attach the steering pivot or fulcrum to the running-gear, as it will work with greater precision than when attached to the body. The upright 80 is attached to the pivot 83 by flexible joint 84, permitting it to swing backward and forward, beside turning steering-joint 84. Near the center of 80 is attached by a joint 85, that turns loosely around 80, a horizontal rod 86, working a sliding cam-block 87. The lower cam 88 on block 87 engages the forked end of rocking lever 89, the lower end of which is attached to the rods 38 for traversing friction-wheels 29. The upper cam 90 engages a similar forked lever 91, attached to the segment of a bevel-wheel 92, which meshes with a pinion 93, attached to square shaft 45, which turns the eccentrics 44. The back and forward movement of lever 80 from a perpendicular by means of rod 86, block 87, cam 88, rocker-arm 89 causes wheels 29 to traverse disk 22 and vary the speed, as described. When the lever 80 has been moved backward so far that the wheels 29 are at the extreme periphery of disk and arms 37 against stops 73, cam 90 engages fork on 91, and by means of gears 92 93, shaft 45, eccentrics 44, and operating-levers 36 friction-wheels 29 are released. A farther backward movement of lever 80 causes the cam 88 to override the end of the rear arm of fork on lever 89 and lock said lever in its adjusted position, and this backward movement of lever 80 also sets the brakes. If now the lever 80 is moved forward, these operations are reversed, brakes are released, wheels clamped, and traversing from the periphery of the disk toward the center thereof or from slow to fast commences.

The cams 68 and links 69 of reversing device are operated by upright rock-shaft 94, the lower arm 95 of which is coupled to them at 70. The upper arm 96 is forked like levers 91 and 89. Pivoted to reversing-lever 81 is a horizontal slide-bar 97. This bar has an offset at 98, which engages one prong of fork 96, turning rock-shaft 94 and by means of its lower arm 95, link 69, and cams 68 reversing the motion of the friction-wheels 29, as hereinbefore described. In the return movement of 81 the lower offset 99 of bar 97 engages the lower prong of fork 96, and the movement is reversed.

It will be observed that the forks 89, 91, and 96 have prongs offset, so that when their respective cams 88 90 98 99 pass the point the straight parts 100, 101, 98, and 99 slide over and lock them in position. As the movements of friction-wheels 29 and brake 74 necessary in backing are effected by cam-block 87, instead of putting in an extra set of mechanism for this purpose I use a device that automatically couples bar 97 with cam-block 87 and performs these functions with the mechanism already provided. A backward extension of bar 97 has a rack 102, that meshes into a pinion 103, having an arm provided with a pin 104, which works in a slot in a vertical lever 105, having its lower end pivoted and its upper end 106 engaging a projection 107 on cam-block 87. In its forward movement 106 engages a latch 108, which is tripped at the point where cam 88 strikes fork 89, so that block 87 does not follow 105 in the remainder of its forward movement.

The cycle of movements of reversing-lever is as follows: The initial movement from extreme forward point 106 will engage 87 at any point where it happens to be left and traverse friction-wheels 29 to extreme periphery of disk and lock them there. When cam 90 strikes 91 and slightly releases wheels 29, offset 98 engages 96 and reversing commences and goes on simultaneously with tightening the brakes, &c., already described. When pin 104 of pinion 103 reaches the position 109, lever 105 commences to swing forward, and point 106 engages latch 108, releasing brakes and tightening wheels 29. When pin 104 reaches the position 110, the machine is moving backward. In the forward movement of lever 81 the motion of pinion 103 is reversed. When lever 105 has moved block 87 and cam 90 to engage 91 and release pressure of friction-wheels 29, the lower offset 99 on bar 97 engages the lower prong of fork 96 and the reversing commences and goes on simultaneously with releasing 29 and tightening the brakes, as in the previous movement. When pin on pinion reaches position 104, lever 105 is disengaged from latch 108 and the machine is moving forward and the lever 82 is free to traverse wheels 29.

The lever 111 serves to tighten the grip of friction-wheels or brake independently of the other mechanism. It will be understood that eccentrics 44 are encumbered with friction, so that they remain in any position and do not depend on the levers to hold them. It will also be observed, first, that the initial movement either in stopping or reversing is to traverse the friction-wheels 29 from center to circumference of disk 22, reducing the speed, for example, from twenty to five miles per hour before applying the brakes. This in itself is a very efficient brake, as it effects

this reduction without slipping or friction of any sort; second, reversing cannot take place until speed is reduced, brake applied, and machine stopped; third, as hereinbefore pointed out, brakes cannot be applied when friction-wheels are engaged, and vice versa, also the friction-wheels cannot be applied except at the periphery of the disk, where they have the greatest leverage to start the machine, and then not when disk is moving in opposite direction; fourth, all the changes are positive, automatic, and interlocked, and no change can take place until the previous movement in the order has been completed, making accidents or derangements from carelessness or inexperience on the part of the driver impossible; fifth, all movements are natural—that is, a backward movement for slow, stop, or back and a forward movement for start, fast, or forward, so that nervous drivers in an emergency would make the proper movements instinctively; sixth, when stopped or the brakes applied the motor is practically disconnected from the driving mechanism.

If it is desired to use all four of the wheels as drivers, as would probably be the case in heavy machines in carrying from six to eight persons or for freighting purposes, I would place a driving-gear similar to that shown and operated in the same way in front, and I would preferably adapt all wheels for both driving and steering purposes substantially as shown and described in my patent for an improvement in traction-engines, No. 154,846, dated September 8, 1874.

I preferably place the disk 22 in position and geared to the axle, as shown. It is obvious, however, that it can be placed directly on the driving-axle 4 or any point between it and the motor or in any position, inclined, horizontal, or vertical, or the relations can be reversed and disk 22 made the driver and the friction-rollers be driven.

Another function of the rods 53, flexibly jointed at both ends, is to allow the body to play with the springs freely without interfering with the transmission of the power from the motor to drivers, and the transmission of the power has no effect to lift or pull down the body.

It will be evident that many changes in the details of construction and arrangement of the apparatus hereinbefore described can be made without departing from the spirit and scope of my invention. Thus, for instance, other forms of universal or flexible joints may be introduced between the shafts 53 and the friction-rollers, equivalent devices may be substituted for the eccentrics 44, such as cranks or shafts, and other means of mounting the friction-rollers so that their planes of movement may be adjusted angularly may be substituted for those shown. I intend in the broader claims of this specification to cover all such equivalent devices and in the more specific claims to cover the particular devices illustrated and described and which at the present time seem to me to be the best embodiment of the invention.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In an automobile vehicle, the combination with the driving-wheels, of a rotatable disk, a friction-roller arranged to engage with said disk, and means for adjusting the plane of rotation of said roller angularly whereby it is made to automatically traverse the disk between center and circumference.

2. In a device for changing speed, a rotatable wheel or disk, a friction-roller arranged to engage said wheel or disk, and means for adjusting the plane of rotation of said friction-roller angularly to cause said roller to traverse the said wheel or disk either toward or from its center.

3. In a device for changing speed, the combination with a rotatable wheel or disk, of a friction-roller adapted to engage said wheel or disk, a support in which said roller is pivotally mounted with freedom to turn about a line at right angles to its axis, said support and roller being bodily movable toward and away from the center of the disk, and means for turning said roller about said line at right angles to its axis, for the purpose set forth.

4. In a device for changing speed, the combination with a rotatable disk, of a pair of friction-rollers arranged on opposite sides of said disk and adapted to engage the same, said rollers being free to turn about a line at right angles with the disk whereby they may be caused to traverse the disk between its center and circumference automatically, for the purpose set forth.

5. In a device for changing speed, the combination with a rotatable disk, of a yoke having arms on opposite sides of said disk, friction-rollers carried by said arms and adapted to engage with opposite faces of said disk, said rollers being free to turn and also arranged to swing about an axis at right angles to the disk, and means for turning them simultaneously about said axis whereby they are caused to traverse the disk between its center and circumference.

6. In a device for changing speed, the combination with a rotatable disk, of friction-rollers arranged on opposite sides of said disk, blocks having studs 33 upon which said rollers are mounted, supports to which said blocks are pivoted to move axially about a line at right angles to said disk, arms connected with the blocks, and means for turning said arms to cause the rollers to traverse the disk automatically between its center and circumference.

7. The combination with a rotatable wheel or disk, of a yoke-piece having arms on opposite sides of said disk, levers pivoted on the arms of said yoke, and friction-wheels mounted on said levers and adapted to engage the disk between them.

8. The combination with a rotatable wheel

or disk, of a yoke-piece having arms on opposite sides of said disk, levers pivoted on the arms of said yoke, and friction-wheels mounted on said levers and adapted to engage the disk, said yoke being arranged to slide on a support which is parallel with the plane of the disk to carry said friction-rollers toward and away from the center of the disk, for the purpose set forth.

9. The combination with a rotatable wheel or disk, of a yoke-piece having arms on opposite sides of said disk, levers pivoted to said arms, friction-rollers carried by said levers, and eccentrics or equivalent devices pivotally supported on said yoke-piece and connected with said levers for the purpose of moving the rollers into and out of engagement with the disk.

10. The combination with a rotatable wheel or disk, of a yoke-piece having arms on opposite sides of said disk, levers pivoted to said arms, extension-pieces adjustably connected to said levers, friction-rollers carried by said extension-pieces and adapted to engage the disk, and means for simultaneously rocking the levers to move the rollers into and out of engagement with the disk.

11. The reversing device comprising a motor-shaft provided with a clutch member, a pair of shafts to be driven thereby, and each provided with a clutch member, and means for engaging the motor-shaft clutch member with either of the driven-shaft clutch members.

12. A reversing device comprising a movable block, a pair of shafts having bearings in said block, intermeshing gears on said shafts whereby they are made to rotate in opposite directions, clutch members on said shafts, a motor-shaft having a clutch member, and means for shifting said block and shafts to engage either of their clutch members at will with the motor-shaft whereby said driven shafts may be driven in either direction as desired.

13. A reversing device comprising a motor-shaft having a clutch member, a pair of shafts to be driven thereby each provided with a clutch member, intermeshing gears on said shafts, a common support or block in which said shafts are mounted, and cams governing the movements of said support or block whereby the clutch member of either driven shaft may be locked in engagement with the motor-shaft clutch member, for the purpose set forth.

14. The combination with a disk to be driven, of friction-rollers arranged on opposite sides of said disk and movable radially of the disk to vary its speed, extensible shafts for driving said friction-rollers, intermeshing gears on said shafts, clutch members on said shafts, a motor-shaft having a coöperating clutch member, and means for engaging either of the roller-shaft clutch members with the motor-shaft clutch member.

15. The combination with a disk to be driven, of friction-rollers on opposite sides of the disk and movable radially thereto to vary its speed, extensible driving-shafts for said friction-rollers, intermeshing gears on said driving-shafts, flexible joints connecting said shafts with said rollers and gears, a motor-shaft having a clutch member, corresponding clutch members on said gears, and means for shifting the gears to engage either of them at will with the motor-shaft clutch member, for the purpose set forth.

16. In a motor-vehicle, the combination with a driven disk, of a pair of friction-wheels arranged on opposite sides of said disk for driving the same, a pair of brake-shoes on opposite sides of said disk, and a common means for engaging the friction-rollers and the brake-shoes alternately with the disk to operate and stop the same.

17. In a motor-vehicle, the combination with a disk, friction-rollers arranged on opposite sides of said disk, levers upon which said friction-rollers are mounted, and means for rocking the levers to engage and disengage the friction-rollers and disk, of movable brake-shoes arranged on opposite sides of the disk, and connections between said levers and brake-shoes whereby the movement of the levers to disengage the rollers effects the application of the brake-shoes to the disk.

18. In a motor-vehicle, the combination of a disk, friction-rollers on opposite sides of said disk, means for moving said rollers radially of the disk to vary its speed, levers for clamping and releasing said friction-rollers, brake-shoes movably mounted on opposite sides of the disk, and connections between said levers and said brake-shoes whereby the latter are applied when the levers are moved to disengage the friction-rollers from the disk, the braking power being the same in any adjustment of the levers and friction-rollers with respect to the center of the disk.

19. In a motor-vehicle, the combination with a motor, driving-wheels, and mechanisms for applying brakes, varying speed, and connecting and disconnecting the motor, of a single operating-lever connected to said mechanisms, and means whereby the rearward movement of said lever brings the speed to a minimum, then disconnects the motor and finally applies the brakes, and the reverse or forward movement of said lever successively releases the brakes, connects the motor to the driving-wheels at reduced speed, and finally increases the speed to a maximum, substantially as set forth.

20. In a motor-vehicle, the combination with the driving-wheels and a motor, of reversing mechanism between said driving-wheels and motor, a lever for operating said reversing mechanism, means for connecting and disconnecting the motor with the driving-wheels, a lever for operating said means, and means for interlocking the reversing and disconnecting mechanisms whereby the motor must be

disconnected before the direction of rotation of the driving-wheels can be reversed.

21. In a device for changing speed, the combination with a driven disk, of a pair of friction-rollers arranged on opposite sides of said disk and adapted to engage and drive the same, blocks upon which said rollers are mounted, said blocks and rollers being adjustable about an axis at right angles to the plane of the disk, arms 37 extending from said blocks in a direction contrary to the direction of movement of the contiguous part of the disk, and means for adjusting said arms to cause the friction-wheels to travel radially across the disk.

22. In a device for changing speed, the combination of the driven disk, the friction-roller for driving the same, a pivotally-mounted block carrying said roller, the arm for adjusting said block about an axis at right angles to the disk, and the stop 73 for limiting the outward movement of said arm.

23. The combination with the driven disk, of a friction-roller for driving the same, a block in which said friction-roller is mounted with freedom for adjustment about an axis at right angles to the plane of the disk, the driving-shaft for said friction-roller, and the joint between said driving-shaft and friction-roller comprising the hollow sleeve on one of said parts provided with longitudinal slots, and the radial pins on the other part coöperating with said slots.

24. In a motor-vehicle, the combination with the driving-wheels, a disk for driving the same, a motor for driving said disk, and brake-shoes coöperating with said disk, of means for alternately applying the motor and the brake-shoes to said disk, and a steering-lever connected to and operating said means and also connected to the steering-wheels, substantially as described.

25. In a motor-vehicle, the combination with a shaft, such as 45, for controlling the motor and the brake, of a steering-lever, and connections between said lever and said shaft for turning the latter as the former is moved forward or backward.

26. In a motor-vehicle, the combination with a shaft, such as 45, for operating the brakes and connecting and disconnecting the motor, of a lever for operating said shaft, and connections comprising a sliding rod 86, forked arm 91, cam-piece on said rod for operating said arm, and bevel-gears 92, 93 connecting said arm and said shaft, for the purpose set forth.

27. In a reversing-gear for motor-vehicles, the combination with a driven disk, and friction-wheels adjustable radially to said disk to change its speed, of devices for reversing the direction of said friction-wheels, a lever for operating said devices, and connections between the speed changing and reversing devices whereby the reversal can be only brought about when the friction-wheels are brought to the periphery of the driving-disk.

28. In a motor-vehicle, the combination with a motor adapted to run in one direction only, of reversing devices, speed-changing devices, motor-disconnecting devices, and operating mechanism for all of said devices so interlocked that the speed must necessarily be reduced to a minimum and the motor then disconnected before the reversing device proper can operate to change the direction of movement of the vehicle.

29. In a motor-vehicle, the combination with means for varying the speed, and means for applying a brake, of a motor, and connections for operating said means, the speed varying and braking means being so interlocked that the speed must be reduced to a minimum before the brake can be applied.

30. In a motor-vehicle, the combination of speed-changing means, a forked lever 89 for operating the same, braking means, and a forked lever 91 for operating the same, with a cam-block having projections to engage said forked levers and operate them alternately.

31. In a motor-vehicle, the combination with forked levers such as 89 and 91, the prongs of said forks being offset, of a cam-block having projections to operate on one prong of each fork, and elongated surfaces to coöperate with the other prong of each fork, whereby the forked levers are operated during a portion of the movement of the cam-block, said levers being arranged to operate alternately.

32. In a motor-vehicle, the combination of speed-changing and motor-disconnecting devices, and a lever for operating the same, of reversing devices, an independent lever for operating the reversing devices, and means for connecting the reversing-lever also with the speed-changing and brake-applying devices.

33. In a motor-vehicle, the combination with speed-changing devices, a brake device, and a motor-disconnecting device, of reversing devices, interlocking connections between all of said devices, and a single hand-lever adapted and arranged to operate all of said devices.

34. In a motor-vehicle, the combination with the reversing-clutch, of a rock-shaft for operating the same, the arm on said shaft having an offset fork, the offset rod adapted to operate alternately on the prongs of said fork, and the lever connected to said rod.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD P. COWLES.

Witnesses:
ROBT. E. GORTON,
W. D. PACKARD.

123/346 123/40.16 92/13.8

No. 667,908. Patented Feb. 12, 1901.

W. A. HATCHER.

SPEED REGULATOR FOR EXPLOSIVE ENGINES.

(Application filed Jan. 16, 1900.)

(No Model.) 3 Sheets—Sheet 1.

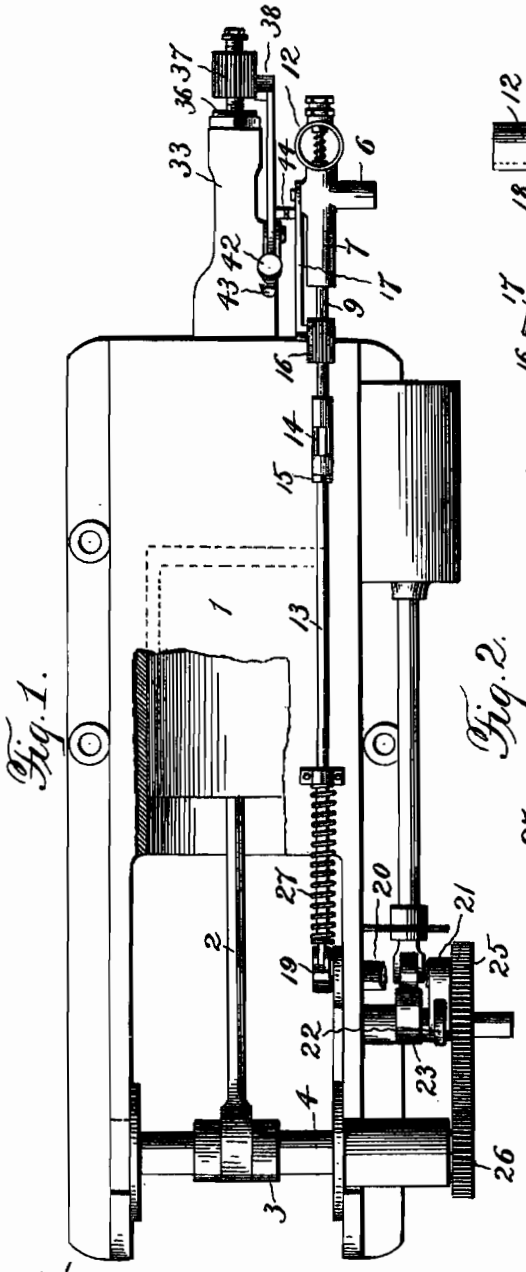

Fig. 1.

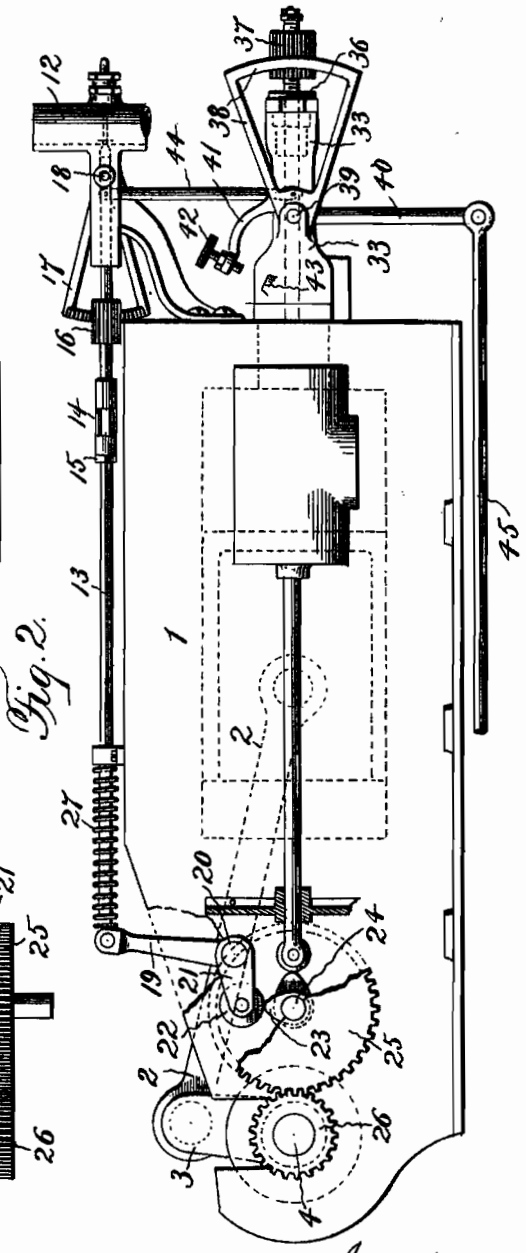

Fig. 2.

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No. 667,908. Patented Feb. 12, 1901.

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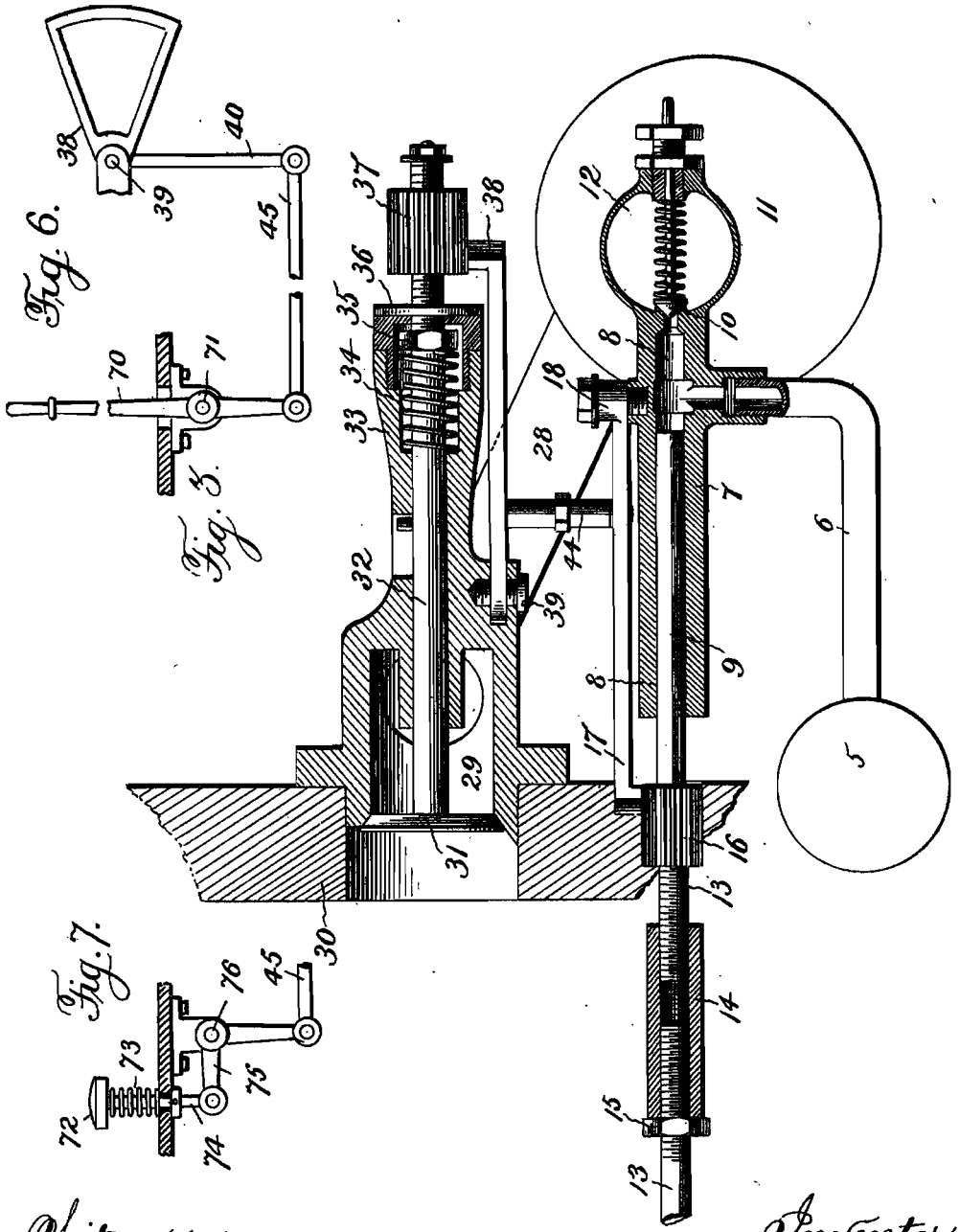
SPEED REGULATOR FOR EXPLOSIVE ENGINES.

(Application filed Jan. 18, 1900.)

(No Model.) 3 Sheets—Sheet 2.



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No. 667,908. Patented Feb. 12, 1901.

W. A. HATCHER.

SPEED REGULATOR FOR EXPLOSIVE ENGINES.

(Application filed Jan. 16, 1900.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 4.

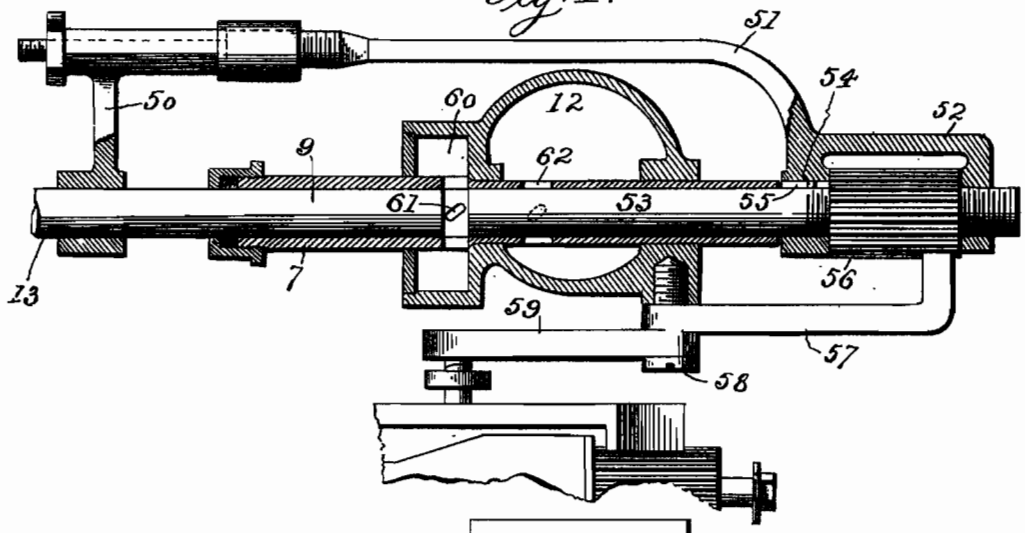
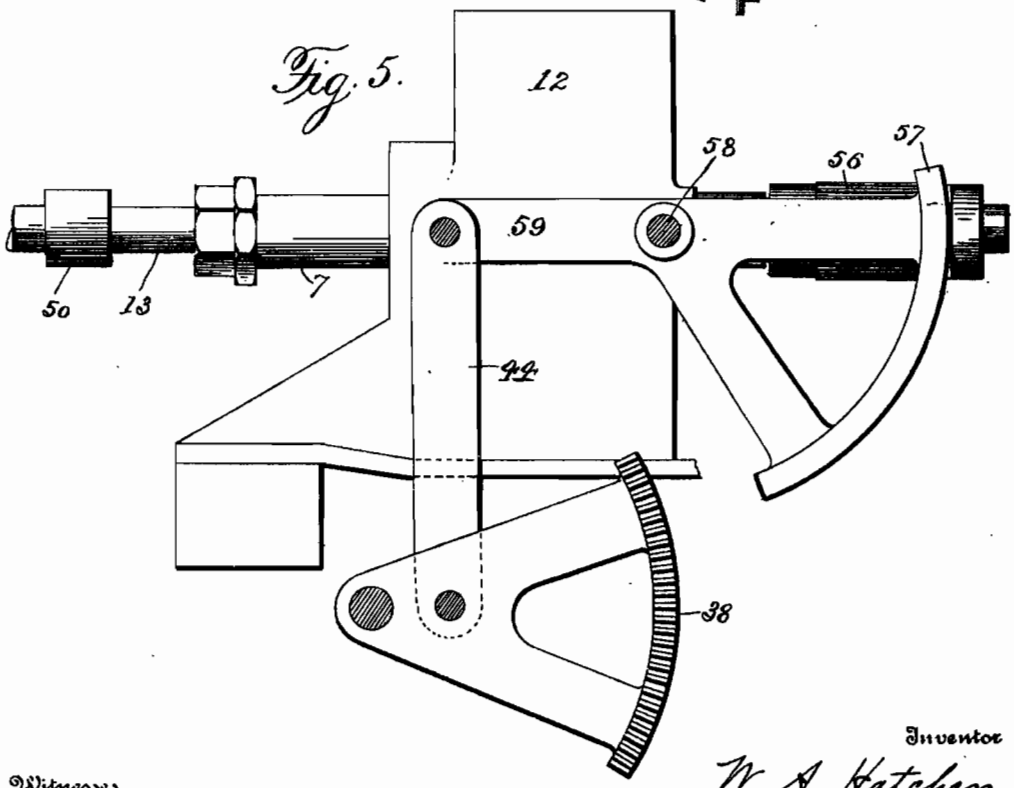


Fig. 5.



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UNITED STATES PATENT OFFICE.

WILLIAM A. HATCHER, OF WARREN, OHIO, ASSIGNOR TO JAMES W. PACKARD, OF SAME PLACE.

SPEED-REGULATOR FOR EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 667,908, dated February 12, 1901.

Application filed January 16, 1900. Serial No. 1,666. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. HATCHER, a citizen of the United States, residing at No. 2 High street, Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Hydrocarbon-Motors, of which the following is a specification.

This invention comprises devices for regulating the speed and power of explosive-engines, and is particularly designed for use on motor-carriages, which require the speed and power of the engine to be under easy and constant control of the motorman.

In the accompanying drawings, forming part of this specification, Figure 1 is a plan view, and Fig. 2 a side elevation, of so much of a hydrocarbon-engine as is necessary to illustrate the present invention, parts being broken away. Fig. 3 is a section through the pump and inlet-valves. Fig. 4 is a plan view in section. Fig. 5 is a side view showing a different form of pump. Fig. 6 illustrates a means of operating the speed-controller by hand-power, and Fig. 7 illustrates a means of controlling the same by foot-power.

Referring to the drawings, 1 indicates the cylinder, 2 the connecting-rod, 3 the crank, and 4 the crank-shaft, of a hydrocarbon-engine using, for instance, gasolene. The gasolene is contained in a suitable tank 5, from which it passes through a pipe 6 to the pump 7 by gravity. The pump-barrel has a cylindrical opening 8, in which works a piston 9, which measures the amount of each charge of gasolene and forces the same through a spring-pressed valve 10 into a mixing-chamber 11. As the piston 9 moves forward it closes the inlet from pipe 6, and thereafter the liquid in the forward end of the barrel 8 is forced into the air-tube 12, leading to the mixer 11, during the balance of the forward stroke of the piston 9. By regulating the amount of stroke of the piston beyond the pipe 6 the charge of hydrocarbon is correspondingly regulated. The piston-rod 13 is formed in two parts, which are united by right and left screw-threads and a right-and-left nut 14. The nut 14 is rigidly connected to the piston-rod proper by a lock-nut 15, while the piston 9 is free to be turned into and out of the right-and-left nut to shorten and lengthen the distance it travels past the inlet from pipe 6. The piston is turned by an elongated pinion 16, which is fast upon it and which meshes with a sector-gear 17, pivoted at 18 and operated in a manner to be presently described. The piston-rod 13 is reciprocated in one direction by arm 19, rock-shaft 20, arm 21, cam-roll 22, and cam 23 on the short shaft 24, which is driven by a gear 25, meshing with a pinion 26 on the crank-shaft 4. The gear 25 has twice as many teeth as the pinion 26 and rotates one-half as fast as the crank-shaft. Rod 13 is reciprocated in the opposite direction by spring 27.

From the mixer 11 the explosive mixture is drawn through a pipe 28 to a chamber 29, connected to the head 30 of the cylinder, and is thence drawn in through a valve 31 to the cylinder during the forward movement of the piston. The valve-rod 32 extends back through a stuffing-box 33, and the valve is normally closed by a spring 34, which encircles the rod and bears upon the nut 35 upon said rod. On the end of the stuffing-box is a cap 36, through which the valve-rod passes. The end of the rod is threaded, and an internally-threaded pinion 37, having elongated teeth, turns thereon. When the valve is opened, the pinion 37 strikes the cap 36 and limits the opening. By regulating the position of the pinion 37 the opening of the valve and the amount of explosive mixture drawn into the cylinder may thus be controlled. The position of pinion 37 is controlled by a sector-gear 38, which is pivoted at 39 and which carries an arm 40, by means of which it is operated, and a second arm 41, which limits its movement in one direction. The arm 41 carries an adjustable stop 42, which coöperates with an abutment 43 upon the valve-chamber 33.

It is important to regulate the amount of gasolene admitted to the mixing-chamber in accordance with the amount of mixture admitted to the cylinder, so that the same proportion of air and gasolene may exist in the mixture at all times. To accomplish this, the controller of the gasolene-pump is connected with the controller of the inlet-valve 31. As shown, this is effected by connecting

the sector-gears 17 and 38 by link 44. Any movement of the arm 40 is thereby communicated simultaneously to the elongated pinions 16 and 37, and the charge of gasolene is increased or diminished as the opening of the valve 31 is increased or diminished. The amount of air taken into the mixer is of course proportional to the amount of mixture admitted by the valve 31. The arm 40 is connected by a rod 45 to a hand-lever 70, pivotally connected at 71 to the forward part of the vehicle. By moving the hand-lever back and forth the amount of hydrocarbon delivered to the engine at each stroke may be varied at the will of the operator and the speed and power of the engine correspondingly varied. In Fig. 7 is shown means of operating the controlling devices by foot-power. This consists of a bolt 72, which is normally held in an elevated position by a spring 73. The lower end of the bolt is connected by a link 74 to one arm of an elbow-lever 75, which is pivoted at 76. The other arm of said lever is connected to a rod 45.

Referring to Figs. 4 and 5, it will be seen that the pump-piston 9 is an integral continuation of the piston-rod 13, the joint 14 being omitted. The rod 13 is provided with an arm 50, in the outer end of which is adjustably fitted a bracket 51, said arm and bracket being movable with the pump-rod. The forward end of bracket 51 carries a box 52, which has openings in line with the piston-rod 13 for the reception of a measuring-plunger 53. This plunger has a key 54, which slides in the slot 55 to prevent the plunger from rotating. Within the box 52 is an elongated pinion 56, which is internally threaded and mounted on a correspondingly-threaded portion of the plunger 53. The pinion 56 is operated by a sector-gear 57, which is rocked on a pivot or shaft 58 by means of an arm 59, to which is connected the link 44, previously mentioned.

Gasolene is delivered from a chamber 60 through ports 61 to a chamber between the piston 9 and the measuring-plunger 53 while the piston is in its rearmost position. The piston then moves forward, carrying with it the measuring-plunger and a charge of gasolene, which fills the space between them, depending upon the relative position of the measuring-plunger, and therefore upon the position of the sector 57. At the forward end of the stroke of the piston the charge of gasolene is delivered to the air-pipe 12, leading to the mixer through ports 62. By the mechanism just described each charge of gasolene is accurately measured, being greater or less, according to requirements, and being absolutely under the control of the motorman, who by shifting the rod 45 can admit more or less, as desired.

It will be obvious that various changes in details of construction and arrangement may be made in the apparatus herein described without departing from the spirit of my invention. Therefore, without limiting myself to the precise construction and arrangement shown and described,

I claim—

1. In a hydrocarbon-engine for motor-vehicles, the combination with a cylinder and mixing-chamber, of a pump discharging into the mixing-chamber and having a measuring-chamber for the fluid, a valve for controlling the admission of mixture to the cylinder, a stop for limiting the movement of the valve, and means, controllable at will, for simultaneously varying the capacity of the pump measuring-chamber and the position of said stop relative to its valve to vary the speed and power of the engine.

2. In a hydrocarbon-engine for motor-vehicles, the combination with a cylinder and mixing-chamber, of a pump discharging into the mixing-chamber, a valve controlling the admission of mixture to the cylinder, a stop mounted on and movable longitudinally of the stem of said valve to regulate the extent of movement thereof, and means, controllable at will, for simultaneously varying the volume of the charge of fluid delivered by the pump to the mixing-chamber and moving said stop longitudinally of the valve-stem, whereby the amount of fluid admitted to the mixing-chamber is properly proportioned to the amount of mixture admitted to the cylinder.

3. In a hydrocarbon-engine for motor-vehicles, the combination with a cylinder and a mixer, of a pump discharging into the mixer and having a longitudinally-extensible piston, a valve controlling the admission of mixture to the cylinder, a stop connected with the valve for limiting its opening movement, and means, controllable at will, for simultaneously varying the length of the pump-piston and adjusting said stop relatively to the valve, to vary the speed and power of the engine.

4. In a hydrocarbon-engine for motor-vehicles, the combination with a cylinder and a mixing-chamber, of a pump discharging into the mixing-chamber and having a piston comprising two members whose adjacent ends are threaded and connected by an interiorly-threaded sleeve, a pinion secured to one of the piston-sections, a valve for controlling the admission of mixture to the cylinder, a stop adjustably secured to the valve-stem for limiting the opening movement thereof, and gearing, controllable at will, adapted to simultaneously rotate the pinion on the pump-piston, to vary the length of said piston, and to move the stop longitudinally of said valve-stem, to vary the speed and power of the engine.

5. In a hydrocarbon-engine for motor-vehicles, the combination with a cylinder, of an inlet-valve therefor having a threaded valve-stem, an abutment adjacent the cylinder, and an internally-threaded stop fitted to and adjustable longitudinally of the valve-

stem and adapted to contact with said abutment to limit the opening of the valve, for the purpose set forth.

6. In a hydrocarbon-engine for motor-vehicles, the combination with a cylinder, of an inlet-valve having a threaded stem, an internally-threaded pinion on said stem, a gear engaging said pinion, a stop for said pinion, and means for adjusting the gear, for the purpose set forth.

7. In a hydrocarbon-engine for motor-vehicles, the combination with the mixer, the pump discharging into the mixer, the elongated pinion, and the sector-gear for regulating the discharge of the pump, of the cylinder, the inlet-valve for the cylinder, the elongated pinion and sector-gear for regulating the opening of the inlet-valve, the stop for said latter pinion, and the connection between said sector-gears whereby they are simultaneously operated, for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM A. HATCHER.

Witnesses:
J. W. PACKARD,
ROBT. E. GORTON.

No. 667,911. Patented Feb. 12, 1901.

W. A. HATCHER.

MOTOR VEHICLE.

(Application filed Jan. 16, 1900. Renewed Jan. 15, 1901.)

(No Model.) 5 Sheets—Sheet 1.

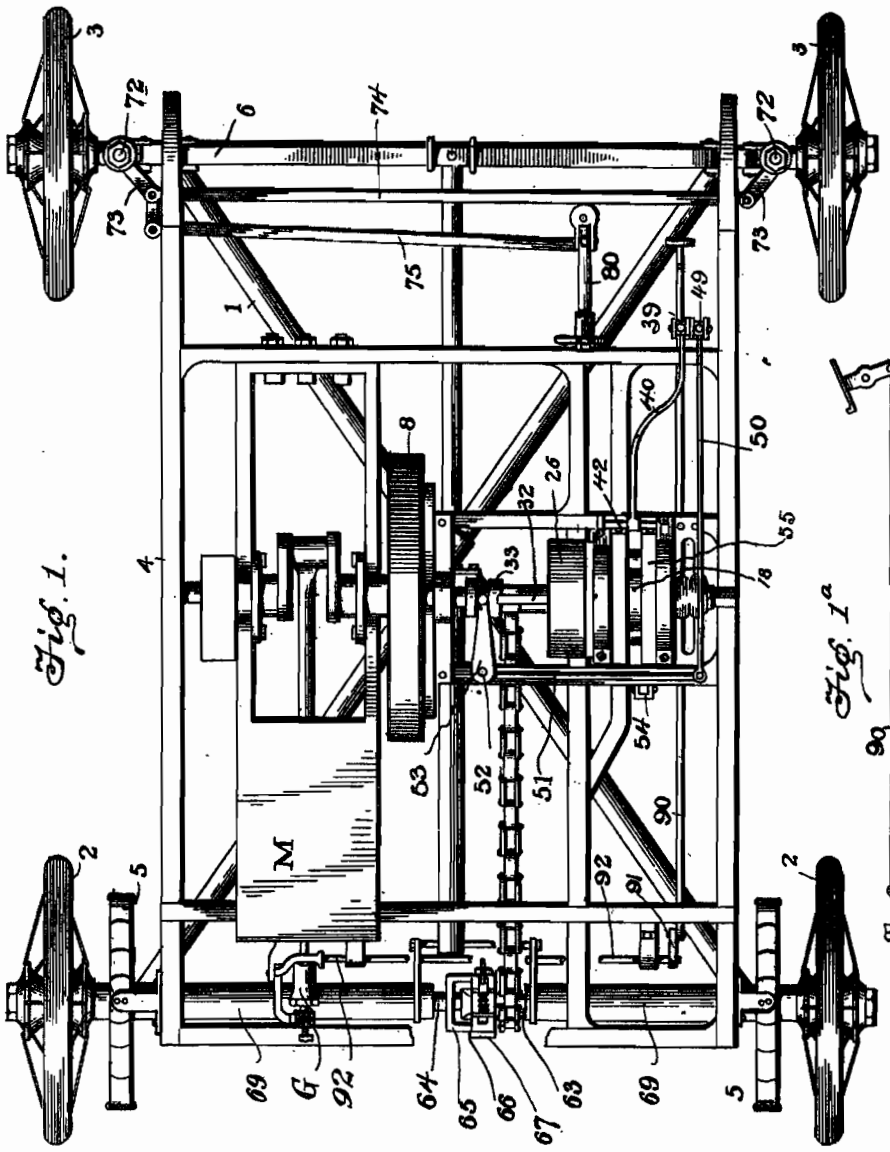

Fig. 1.

Fig. 1a.

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No. 667,911. Patented Feb. 12, 1901.

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MOTOR VEHICLE.

(Application filed Jan. 16, 1900. Renewed Jan. 15, 1901.)

(No Model.) 5 Sheets—Sheet 2.

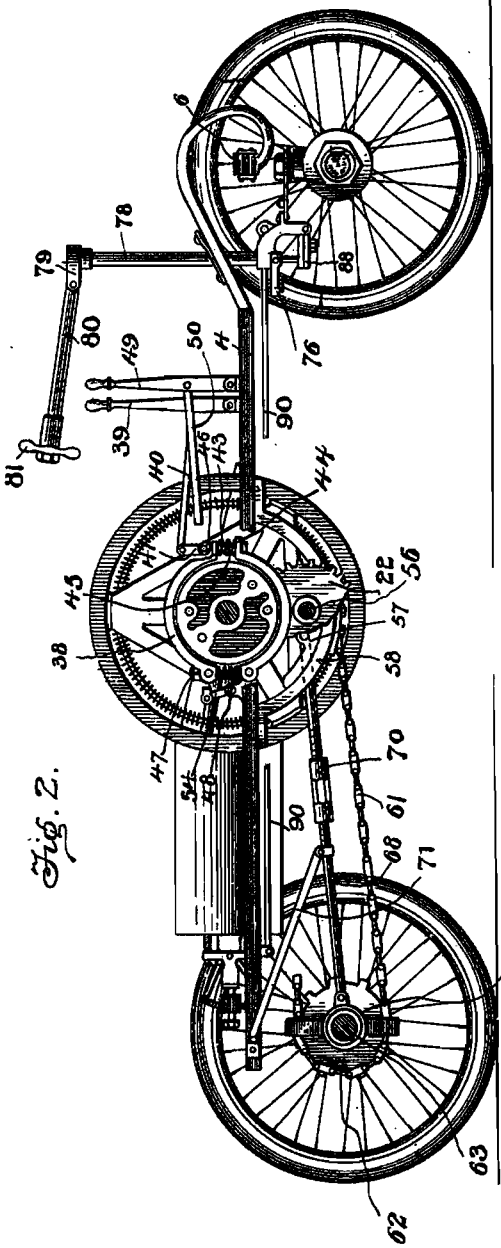

Fig. 2.

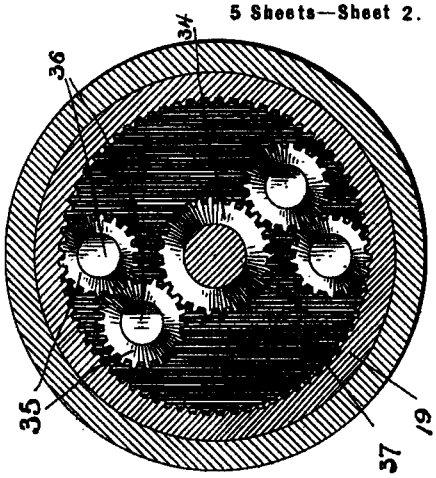

Fig. 12.

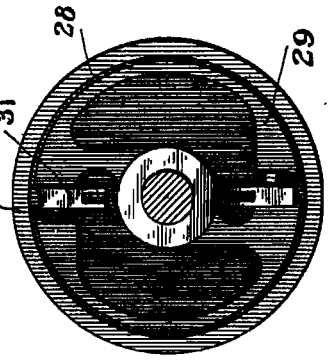

Fig. 13.

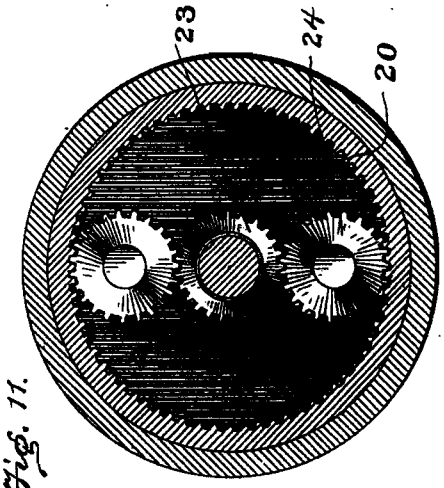

Fig. 11.

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No. 667,911. Patented Feb. 12, 1901.

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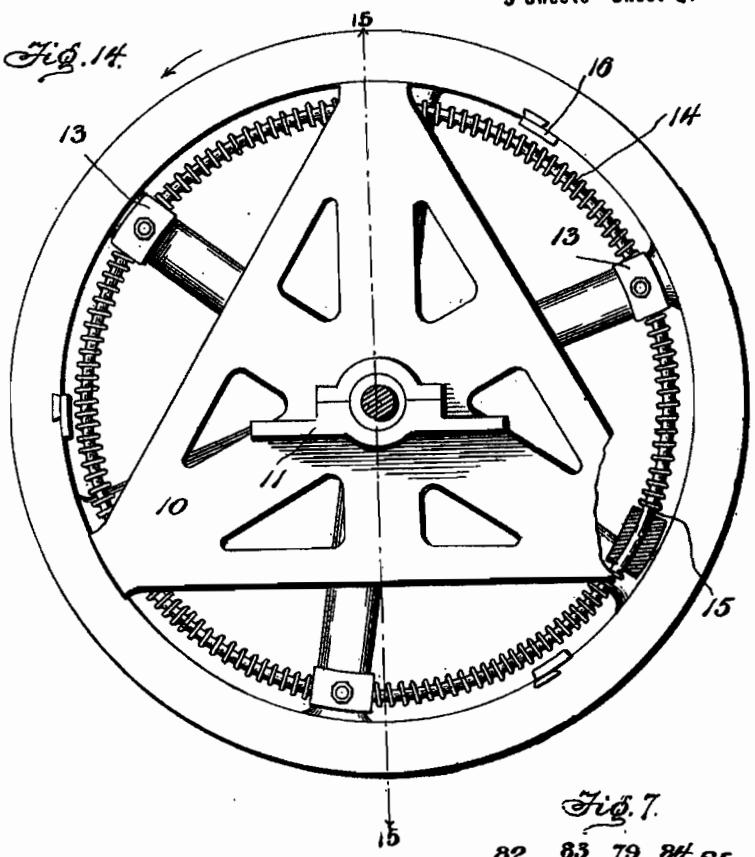
MOTOR VEHICLE.

(Application filed Jan. 16, 1900. Renewed Jan. 15, 1901.)

(No Model.) 5 Sheets—Sheet 3.

Fig. 14.



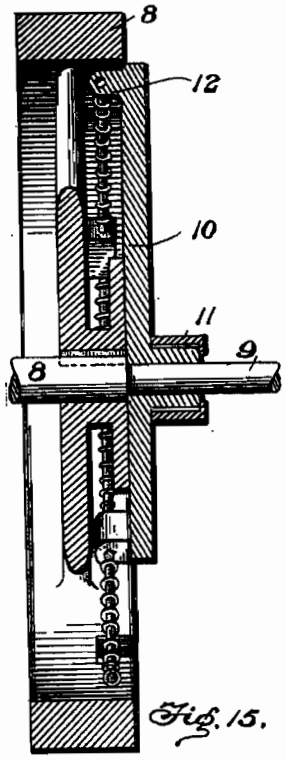


Fig. 15.

Fig. 7.

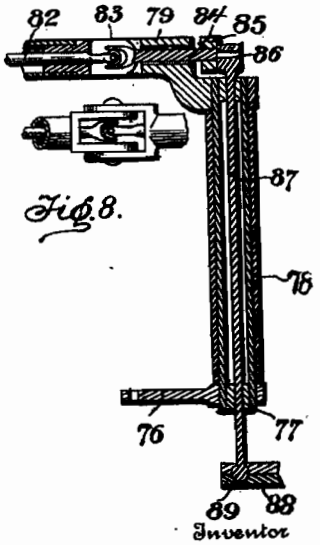


Fig. 5

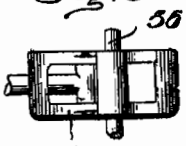


Fig. 6.

Fig. 3.

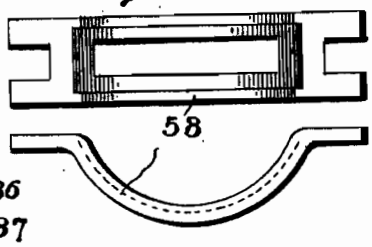


Fig. 4

Fig. 8.

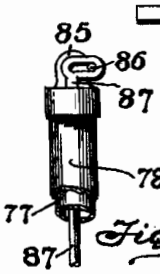
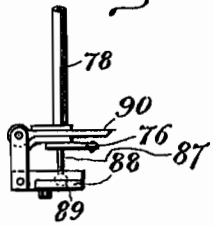


Fig. 9.

Fig. 7.a



Witnesses
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No. 667,911. Patented Feb. 12, 1901.

W. A. HATCHER.

MOTOR VEHICLE.

(Application filed Jan. 16, 1900. Renewed Jan. 15, 1901.)

(No Model.) 5 Sheets—Sheet 4.

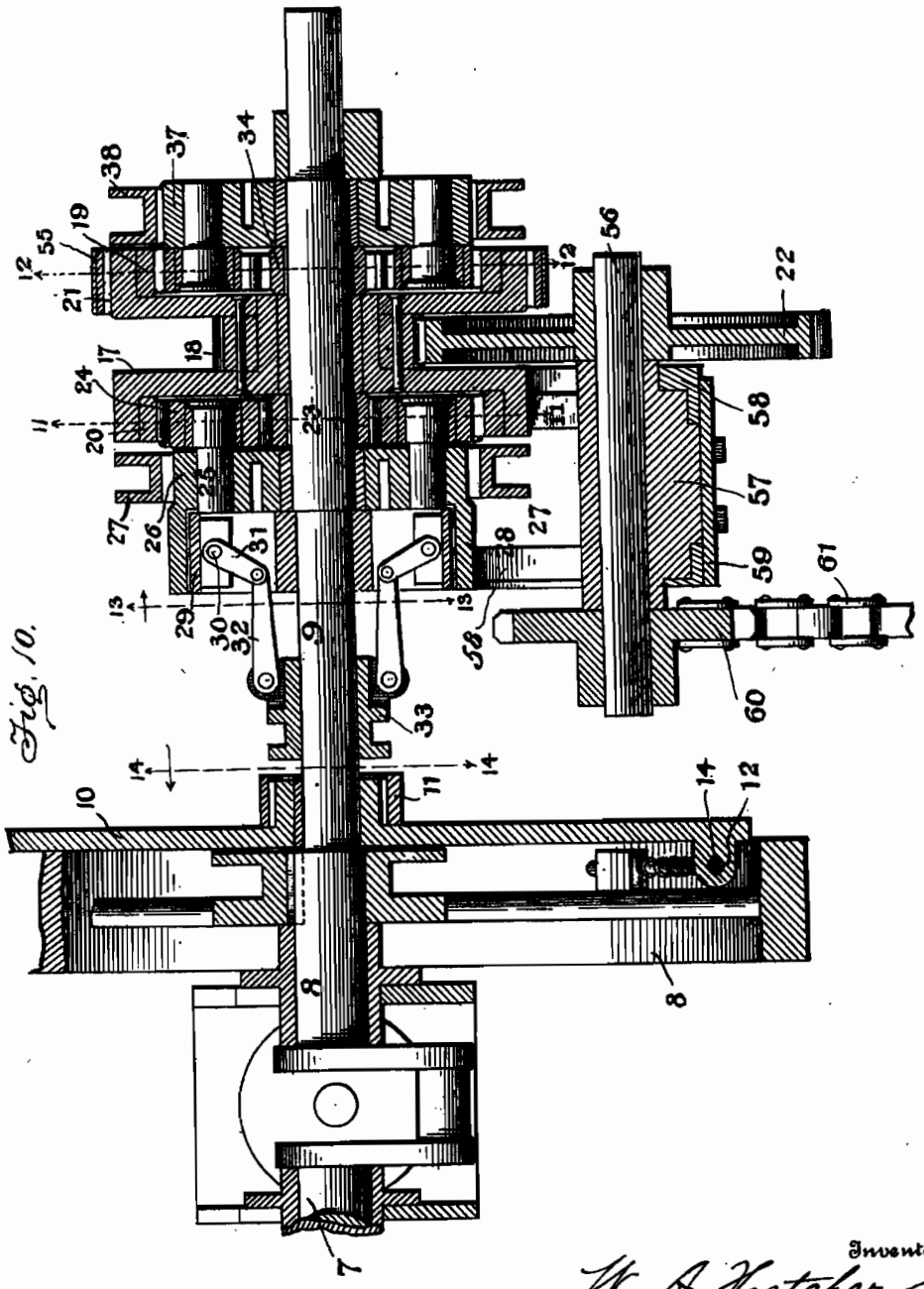

Fig. 10.

Witnesses
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No. 667,911. Patented Feb. 12, 1901.

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MOTOR VEHICLE.

(Application filed Jan. 16, 1900. Renewed Jan. 15, 1901.)

(No Model.) 5 Sheets—Sheet 5.

Fig. 16.

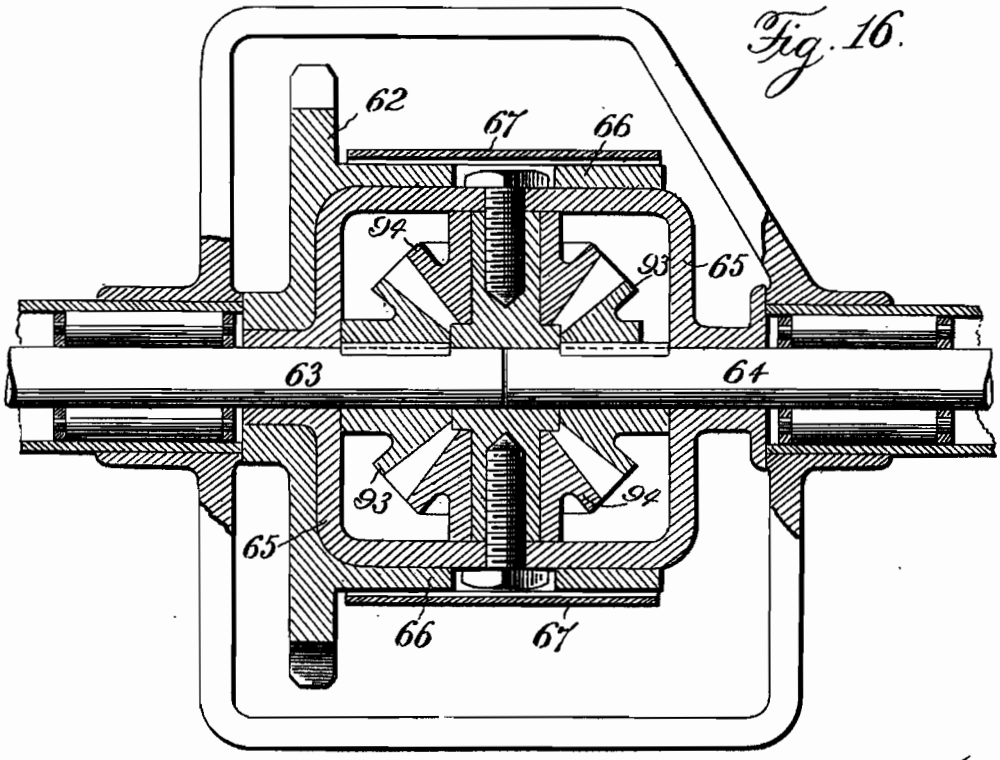

Fig. 17.

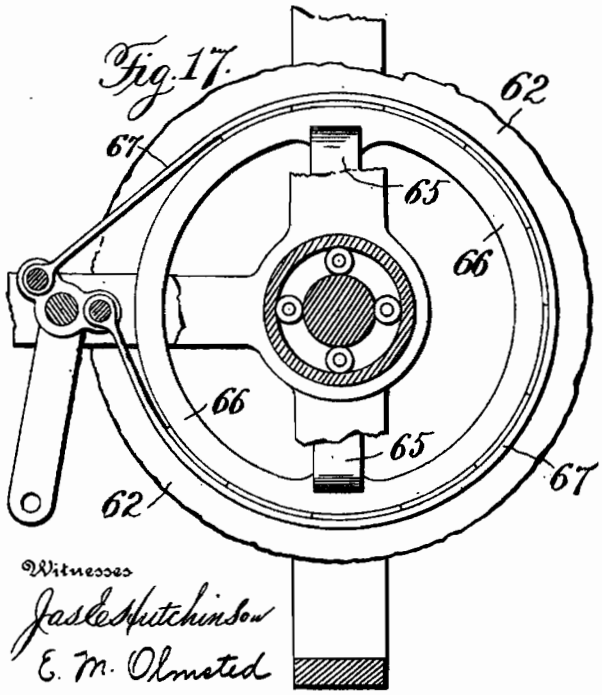

Fig. 18.

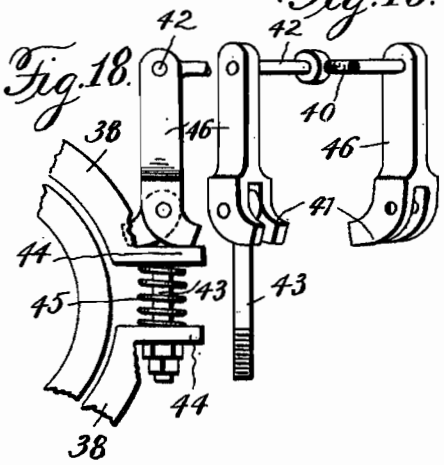

Fig. 19.

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UNITED STATES PATENT OFFICE.

WILLIAM A. HATCHER, OF WARREN, OHIO, ASSIGNOR TO JAMES W. PACKARD, OF SAME PLACE.

MOTOR-VEHICLE.

SPECIFICATION forming part of Letters Patent No. 667,911, dated February 12, 1901.

Application filed January 16, 1900. Renewed January 15, 1901. Serial No. 43,390. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM A. HATCHER, a citizen of the United States, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Motor-Vehicles, of which the following is a specification.

My invention comprises various improvements in motor-vehicles, and more particularly in the devices for changing speed, reversing, braking, and otherwise controlling the speed and movement of the vehicle.

The invention will be particularly described in connection with the accompanying drawings, in which—

Figure 1 is a plan view of so much of a motor-vehicle as is necessary to illustrate the present invention. Fig. 1ª is a detail of Fig. 1. Fig. 2 is a side elevation, partly in section. Figs. 3 to 9, inclusive, and Fig. 7ª illustrate various details. Fig. 10 is a section through the main shaft and counter-shafts, illustrating the details of the speed-changing mechanism. Figs. 11, 12, 13, and 14 are sections on the lines 11, 12, 13, and 14, respectively, of Fig. 10. Fig. 15 is a section on the line 15, Fig. 14. Fig. 16 is a sectional view of the rear sprocket and equalizing-gears. Fig. 17 is a side view of the brake wheel and band, and Figs. 18 and 19 are details of the reversing-gear.

Referring to the drawings, 1 indicates the frame of the running-gear; 2, the driving-wheels; 3, the steering-wheels, and 4 the frame carrying the motor mechanism, said frame being supported at the front and rear upon suitable springs 6 5.

The power-shaft 7 is driven by a suitable motor M, preferably a hydrocarbon-engine. Upon one end of the power-shaft is a fly-wheel 8, and in line with the power-shaft is a counter-shaft 9, the ends of said shafts being close together. Referring to Figs. 10, 14, and 15, 10 indicates a frame or spider which is fast upon counter-shaft 9. The shaft and frame are supported, as shown, by the bearing 11. The spider 10 has a series of lugs 12, which are integral with and in the same circle with lugs 13 upon the fly-wheel 8. Through the lugs 12 and 13 passes a circular rod 14, surrounded by spiral springs 15, which springs keep the lugs 12 centrally located between lugs 13. The arrangement of lugs and springs forms a yielding connection between the motor and the driving-wheels, which prevents strains in the machinery due to suddenly starting the motor or applying the brakes and also due to inequalities in the roadway. To prevent undue strain upon the springs 15, the fly-wheel is also provided with intermediate fixed lugs 16, against which the lugs 12 abut when there is an extreme strain upon the motor.

Turning freely on the counter-shaft 9 is a part 17, which is provided with a power-transmitting gear 18, two internal gears 19 and 20, and a braking-surface 21, all of which parts are either integral or securely fastened together. The driving-gear 18 intermeshes with a gear 22, from which power is transmitted to the driving-wheels through devices which will be hereinafter described.

A slow backward movement is imparted to the driving-gear by means of a gear 23, Figs. 10 and 11, which is keyed upon the shaft, and intermediate gears 24, which mesh with the gears 23 and 20. The gears 24 are carried upon the studs 25 upon disk 26, which is free to revolve upon the shaft 9. Surrounding the disk 26 are brake-shoes 27, which may be applied to stop the rotation of said disk, as will be hereinafter described. When the disk 26 is stopped, power is positively transmitted from the gear 23 through the gears 24 and 20 to the gears 18 and 22, giving the vehicle a backward movement.

Integral with the disk 26 is a flange 28, within which are shoes 29 of an expanding clutch, Fig. 13. As shown, the clutch-shoes 29 are expanded by means of screws 30, arms 31, links 32, sliding collar 33, and means for moving the collar, which will be referred to hereinafter. When the clutch-shoes 29 are rendered operative, the disk 26 and its pinions are carried around positively with the shaft 9 and the pinions 24 lock the gear 23 to the internal gear 20. The driving-gear 18 is thus rotated with the speed of the driving-shaft 7 and the counter-shaft 9, giving the vehicle a high speed forward.

A low speed forward is given to the vehicle by means of a gear 34, fixed on the shaft 9,

and two pairs of intermediate gears 35, Figs. 10 and 12, mounted on studs 36, which are carried by a disk 37, loose upon the shaft 9. The disk 37 may be held stationary by brake-shoes 38 and when so held the integral gear 19 and the driving-gear 18 will be slowly rotated forward, thus cutting down the speed and increasing pull upon the driving-wheels for the purpose of climbing hills and overcoming other resistances.

It will be noted that the speed changing and reversing devices just described are simple in construction and arranged in an exceedingly compact and effective manner. It will also be noticed that under normal conditions—that is, when the machine is running full speed ahead—the gearing between the shaft 9 and the driving-gear 18 is eliminated, the parts being all rigidly connected together and the friction and wear of machinery reduced to a minimum.

The brake shoes or bands 27 and 38 are operated by a hand-lever 39, connecting-rod 40, rod 42, connecting cam-levers 46, and cams 41 on said levers, Figs. 1, 2, 18, and 19. The cam-levers are pivoted to the upper ends of rods 43, which connect lugs 44 upon the shoes 27 and 38. The lugs 44 are pressed apart by springs 45, and thereby the shoes are normally held away from the disks. The brake-shoes are applied to the disks by means of the cams 41, which are oppositely disposed and arranged, so that when the lever 39 is moved forward the shoes 38 are applied and the slow forward movement is given to the vehicle, and when the lever 39 is moved backward the shoes 27 are applied and a slow backward movement is given. In the middle position of the lever the shoes 27 and 38 are free from their disks and the motor is disconnected from the vehicle unless the high-speed clutch is applied. The rear ends of the brake-shoes 27 and 38 are adjustably connected by bolts 47. (See Fig. 2.) They are normally held apart by springs 48 and they may be drawn together to take up wear by suitable nuts on the bolts 47.

The high-speed clutch is operated by a lever 49, link or rod 50, arm 51, rock-shaft 52, and arm 53, the latter arm engaging the clutch-collar 33. The forward movement of the lever 49 applies the clutch-shoes 29 and imparts a high forward speed to the vehicle. A rearward movement of the lever 49 operates through lever 51 and connecting-arm 54, Figs. 1 and 2, to apply a brake-band 55 to the brake-surface 21 of the gear-piece 17. This forms an efficient brake for the vehicle, the gear-piece 17 being connected with the driving-wheels, as will now be described. Below the counter-shaft 9 is a swing-shaft 56, carried by a bearing 57, which slides in semicircular guides 58, Figs. 2, 3, 4, and 10. Bearing-block 57 is suitably held in the guides 58 by a cap-plate 59. The semicircular guides 58 are attached rigidly to the frame which carries the shaft 9 and conform to the arc of a circle which is concentric with said shaft. The shaft 56 is therefore always at the same distance from the shaft 9, and gears 18 and 22 intermesh properly in any position of the bearing-block 57. On one end of the shaft 56 is a sprocket-wheel 60, from which power is communicated to the driving-wheels through chain 61 and sprocket-wheel 62. The rear axle is in two independent parts 63 64, one of the driving-wheels being connected to each part. The inner ends of the axle-sections are provided with bevel-gears 93, and a rotating box or frame 65 carries equalizing bevel-gears 94, which intermesh with the bevel-gears on the axle. The box 65 also carries the rear sprocket-wheel 62 and a braking-surface 66, with which a brake-band 67 coöperates, thus affording an additional means of stopping or retarding the carriage, Figs. 1 and 16.

For the purpose of maintaining a constant relation between the sprocket-wheels 60 and 62 the bearing-block 57 is connected with the rear axle by a brace 68. As shown, this brace is pivotally connected with one end of the block 57 and at the other end with the rear tube 69 of the frame, the axle 63 running in suitable bearings in said tube. The brace 68 is formed in two parts, having right and left threaded ends united by a turnbuckle 70, by means of which the tightness of the chain 61 can be adjusted. To prevent the upper frame 4, which carries the motor and counter-shaft from vibrating longitudinally with relation to the lower frame 1, which carries the axles, the brace 68 is connected with said upper frame by a link 71, Fig. 2. The point of connection of the link 71 with the brace 68 is so arranged that the upper frame 4 can have no longitudinal movement relatively to the lower frame, and the gear 18 is therefore prevented from "climbing" on the gear 22. The upper frame 4 is free to vibrate vertically on its supporting-springs.

The axles of the steering-wheels 3 turn about vertical shafts 72 in the usual manner, said axles being provided with arms 73, which are connected by a link 74. A second link 75 connects one of the arms with an arm 76, rigid upon a tubular shaft 77, arranged within a tubular standard 78 upon the front portion of the vehicle-body. To the upper end of the shaft 77 is rigidly connected an arm 79, to which the steering-lever 80 is joined by a hinge-joint, which permits it to move in a vertical plane.

To provide a convenient means of controlling the speed of the motor, I connect the governing devices G of the motor with a rotary knob or handle 81 on the end of the steering-lever 80. The connections comprise a shaft 82 within the lever 80, a universal joint 83 at the point where the lever 80 joins the arm 79, a rotating shaft 84 within the arm 79, a crank 85 and crank-pin 86 on the end of said shaft, a rod 87, reciprocating within the hollow shaft 77, and an elbow-lever 88, to which the rod 87 is connected by a ball-and-socket

joint 89. The elbow-lever 88 is connected by a link 90 to the arm 91 on a shaft 92, running across the rear end of the machine to the governing devices G. These governing devices comprise means for regulating the supply of explosive mixture to the engine. If another form of motor is used, they would of course be adapted to it. The particular governing devices are illustrated and described in detail in a separate application for Letters Patent filed by me of even date herewith, and it is thought that a detailed description of them is not necessary in this case.

In Figs. 1 and 1ª I have shown the rod 90 with connections to the governing devices as being operated by a foot-lever instead of by the handle 81. In some instances I may use the foot-lever in place of the handle.

It will be evident that various changes in construction and arrangement may be made without departing from the spirit and scope of my invention. Therefore I do not limit myself to the exact details illustrated and described.

What I claim is—

1. In a motor-vehicle, the combination with a motor and its shaft, of a counter-shaft in line with the motor-shaft, a frame secured to said counter-shaft, a balance-wheel mounted on the motor-shaft and having a circular flange surrounding the frame on the counter-shaft, curved rods connecting lugs on said balance-wheel with the frame on the counter-shaft, coiled springs surrounding said rods and each extending from said frame to one of said lugs, and stops secured to the balance-wheel flange and projecting radially into the path of the frame of the counter-shaft, whereby excessive compression of the springs is prevented.

2. In a motor-vehicle, the combination with the motor-shaft, the balance-wheel on said shaft, lugs on said wheel, curved rods connecting said lugs, spiral springs surrounding said rods, and fixed stops on said wheel intermediate said lugs, of a counter-shaft in line with the motor-shaft, a frame fixed on said counter-shaft, and lugs on said frame through which said curved rods pass and upon which said springs bear, said lugs being adapted to abut against the fixed stops when the springs are overloaded, for the purpose set forth.

3. In a motor-vehicle, the combination of a shaft, the gear-piece 17 loose on said shaft and provided with the driving-gear 18 and the internal gears 19, 20, gears 23 and 34 fixed on said shaft in the planes of the internal gears, and disks 26 and 37 loose on said shaft and arranged on opposite sides of the gear-piece, said disks carrying pinions adapted to connect the gears 23 and 34 with the internal gears, and means for stopping said disks, for the purpose set forth.

4. In a motor-vehicle, the combination of a shaft, a gear-piece loose on said shaft and provided with a drive-gear 18 and an internal gear 20, a gear 23 fixed on said shaft in the plane of the internal gear, a disk 26 adjacent to said internal gear and carrying pinions which intermesh with the internal gear and the gear 23, a brake for stopping said disk, and a clutch for locking said disk to the shaft, for the purpose set forth.

5. In a motor-vehicle, the combination with a shaft and a gear-piece loose on said shaft and provided with a drive-gear and an internal gear, of a gear 23 fixed on the shaft in the plane of the internal gear, a disk adjacent thereto and carrying pinions which intermesh with said gears, said disk being normally loose on the shaft, a brake for stopping said disk, a flange carried by said disk, an expanding clutch within the flange adapted to connect the flange rigidly with the shaft, and means for operating the clutch, for the purpose set forth.

6. In a motor-vehicle, the combination with a shaft, means for driving said shaft, a gear-piece 17 loose on the shaft and provided with a driving-gear, and with two transmitting-gears, 19, 20, arranged on opposite sides of the driving-gear, gears 23, 34 secured to the shaft in the planes of said transmitting-gears, disks loose on the shaft and carrying pinions adapted to connect the gears 23, 34 with said transmitting-gears of the gear-piece 17, and means for locking either of said disks against rotation.

7. In a motor-vehicle, the combination of a shaft, a gear-piece loose on said shaft and provided with a central driving-gear 18, and two transmitting-gears 19, 20, of greater diameter than the driving-gear and arranged on opposite sides thereof, gears 23, 34, fast on the shaft in the planes of said transmitting-gears, disks mounted loosely on the shaft on opposite sides of the gear-piece 17 and carrying pinions adapted to respectively connect the gears 23, 34 with the transmitting-gears 20, 19, and independent means for preventing rotation of either of said disks.

8. In a motor-vehicle, the combination with the supporting-frame, the power-shaft, the direct driving-gear and reverse-gear, and the drive-gear mounted on said shaft, of a guide stationarily secured to the frame and extending concentric with said shaft, a swing-shaft having its bearing mounted to slide on said guide, a gear on said shaft meshing with the drive-gear, and a sprocket-wheel on said shaft, for the purpose set forth.

9. In a motor-vehicle, the combination with the shaft, the drive-gear mounted on said shaft, and the curved guides concentric with said shaft, of a bearing mounted to slide on said guides, a shaft in said bearing provided with a gear which is in mesh with the drive-gear, a sprocket-wheel on said latter shaft, a sprocket-wheel on the rear axle, a chain connecting said sprocket-wheels, and an adjustable rod extending between said bearing and the rear axle whereby the tightness of the

chain and the relative positions of said rear axle and said bearing may be adjusted.

10. In a motor-vehicle, the combination with the running-gear frame, the springs upon said frame, and the motor-frame supported on said springs, of the brace 68 and the link 71 connecting said frames whereby relative lateral movement is prevented without preventing relative vertical movement between the frames.

11. In a motor-vehicle, the combination of the rear axle, and a sprocket-wheel thereon, of a motor-frame supported upon said axle by intermediate springs, a sprocket-wheel supported by the motor-frame, a brace between the rear axle and the last-named sprocket-wheel, and a link connecting said brace with said motor-frame, for the purpose set forth.

12. In a motor-vehicle, the combination with direct and reverse gearing, of clamps for bringing said gearing into action, cams operating the clamps of the direct and reverse gearing alternately, an operating-lever, and a connection between said lever and said cams.

13. In a motor-vehicle, the combination of a shaft, a gear-piece loose on said shaft and provided with a driving-gear and an internal transmitting-gear, a gear fixed on the shaft in the plane of said internal gear, a disk loosely mounted on the shaft adjacent to said internal gear and carrying pinions which intermesh with the internal gear and the fixed gear, a brake-band surrounding said disk and having its ends projecting radially therefrom, a bolt connecting the ends of the brake-band, a spring surrounding said bolt and acting to normally hold the ends of the brake-band apart, a cam, and an operating-lever arranged to move said cam against one end of the brake-band to force said band upon the disk and prevent rotation thereof.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM A. HATCHER.

Witnesses:
J. W. PACKARD,
ROBT. E. GORTON.

auto spark control

No. 667,792. Patented Feb. 12, 1901.

J. W. PACKARD.

IGNITING DEVICE FOR HYDROCARBON ENGINES.

(Application filed Mar. 10, 1900.)

(No Model.)

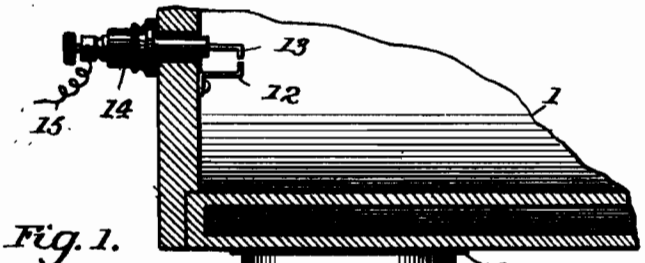
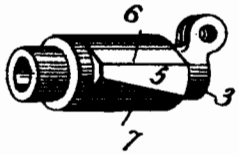


Fig. 3.

Fig. 1.



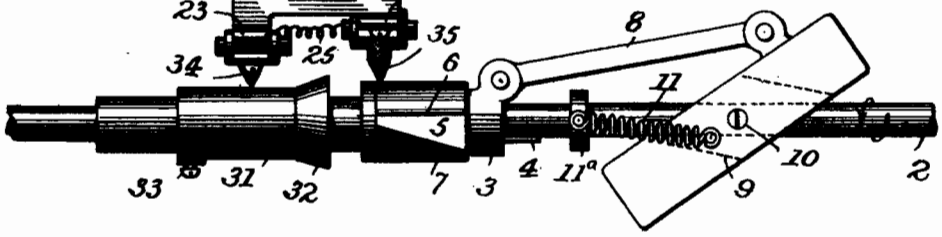


Fig. 2.

Fig. 5

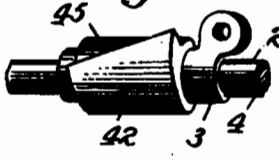
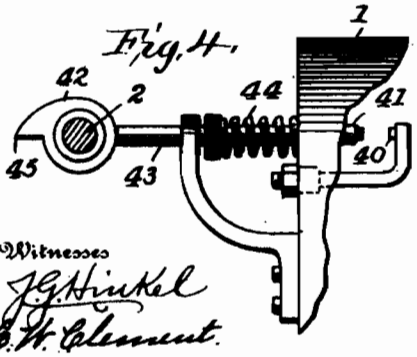


Fig. 4.



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Inventor
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By Watson & Watson
Attorneys

auto spark advance

UNITED STATES PATENT OFFICE.

JAMES W. PACKARD, OF WARREN, OHIO.

N.9.

IGNITING DEVICE FOR HYDROCARBON-ENGINES.

SPECIFICATION forming part of Letters Patent No. 667,792, dated February 12, 1901.

Application filed March 10, 1900. Serial No. 8,182. (No model.)

To all whom it may concern:

Be it known that I, JAMES W. PACKARD, a citizen of the United States, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Igniting Devices for Hydrocarbon-Engines, of which the following is a specification.

The present invention has for its objects, first, to provide an electric igniter which will produce a spark of substantially constant duration regardless of the speed of the engine; secondly, to provide automatic means for controlling the time at which the spark-circuit is closed with reference to the time at which the crank passes the dead-center, the circuit being closed more and more in advance of the dead-center as the engine increases its speed, and, thirdly, to provide an automatic cut-out for the igniter-circuit which may be set to break the circuit at any given speed of the engine, thereby constituting a governor to limit the engine to any desired speed.

In carrying out my invention I preferably use a cam arranged to rotate with and slide upon a shaft which is driven from the crank-shaft of the engine, and a speed-governor connected with said shaft and arranged to slide the cam thereon. The cam operates upon a contact device which is arranged to make or break the circuit according to the nature of the igniter. Another device, which is also under control of the governor, is adjustable and adapted to be set to break the igniter-circuit when the speed of the engine reaches the number of revolutions per minute which is desired as a maximum.

While the present invention is adapted for the control of any variable-speed hydrocarbon-engine, it is particularly valuable in connection with motors used for motor-vehicles. I am enabled by its use to maintain the speed of the engine, and therefore of the vehicle, automatically at any desired rate. I have found that an instantaneous spark sometimes fails to ignite the explosive charge in the cylinder and that the spark provided by the governing devices, hereinafter described, which is of substantially constant duration regardless of the speed of the engine, will ignite every explosive charge with certainty.

In the accompanying drawings, Figure 1 is a plan view, and Fig. 2 an end elevation, illustrating the preferred form of my invention, the parts being shown in connection with a fragment of a hydrocarbon-engine. Fig. 3 is a perspective view of the cam. Fig. 4 is a view illustrating a modification. Fig. 5 is a perspective view of the cam shown in Fig. 4.

Referring to Figs. 1 and 2, 1 indicates the cylinder of a hydrocarbon-engine, and 2 a shaft arranged parallel with the cylinder. The shaft 2 is connected with the crank-shaft of the engine in some suitable manner, so as to rotate in fixed relation therewith. Upon the shaft 2 is a sleeve 3, which is free to slide longitudinally on the shaft, but compelled to turn therewith by means of a groove in the sleeve coöperating with a feather 4 upon the shaft or other equivalent device. The sleeve 3 has fixed thereon a cam 5, the operative face of which is tapered, said cam having, preferably, a rear edge 6, which is parallel with the shaft, and an inclined edge 7 for a purpose to be hereinafter explained. The sleeve 3 is connected by a link 8 with a governor 9, which consists of a block centrally pivoted at 10 to the shaft 2. The governor-block is normally held inclined to the shaft by a spring 11, which connects it with a collar 11^a. As the speed of the shaft increases, however, centrifugal force acting upon the governor causes it to move toward a position at right angles to the shaft. The cam 5 is therefore made to slide back and forth on the shaft as the speed of the engine increases and diminishes.

In Fig. 1 I have shown a "jump-spark" igniter, consisting of a terminal 12, connected to the cylinder-head, and a terminal 13, separated from terminal 12 and mounted in an insulating-plug 14. The terminal 13 is connected to one branch 15 of the secondary circuit of an induction-coil 16. The other branch 17 of said secondary circuit connects the induction-coil with the engine at 18, thus completing the circuit, with the exception of a gap between the terminals 12 and 13.

One branch 19 of the primary circuit of the induction-coil is for convenience connected to a bracket 24, hereinafter mentioned, and the other branch 20 is connected to a stationary contact-point 21. A second contact-point 22, carried by a spring-arm 23, normally abuts against the contact 21. The arm 23 is

carried by but insulated from the bracket 24. From spring-arm 23 the circuit passes through a conductor 25 to a spring-arm 26, which is also carried by but insulated from the bracket 24. The spring-arm 26 carries a contact-point 27, which is normally separated from a fixed contact 28, carried by the bracket 24. The contact 28 is preferably provided with an adjusting-screw 29. The bracket 24, as shown, is insulated from the engine by suitable insulating material 30. In the circuit 19 I have shown a switch 19^a and a battery 19^b.

Upon the sleeve 3 is a collar 31, having a tapered surface 32, and means, such as the set-screw 33, for fastening it in any desired adjustment upon the sleeve. The tapered surface 32 coöperates with an antifriction-roller 34, carried by but insulated from a spring-arm 23. It will be evident that when the tapered surface 32 engages the roller 34 the circuit will be broken at the points 21 22 and the igniter thrown out of action. By suitably adjusting the collar 31 upon the sleeve 3 the circuit may be broken at any predetermined speed of the engine. Thus, for instance, the collar 31 may be adjusted to break the igniter-circuit when the engine reaches one hundred or two hundred or any other desired number of revolutions per minute.

The spring-arm 26 carries an antifriction-roller 35, which coöperates with the cam 5. This cam rotates with the shaft in the direction of the arrow, Fig. 1, and the inclined edge 7 of the cam comes first into contact with the roll 35. When the engine is running slowly, the roll 35 will contact with the cam approximately at the time when the crank is on the dead-center, this being the time at which the spark or ignition should take place. The face of the cam 5 is sufficiently broad at its narrow end to give the spark necessary duration for efficient ignition at slow speed. The cam moves back the spring-arm 26, bringing the points 27 28 into contact, and thus completing the primary circuit. In the form of the invention shown in Figs. 1 and 2 the coil is provided with a vibrator (not shown) in the usual manner, and the secondary circuit produces a spark between the terminals 12 13 during the time the circuit is closed at the points 27 28.

An important feature of the invention is that the duration of the spark is substantially the same for all speeds. If the cam-surface 5 were a parallelogram, the duration of the spark would decrease as the speed increased; but by making said cam-surface tapered, as shown in Figs. 1 and 3, the circuit is closed during a greater angular part of each revolution of the shaft 2 when the engine is running fast than when it is running slow—that is, if the face of cam 5 is one-eighth of an inch at the point traversed by the roll 35 when the engine is making one hundred revolutions per minute it should be two-eighths at the point traversed when the engine is running two hundred revolutions, three-eighths for three hundred revolutions, &c. The inclined forward edge 7 of the cam closes the circuit earlier in the course of each revolution of the shaft as the speed increases, and the spark is thereby advanced with reference to the dead-center. Thus by one and the same cam I provide for advancing the spark with reference to the dead-center as the engine increases its speed and for producing a spark of the same duration at all speeds. The cam 5 is also arranged to limit the speed of the engine and prevent it from racing. This is effected by limiting the length of the cam so that after the engine reaches a certain speed the cam will pass beyond the roll 35, and thereafter the circuit will not be closed at the points 27 28 until the speed is reduced.

The igniting device, consisting of the governor, the cam 5, and other coöperating parts, may be used without the speed-governing device 32, the cam 5 being relied upon to prevent the engine from running away. The speed-governing device, however, will be found very valuable for various purposes, especially for automobiles, in which it is often desirable—for instance, in crowded cities or with inexperienced operators—to limit the speed of the motor.

In Figs. 4 and 5 I have shown a modification in which a standard single circuit-sparking device is used in place of the induction-coil. In this instance the spark takes place as the circuit is broken. The circuit has a fixed terminal 40 within the cylinder, and a movable terminal 41, which is forced into contact with the fixed terminal once during each cycle of the engine by a cam 42, the plunger 43, carrying the terminal 41, being pressed into contact with the cam by a spring 44. The edge 45 at the highest point of the cam is spirally arranged with reference to the shaft 2 and so located that the spark will take place earlier in each revolution as the speed of the engine increases. This cam is intended to be controlled by a governing device exactly as the cam 5 in Fig. 1 is controlled.

It will be evident that my invention is susceptible of embodiment in various forms of mechanism and that various changes in construction and arrangment may be made without departing from its spirit and scope. For instance, instead of sliding the cam upon the shaft the cam may be fixed thereon and the governor connected to the roll or other part which coöperates with the cam. The governor is preferably of the form shown; but it will be evident that any other form of governor may be substituted which is sensitive to changes in speed. I do not, therefore, limit myself to the precise construction and arrangement of parts illustrated and described.

What I claim, and desire to secure by Letters Patent, is—

1. An igniting device for hydrocarbon-en-

gines comprising, in combination, a sparking-circuit, a circuit-closer, a governor, and means, controlled by the governor, for causing the circuit-closer to produce a spark of constant duration at different speeds of the engine, for the purpose set forth.

2. An igniting device for hydrocarbon-engines comprising, in combination, a sparking-circuit, a circuit-closer, a rotating shaft, a cam arranged to rotate with and slide on said shaft, said cam having an operative face constructed to control the circuit-closer so as to produce a spark of constant duration as the speed of the engine varies, a governor driven by the engine, and connections between said governor and said cam whereby the cam is moved longitudinally of the shaft as the speed increases or decreases, for the purpose set forth.

3. An igniting device for hydrocarbon-engines comprising, in combination, a sparking-circuit, a circuit-closer, a cam governing the circuit-closer having a tapered operative face, and means for bringing different parts of said face into operation to effect and control the duration of the spark, for the purpose set forth.

4. An igniting device for hydrocarbon-engines comprising, in combination, a sparking-circuit, a circuit-closer, a cam governing the circuit-closer having a tapered operative face to control the duration of the spark, and a governor arranged to bring different parts of said face into operation as the speed varies, for the purpose set forth.

5. An igniting device for hydrocarbon-engines comprising, in combination, a sparking-circuit, a rotating cam having a tapering operative face, the initial edge of which is inclined to the axis of rotation, a circuit-closing device operated by said cam, a governor, and connections between the governor and the cam whereby the latter is moved relatively to the circuit-closing device as the speed of the engine increases or decreases.

6. An igniting device for hydrocarbon-engines comprising, in combination, a sparking-circuit, a circuit-closer therefor, a rotating shaft, a cam arranged to slide on and turn with said shaft, and a centrifugal governor operated by said shaft and connected to said cam, said cam having a tapering operative face, said governor being arranged to bring the wider portion of said face into operation as the speed increases and the narrower portion as the speed decreases, for the purpose set forth.

7. An igniting device for hydrocarbon-engines comprising, in combination, a sparking-circuit, a rotating cam having a tapering operative face, a circuit-closer operated by said cam, and a governor arranged to move the cam relatively to the circuit-closer, said cam being so related to the circuit-closer and governor that it will become inoperative when the engine exceeds its maximum allowable speed, for the purpose set forth.

8. A combined igniting device and speed-governor comprising, in combination, a sparking-circuit, a normally closed switch or contact therein, a rotating shaft, a centrifugal governor driven by said shaft, a collar sliding on said shaft and provided with a tapering surface, and connections between said governor and said collar whereby said surface is made to open said switch or contact when the engine reaches a predetermined speed, for the purpose set forth.

9. A combined igniting device and speed-governor comprising, in combination, a sparking-circuit, a normally closed contact therein, a normally open contact, a rotating shaft and governor, a sleeve arranged to slide on and turn with said shaft, a connection between the governor and the sleeve, a cam on said sleeve arranged to periodically close said circuit, and a device adjustably mounted on said sleeve and adapted to break said circuit when the engine reaches a speed predetermined by the adjustment of said device, for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES W. PACKARD.

Witnesses:
ROBT. E. GERTON,
M. S. ANDREWS.

No. 722,431. PATENTED MAR. 10, 1903.

J. W. PACKARD.

HYDROCARBON MOTOR.

APPLICATION FILED MAY 8, 1900.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

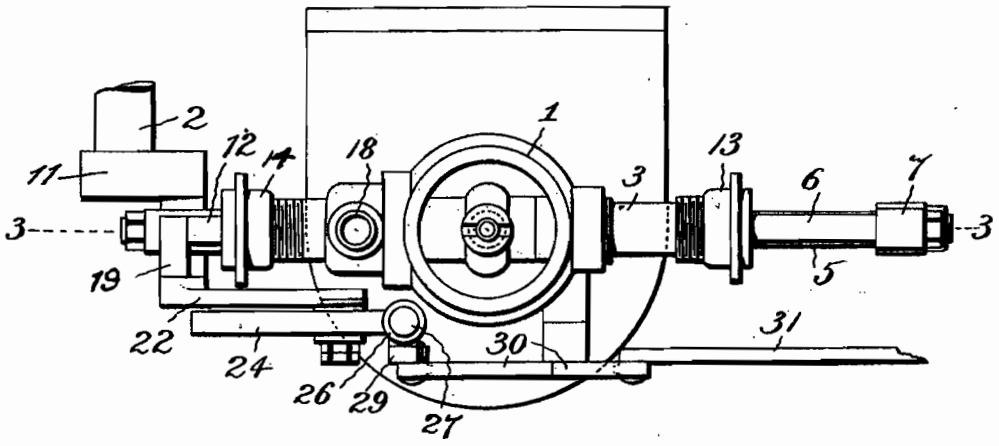
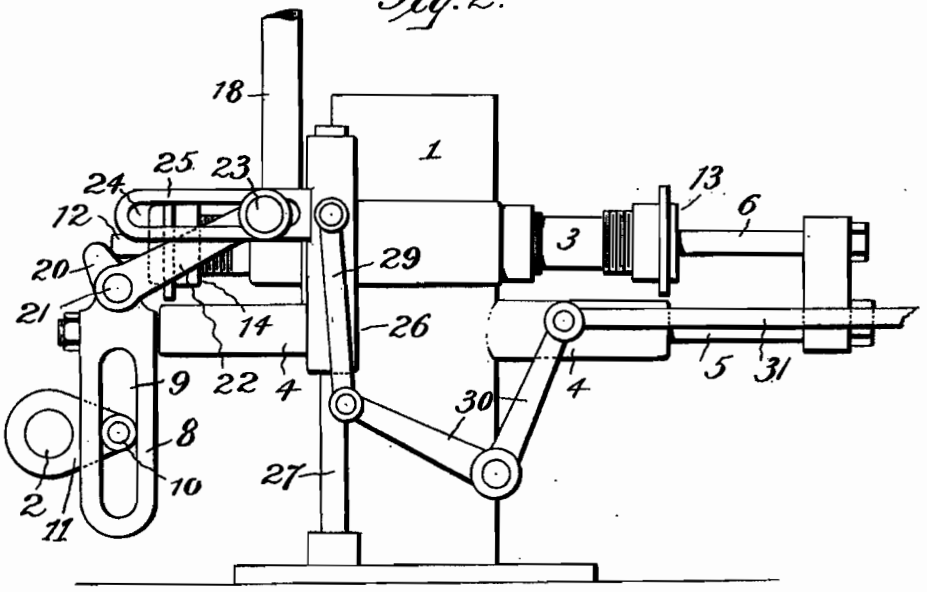


Fig. 2.



Witnesses:
Jas. E. Hutchinson
Arthur L. Bryant

Inventor.
J. W. Packard
By Watson & Watson
Attorneys

No. 722,431. PATENTED MAR. 10, 1903.

J. W. PACKARD.

HYDROCARBON MOTOR.

APPLICATION FILED MAY 8, 1900.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

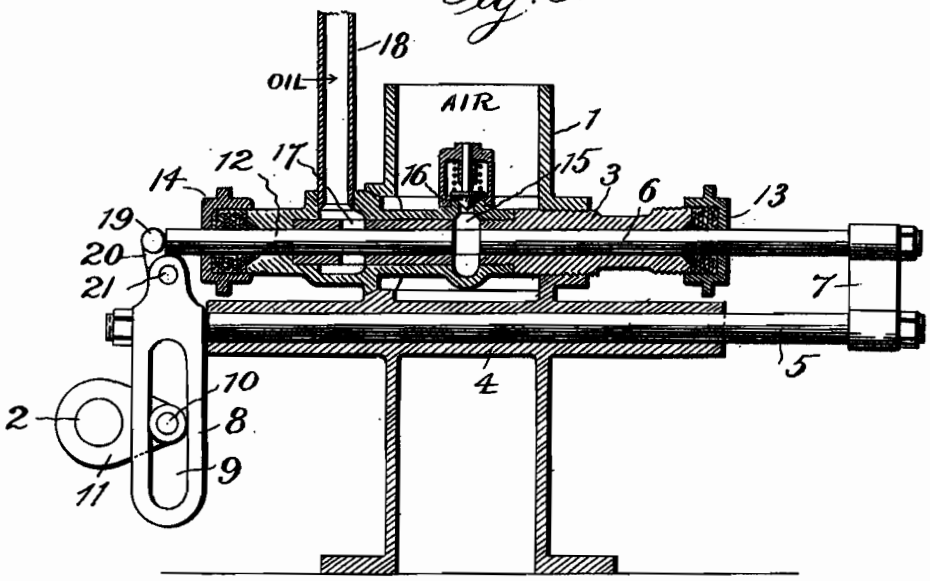


Fig. 4.

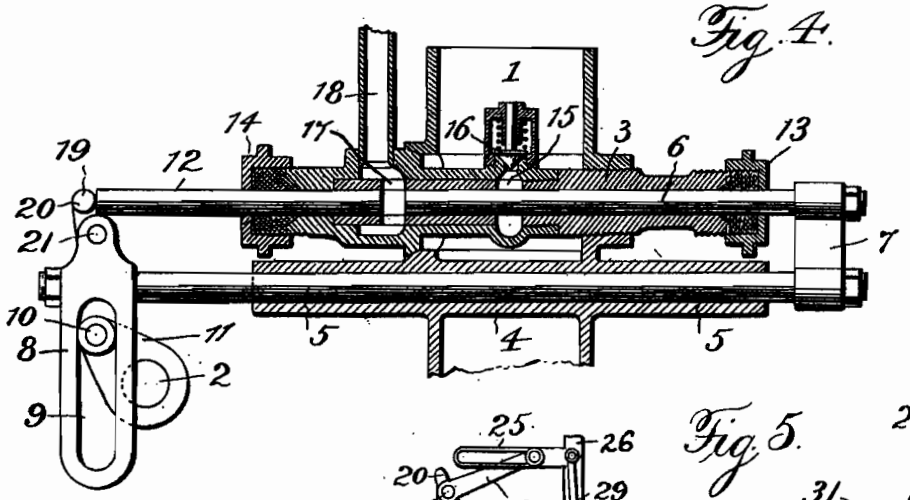
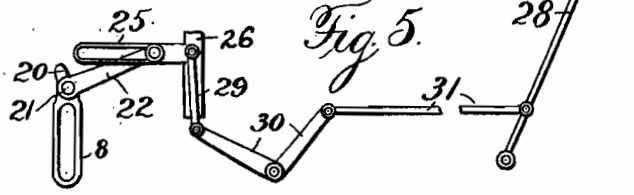


Fig. 5.



Witnesses:
Jas. E. Hutchinson
Arthur L. Bryant

Inventor.
J. W. Packard
By Watson & Watson
Attorneys.

UNITED STATES PATENT OFFICE.

JAMES W. PACKARD, OF WARREN, OHIO, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

HYDROCARBON-MOTOR.

SPECIFICATION forming part of Letters Patent No. 722,431, dated March 10, 1903.

Application filed May 8, 1900. Serial No. 15,878. (No model.)

To all whom it may concern:

Be it known that I, JAMES W. PACKARD, a citizen of the United States, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Hydrocarbon-Motors, of which the following is a specification.

The object of the present invention is to provide a feeding device for hydrocarbon-engines adapted to transfer a definite charge of hydrocarbon to the mixer for each explosion and to provide means for varying the charge according to the work required to be done.

The present improvement is designed especially for use in hydrocarbon-engines for motor-vehicles, and the device is adapted to be controlled by a lever conveniently situated near the seat of the operator of the vehicle.

The details of the invention will now be described, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view of the mixer and hydrocarbon-feeding devices. Fig. 2 is a side view of the same. Figs. 3 and 4 are central sectional views on the line 3 3 of Fig. 1, illustrating the parts in different positions; and Fig. 5 shows the connections between the regulating device and its operating-lever.

Referring to the drawings, 1 indicates the mixer-tube, through which air and oil pass to the cylinder of the engine, and 2 is a shaft driven constantly from the crank-shaft of the engine. Transversely arranged in the air-tube 1 is a pump-barrel 3, and below said pump-barrel is a second transverse tube 4. A connecting-rod 5 reciprocates in the tube 4, and the pump-piston 6 is reciprocated in the barrel 3 by means of a head 7, which connects it with the rod 5. The rod 5 is reciprocated by means of an arm 8, having a slot 9, in which works a crank-pin 10, carried by a crank 11 on the shaft 2. In line with the piston-rod 6 is a plunger 12 of the same diameter. The piston-rod passes through a stuffing-box 13 at one end of the barrel 3, and the plunger 12 passes through a stuffing-box 14 at the other end thereof. At the middle of the barrel is a lateral opening 15, normally closed by a spring-valve 16. The end of the piston-rod moves from a position to the right of the opening 15, as shown in Fig. 3, to a position at the left of a second transverse opening 17, which communicates with an oil-supply pipe 18.

The operation of the feed-pump is as follows: Assuming that the piston and plunger are in the positions shown in Fig. 4, the space between them will be immediately filled by gasolene or other fluid fuel from the supply-pipe 18. The turning of the shaft 2 now carries the piston to the right, and an adjustable abutment 19 upon the arm 8 carries the plunger to the right also, preserving the same distance between the adjacent ends of the plunger and piston until the piston has reached the end of its stroke and the open space between said plunger and piston registers with the opening 15. The piston now starts on its return stroke, and the plunger is held stationary by friction, the material in the stuffing-box being clamped tightly about it for this purpose. During the first part of the return stroke of the piston the oil between the piston and plunger is forcibly ejected and an equal amount of oil passes from the space 15 through the valve 16 into the air-chamber. The piston then moves the plunger over until it again reaches the position shown in Fig. 2. The piston then starts back, and the plunger remains stationary for a few moments, during which time the oil is positively drawn into the space between the piston and plunger. The abutment 19 then engages the plunger, and the piston and plunger move again to register with the space 15 and valve 16. In this manner a positive feed for the gasolene or other fluid is effected.

It is necessary to vary the charges of hydrocarbon according to the work to be performed by a motor-vehicle. Thus in running upon a level small charges will be sufficient, while in climbing a hill very much more hydrocarbon will be necessary. The charges are varied as follows: The abutment 19 is in the form of a crank-pin carried by a crank or arm 20 on a rock-shaft 21. A second arm 22 on said shaft is provided with a pin 23, which extends through a slot 24 in a horizontal arm

25, carried by a vertical slide 26, said slide being in the form of a cylinder, through which passes a stationary vertical post 27.

The slot 24 is equal to or somewhat greater in length than the stroke of the pump-piston, and when the slotted arm is stationary the abutment 19 will bear the same relation to the slotted arm 8 throughout the stroke of the pump. By rocking the arm 20 the distance between the abutment 19 and the end of the piston 6 may be varied and the opening between the piston and plunger likewise varied. Therefore by adjusting the slide 26 the chamber between the piston and the plunger may be adjusted or varied to carry different quantities of hydrocarbon. The hydrocarbon, however, in all instances is positively drawn into said chamber and positively ejected therefrom.

The slide 26 may be operated in any suitable manner from the front of the vehicle. As shown, it is connected with a hand-lever 28 by means of a link 29, elbow-lever 30, and link 31.

It will be evident that numerous changes in the details of construction and arrangement of parts may be made without departing from the spirit and scope of my invention.

What I claim, and desire to secure by Letters Patent, is—

1. In an engine of the class described, in combination, the pump-barrel having lateral inlet and discharge openings, a piston reciprocating in said barrel, a plunger in said barrel arranged to be moved in one direction by the piston, an adjustable abutment arranged to move said plunger in the opposite direction, connections between said piston and said abutment whereby they are moved simultaneously, an operating-lever, and connections between said lever and said abutment whereby the abutment may be adjusted relatively to the piston while the engine is running.

2. In an engine of the class described, in combination, an air-inlet pipe, a barrel arranged transversely therein, an oil-outlet, a valve therefor arranged within the air-pipe, an oil-inlet to the barrel arranged outside of the air-pipe, a piston and plunger reciprocating in said barrel, said plunger having a small amount of lost motion, means for reciprocating the piston, an adjustable abutment reciprocating with the piston and operating on the plunger, and means for adjusting the abutment when the engine is running.

3. In an engine of the class described, in combination, the barrel having inlet and discharge openings, the piston and plunger operating in said barrel, the rod 5 connected with the piston, the abutment adjustably mounted on said rod and coöperating with the plunger, the arm connected with said abutment and provided with a pin, the horizontal slotted arm in which said pin travels, the hand-lever, and connections whereby said slotted arm is adjusted vertically by said hand-lever to vary the position of said abutment relatively to the piston.

In testimony whereof I affix my signature in presence of two witnesses.

JAS. W. PACKARD.

Witnesses:
ROBT. E. GORTON,
M. S. ANDREWS.

No. 667,910. Patented Feb. 12, 1901.

W. A. HATCHER & J. W. PACKARD.

MIXER AND VAPORIZER FOR EXPLOSIVE ENGINES.

(Application filed June 26, 1900.)

(No Model.) 3 Sheets—Sheet 1.

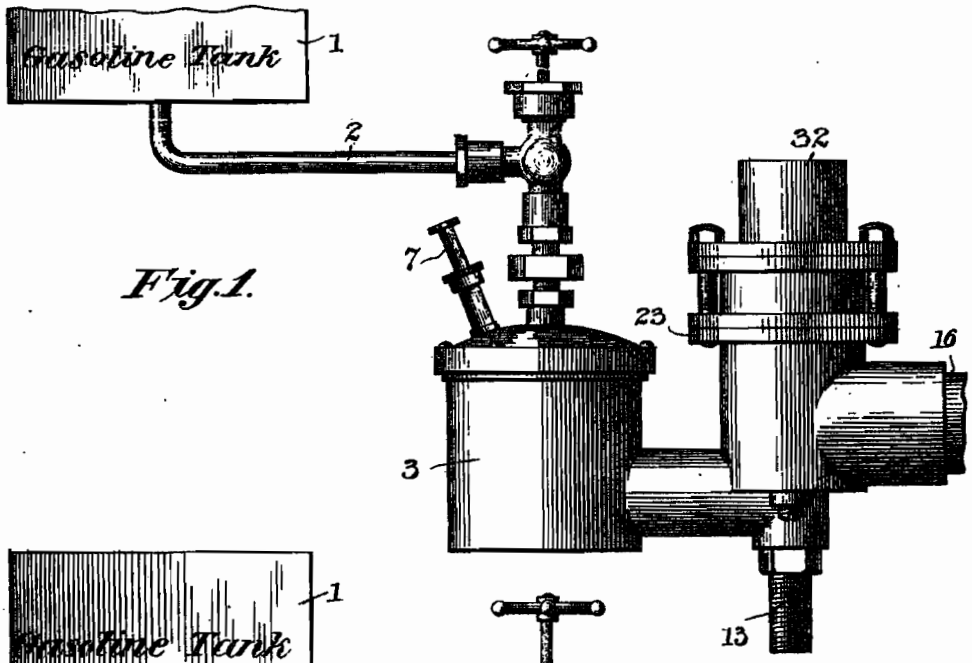


Fig. 1.

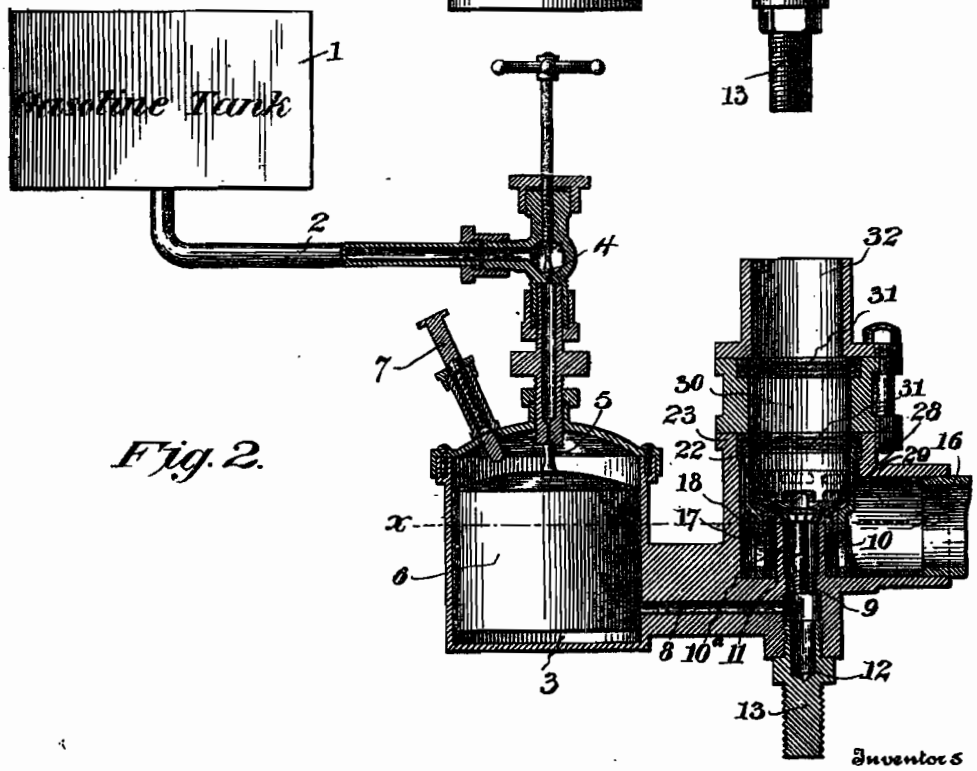


Fig. 2.

Witnesses
Elmer Seavey.
Arthur L. Bryant.

Inventors
W. A. Hatcher and J. W. Packard
By Watson & Watson
Attorneys.

No. 667,910. Patented Feb. 12, 1901.

W. A. HATCHER & J. W. PACKARD.

MIXER AND VAPORIZER FOR EXPLOSIVE ENGINES.

(Application filed June 26, 1900.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 3.

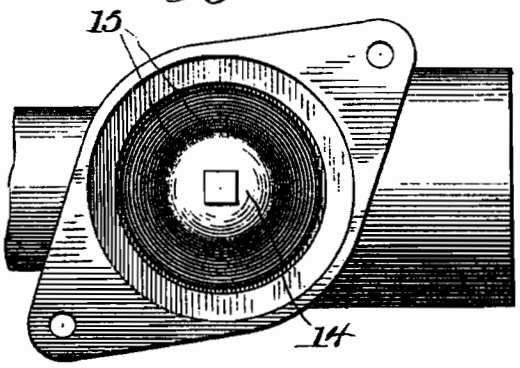


Fig. 4.

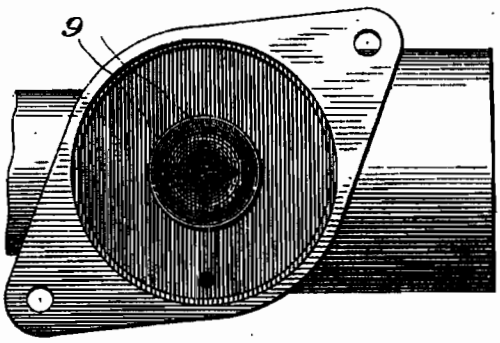


Fig. 5.

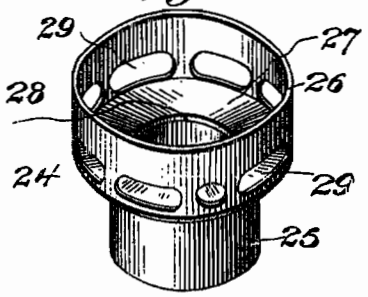


Fig. 6.

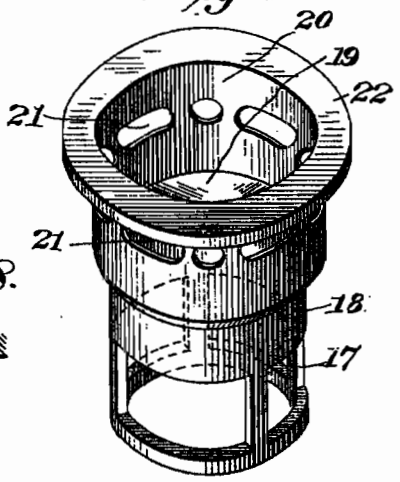


Fig. 8.

Fig. 7.

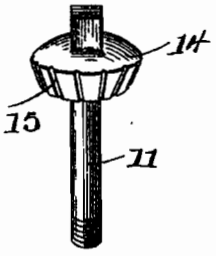
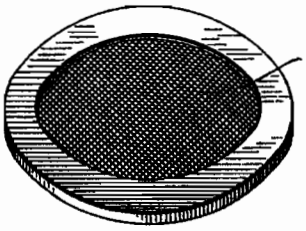


Fig. 9.



Witnesses
Elmer Seavey.
Arthur L. Bryant

Inventors
W. A. Hatcher and J. W. Packard
Watson & Watson
By Attorneys.

No. 667,910. Patented Feb. 12, 1901.

W. A. HATCHER & J. W. PACKARD.

MIXER AND VAPORIZER FOR EXPLOSIVE ENGINES.

(Application filed June 26, 1900.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 10.

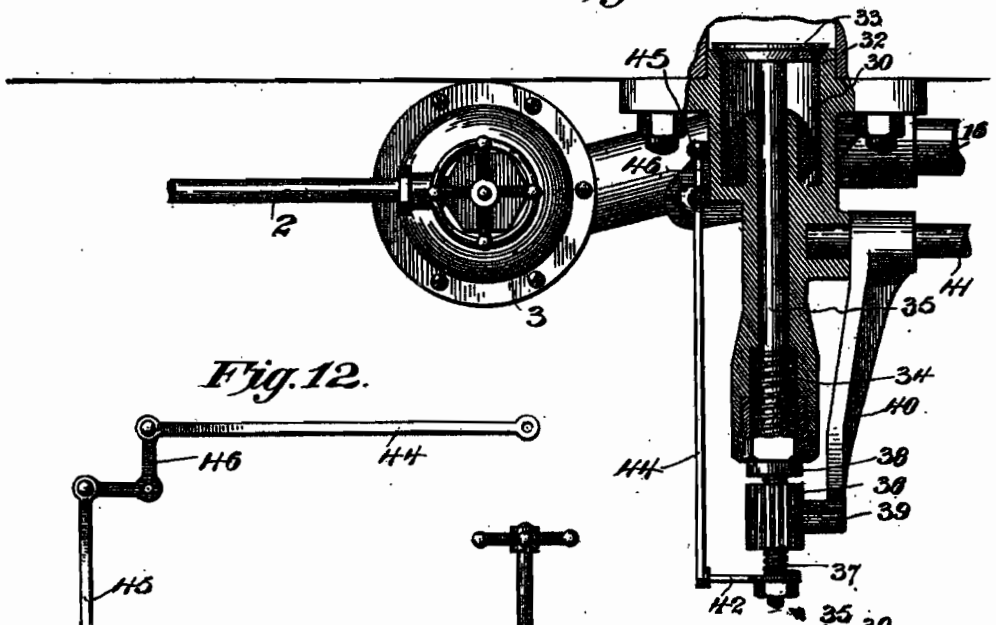


Fig. 12.

Fig. 11.

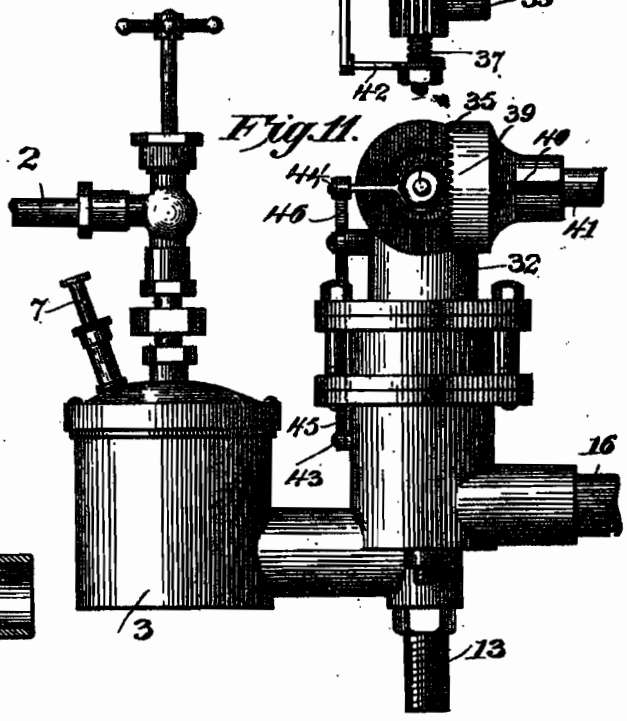
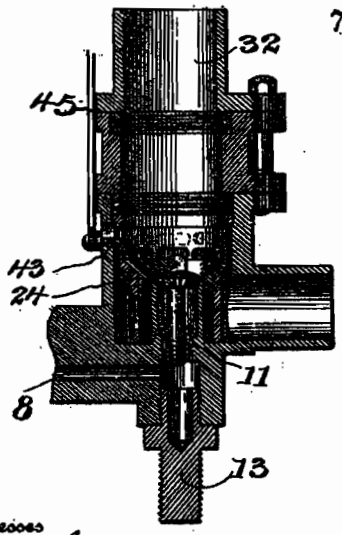


Fig. 13.



Witnesses
Elmer Seavey.
Arthur L. Bryant

Inventors
W. A. Hatcher & J. W. Packard
Watson & Watson
By Attorneys.

UNITED STATES PATENT OFFICE.

WILLIAM A. HATCHER AND JAMES W. PACKARD, OF WARREN, OHIO; SAID HATCHER ASSIGNOR TO SAID PACKARD.

MIXER AND VAPORIZER FOR EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 667,910, dated February 12, 1901.

Application filed June 26, 1900. Serial No. 21,648. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM A. HATCHER and JAMES W. PACKARD, citizens of the United States, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Mixers and Vaporizers, of which the following is a specification.

This invention relates to hydrocarbon-motors, and more particularly to mixers and vaporizers for this class of motors.

The object of the invention is to provide a simple apparatus for effectively regulating the admission of gas and air to the mixing-chamber.

The invention will be described in detail in connection with the accompanying drawings, in which—

Figure 1 is a side view of so much of the apparatus as is necessary to illustrate the invention. Fig. 2 is a central sectional view of the same. Figs. 3 to 9, inclusive, are details of the apparatus shown in Figs. 1 and 2. Figs. 10 to 13, inclusive, illustrate a modified form of the invention.

Referring first to Figs. 1 to 9, inclusive, 1 indicates the storage-reservoir, from which the gasolene passes through a tube 2 into the tank or vessel 3. The supply of hydrocarbon to the tank 3 may be positively shut off or regulated by a valve 4. It is also automatically controlled by a valve 5, carried by a float 6 in tank 3. In the top of the tank 3 is a plunger 7, by means of which the float may be positively depressed when it is desired to fill the tank with fluid. The hydrocarbon flows from the tank 3 through a passage 8 and upward through small passages 9, Figs. 2 and 4, into a cylindrical chamber 10. In the lower part of this chamber is a threaded opening into which is screwed a stem 11, Figs. 2 and 7. Beneath the stem 11 is a cavity or well 12, in which dirt may accumulate, the bottom of said well being in a removable cap 13. The upper end of the wall of chamber 10 is beveled, forming a conical seat for a conical head 14 upon the stem 11. This head is provided with a series of small peripheral grooves 15, Figs. 3 and 7. The float is so proportioned that it permits the gasolene in the tank and in the chamber 10 to rise approximately to a level with the under side of the head 14, as indicated by the line x x, Fig. 2. The air enters through a pipe 16 and through openings 17 in the side of a cylindrical jacket 18, which surrounds the chamber 10 at some little distance from its wall, Figs. 2 and 6. The jacket 18 is provided with an offset portion 19, forming a seat, for a purpose to be referred to hereinafter, and a cylindrical extension 20 above said seat. In the extension 20 are openings 21. The jacket or pot 18 is also provided with a flange 22, which fits the inner wall of the casing 23, in which the jacket is located. Within the jacket 18 and resting upon the seat 19 is an air-valve 24, comprising a cylindrical portion 25, which has a working fit in the lower part of the jacket, a cylindrical part 26, which has a working fit in the upper part of the jacket, and an offset 27 between said parts adapted to rest on the seat 19 of the jacket. The air-valve also has an inwardly-projecting flange 28, which fits close up to the wall 10^a of the chamber 10. In the upper cylindrical portion of the air-valve are a series of openings 29. When the valve is in its lowest position, as shown in Fig. 2, the openings 29 do not register with the openings 21 in the jacket; but when the air-valve is sufficiently raised communication is opened between the air-chamber surrounding the jacket through the openings 21 and 29 and the mixer-chamber 30. The mixer may be provided with any suitable number of screens 31 or other devices to thoroughly commingle the air and oil.

The operation of the invention above described is as follows: The gasolene stands at the level of the line x just at the base of the openings 15, and the air-valve normally stands in its closed position, cutting off all communication with the air-inlet pipe, as shown in Fig. 2. At stated intervals suction is created in the pipe 32 in the usual manner, the effect of which is to draw into the mixing-chamber a charge of gasolene, which is sprayed in through the openings 15, and to simultaneously raise the air-valve and permit a charge of air to enter at the inner edge of the flange 28, the air and oil coming into intimate contact and being carried up into the mixer together. When the engine is taking light

charges of the mixture, the air-valve is raised but slightly and the openings 21 are not uncovered. When, however, the draft upon the mixture is stronger, the air-valve is raised sufficiently to uncover more or less of the openings 21, so that air may enter through said openings, as well as through the central opening of the flange 28. The air-valve falls back to its seat and closes all of the air-inlets after each charge of mixture is drawn into the cylinder. We have found an apparatus constructed as above to regulate automatically the charges of air and hydrocarbon in a very satisfactory manner.

In Figs. 10 to 13, inclusive, we have shown the same devices as in Figs. 1 to 9, inclusive, and in addition we have shown means for positively moving the air-valve as follows: A pipe 32, leading from the mixing-chamber 30 to the cylinder, is normally closed by a valve 33, said valve being drawn to its seat by a spring 34, surrounding its stem 35. The maximum opening of the valve 33 is regulated by a threaded pinion or nut 36, which is adjustable upon a threaded extension 37 of stem 35. At each opening of the valve the nut 36 abuts against a fixed seat 38 on the valve-casing, and the position of the nut regulates the opening of the valve, as will be readily understood. The nut or pinion 36 is adjusted by means of a sector-gear 39 on an arm 40 of a rock-shaft 41, the said rock-shaft being controlled in any suitable manner, either automatically or by hand-lever. The devices for controlling the rock-shaft form no part of the present invention.

Connected to the stem 35 is an arm 42, and connected to the air-valve is an arm 43, which arms are operatively connected together by means of links 44 and 45 and an intermediate right-angled elbow-lever 46.

It will be seen that the devices shown in Figs. 10 to 13, inclusive, effect the opening of the air-valve 24 positively and in proportion to the opening of the mixer-valve 33, the opening of both of said valves being under the control of a sector-gear 40.

Having described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a hydrocarbon-motor, the combination of the chamber 10 in communication with the gasolene-supply, the series of openings in the top of said chamber, and the freely-moving air-valve having an inner flange located close to said openings when the valve is closed.

2. In a hydrocarbon-engine, the combination of the chamber 10 communicating with the gasolene-supply, and provided with a series of small openings at its upper end, a jacket surrounding said chamber and separated therefrom, the air-valve sliding in said jacket and normally closing the space between the jacket and the chamber, and the mixer above said air-valve, for the purpose set forth.

3. In a hydrocarbon-engine, the combination with the gasolene-chamber 10 having a series of perforations in its upper portion, the jacket surrounding and separated from said chamber, means for admitting air to the lower portion of said jacket, a series of openings in said jacket communicating directly with the mixer, and an air-valve sliding within the jacket and arranged to normally close said openings, said air-valve being provided with openings to register with the openings in the jacket when the air-valve is raised.

4. In a hydrocarbon-engine, the combination of the gasolene-chamber 10, the tank in communication therewith, and a float for maintaining a constant level in said tank, of a head in said chamber provided with a series of peripheral grooves, an air-valve surrounding the chamber and having a flange fitting close to the outlets of said grooves, a jacket in which said air-valve works, a series of openings in said jacket, and a corresponding series of openings in said air-valve adapted to register with the aforesaid openings when the air-valve is raised.

5. In a hydrocarbon-engine, the combination of an oil-inlet pipe, a circular series of openings through which the oil is sprayed, and an air-inlet valve immediately surrounding and coöperating with said oil-openings to admit air adjacent thereto, with a valve for admitting mixture to the cylinder, and connections between said mixture-valve and said inlet-valve, for the purpose set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

WILLIAM A. HATCHER.
JAMES W. PACKARD.

Witnesses:
M. S. ANDREWS,
ROBT. E. GORTON.

No. 712,928. Patented Nov. 4, 1902.

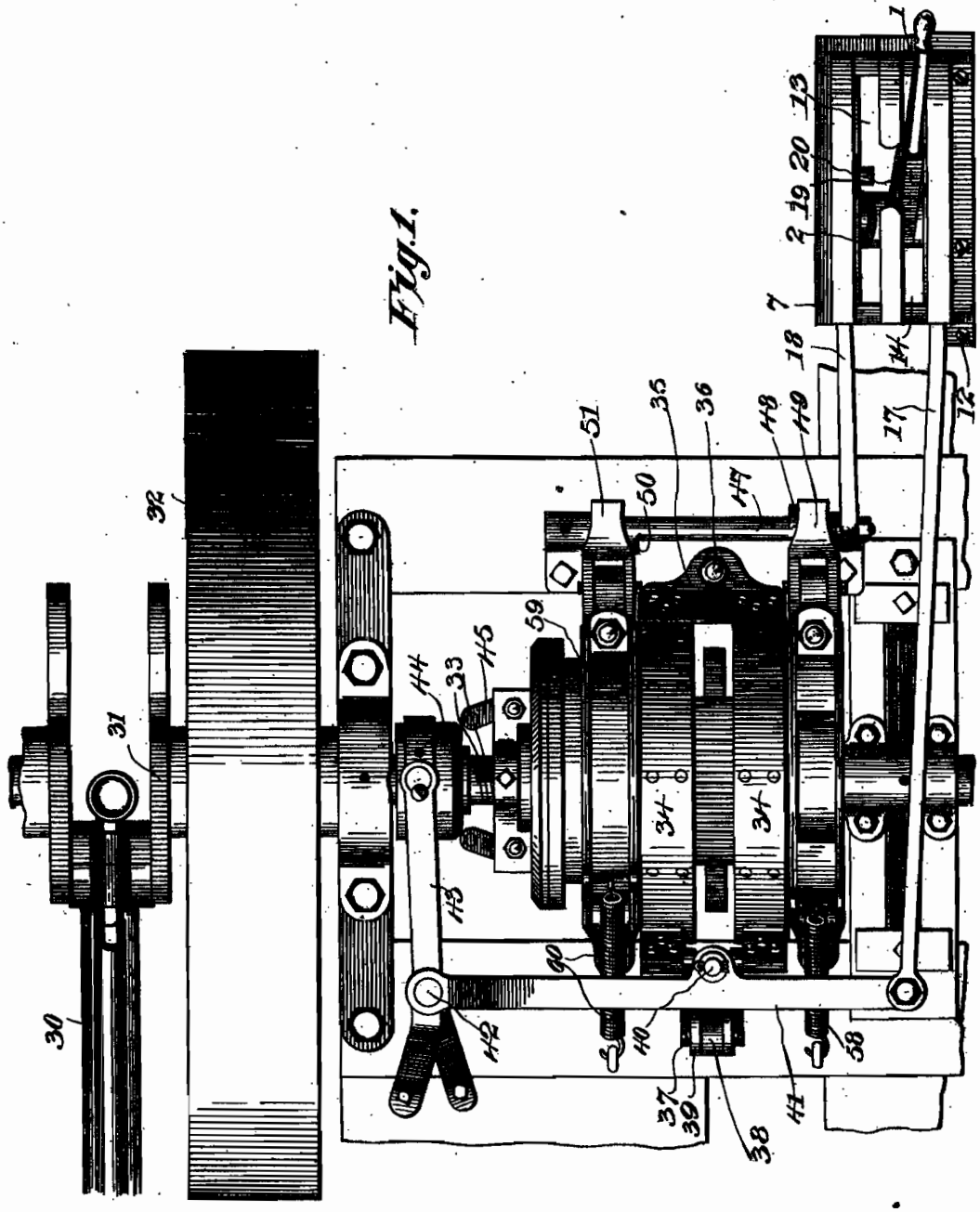
W. A. HATCHER & J. W. PACKARD.

CONTROLLING DEVICE FOR MOTOR VEHICLES.

(Application filed June 26, 1900.)

(No Model.) 5 Sheets—Sheet 1.

Fig. 1.



Witnesses
Elmer Seavey.
Arthur L. Bryant.

Inventors
W. A. Hatcher and J. W. Packard
Watson & Watson
By Attorneys.

No. 712,928. Patented Nov. 4, 1902.

W. A. HATCHER & J. W. PACKARD.

CONTROLLING DEVICE FOR MOTOR VEHICLES.

(Application filed June 26, 1900.)

(No Model.) 5 Sheets—Sheet 2.

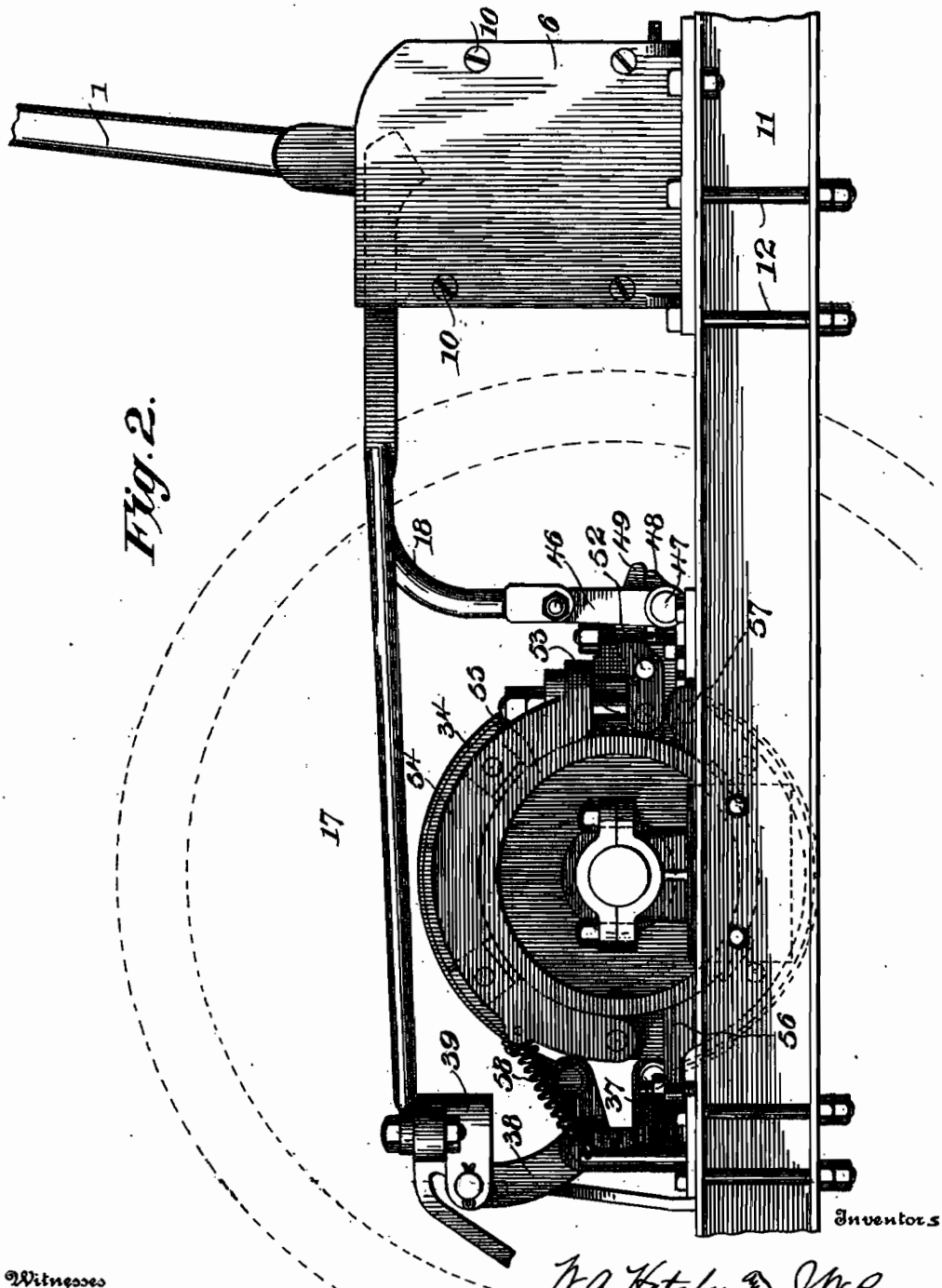


Fig. 2.

Witnesses
Elmer Seavey.
Arthur L. Bryant

Inventors
W. A. Hatcher and J. W. Packard
By Watson & Coleman
Attorneys.

No. 712,928. Patented Nov. 4, 1902.

W. A. HATCHER & J. W. PACKARD.

CONTROLLING DEVICE FOR MOTOR VEHICLES.

(Application filed June 26, 1900.)

(No Model.) 5 Sheets—Sheet 3.

Fig. 3.

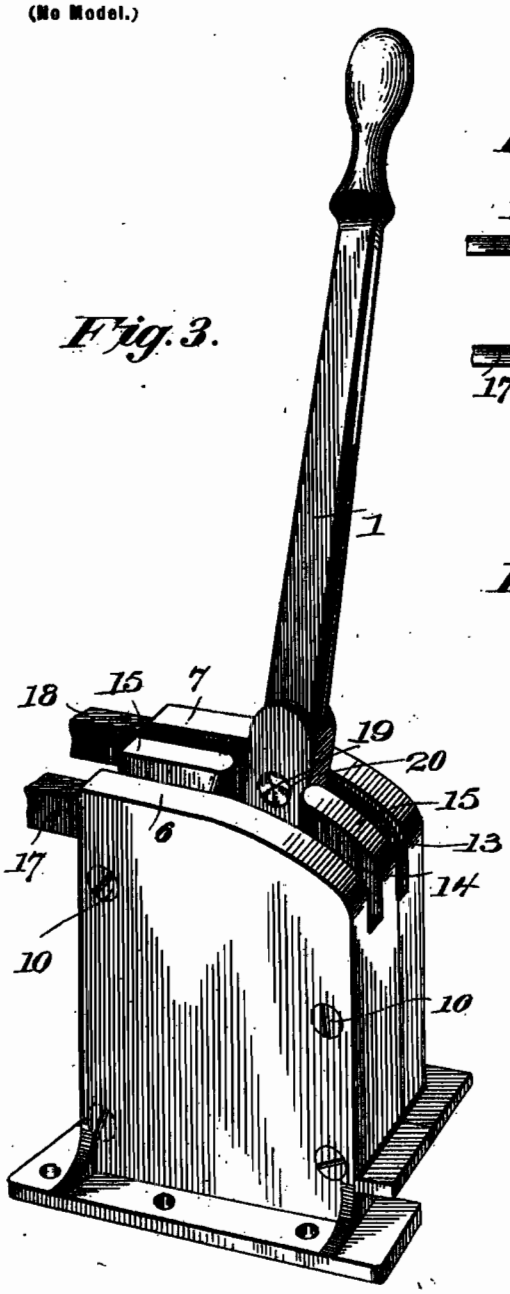


Fig. 4.

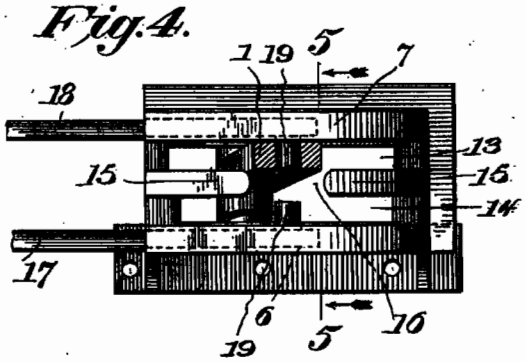
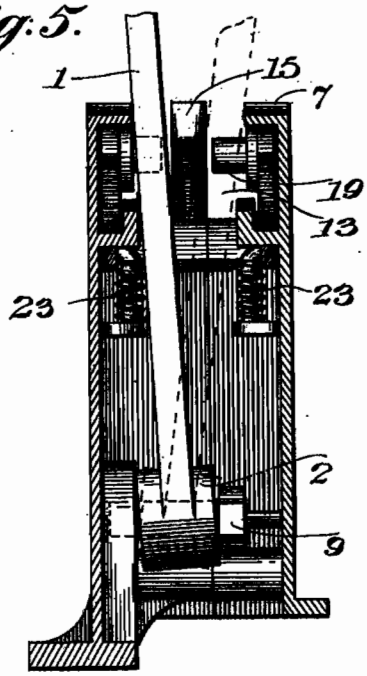


Fig. 5.



Witnesses
Elmer Seavey,
Arthur L. Bryant.

Inventors
W. A. Hatcher and J. W. Packard
By Watson & Watson
Attorneys.

No. 712,928 Patented Nov. 4, 1902.

W. A. HATCHER & J. W. PACKARD.

CONTROLLING DEVICE FOR MOTOR VEHICLES.

(Application filed June 26, 1900.)

(No Model.) 5 Sheets—Sheet 4.

Fig. 6.

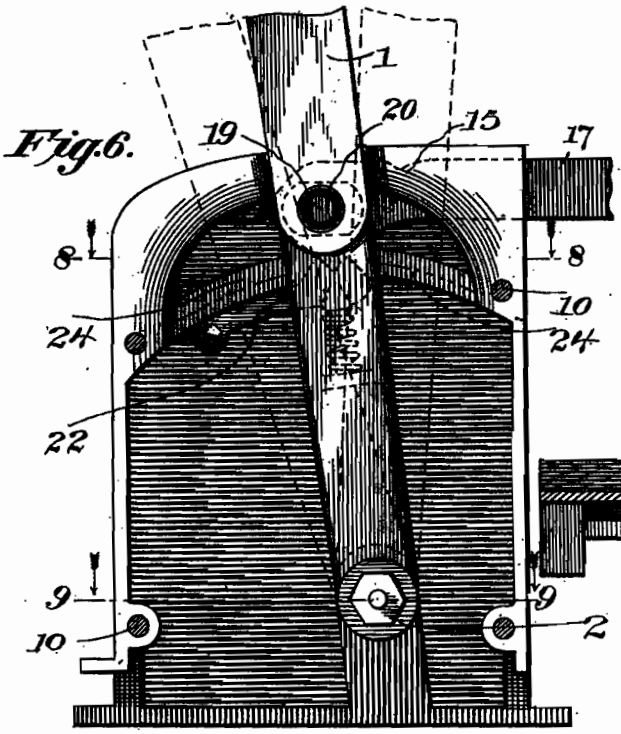


Fig. 8.

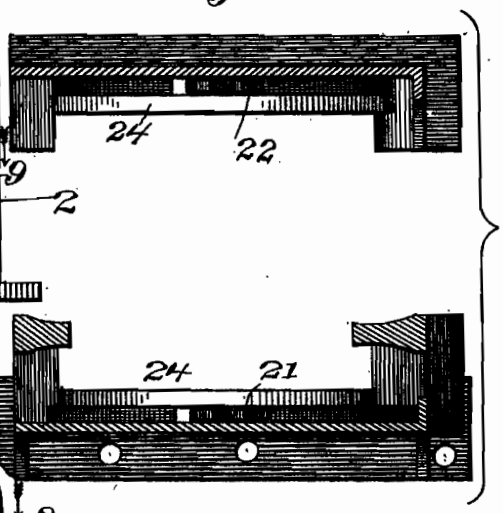
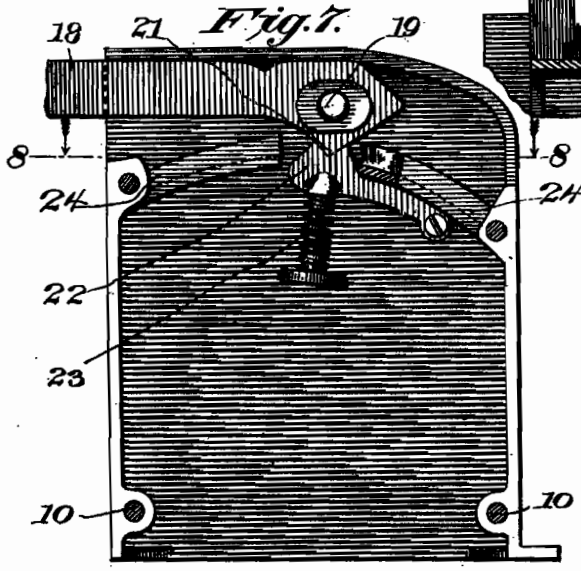


Fig. 7.



Witnesses
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No. 712,928. Patented Nov. 4, 1902.

W. A. HATCHER & J. W. PACKARD.

CONTROLLING DEVICE FOR MOTOR VEHICLES.

(Application filed June 26, 1900.)

(No Model.) 5 Sheets—Sheet 5.

Fig. 9.

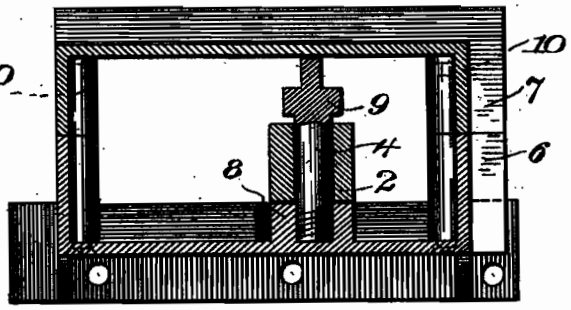


Fig. 10.

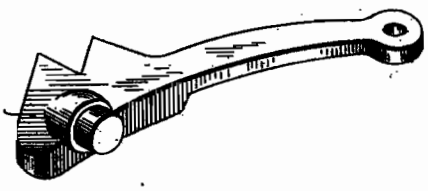


Fig. 11.

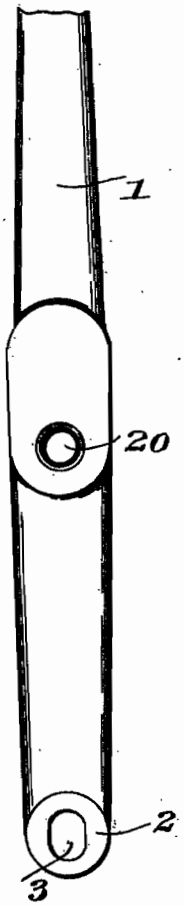
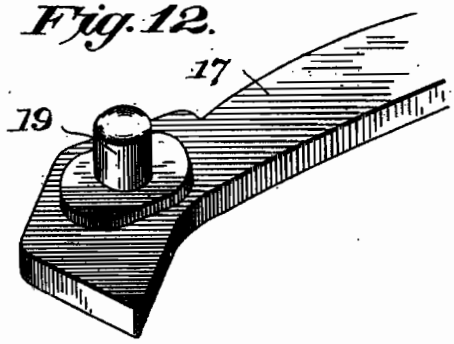


Fig. 12.



Witnesses
Elmer Seavey
Arthur L. Bryant

Inventors
W. A. Hatcher and J. W. Packard
Watson & Watson
By Attorneys

UNITED STATES PATENT OFFICE.

WILLIAM A. HATCHER AND JAMES W. PACKARD, OF WARREN, OHIO, ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, TO OHIO AUTOMOBILE COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

CONTROLLING DEVICE FOR MOTOR-VEHICLES.

SPECIFICATION forming part of Letters Patent No. 712,928, dated November 4, 1902.

Application filed June 26, 1900. Serial No. 21,650. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM A. HATCHER and JAMES W. PACKARD, citizens of the United States, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Controlling Devices for Motor-Vehicles, of which the following is a specification.

This invention comprises various improvements in controlling mechanism for motor-vehicles, and more particularly devices for changing speed, reversing, braking, and otherwise controlling the movement of such vehicles.

The invention will be particularly described in connection with the accompanying drawings, in which—

Figure 1 is a plan view of so much of the driving mechanism of a motor-vehicle as is necessary to illustrate the invention. Fig. 2 is a right side elevation of the parts shown in Fig. 1. Fig. 3 is a perspective elevation of the controlling-lever and the parts with which it is directly connected. Fig. 4 is a plan view of the devices shown in Fig. 3, the lever being shown in section. Fig. 5 is a section on the line 5 5 of Fig. 4. Figs. 6 and 7 are inside views of the two parts of the lever-box. Figs. 8 and 9 are sections on the lines 8 8 and 9 9, respectively, of Fig. 6; and Figs. 10, 11, and 12 are details.

Referring to the drawings, 1 indicates the controlling-lever, which is provided with an enlarged hub 2, having an elongated or elliptical hole 3, which permits the lever to rock laterally upon its pivot-pin 4, Figs. 1, 2, and 11. The lever is mounted in a box or casing comprising two parts 6 7. As shown, the pin 4 is screwed into a socket 8 in the part 6, near the bottom thereof, and it is provided with the shoulder 9 to confine the lever in central position. The two parts of the box are connected by suitable screws or bolts 10, and the box is connected with the frame 11 of the vehicle by means of suitable bolts or other fastenings 12.

Referring to Figs. 3 to 8, inclusive, it will be seen that the box has two slots 13 14 in its top or cover which are separated by a partition 15, said partition having a central opening 16, through which the lever may be rocked laterally from one slot to the other. The partition 15 and the sides of the box form guides for the movement of the lever back and forth in the slots. Extending into the lever-box are two operating links or elements 17 18. These links are provided at their forward ends with inwardly-projecting studs or pins 19, adapted to be engaged by an opening 20 in the lever 1. The forward ends of the links are also provided with projections 21, adapted to coöperate with locking-pawls 22. As shown, the pawls have V-shaped notches, into which the projections 21 fit, and the pawls are held against the links by springs 23. The engagement of the pawls with the links is such that the links may be readily moved in either direction by means of the lever. The pawl, however, is sufficient to hold the link in mid-position when it is not in engagement with the lever, as shown in Fig. 7. The ends of the links travel in guides 24 when they are disengaged from the pawls 22.

The operation of the devices above described is as follows: The lever 1 may be rocked from one guide-slot to the other through the opening 16. When the lever registers with the opening, the projections 21 on the links register with the pawls 22. The lever 1 is therefore capable of moving both the links 17 and 18 in either direction from their normal middle positions in which they are held by the pawls 22. These movements of the links may be made to effect different operations. The series of operations which we prefer to effect and which are illustrated in the drawings are as follows: The forward movement of the lever in slot 13 causes a reversal of the driving mechanism and a backing of the vehicle. By shifting the lever into the rear end of slot 13 a slow forward movement is given to the vehicle. A forward movement of the lever in slot 14 applies the brake and stops the vehicle, and a rearward movement of the lever in said slot gives a fast forward movement to the vehicle. It will thus be seen that with a single lever and very simple connections we produce four distinct ef-

fects, those illustrated being a slow forward movement ahead, a rapid movement in the same direction, backing, and applying the brake. The driving mechanism to which the links 17 and 18 are connected may be of any suitable form. That shown in the drawings is quite similar to that shown in a pending application filed by W. A. Hatcher, January 16, 1900, Serial No. 1,665. We will herein give a brief outline of said mechanism, a detailed description of the same not being deemed necessary for the purposes of the present application.

Referring to Figs. 1 and 2, 30 indicates the connecting-rod of an engine or motor; 31, the crank; 32, a fly-wheel, and 33 a power-shaft driven from the fly-wheel. In the embodiment of the invention shown the motor is presumed to run constantly, and the driving-gears are connected and disconnected by means of suitable devices. Two brake-bands 34 are used, each consisting of an upper and and lower section. The rear end of the lower section is fixed to the frame at 37, and the forward ends of the two sections are adjustably connected together by means of plates 35 and the bolt 36. The rear end of the upper section of each band is connected to the horizontal arm of an elbow-lever 38. The lever 38 has connected to it a block or yoke 39, which carries a pin 40 engaging with a brake-lever 41, which is connected to the link 17. Lever 41 is mounted on a fixed pivot 42 and has an arm 43, connected to a clutch-block 44. When link 17 is drawn forward, the levers 41 and 38 draw the brake-bands 34 together and apply the brake with considerable power. When the link 17 is moved backward, the brake is thrown off, and the clutch-block 44 is thrown into engagement with clutching-arms 45, the effect of which is to connect the motor directly to the running-gear and impart a fast speed ahead to the vehicle. These effects are produced by the lever 1 working in the slot 14 of the lever-box. The link 18 is connected to an arm 46 upon a rock-shaft 47. The shaft 47 has a forwardly-projecting toe or cam 48, extending under the lever 49, and a rearwardly-extending toe or cam 50, engaging the under side of a lever 51. When the link 18 is moved rearward, cam 48 rocks lever 49 upon its fixed pivot 52, and through bolt 53 brake-shoe 54 is drawn into engagement with flange 55. The rear end of upper shoe 54 is connected pivotally to the under shoe 56, which under shoe is pivoted at its forward end to the fixed pivot 57. A spring 58 disengages the shoes 54 and 56 when the link 18 is returned to normal position. When link 18 is moved forward, cam 50 operates lever 51 and applies brake-shoes 59 exactly as the shoes 54 and 56 are applied by cam 49. These shoes are released by springs 60 and 58. The effect of the application of the shoes 59 is to reverse the direction of the driving-gear and back the vehicle.

Having described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. The combination with mechanism for controlling the movement of a motor-vehicle, of a plurality of operating elements therefor, a lever for moving said elements, and means preventing engagement of said lever with either operating element except when both said lever and the element to be engaged are respectively in intermediate positions.

2. The combination with mechanism for controlling the movement of a motor-vehicle, of a plurality of operating elements therefor, and a lever common to all of said elements, means for normally holding each of said elements in an intermediate position, and means for positively engaging the lever with any one of said elements while the latter is in said intermediate position, said lever being thus adapted to move any particular element in either of two directions.

3. The combination with mechanism for controlling the movement of a motor-vehicle, of two operating-links therefor, means for normally holding each of said links in an intermediate position, and a lever mounted between and adapted to be moved laterally into engagement with either of said links and to move the engaged link longitudinally in either direction from its normal intermediate position.

4. The combination with mechanism for controlling the movement of a motor-vehicle, of two operating-links therefor, a lever adapted to engage with either of said links while in its central position, means for preventing disengagement of the lever from its engaged link excepting when said link is in normal central position, and means for yieldingly holding each of said links in normal central position.

5. In a controlling mechanism for motor-vehicles, the controlling-lever and the operating-links, in combination with a box in which said lever is fulcrumed, said box having two parallel guide-slots for the lever and a wall between said guide-slots having an opening intermediate its ends, said lever being movable through said opening and to and from either extremity of either guide-slot whereby it is made to assume four different positions and effect four distinct functions, for the purpose set forth.

6. In a controlling mechanism for motor-vehicles, the combination with a lever having a rocking movement and a lateral movement upon its pivot, of two parallel slotted guides for the lever having an opening between them midway of their length through which the lever may pass from one guide to the other, and two operating-links adapted to engage alternately with said lever, the lever being adapted to rock toward either extremity of either guide from its position in alinement with said opening, for the purpose set forth.

7. In a controlling mechanism for motor-vehicles, the combination of two operating-

links, two spring-pawls arranged to engage said links when the latter are in mid-position, and a pivoted lever arranged between said links and having a rocking and a lateral movement, the lateral movement of the lever adapting it to engage with either of said links, and means for preventing such lateral movement of the lever except when the links are engaged by said pawls.

8. In a controlling mechanism for motor-vehicles, the combination of the lever-box having two parallel slots in its upper end connected by a central opening in the partition-wall, a lever adapted to rock upon its pivot in opposite directions from said central opening in either of said slots and to move laterally from one slot to the other, operating-links connecting the power mechanism with the lever-box, and means for engaging the lever with either of said links, for the purpose set forth.

9. In a controlling mechanism for motor-vehicles, the combination with the links 17, 18 provided with studs at their forward ends, of the lever-box in which the forward ends of said links are located, guides in said box for said links, a lever pivotally mounted within the box and provided with an opening adapted to engage the studs upon the links, and means for locking the links yieldingly in mid-position in the box, said links being movable in either direction from mid-position by means of said lever, for the purpose set forth.

10. In a motor-vehicle, the combination with two independent sets of means controlling the brake, the low and high gears and the reverse-gear, each set performing a double function, of a single lever for independently actuating each set of means, as set forth.

11. In a motor-vehicle, the combination with two independent sets of means controlling the brake, the low and high gears and the reverse-gear, each set performing a double function, of a single lever for actuating each set of means, and means for holding one set practically immovable while the other set is being so actuated, substantially as set forth.

12. In a motor-vehicle, the combination with two rods for controlling the brake, the low and high gears and the reversing-gear, each rod performing a double function, of a single lever for actuating both rods, connecting means between the lever and each rod, and means for guiding the lever when actuating either rod, substantially as set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

WILLIAM A. HATCHER.
JAMES W. PACKARD.

Witnesses:
M. S. ANDREWS,
ROBT. E. GORTON.

No. 667,909. Patented Feb. 12, 1901.

W. A. HATCHER & J. W. PACKARD.

MOTOR VEHICLE FRAME.

(Application filed June 26, 1900.)

(No Model.)

Fig. 1.

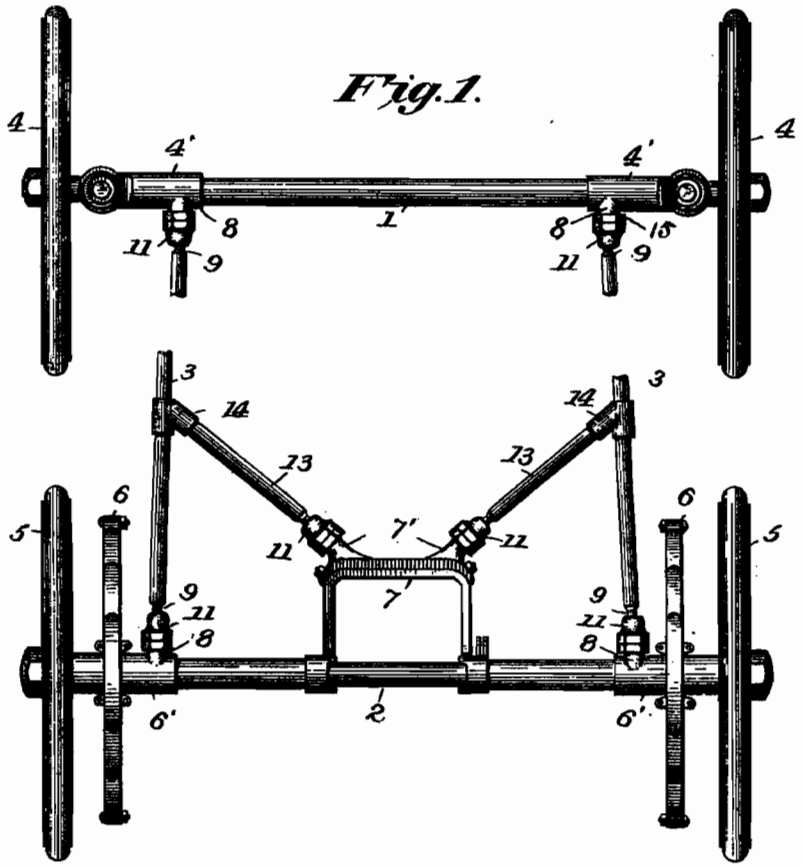


Fig. 3.

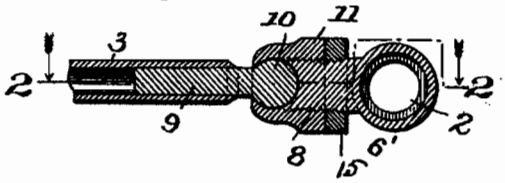


Fig. 2.

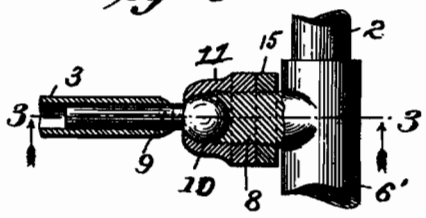
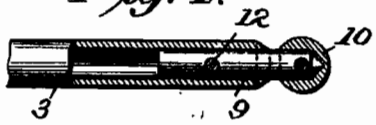


Fig. 4.



Witnesses
Edwin Seavey
Arthur L. Bryant

Inventor
and W. A. Hatcher;
J. W. Packard.

By Watson & Watson Attorneys

UNITED STATES PATENT OFFICE.

WILLIAM A. HATCHER AND JAMES W. PACKARD, OF WARREN, OHIO; SAID HATCHER ASSIGNOR TO SAID PACKARD.

MOTOR-VEHICLE FRAME.

SPECIFICATION forming part of Letters Patent No. 667,909, dated February 12, 1901.

Application filed June 26, 1900. Serial No. 21,647. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM A. HATCHER and JAMES W. PACKARD, citizens of the United States, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Motor-Vehicle Frames, of which the following is a specification.

Our invention relates to an improvement in vehicle-frames or running-gear, and particularly to improvements in the frames of motor-vehicles.

The object of the invention is to provide a frame of simple and cheap construction having its parts so constructed and related to each other that the frame will readily accommodate itself to irregular and rough surfaces and at the same time maintain the wheels and axles in proper running relation.

The invention will be particularly described hereinafter in connection with the accompanying drawings, in which—

Figure 1 is a plan view of the frame of a motor-vehicle embodying our improvements. Fig. 2 is a detail view, partly in section, on the line 2 2 of Fig. 3 of one of the flexible joints. Fig. 3 is a sectional view taken on the line 3 3 of Fig. 2. Fig. 4 is a detail view showing a slightly-modified construction.

Referring to the drawings, it will be seen that our improved motor-vehicle frame comprises front and rear axles 1 2, which are connected by suitable longitudinal reach-bars 3. The forward wheels 4 are suitably connected with the forward axle, being in the embodiment of the invention herein illustrated pivotally connected to enlarged end sections 4′ of said axle. The rear wheels 5 are suitably mounted upon the ends of the rear axle, and springs 6 are mounted on sleeves 6′, which surround the rear axle 2 adjacent to said wheels. A frame 7 is connected to and projects forward from the middle or central portion of the rear axle and is adapted to support more or less of the driving-gear. (Not shown.)

The reach-bars 3, which are preferably made from suitable tubing, have their ends connected to the axles 1 2 by ball-and-socket or universal joints. These joints may be formed in several ways. The axles 1 2 are respectively provided with rearwardly and forwardly projecting studs 8. These are shown as being formed on the enlarged end sections or sleeves 4′ of the front axle and the sleeves 6′ on the rear axle and each has a concave seat or recess formed in its free end and a suitable thread formed on its exterior surface. Pins 9 are suitably secured within the ends of the tubular reach-bars and each has a spherical head 10, which lies beyond the end of the tubular portion of the reach and is of such size as to fit closely in one of the concave seats formed as aforesaid in the ends of the axle-studs 8. The ball-like heads at the ends of the reach-bars are held against the seats provided therefor on the axles by means of retaining-sleeves 11. These are provided with internal threads, so that they can be screwed upon the axle-studs 8, and are adapted to surround the heads 10, as shown. In constructing the frame above described the pins 9 are first passed through the retaining-sleeves 11 and then inserted in and secured within the tubular sections of the reach-bars. Preferably the pins 9 are brazed to the tubes 3, and the spherical head is formed integral with the body of the pin, as shown in Figs. 2 and 3 of the drawings. If desired, however, the pins and tubes may be united by means of rivets or cross-pins 12, and the head 10 can be formed separate from the pin and afterward riveted thereto, as shown in Fig. 4.

From the drawings and the above description it will be seen that the reach-bars are thus connected to both axles by ball-and-socket joints, so that either axle is free to vibrate vertically independent of the other. The retaining-sleeves 13 serve to hold the ball-like heads 10 in their seats on the axles, and by adjusting said sleeves on the studs the joints can be kept properly tightened and any wearing of the parts compensated. The joints are held in adjustment by lock-nuts 15. To brace the frame against lateral distortion, we provide the diagonally-extending brace-rods 13. These brace-rods are rigidly connected at their forward ends to the reach-bars 3 by couplings 14, and their rear ends are connected with the rear axle through the forwardly-projecting frame 7 by universal

joints similar to those above described by which the reach-bars are connected to the axles—that is, the frame 7 on the rear axle is provided with studs 7′ similar to those on the front and rear axles, and the bars 13, which, like the reach-bars, are tubular, have suitable balls secured to their rear ends, which balls are held in seats formed in the ends of the studs 7′ by adjustable retaining-sleeves and lock-nuts.

It will be seen that a motor-vehicle frame constructed as herein described will be extremely flexible vertically and at the same time have sufficient rigidity horizontally. For instance, any one of the wheels may rise or fall in passing an elevation or depression in the road without affecting the other wheels or straining the connecting-frame. The construction is also comparatively cheap and the joints are all simply and easily adjusted to take up wear and prevent rattling.

Having thus described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. In a motor-vehicle frame, the combination of the front and rear axles, two reach-bars extending from the front axle to the rear axle and connected to both axles by universal joints, and two diagonal braces each connected rigidly to an intermediate portion of a reach-bar at one end and connected by a universal joint to an intermediate portion of the rear axle at its other end.

2. In a motor-vehicle frame, the combination of the front and rear axles, a forwardly-projecting frame connected to the middle of the rear axle, reach-bars connected at their ends to the axles by universal joints, and braces each connected rigidly to a reach-bar at one end and having its other end connected with the forwardly-extending frame on the rear axle by a universal joint.

3. In a motor-vehicle frame, the combination of an axle, a threaded stud secured at one end to the axle and having a concave seat or recess formed in its free end, a reach-bar having at one end a ball-like projection adapted to fit in said seat formed in the axle-stud, and a threaded retaining-sleeve fitting said stud and engaging with the ball at the end of the reach-bar to hold the same to its seat on the stud.

4. In a vehicle-frame, the combination of axles having studs projecting therefrom provided with ball seats or sockets in their free ends, tubular reach-bars, balls secured to the ends of said reach-bars and adapted to fit said seats or sockets in the axle-studs, and sleeves adjustably connected to the axle-studs and engaging with the balls at the ends of the reach-bars to hold the same in their sockets.

5. In a motor-vehicle frame, the combination of the front and rear axles, the frame 7 projecting forwardly from the rear axle, the threaded studs rigidly connected to the front and rear axles and to said frame, the reach-bars having balls connected to their ends, the threaded sleeves connecting said balls with the studs on the axles, the diagonal brace-rods having their outer ends connected rigidly with intermediate portions of the respective reach-bars, balls connected by the inner ends of said brace-rods, and threaded sleeves connecting said balls with the studs upon said frame.

In testimony whereof we affix our signatures in presence of two witnesses.

WILLIAM A. HATCHER.
JAMES W. PACKARD.

Witnesses:
M. S. ANDREWS,
ROBT. E. GORTON.

No. 694,184. Patented Feb. 25, 1902.

J. W. PACKARD & W. A. HATCHER.

VEHICLE BRAKE.

(Application filed Oct. 29, 1900.)

(No Model.)

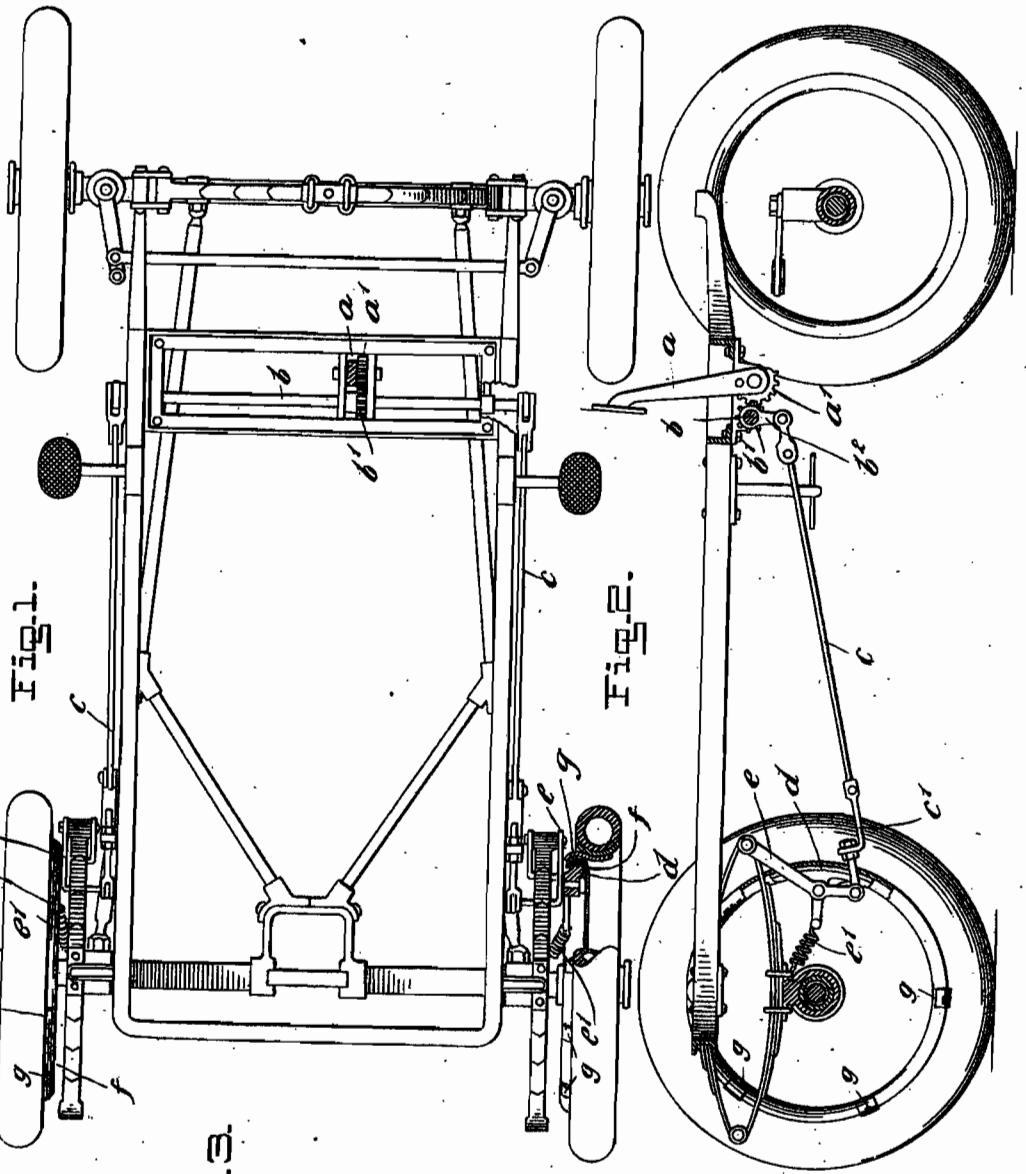


Fig. 1.

Fig. 2.

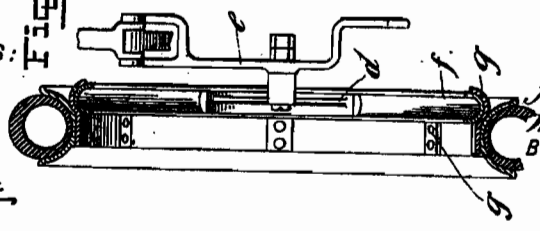


Fig. 3.

WITNESSES:

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J. B. Owens.

INVENTORS

James W. Packard.

William A. Hatcher.

BY. Munn & Co.

ATTORNEYS

UNITED STATES PATENT OFFICE.

JAMES W. PACKARD AND WILLIAM A. HATCHER, OF WARREN, OHIO.

VEHICLE-BRAKE.

SPECIFICATION forming part of Letters Patent No. 694,184, dated February 25, 1902.

Application filed October 29, 1900. Serial No. 34,742. (No model.)

To all whom it may concern:

Be it known that we, JAMES W. PACKARD and WILLIAM A. HATCHER, citizens of the United States, and residents of Warren, in the county of Trumbull and State of Ohio, have invented a new and Improved Vehicle-Brake, of which the following is a full, clear, and exact description.

This invention relates to a brake designed especially for automobiles, in which connection it is here shown, although it is obvious that it could be applied to other vehicles without departing from the spirit of the invention.

The brake comprises a shoe with certain special devices for hanging and actuating it, the shoe coacting with the inner periphery of an annular brake-rim fastened directly to the inner periphery of the rim of a wheel at one side of the spokes by means of brackets attached to the inner periphery of the wheel and to the outer periphery of the brake-rim.

This specification is a specific disclosure of one form of the invention, while the claims define the actual scope thereof.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a plan view of the running-gear of an automobile vehicle to which our invention is applied, parts being shown in section. Fig. 2 is a longitudinal section of the same; and Fig. 3 is a sectional view of one of the wheels, showing a part of the brake in elevation.

The brake is here shown as applied to the two rear wheels of a vehicle, although it is obvious that it may be applied to only one wheel and that it may be the front or rear wheel, as desired. We consider the arrangement shown, however, preferable. The brake is operated by a foot-lever a, mounted to swing on an axis below the flooring of the vehicle and provided with a toothed sector a', the axis of which is coincident with the axis of the foot-lever. This sector a' engages with a pinion b' on a transverse shaft b, mounted below the floor of the vehicle and provided at each end with a downwardly-projecting arm b^2, attached to a rod or other connection c, which extends rearward to the rear wheels, as shown in Fig. 2.

The brake-shoes d are carried, respectively, on levers e, which are fulcrumed at their upper ends on the front ends of the elliptical springs of the vehicle. Retractile springs e' are connected with the levers e and with the rear axle of the vehicle, and these springs tend to move the levers rearward and disengage the brake-shoes from the wheels, the springs normally holding the brakes released. The rods c are attached by suitable connections c' to the lower ends of the levers e, and when the foot-lever a is thrown forward it turns the shaft b, so that the rods c are drawn forward, and this movement being transferred to the levers e and brake-shoes d the latter are moved forward into active position. The brake-shoes act against annular brake-rims f, the cross-sectional form of which is essentially semicircular or concavo-convex, the concave sides being inward. The brake-rims are attached to the inner peripheries of the wheels through the medium of brackets or other fastening devices g. These brackets are riveted to the inner peripheries of the vehicle-wheels and to the outer peripheries of the brake-rims, and at the points where the brackets engage the brake-rims the brackets are curved to conform to the curvature of the rims. The auxiliary rims are therefore located at the inner sides of the wheels out of the way of the spokes thereof and in position to be properly engaged by the brake-shoes in the manner illustrated in the drawings. By this arrangement the brakes may be applied effectively and the movements of the vehicle completely controlled. At the same time it does not necessitate the application of the brakes to the pneumatic tires of the wheel, which is known by persons skilled in the art to be detrimental to the tires. The auxiliary rim f may be made detachable, if so desired; but this is non-essential so far as our invention is concerned.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. A vehicle provided with a wheel having an outer concave bearing-surface, and a con-

cave rim attached to the inner side thereof at one side of the plane of the spokes, said rim having its concave side inward for the purpose specified.

2. A vehicle provided with a wheel having an outer concave bearing-surface, a concave rim attached to the inner side thereof, said rim having its concave side inward for the purpose specified, a brake-lever fulcrumed to the vehicle-spring, a brake-shoe bearing on said concave rim, and a spring for retracting the lever and shoe, said spring being attached adjacent to the axle of the wheel.

3. A vehicle-brake comprising an annular brake-rim adapted to be engaged by the brake-shoe, and located at one side of the spokes of the wheel directly adjacent to the inner periphery of the rim of the same, and brackets attached to the inner periphery of the wheel and to the outer periphery of the brake-rim to hold the brake-rim in place.

4. A vehicle-brake, comprising an annular brake-rim adapted to be engaged by the brake-shoe, said rim being located at one side of the wheel, and brackets attached to the wheel and projecting laterally to the brake-rim, whereby to hold the brake-rim in place.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

JAMES W. PACKARD.
W. A. HATCHER.

Witnesses:
M. S. ANDREWS,
ROBT. E. GORTON.

E. P. COWLES.

MOTOR VEHICLE.

APPLICATION FILED SEPT. 6, 1901.

1,050,810.

Patented Jan. 21, 1913

4 SHEETS—SHEET 1.

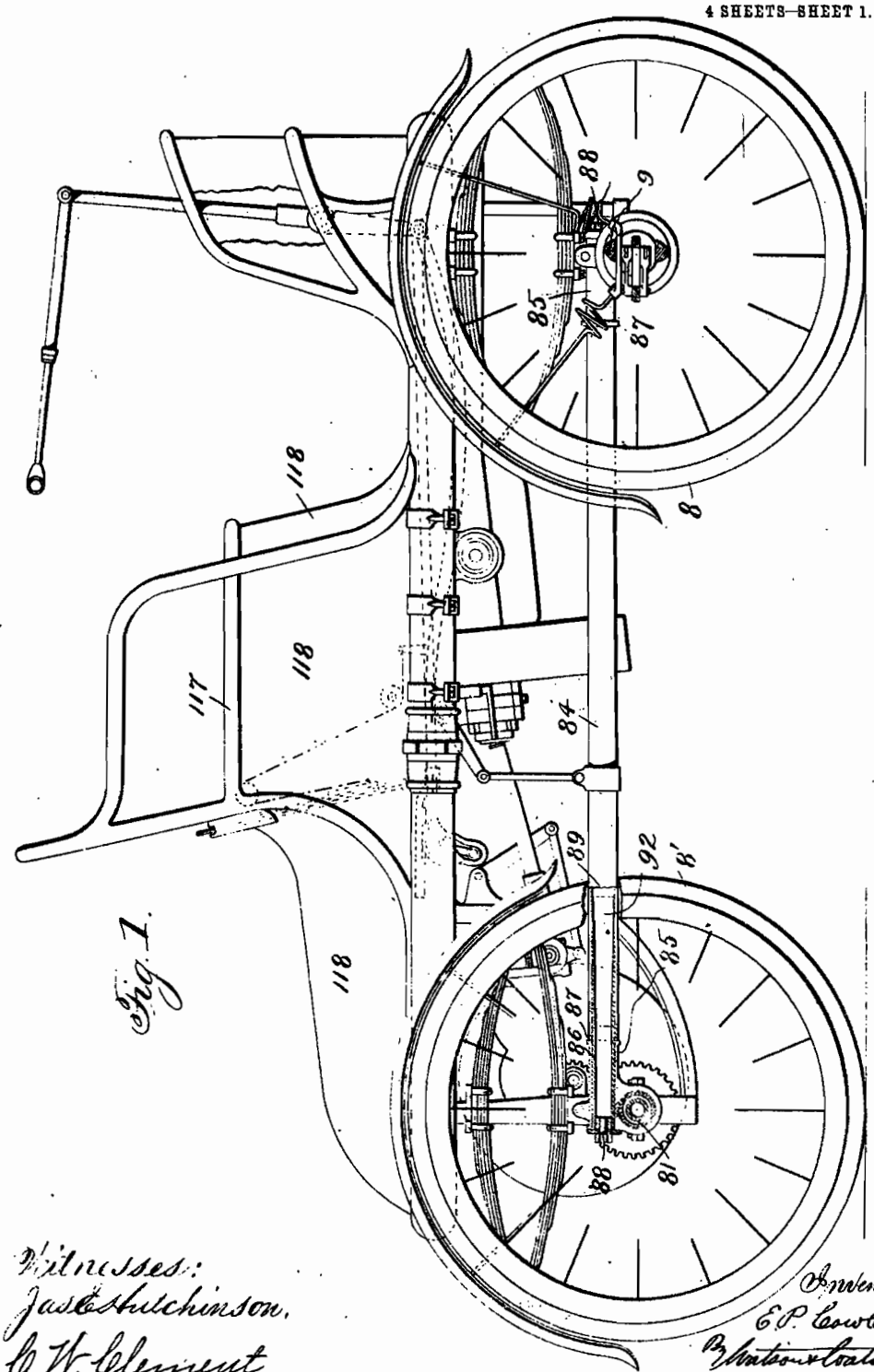

Fig. 1.

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MOTOR VEHICLE.

APPLICATION FILED SEPT. 6, 1901.

1,050,810. Patented Jan. 21, 1913

4 SHEETS—SHEET 2.

Fig. 2.

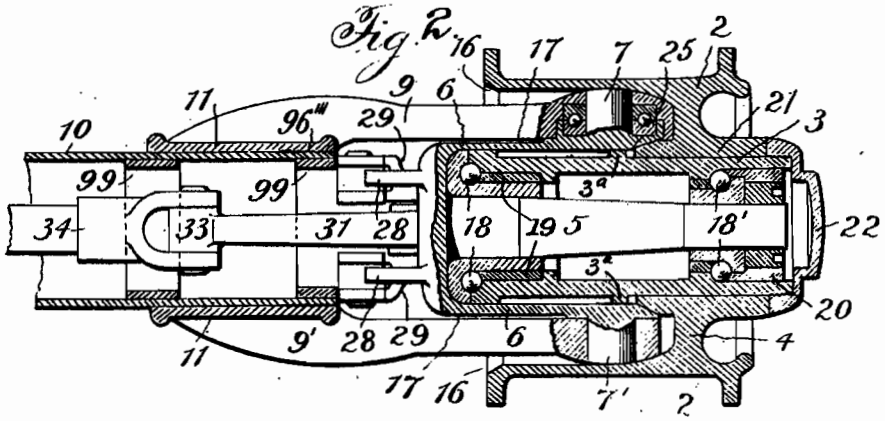


Fig. 3.

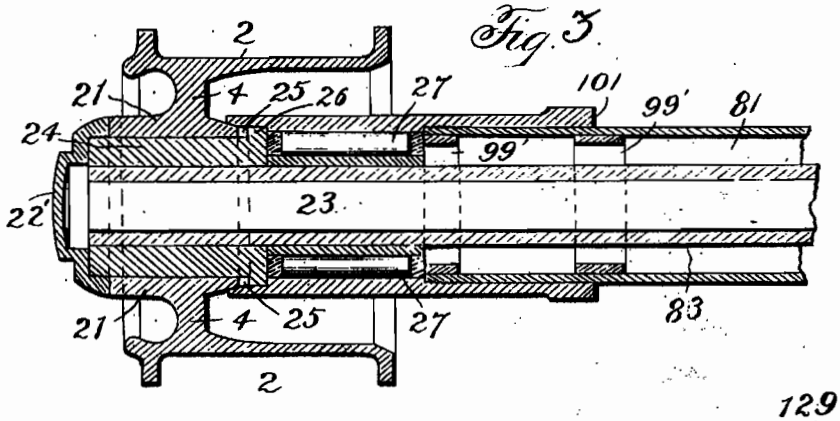
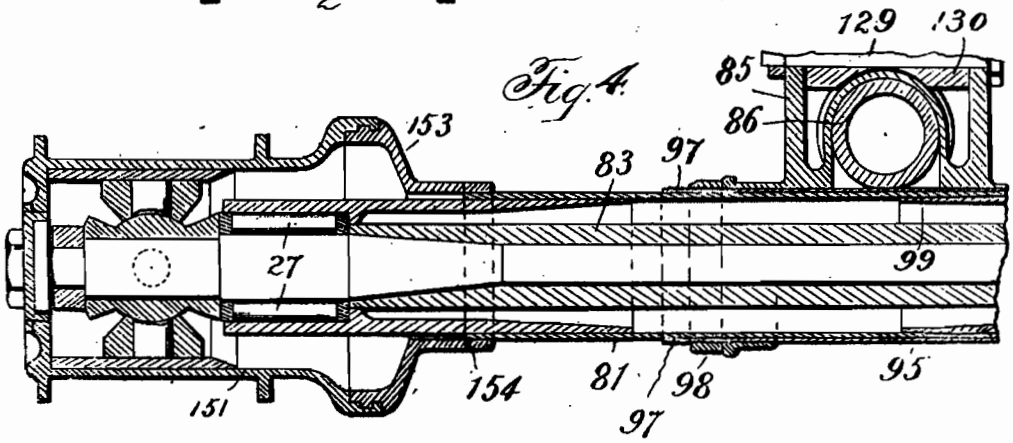


Fig. 4.



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MOTOR VEHICLE.

APPLICATION FILED SEPT. 6, 1001.

1,050,810.

Patented Jan. 21, 1913.

4 SHEETS—SHEET 3.

Fig. 5.

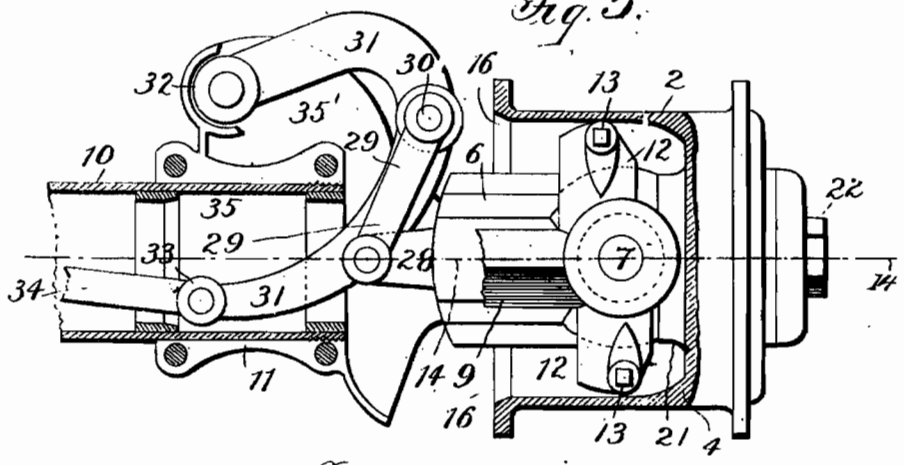
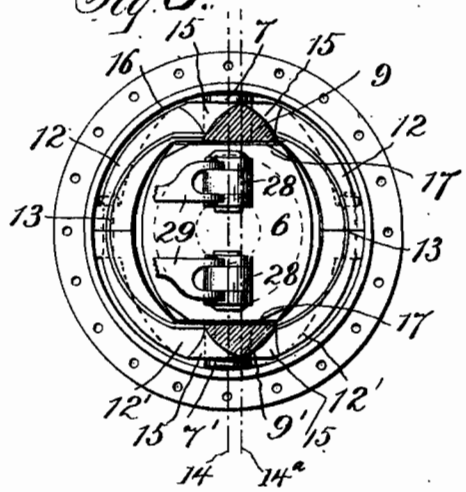


Fig. 9.



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MOTOR VEHICLE.

APPLICATION FILED SEPT. 6, 1901

1,050,810.

Patented Jan. 21, 1913

4 SHEETS—SHEET 4.

Fig. 6.

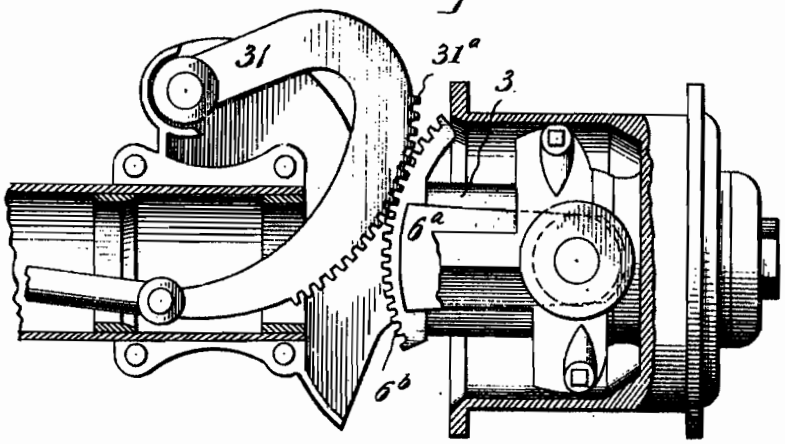


Fig. 7.

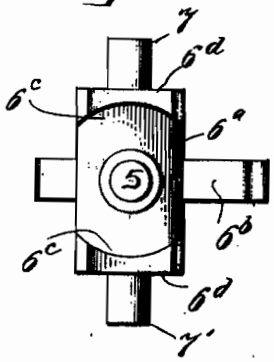
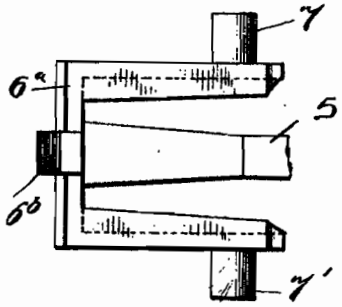


Fig. 8.



Witnesses

Fenton S. Belt.

Arthur L. Bryant.

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Attorneys

UNITED STATES PATENT OFFICE.

EDWARD P. COWLES, OF WARREN, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

MOTOR-VEHICLE.

1,050,810. Specification of Letters Patent. Patented Jan. 21, 1913.

Application filed September 6, 1901. Serial No. 74,497.

To all whom it may concern:

Be it known that I, EDWARD P. COWLES, a citizen of the United States, residing at Warren, in the county of Trumbull, State of Ohio, have invented certain new and useful improvements in Motor-Vehicles, of which the following is a specification.

The present invention relates to improvements in motor vehicles and particularly to an improved steering wheel hub and means for mounting the same.

In the accompanying drawings, Figure 1 is a side elevation of a motor vehicle provided with wheel hubs constructed in accordance with the present invention; Fig. 2 is a vertical section through a steering wheel hub constructed in accordance with this invention and a portion of the axle; Fig. 3 is a similar view through a driving hub; Fig. 4 is a similar view through a hub adapted for both steering and driving; Fig. 5 is a view showing the hub illustrated in Fig. 2, partly in section, a portion of the shaft in section and the connecting mechanism in plan; Figs. 6, 7, and 8, are views showing a similar hub having a differently formed and connected trunnion fork and axle: Fig. 9 is an inner end view of the hub shown in Fig. 5.

In Fig. 1 of the drawing there is illustrated a motor vehicle comprising a suitable body 118 which is supported on a frame having front steering wheels 8 and rear driving wheels 8′. The running gear or supporting frame of the vehicle illustrated, comprises a forward or front tubular axle 10, a rear axle 81 made hollow and through which the driving shafts for the rear wheels extend, said axles being connected by tubular reach bars 84. The connections between the reach bars and axle are shown as formed by long bearing T-shaped couplings 85 in which the reach bars and axles are free to turn. Preferably I arrange the member of each of the T-couplings through which the reach bars pass above the member through which the axle passes, as shown. That part 86 (section Figs. 1 and 4) of the reach bars which passes through the couplings 85 is reduced somewhat leaving a shoulder 87 which bears gainst the end of the coupling. On the end of the reach bar is a nut and washer 88 which bears against the opposite end of the coupling.

Fig. 2 illustrates driving and steering mechanism for a motor vehicle but as such features are not included in the claims, a specific description thereof is not considered necessary. The patentable features illustrated and not herein claimed are reserved for other applications. The steering wheels illustrated in the drawings are of that form or type in which the main axle or wheel support is fixed and the wheel is adapted to turn, to guide the vehicle, on joints or "steering knuckles" arranged at or near the central revolving plane of the wheel.

Referring particularly to Figs. 2, 5, and 9, it will be seen that each steering hub is composed of two hollow cylinders 2, 3, placed concentrically one within the other and joined by a web or spider 4, which is locked to the cylinder 3. The inner cylinder 3 is what may be termed the bearing member, corresponding to the "box" or "sleeve" in hubs of ordinary construction. The outside cylinder 2 receives the wheel spokes which can be of wire, as shown, or of any other suitable material. 5 designates the axle journal or trunnion, the base 6 of which in these views is formed in the cup shape shown, extending entirely around the axle and into the hub between the two cylinders 2, 3. At its free end this cup shaped member of the axle is provided with two short trunnions 7, 7′, arranged diametrically opposite each other. The said trunnions 7, 7′, are arranged in the same vertical planes, their axes being in the central plane of rotation of the wheel. Said trunnions extend into and have bearings in eyes formed in the upper and lower arms or branches 9, 9′, of a fork which is attached to the end of the stationary or fixed axle 10 by a divided socket 11. It is obvious that by this construction the wheel while being held rigidly upright is free to turn laterally on a vertical axis which lies in the central plane of rotation of the wheel and that the tendency of the wheel to be deflected from its proper course by contact with obstructions is reduced to a minimum.

To give the fork 9, 9′, the necessary strength without making it undesirably heavy the upper and lower members thereof are provided at their free ends with arms 12, 12′, respectively. These arms, two from each fork member, extend about the cup-shaped portion 6, of the axle and are bolted together at 13 where they meet in the central

horizontal plane of the axle. By this means both members of the fork are caused to equally sustain the weight on the axle and by making the arms 12, 12′, integral with the fork they form in connection with the socket 11 a rigid parallelogram and the truss principle is made available to multiply their united strength. By this arrangement the fork can be made very light and have abundance of strength.

It will be observed that the steering wheels, when outside of the curve they are turning, swing laterally much less than when inside, by reason of the necessity of their revolving planes being always tangential to concentric circles. By placing the fork arms 9, 9′, a little forward of the rotating axis of the wheel, shown by dotted lines 14 in Fig. 9, the line 14ª indicating the central plane of the fork, and by making their outside surfaces 15 conform to the inner face of the outside cylinder 2 of the hub when turned laterally to their extreme limit, I am able to get the largest section of arms 9, 9′, with a minimum diameter of hub and also to make said arms of the triangular section shown in Fig. 9, which is well adapted to resist lateral strains on said arms.

By cupping the base 6 of axle journal as shown and making the axle trunnion 5, cup 6, and trunnions 7, 7′, of one piece, the sides of cup 6 are made available to sustain and stiffen the trunnions 7, 7′, and I am able to flatten the upper and lower side of cup 6, as at 17, and bring the fork arms 9, 9′, relatively near together. By making the fork in two parts, the ends of arms 9, 9′, can be placed over the fixed trunnions and the eyes at the ends of arms 9, 9′, can be made solid. This connection with a one-piece axle trunnion, described above, makes it possible to construct a strong steering knuckle inside of the wheel hub with a sufficiently long pivot to give the wheel stability and to make the steering knuckle very compact and light, without materially increasing the diameter of the hub over that ordinarily employed.

The steering hub hereinbefore described is adapted to any kind of bearing. Preferably I use a combined ball and plain bearing, the ball bearings 18, 18′, of which are of the usual form. The bearing cylinder 3 of the hub has a bronze ring or sleeve 19 fitted therein near its inner end, which sleeve bears against the surface of the axle 5, or the ball race-sleeve which surrounds the axle. About the ball race and jam nut of the ball bearing 18′ is fitted another bronze ring 20 which contacts with the inner surface of the outer end of the bearing cylinder 3. These plain bearings ordinarily are inoperative but under great strains they assist the ball bearings, and when either or both ball bearings are disabled the plain bearings will do all the work.

The rear wheels of an automobile by reason of their function of both driving and carrying the most weight are much more subject to wear and liable to be disabled than the front wheels, and it often happens that a rear wheel tire which has become so much worn that it would soon be useless on a driving wheel would last indefinitely on a front or steering wheel. It is a great advantage therefore to have steering and driving wheels interchangeable. I accomplish this desirable end by forming on the web 4 which connects the two hub cylinders 2, 3, a boss 21 that is bored out so as to fit closely over the outer end of the bearing cylinder 3. This boss is provided with an inwardly projecting flange the inner face of which is provided with teeth or projections that interlock with projections 3ª, on the cylinder 3. A cap nut 22, threaded on the outer end of the cylinder forces and retains the boss 21 firmly in place. The rear driving axle 23, Fig. 3, may as shown, have its outer end enlarged by a spool 24, the outside diameter of which is accurately the same as the diameter of the outer end of cylinder 3 of the steering wheel hub so that the boss 21 of any wheel will fit either the cylinder 3 or the spool 24. The rotating motion of driving axle 23 can be transmitted to the boss 21 by a feather or key, or any other suitable means, but I prefer to provide the inner end of the spool 24, adjacent the roller bearings 27, with a flange or shoulder 26, which is provided on its outer face with a series of teeth or projections adapted to engage with teeth or projections 25, on the boss 21 of the hub; and which are engaged by the teeth 3ª when the hub is applied to a steering axle. A cap nut 22′, similar to 22 holds the teeth on the boss 24 in engagement with those on shoulder 26. By simply removing nuts 22, 22′, the wheels can be interchanged, or in case of extended journeys an extra wheel carried on the carriage can be quickly and conveniently put on to replace a disabled one, without disturbing the ball or roller bearings in any way. Another important advantage gained by this improved hub is: The roller bearing 27 of the driving axle can be extended inside the hub of the driving wheel well toward the center, relieving driving axle 23 of much strain in carrying the weight of the vehicle.

One essential feature of an efficient motor vehicle steering mechanism is that there shall be no lost motion between the parts thereof and that the slightest movement of the steering lever shall produce a corresponding movement of the steering wheels. For this reason it is necessary that the fulcrums of the various levers have rigid metal connections and that the joints be kept free from dust to avoid wear. To

gain this end I place practically all of the steering mechanism inside the front axle 10 which is a single tube of large diameter. This also has the effect of giving the front axle a more symmetrical appearance as the rods, levers, etc., usually exposed are concealed.

As shown in Figs. 2, 5 and 9, two lugs or projections 28 on the base 6 of the axle trunnion 5 are connected by links 29 to a curved lever 31, said links and lever being pivotally connected at 30. The lever 31 (see Fig. 5) is pivoted at one end, as at 32, to the socket 11, the other end of said lever being pivoted at 33 to a rod 34 which is connected to the operating mechanism not shown and which may be of any suitable character. Lever 31 which is practically a right angled lever is made of the form shown and passes between links 29 and lugs 28 in order to bring the wheel as near as possible to the end of the fixed axle 10 and reduce the strain on socket joint 11. The action of curved lever 31 and base 6 of axle trunnion is practically the same as two gears intermeshing, links 29 taking the place of gear teeth, and in Fig. 6, this toothed arrangement is shown. Referring to said figure, and also to Figs. 7 and 8, it will be noted that the outer edge of the curved lever 31 is provided with teeth 31^a and the end of the base 6^a is provided with a segmental rack 6^b meshing with the teeth upon the lever. In said figures, is shown a modified form of trunnion base 6^a, which instead of being cup-shaped and surrounding the axle sleeve, is forked, as clearly shown in Figs. 7 and 8. The inner side 6^c of each fork arm is curved to conform to the curvature of the axle sleeve, while the outer sides 6^d are flat and parallel, thus giving them practically a "channel iron" cross section. By giving the fork arms a channel iron section, and making them integral with the axle, base and trunnions, it is possible to obtain sufficient strength and stiffness within a small space and leave the entire space between the hub cylinders, at the sides, through which the arms 12, 12′ extend, clear. By this arrangement it is possible to provide a strong and durable center steering hub of compact size which will not be undesirably heavy. Many forms of hubs of this character have been heretofore proposed, but have, after practical tests, been found unsatisfactory because they were easily broken or disarranged and if heavy enough to have the desired strength were large and clumsy. According to the present invention, however, all of these objections are overcome.

The axles shown are formed of tubes which may be reinforced by rings 99. In addition to being clamped to the front axle in the manner described, the fork of the steering wheels may be engaged with said axle by a thread 96‴.

The rear axle may be reinforced by a split tube 95 having a threaded section 97 which is surrounded by a clamp nut 98 and the roller race 101 is threaded on said axle as shown, reinforcing rings 99′ being also arranged within the axle adjacent said race. The driving shaft 23, or 83, extends through the rear axle, as shown in Figs. 3 and 4. The latter figure illustrates a slightly different form of hub and connection between the hub and axle than that shown in the other figures. In this form of hub the driving axle 83 is connected with the interior of a hollow hub body 151 by a universal joint arranged in the central plane of the revolution of the wheel and permitting the latter, while receiving the rotating power of the driving axle, to oscillate freely in either direction. The inner end of the tubular body 151 of the hub engages a sway block 153 having a horizontal slot 154 sliding on the axle. This holds the wheel rigidly upright, while allowing it to oscillate to conform to the direction of the motion of the vehicle.

Having described my invention what I claim and desire to secure by Letters-Patent is,

1. In a motor vehicle, the combination with a stationary axle, of a wheel hub consisting of two connected and concentrically arranged members, a horizontal trunnion extending through the inner of said tubular hub members, bearings arranged between said horizontal trunnion and inner hub member, two vertical trunnions formed integral with the horizontal trunnion and supported from the axle between said tubular hub members, and means for adjusting the hub about the axis of said vertical trunnions.

2. In a motor vehicle, the combination with an axle, of a wheel hub consisting of two concentrically arranged members, a forked trunnion support provided with an integral horizontal trunnion extending into the inner hub member and with arms extending into the space between said hub members, above and below the inner hub member, and having their inner faces grooved or channeled to conform to the adjacent surface of such inner hub member, the arms being of such width as not to obstruct the spaces between the sides of the hub members and provided with integral vertical trunnions, bearings for said vertical trunnions supported on the axle, and means for adjusting the hub about said vertical trunnions.

3. In a motor vehicle, the combination with an axle, of a wheel hub consisting of two concentrically arranged members, a forked trunnion support connected with the

hub and having its arms extending into the space between the hub members, above and below the inner hub member, and having their inner faces grooved or channeled to conform to the adjacent surface of such inner hub member, the arms being of such width as not to obstruct the spaces between the sides of the hub members and provided at or near their ends with integral vertical trunnions, bearings for said vertical trunnions supported on the axle, and arms extending about the inner hub member, in said spaces between the sides of the hub members, and connecting said bearings for the vertical trunnions.

4. In a motor vehicle, the combination with an axle, of a wheel hub consisting of two concentrically arranged members, a forked trunnion support having its arms extending into the space between said hub members, above and below the inner hub member, said arms being of such width as not to obstruct the spaces between the sides of the hub members and provided at or near their ends with integral vertical trunnions, a horizontal trunnion carried by said trunnion support and extending into the inner hub member, and a separable fork secured to the axle and extending into the space between the hub members, said axle fork having formed in each member an eye, entirely surrounded by the solid body of the member, to receive one of said vertical trunnions.

5. In a motor vehicle, the combination with an axle, of a wheel hub consisting of two concentrically arranged members, a forked trunnion support having its arms extending into the space between said hub members, above and below the inner hub member, said arms being of such width as not to obstruct the spaces between the sides of the hub members and provided at or near their ends with integral vertical trunnions, a horizontal trunnion carried by said trunnion support and extending into the inner hub member, a separable fork secured to the axle and extending into the space between the hub members, said axle fork having formed in each member an eye, entirely surrounded by the solid body of the member, to receive one of said vertical trunnions, and arms extending about the inner hub member in the spaces between the sides of the hub members and connecting the arms of the axle fork in the plane of the eyes therein.

6. In a motor vehicle, the combination with a stationary axle, of a wheel hub consisting of two tubular detachably connected and concentrically arranged members, a spindle extending into said hub from the inner end thereof, a support for said spindle bent on opposite sides thereof to enter the space between the aforesaid hub members and provided within said hub with two vertical trunnions arranged at diametrically opposite points, a fork secured to the axle and having eyes entirely surrounded by the solid body of the fork into which said vertical trunnions extend, and means for adjusting the hub about said vertical trunnions.

7. In a motor vehicle, the combination with a stationary axle, of a wheel hub consisting of two connected and concentrically arranged tubular members, a trunnion support extending over the inner member of the hub, a spindle arranged within the hub and secured at its inner end to said support, a fork secured to the axle and having the outer ends of its arms extending into the space between the members of the hub, two vertical trunnions carried by said trunnion support and extending into apertures in the arms of said fork, bearings interposed between the spindle and inner hub member, a supplemental ring bearing between said spindle and inner hub member, and means for adjusting the hub about said vertical trunnions.

8. In a motor vehicle, the combination of a tubular axle, a horizontally movable trunnion at the end of the axle, a steering wheel upon said trunnion, a pair of inwardly projecting ears at the base of said trunnion, a curved lever fulcrumed at one side of the axle and having its free end extending into the end of the axle, links connecting said lever with the steering wheel and a reciprocative rod for actuating said lever arranged within and extending longitudinally of the axle.

In testimony whereof I affix my signature in presence of two witnesses.

EDWARD P. COWLES.

Witnesses:

G. K. CANFIELD,

HOMER E. STEWART.

No. 887,013. PATENTED MAY 5, 1908.

J. W. PACKARD & W. A. HATCHER.

HYDROCARBON ENGINE.

APPLICATION FILED FEB. 12, 1902.

2 SHEETS—SHEET 1.

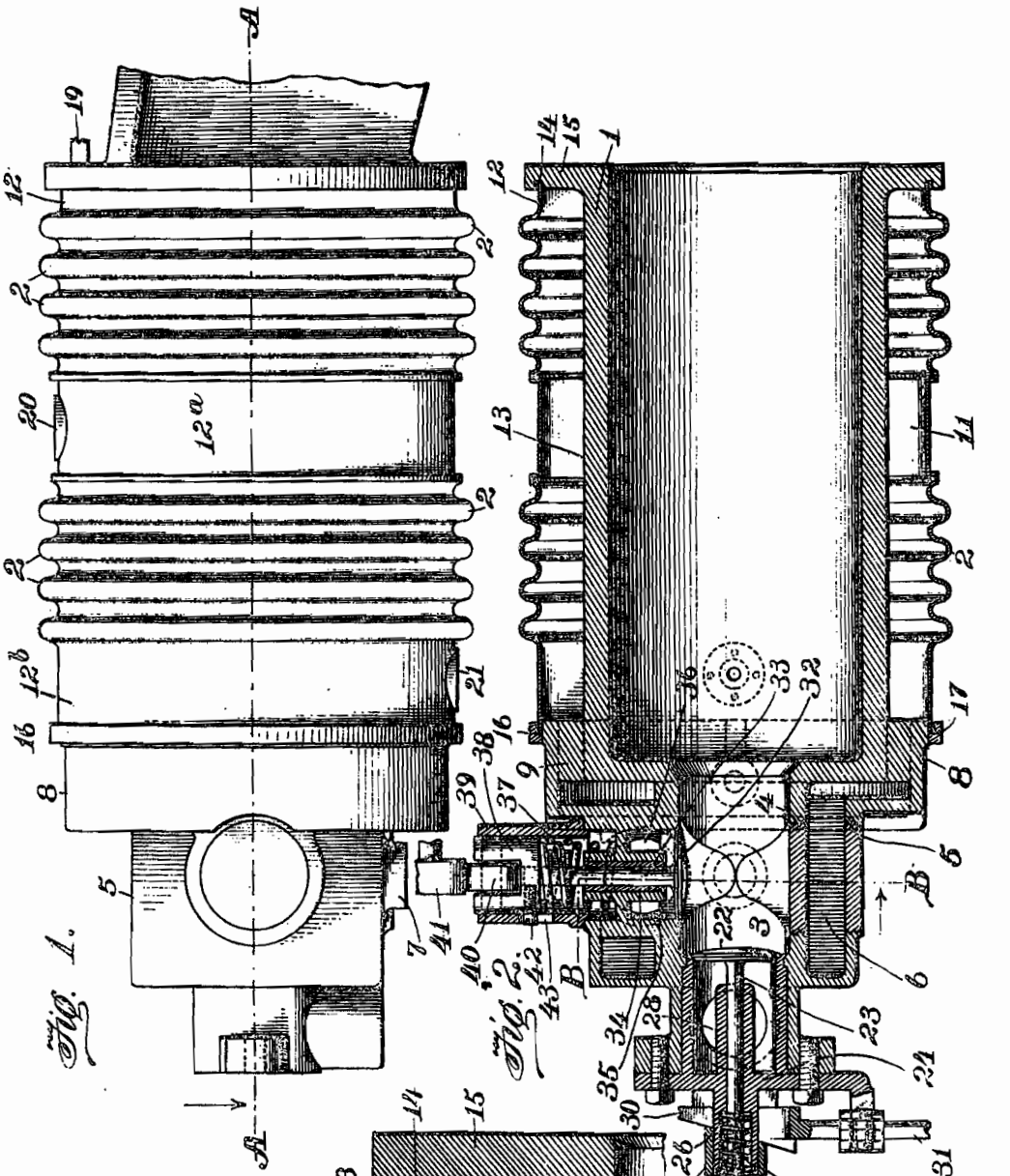

Fig. 1.

Fig. 2.

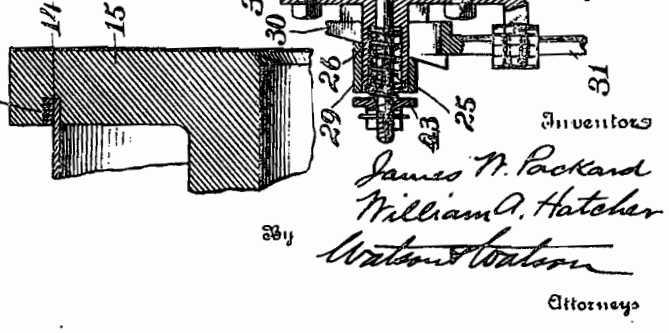

Fig. 3.

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No. 887,013. PATENTED MAY 5, 1908.

J. W. PACKARD & W. A. HATCHER.

HYDROCARBON ENGINE.

APPLICATION FILED FEB. 12, 1902.

2 SHEETS—SHEET 2.

Fig. 4.

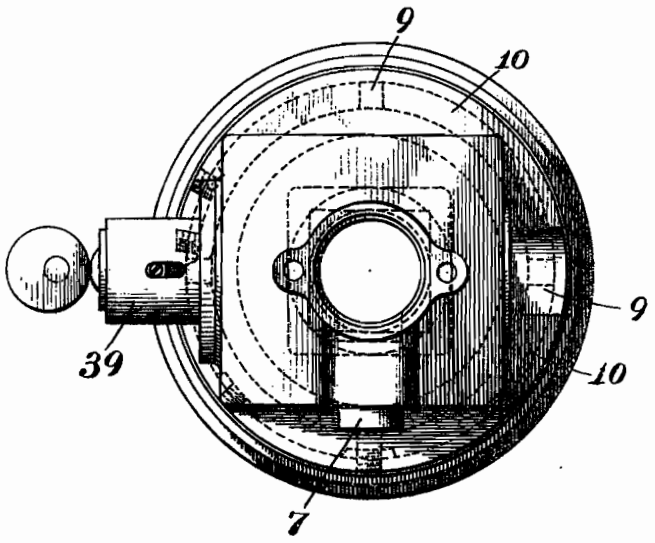
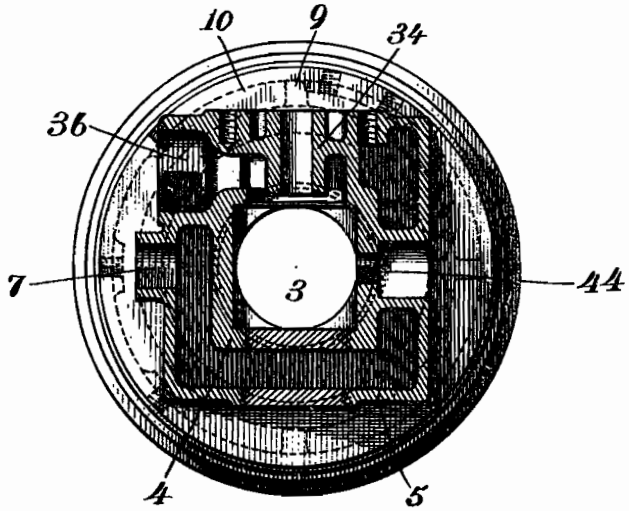


Fig. 5.



Witnesses
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UNITED STATES PATENT OFFICE.

JAMES W. PACKARD AND WILLIAM A. HATCHER, OF WARREN, OHIO, ASSIGNORS, BY MESNE ASSIGNMENTS, TO PACKARD MOTOR CAR COMPANY.

HYDROCARBON-ENGINE.

No. 887,013. Specification of Letters Patent. Patented May 5, 1908.

Application filed February 12, 1902. Serial No. 93,755.

To all whom it may concern:

Be it known that we, JAMES W. PACKARD and WILLIAM A. HATCHER, citizens of the United States, residing at Warren, in the county of Trumbull, State of Ohio, have invented certain new and useful Improvements in Hydrocarbon-Engines, of which the following is a specification.

This invention comprises improvements in explosive engines, and it relates to the arrangement of the water jacket surrounding the cylinder, and to other features illustrated in the accompanying drawing and set forth in the following specification.

In the drawing, Figure 1 is a side elevation of the engine cylinder; Fig. 2 is a sectional view of the lower half of the cylinder taken on the line A—A of Fig. 1, and showing the gas inlet and exhaust valves; Fig. 3 is a detail view showing the manner of securing the water jacket to the cylinder; Fig. 4 is a rear end view of the cylinder, and Fig. 5 is a section on the line B—B of Fig. 2.

Referring to the drawing, 1 indicates the cylinder having the usual cylindrical opening within which the piston operates and having a gas chamber 3, at its rear end. The casing surrounding the gas chamber, and the rear end of the cylinder, is formed with double walls 4 and 5, between which is a water circulating space 6, having an inlet opening 7 in the lower side of the outer wall. The outer wall 5, extends around the rear end of the cylinder for a short distance, forming a hollow flange or head 8 upon the cylinder which is connected at intervals to the main body of the cylinder by integral webs 9, between which are left water passageways 10, as indicated by dotted lines in Figs. 2, 4 and 5. These passageways communicate with a water space 11, which is included between a sheet metal jacket 12 and the outer surface 13 of the cylinder body. As the body of the cylinder is subject to higher temperatures, and more sudden changes in temperature than the jacket, the longitudinal expansion of each, due to the heat is unequal, and it therefore becomes desirable to provide a jacket which may be expanded and contracted mechanically by the cylinder without straining the jacket or the joints between the jacket and the cylinder. The water jacket, therefore, consists of a sheet metal cylinder having annular corrugations 2 which render it readily expansible in the direction of its length. The forward end of the jacket is held within an annular groove 14 upon the rear face of a flange 15, cast upon the forward end of the cylinder, and the rear end within a flanged ring 16 which is shrunk upon the hollow flange 8. The jacket 12 is placed upon the cylinder by passing it over the rear end of the cylinder until the forward end enters the groove 14 and the flanged ring or collar 16 is then shrunk upon the cylinder against the rear end of the jacket, said rear end fitting within the annular recess 17, formed between the flange upon the ring and the periphery of the part 8. The ends of the jacket are secured within the recesses 14 and 17, in a water tight manner, by forcing several coils of wire 18, Fig. 3, within each recess and against the outer surface of the jacket, the wire being preferably of copper and of sufficient diameter to calk tightly within the recesses. The joint thus made is tight, durable and infusible at the highest temperature of the cylinder. An outlet 19, for the water is formed in the flange 15.

It will be seen that cool water entering at the inlet 7 will flow first around the explosion chamber and thence outwardly around the cylinder to the outlet 19, from whence it will escape to the cooling devices. The expansion and contraction of the body of the cylinder will not strain the jacket 12 for the reason that the latter is readily expansible. An oil inlet pipe 20, suitable for attachment of an oil cup extends outwardly from the cylinder through a part 12^a of the jacket which is not corrugated, and the pipe 21 to which the relief valve may be attached also extends through a part 12^b of the jacket which is not corrugated.

The gas inlet valve 22 is mounted upon a stem 23, which is movable longitudinally in a valve casing 24, secured at the end of the explosion chamber. This valve is normally held to its seat by a spring 25 fitting within a socket 26 in the valve casing and bearing outwardly against a collar 43 upon the valve stem. A gas inlet opening 28, extends into the valve casing in the rear of the valve. The distance to which the valve opens for the admission of gas is regulated by a stop collar 29 against which the collar 43 abuts when the valve is opened, and this stop collar is adjustable by means of a forked cam 30, upon a rod 31, the adjustment of the latter being under the control of the operator. The ex-

haust valve 32 is mounted upon a stem 33, sliding within a bearing 34, within a tubular passageway 35, extending through the inner and outer walls 4 and 5. An opening 36, suitable for attachment of an exhaust pipe, connects with said passageway in the rear of the valve 32. The valve is normally held to its seat by a spring 37 surrounding the bearing 34 and pressing outwardly against a head 38 in an extension 39 of the tubular casing. This head is provided with a roller 40 against which the cam 41 on the governor-shaft strikes at the proper time to open the exhaust valve. The head carrying the roller is prevented from turning by means of a guide screw or pin 42, passing through a guide slot 43 in the tubular extension and into the head. A threaded opening 44 is also formed in the walls of the explosion chamber for the attachment of a spark igniter.

Having described our invention what we claim and desire to secure by Letters Patent is:—

1. In an explosive engine, the combination with the cylinder of a water jacket surrounding the cylinder and securely connected at its ends to the ends of the cylinder, said water jacket having a series of transverse or annular corrugations, whereby opening of the joints between the jacket and the cylinder due to relative expansion and contraction is prevented.

2. In an explosive engine, the combination with the cylinder having an annular flange at one end provided with an annular recess and having a ring provided with an annular recess securely connected to its other end, of a water jacket surrounding the cylinder and having its ends securely fastened in said recesses, said water jacket having a series of transverse or annular corrugations, whereby opening of the joints between the jacket and the cylinder due to relative expansion and contraction is prevented.

In testimony whereof we affix our signatures in presence of two witnesses.

JAMES W. PACKARD.
WILLIAM A. HATCHER.

Witnesses:
E. L. WARNER,
C. H. DUNLAP.

No. 712,583. Patented Nov. 4, 1902.

J. W. PACKARD & W. A. HATCHER.

CONTROLLING MECHANISM FOR MOTOR VEHICLES.

(Application filed Feb. 12, 1902.)

(No Model.) 2 Sheets—Sheet I.

Fig. 1.

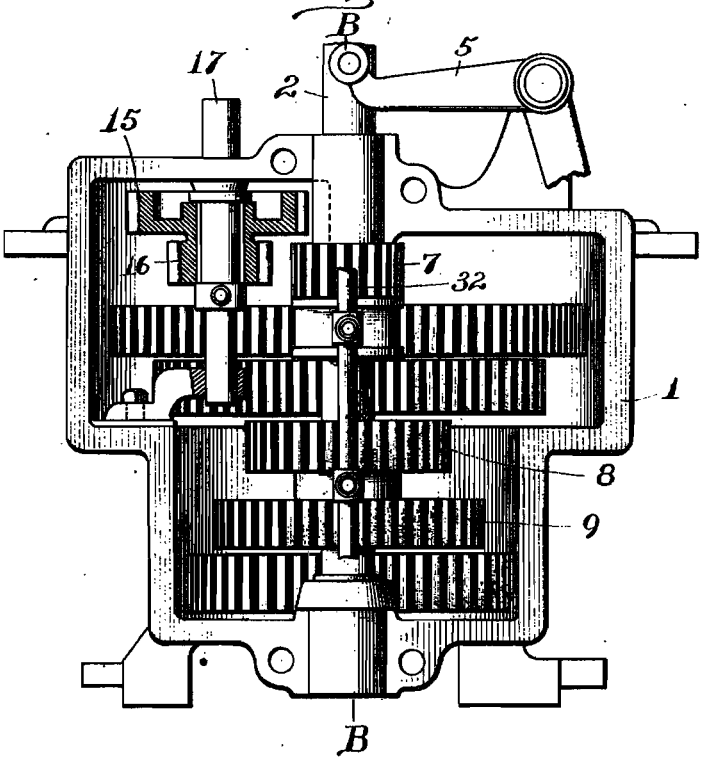


Fig. 2.

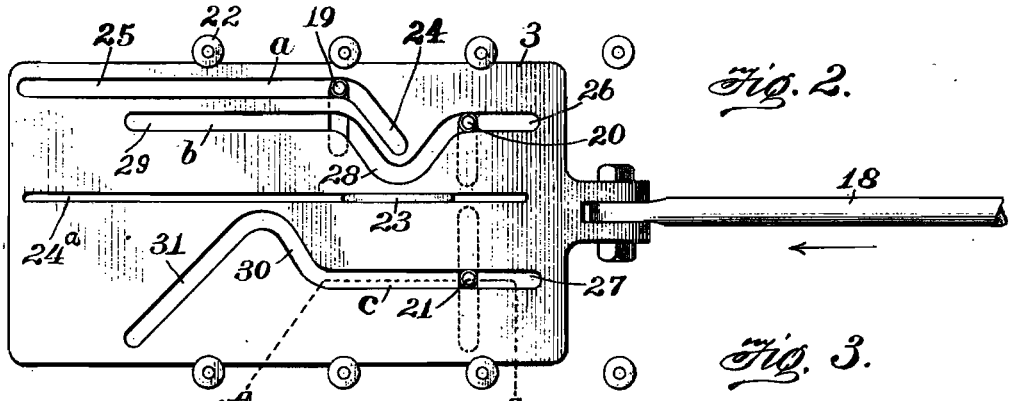
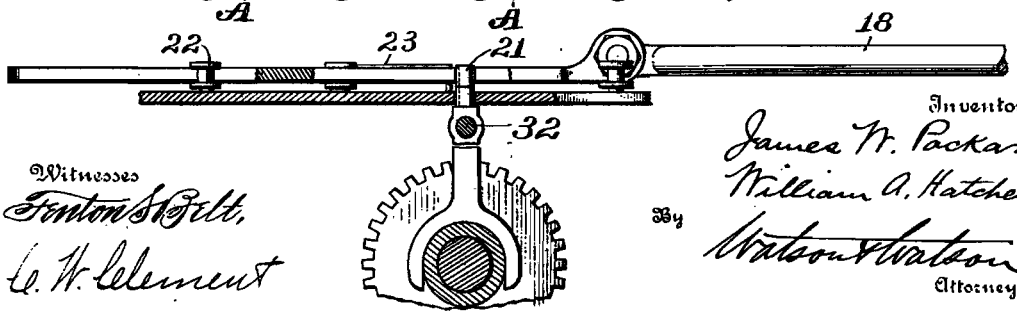


Fig. 3.



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No. 712,583. Patented Nov. 4, 1902.

J. W. PACKARD & W. A. HATCHER.

CONTROLLING MECHANISM FOR MOTOR VEHICLES.

Application filed Feb. 12, 1902.

(No Model.) 2 Sheets—Sheet 2.

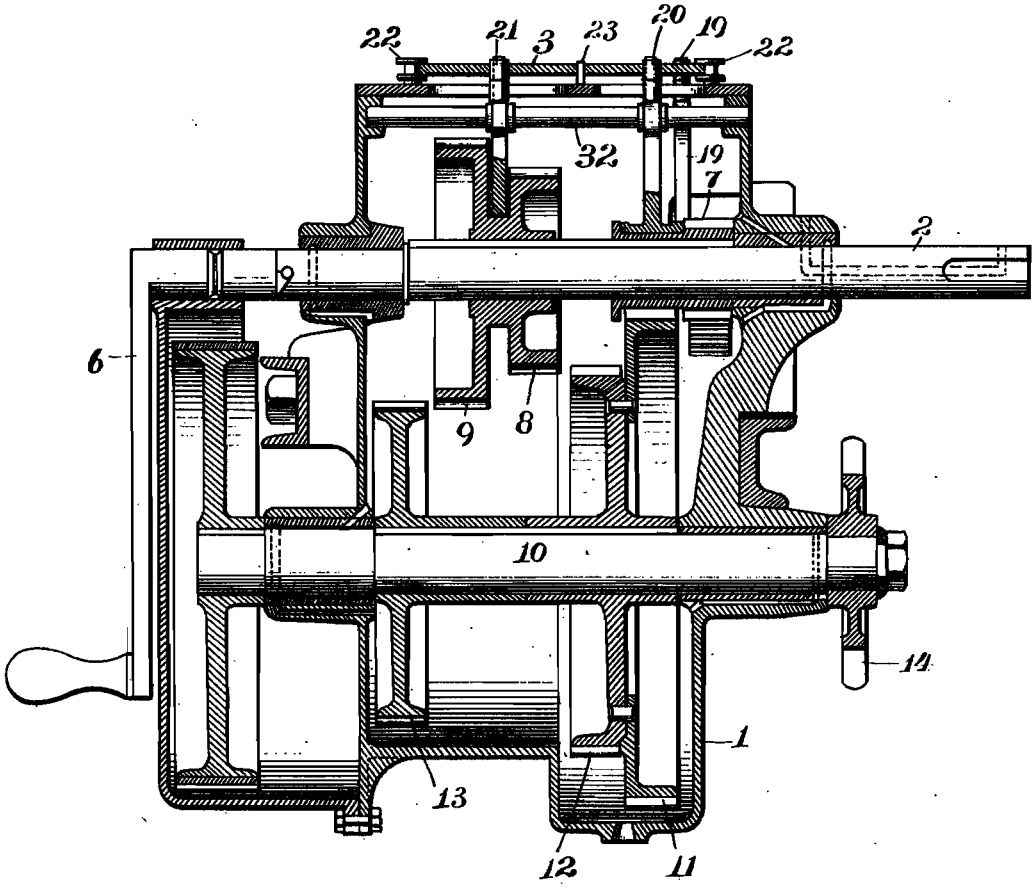

Fig. 4.

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UNITED STATES PATENT OFFICE.

JAMES W. PACKARD AND WILLIAM A. HATCHER, OF WARREN, OHIO, ASSIGNORS TO OHIO AUTOMOBILE COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

CONTROLLING MECHANISM FOR MOTOR-VEHICLES.

SPECIFICATION forming part of Letters Patent No. 712,583, dated November 4, 1902.

Application filed February 12, 1902. Serial No. 93,756. (No model.)

To all whom it may concern:

Be it known that we, JAMES W. PACKARD and WILLIAM A. HATCHER, citizens of the United States, residing at Warren, in the county of Trumbull, State of Ohio, have invented certain new and useful Improvements in Controlling Mechanism for Motor-Vehicles, of which the following is a specification.

This invention comprises improvements in devices for controlling the movements of motor-vehicles; and it relates to means whereby the vehicle may be stopped, started, and reversed and its speed controlled by the simple forward-and-back movement of a controlling-lever.

In the accompanying drawings, which illustrate the invention, Figure 1 is a plan view, partly in section, of the speed-changing and reversing gearing arranged within a casing, the top of the latter being removed. Fig. 2 is a plan view of the cam-plate for effecting the various combinations of gearing. Fig. 3 is a section of the line A A of Fig. 2, and Fig. 4 is a vertical section through the gear-casing on the line B B of Fig. 1.

Referring to the drawings, 1 indicates a casing, within which the gearing is arranged. Extending through the upper portion of the casing is a driving-shaft 2, which may be thrown into and out of engagement with the engine-shaft by means of a suitable clutch operated by a lever 5. A hand-crank 6 is also arranged at one end of the driving-shaft for the purpose of starting an explosive-engine. Keyed to the driving-shaft 2 and movable longitudinally thereon is a small gear 7 and two connected gears 8 and 9 of successively greater diameters. Fixed to a driven shaft 10, which extends through the lower part of the casing parallel with the driving-shaft, are three gears 11, 12, and 13, having successively smaller diameters. The smallest gear 7 upon the driving-shaft is movable into engagement with the largest gear 11 upon the driven shaft, whereby the latter may be moved at a slow speed, and the gears 8 and 9, which are connected together, may be moved so that the gear 8 will engage the gear 12 for an intermediate speed, or the gear 9 may be made to engage the gear 13 for high speed. The gears 12 and 13 are separated from one another by a distance greater than the combined width of the connected gears 8 and 9 in order to prevent the latter from engaging both of said gears 12 and 13 at the same time. In the extreme right and left positions of the gears 8 and 9, therefore, (referring to Fig. 4,) one of said gears will be in engagement with its cooperating gear upon the driven shaft, and in the mid-position the gears will be out of engagement. A sprocket-wheel or other gear 14 is arranged upon the driven shaft and adapted to be connected by a chain or otherwise with the driving-axles of the vehicle. Reversing-gears 15 and 16 are fixed upon a longitudinally-movable shaft 17, which is parallel with the driving-shaft. These gears 15 and 16 are adapted to be moved into and out of engagement with the gears 7 and 11, respectively, when the shaft 17 is moved longitudinally in its bearings. When said gears 15 and 16 are in engagement with the gears 7 and 11, it will be obvious that the direction of rotation of the driven shaft will be reversed.

The various combinations of gears to effect the stopping, starting, and reversing of the driven shaft are effected by means of the movement of a cam-plate 3, arranged upon the top of the casing and movable transversely of the shafts by means of a rod or link 18, which is connected to a suitable hand-lever under the control of the operator. This cam-plate is provided with three cam-slots *a*, *b*, and *c*, into which project the upper ends of the shifting forks or arms 19, 20, and 21, respectively. The shifting-arm 19 is connected with the shaft 17 and adapted when moved laterally to shift said shaft and the reversing-gears. The arm 20 is arranged to shift the gear 7, and the arm 21 is arranged to shift the gears 8 and 9. Suitable devices are provided for guiding the plate in its longitudinal movement and preventing lateral movement, such as the rollers 22 and guide projection 23, which extends upwardly from the casing through a longitudinal guide-slot 24^a in the plate. The cam-slots *a*, *b*, and *c* each have portions parallel with one another and extending longitudinally of the plate. In the normal position of the plate

relatively to the shafts—namely, that shown in Fig. 2—the projecting ends of the arms 19, 20, and 21 will each lie within parallel portions of their respective slots. In this position of the plate all of the gears will be out of mesh. The slot *a* has at its forward end a cam portion 24, inclined inwardly from the line of the rear straight portion 25, while the forward ends 26 and 27 of the slots *b* and *c*, respectively, are straight and parallel with one another. It will be seen that when the plate is moved rearwardly in the direction of the arrow from the position which it occupies in Fig. 2 the arm 19 will be moved laterally by the cam portion 24 of the slot *a*, while the arms 20 and 21 will not be affected. This movement of the arm 19 throws the reversing-gears 15 and 16 into engagement with their coöperating gears and causes reverse movement of the driven shaft and vehicle. The return of the plate to the position shown in Fig. 2 moves the arm 19 laterally in the opposite direction, and thereby disengages the reversing-gears. The main portion 25 of the slot *a*, extending from its inclined end 24 rearwardly, is straight, so that further movement of the plate in the forward direction will not cause lateral movement of the arm 19. The slot *b* has a cam portion 28, inclined inwardly toward the center of the plate and thence outwardly, while the opposing portion of the slot *c* is perfectly straight. If the plate be moved forward from the position shown in Fig. 2, the arm 20 will be moved inwardly toward the center of the plate, thus causing the engagement of the gears 7 and 11, and a further movement of the plate in the right-hand or forward direction will cause the arm 20 to move out of the cam portion of the slot, thereby disengaging the gears 7 and 11. The rear portion 29 of the slot *b* is straight and parallel with the slot *a*, and therefore a still further forward movement of the plate will not cause lateral movement of the arm 20. The rear portion of the slot *c*, however, is inclined inwardly toward the center of the plate, as shown at 30, and thence outwardly beyond the line of the straight portion of the slot, as shown at 31. This arrangement of the slot *c* causes the arm 21 to travel first inwardly as the plate is moved to the right, thus throwing the gears 8 and 12 into engagement, and a movement of the plate to the extreme right-hand or forward position causes the arm 21 to move laterally in the opposite direction far enough to disengage the gears 8 and 12 and to engage the gears 9 and 13.

It will be plain, therefore, that the several combinations of gearing necessary to reverse and change the speed of the vehicle, as well as to stop it, are accomplished by merely moving the plate forward and back, the backward movement of the plate from the normal position (shown in Fig. 2) causing a reversal of the vehicle and a forward movement from the normal position causing successive increases in speed and a reverse movement of the plate reversing these operations.

The arms or forks for shifting the gears are shown slidingly mounted upon a bar 32, extending through the upper part of the casing parallel with the gear-shafts. While the fixed gears are upon the driven shaft and the movable gears are upon the driving-shaft, in the drawings, it would of course be possible to reverse this arrangement, if desired.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. The combination with a driving-shaft and a parallel driven shaft, each having gears thereon and rotatable therewith, the gears upon one of the shafts being adjustable lengthwise thereof into and out of engagement with coöperating gears on the opposing shaft to effect change in speed, of devices for shifting the movable gears comprising a reciprocative cam-plate having cam slots or grooves therein, and shifting-arms engaging said slots and adapted to move the gears.

2. The combination with a driving-shaft and a parallel driven shaft, each having gears thereon and rotatable therewith, the gears upon one of the shafts being adjustable lengthwise thereof into and out of engagement with coöperating gears on the opposing shaft to effect changes in speed, of devices for shifting the movable gears comprising a reciprocative cam-plate movable transversely of the shafts and having cam slots or grooves therein, and shifting-arms engaging said slots and adapted to move the gears.

3. The combination with a driving-shaft and a parallel driven shaft, each having gears thereon and rotatable therewith, the gears upon one of the shafts being adjustable lengthwise thereof into and out of engagement with coöperating gears on the opposing shaft to effect changes in speed, of devices for shifting the movable gears comprising shifting-arms arranged to move the gears and a reciprocative cam-plate having longitudinal cam slots or surfaces arranged to engage said arms and operate the same.

4. The combination with a driving-shaft and a parallel driven shaft, each having gears thereon and rotatable therewith, the gears upon one of the shafts being adjustable into and out of engagement with coöperating gears on the opposing shaft to effect changes in speed, of devices for shifting the movable gears comprising shifting-arms operatively connected with the gears and a reciprocative cam-plate having longitudinal slots or grooves with which said arms engage, said slots having parallel portions and cam portions for moving said arms laterally in succession to effect successive changes in speed.

5. The combination with a driving-shaft and a parallel driven shaft each having gears thereon and rotatable therewith, the gears on one of the shafts being adjustable into and

out of engagement with the coöperating gears on the opposing shaft, to effect changes in speed, and a reversing-gear shaft having reversing-gears thereon movable into and out of engagement with gears upon the driving and driven shafts to cause reversal of the latter, of devices for shifting the movable speed-changing and reversing gears comprising shifting-arms operatively connected with the gears and a reciprocative cam-plate having longitudinal slots or grooves which are engaged by said arm, said slots having cam portions for moving said arms laterally.

6. The combination with a driving-shaft and a parallel driven shaft each having gears thereon and rotatable therewith, the gears upon one of the shafts being adjustable lengthwise into and out of engagement with the coöperating gears on the opposing shaft, to effect changes in speed, and a reversing-gear shaft having reversing-gears thereon movable into and out of engagement with the gears upon the driving and driven shafts, to cause reversal of the latter, of devices for shifting the movable speed-changing and reversing gears comprising shifting-arms operatively connected with the gears and a reciprocative cam-plate having longitudinal slots or grooves with which said arms engage, said slots having cam portions arranged to move said arms successively to shift the gears.

7. The combination with a driving-shaft and a parallel driven shaft each having gears thereon and rotatable therewith, the gears upon one of the shafts being adjustable lengthwise into and out of engagement with the coöperating gears on the opposing shaft, to effect changes in speed, and a reversing-gear shaft having reversing-gears thereon movable into and out of engagement with gears upon the driving and driven shafts to cause reversal of the latter, of devices for shifting the movable speed-changing and reversing gears comprising shifting-arms operatively connected with said gears and a reciprocative cam-plate having longitudinal slots with which said arms engage, one of said slots having a cam portion arranged to move the reversing-gear arm when the plate is reciprocated at one side of its normal position and the other slots having cam portions adapted to move the speed-changing arms successively when the cam-plate is reciprocated at the other side of its normal position.

8. The combination with a driving-shaft and a parallel driven shaft, of a pair of gears having different diameters on one of said shafts and movable together lengthwise thereof, and a pair of coöperating gears fixed upon the opposing shaft, said fixed gears being separated from one another by a distance greater than the combined width of the two movable gears, and means for engaging said movable gears alternately with their coöperating gears comprising a shifting-arm engaging the movable gears and a reciprocative cam-plate having a longitudinal slot or groove with which said arm engages, said slot having a straight part extending in the direction of movement of the plate and a cam portion inclined laterally in one direction from the line of the straight part of the slot and thence laterally across the said part in the opposite direction.

In testimony whereof we affix our signatures in presence of two witnesses.

JAMES W. PACKARD.
WILLIAM A. HATCHER.

Witnesses:
E. L. WARNER,
C. H. DUNLAP.

No. 752,582. PATENTED FEB. 16, 1904.

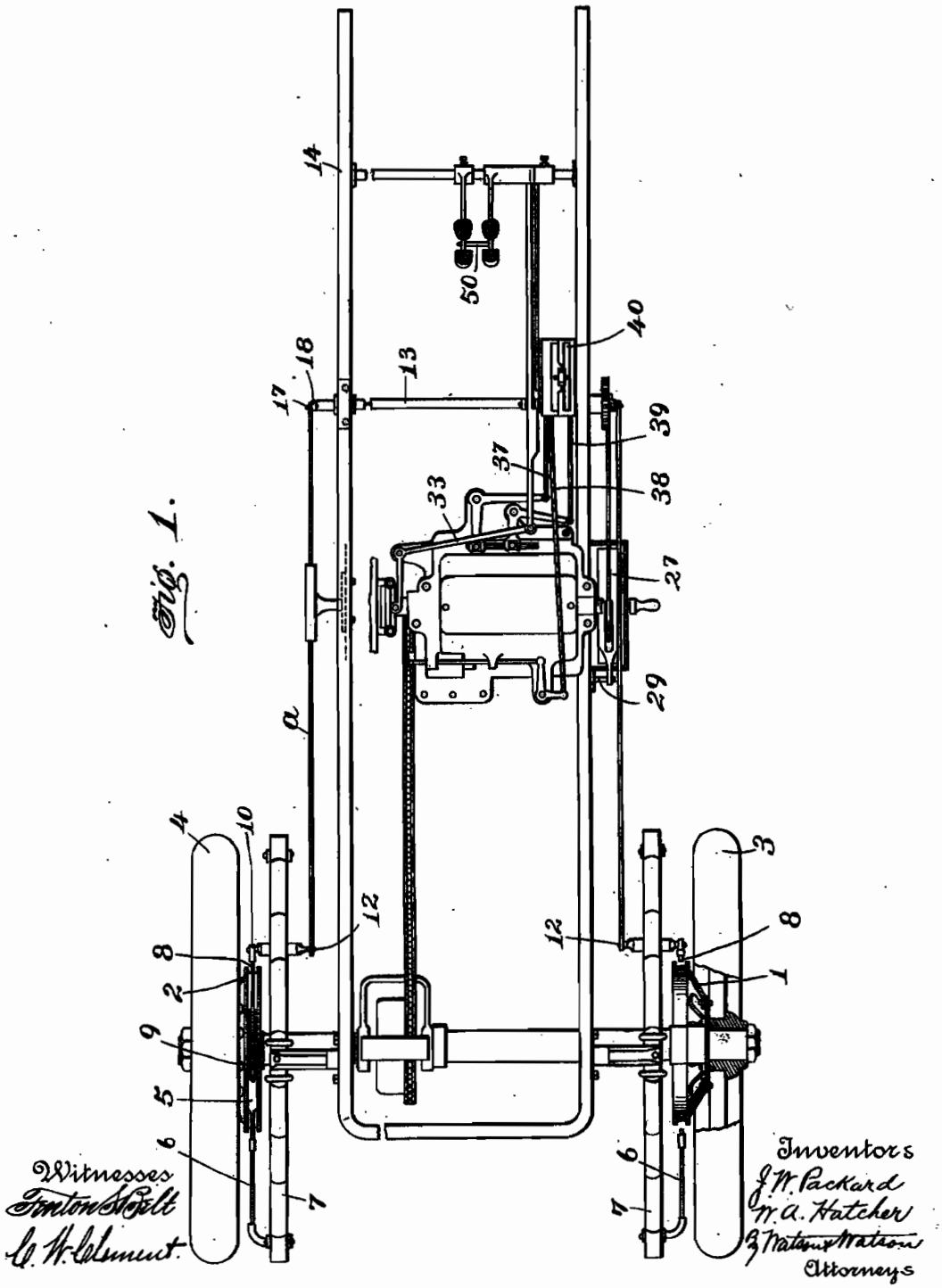
J. W. PACKARD & W. A. HATCHER.

BRAKING MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED MAR. 10, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.



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Inventors
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Attorneys

No. 752,582. PATENTED FEB. 16, 1904.

J. W. PACKARD & W. A. HATCHER.

BRAKING MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED MAR. 10, 1902.

NO MODEL. 2 SHEETS—SHEET 2.

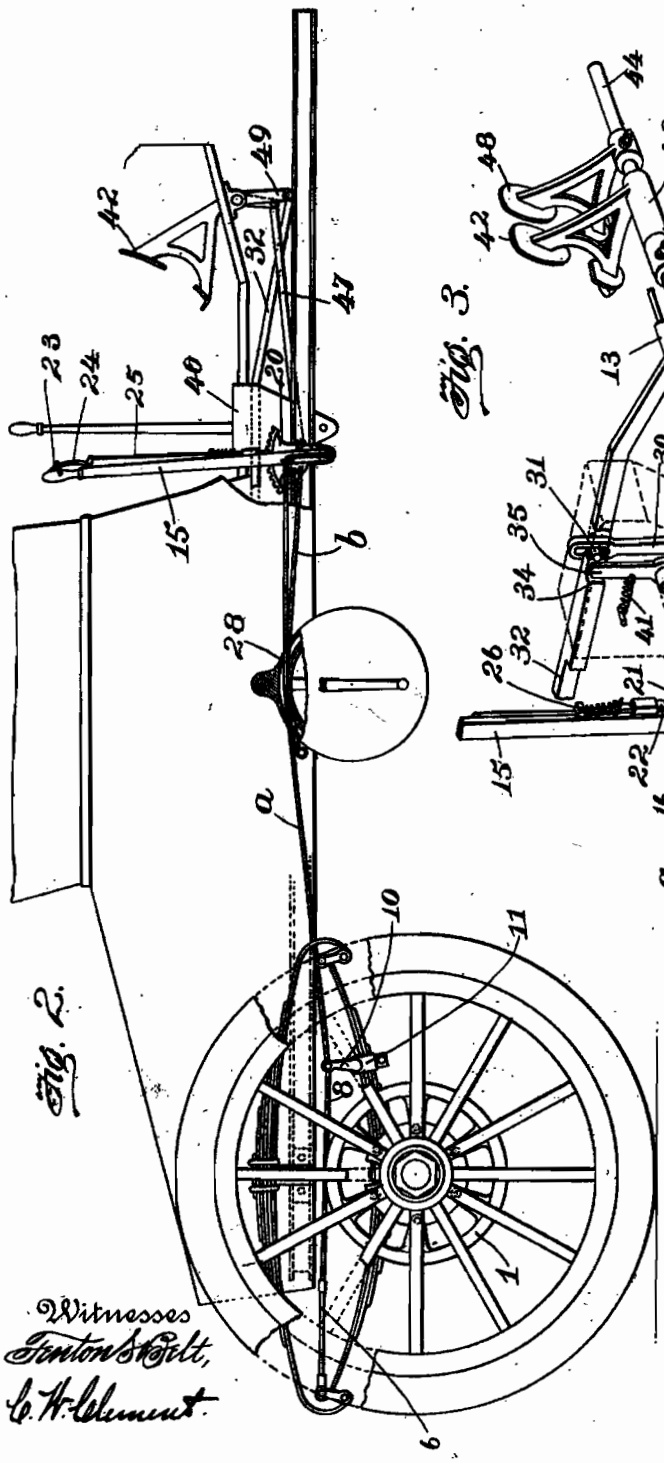

Fig. 2.

Fig. 3.

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W. A. Hatcher
By Watson & Coleman Attorneys

No. 752,582. Patented February 16, 1904.

UNITED STATES PATENT OFFICE.

JAMES W. PACKARD AND WILLIAM A. HATCHER, OF WARREN, OHIO, ASSIGNORS TO OHIO AUTOMOBILE COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

BRAKING MECHANISM FOR MOTOR-VEHICLES.

SPECIFICATION forming part of Letters Patent No. 752,582, dated February 16, 1904.

Application filed March 10, 1902. Serial No. 97,432. (No model.)

To all whom it may concern:

Be it known that we, JAMES W. PACKARD and WILLIAM A. HATCHER, citizens of the United States, residing at Warren, in the county of Trumbull, State of Ohio, have invented certain new and useful Improvements in Braking Mechanism for Motor-Vehicles, of which the following is a specification.

This invention comprises improvements in braking mechanism for motor-vehicles whereby brakes may be applied with equal force to a pair of wheels or driving-axles by means of equalizing connections between a brake-lever and the brakes, said lever being also adapted to operate a clutch for connecting the motive power with the driving-wheels; means for operatively connecting said lever with a brake upon the power mechanism whereby the wheel-brakes may be operated independently of or in conjunction with the power-brake, as desired; means for separately operating the power-brake without disturbing the wheel-brakes or clutch, and independent means for operating both of said brakes and the clutch.

The invention is applicable to vehicles operated by any suitable motive power; but some of these features are particularly applicable to vehicles driven by motors, such as explosive-engines, in which the motor runs constantly and the changes in speed are effected by means of changeable gearing and a clutch for connecting said gearing with the power-shaft. Means are therefore also provided for locking and unlocking the gear-shifting mechanism when the clutch is engaged and released, respectively.

In the accompanying drawings, Figure 1 is a plan view, partly broken away and partly in section, of the driving-wheels and part of the frame of a motor-vehicle with our improvements attached. Fig. 2 is a side elevation of a portion of the vehicle with said improvements thereon, and Fig. 3 is a perspective view of the operating-levers and their connections.

In carrying out the invention brake-wheels 1 and 2 are connected to the wheels 3 and 4, respectively, on opposite sides of the vehicle or to the driving-axles upon which said wheels are mounted. The brake-wheels are flanged on either side, as shown, and surrounding each wheel between the flanges is a brake-band 5, one end of which is secured by a rod 6 to the rear end of the adjacent vehicle-spring 7 or to any suitable fixed part of the vehicle. The free ends of the band-brakes are connected to short sections of cable 8, which extend through slots 9 in the brake-band and are connected to arms 10 upon short rock-shafts, which are journaled in bearings 11, suitably secured to the springs, said rock-shafts having arms 12 at their inner ends, to which the ends of a cable *a* are secured. The cable *a* extends through a tubular rock-shaft 13, which is arranged in suitable bearings transversely of the vehicle-frame 14, the ends of said shaft extending laterally outward from the sides of the frame, as shown, so that the pull of the cable upon the arms 12 will be direct. The rope or cable *a* and the sections 8 are connected together through the rocker-arms 10 and 12 in order to bring the cable close to the frame and yet give a direct pull upon the brake. This is merely a matter of mechanical convenience and the sections 8 are for all practical purposes a continuation of the cable *a*.

A hand brake-lever 15 is secured to the tubular shaft 13, and upon the side of said lever a short distance above the shaft is arranged an eye 16, through which the cable passes. The cable also passes through an eye 17 upon an upright arm 18 at the opposite end of the tubular shaft. It will be seen that when the lever 15 is rocked forward the cable will be tightened and the brakes applied by reason of the movement of the eyes 16 and 17, through which the cable passes and by which the slack in the cable and brake-bands is taken up. As the cable is not secured at any point between its ends, it is free to slide through the eyes and adjust itself so that the pull upon each end of the cable will be the same, and the brakes will therefore be applied with equal power.

A sleeve 19 is journaled upon the tubular

shaft 13 and carries at one end an arm 20, upon the upper end of which is a segmental rack 21, which rack is adapted to be engaged by a pawl 22, mounted upon the lever 15, said pawl being normally held out of engagement by a suitable locking device, such as the ring 23, which slips over the handle 24, which handle is pivoted to the rod 25, to which the pawl is attached. A spring 26 is arranged upon said rod, so that when the ring 23 is raised and the handle 24 released the spring will throw the pawl into engagement with the rack 21. A cable *b* connects the lever-arm 20 with the free end of a brake-band 27, which brake-band is the same in construction as the bands 5. The brake-band 27 extends around a brake-wheel 28, which is mounted upon a shaft connected with the driving power, and the opposite end of the brake-band is secured to a pin 29 or other suitable fixture.

It will be seen that while the pawl 22 is held out of engagement with the rack 21 the operation of the hand-lever 15 will apply and release the wheel-brakes only, while in case of emergency the hand-lever and the lever-arm 20 may be operated together to apply both the wheel-brakes and the brake upon the driving-power by moving the ring 23 out of engagement with the handle 24, thereby permitting the pawl to drop into the rack 21.

A link 30 is secured to the shaft 13, and said link engages a pin 31 upon a rod 32, which is connected to a clutch-lever 33, the arrangement being such that when the hand-lever 15 is thrown forward the rod 32 will be moved to release the clutch, after which a continued forward movement of the hand-lever causes the brakes to be applied. The rod 32 is formed with a shoulder 34, which when said rod is moved forward engages an arm 35 upon a cam-shaft 36. This cam-shaft is arranged to lock and unlock the gear-shifting links 37, 38, and 39, which extend into a controlling-box 40. (Shown in dotted lines in Fig. 3.) The gear-shifting device, the controlling-box, and locking-cam are fully illustrated and described in our copending application, Serial No. 96,829, filed March 5, 1902, and need not be herein described. When the arm 35 is moved forward, the gear-shifting devices are released, so that the gears may be shifted while the clutch is out of engagement, and when the rod 32 is moved backward by the operation of the hand-lever to engage the clutch a spring 41 returns the arm 35 and cam-shaft 36 to their normal positions.

In order to provide means for applying the brake-band to the power-shaft for the purpose of temporarily slowing down the vehicle without throwing the clutch out of engagement, a foot-lever 42 is provided, which lever is secured to a sleeve 43 upon a shaft 44, extending transversely of the vehicle-frame, and said sleeve is provided with an arm 45, which is connected to an arm 46 upon the sleeve 19 by a link 47. It will be evident that the depression of the foot-lever 42 will draw the link 47 forward, thereby rocking the lever-arm 20 and causing the brake 27 to be applied to the brake-wheel 28 upon the power-shaft, and the return of the foot-lever to its normal position will release said brake. By these means the vehicle can be slowed down temporarily without moving the clutch-operating mechanism. Provision is also made for applying by foot-power both the wheel-brakes and the brake upon the power-shaft and simultaneously disengaging the clutch. This is accomplished by means of a foot-lever 48, which is rigidly secured to the shaft 44 and adapted to rock said shaft. An arm 49, also secured to the shaft 44, is connected to one end of the rod 32, which operates the clutch, so that when the foot-lever or treadle 48 is depressed the rod 32 is moved forward and the clutch thereby disengaged. At the same time the link 30, which is rigidly secured to the tubular rock-shaft 13, is moved forward by the rod 32, thereby rocking the shaft 13 and causing the wheel-brakes to be applied. A bar or projection 50, connected with the treadle 42, extends beneath the treadle 48, so that the depression of the treadle 48 carries with it the treadle 42 and causes the brake upon the power-shaft to be applied throughout the medium of the parts hereinbefore described connected with said lever 42.

From the above description it will be understood that by means of the hand-lever the clutch may be operated without applying the brakes and that the wheel-brakes alone may be applied or in conjuction with the brake upon the power-shaft, and the force with which the power-shaft brake is applied depends upon the point at which the pawl engages the rack. It will also be understood that by operating the treadle 42 the power-brake alone will be applied without affecting the clutch or wheel-brakes and that by the operation of the treadle 48 all of the brakes and the clutch may be operated. The cable *a* being in sliding engagement with the levers serves as an equalizing device for applying the brakes equally to each wheel, thereby preventing strain upon the driving-shaft and differential gearing and also preventing tendency of the wheels to turn out of their course, which tendency occurs where the pressure is applied heavily on one side of the vehicle and lightly on the other.

Having thus described our invention, what we claim, and desire to secure by Letters Patent, is—

1. In a motor-vehicle, the combination with a pair of vehicle-wheels upon opposite sides of the vehicle, and a separate braking device for each wheel, of a rope or cable having its ends connected to said braking devices and extending forwardly therefrom at the sides of the vehicle, bearings upon opposite sides of

the vehicle through which said cable extends, and a lever having a part in sliding engagement with and adapted to tighten the cable.

2. In a motor-vehicle, the combination with a pair of vehicle-wheels upon opposite sides of the vehicle and separate braking devices for each wheel, of a rope or cable having its ends connected to said braking devices, a transverse shaft, arms thereon to which the rope or cable is connected, and bearings for said shaft upon opposite sides of the vehicle, said cable extending through said bearings.

3. In a motor-vehicle, the combination with a pair of vehicle-wheels upon opposite sides of the vehicle and separate braking devices for each wheel, of a rope or cable having its ends connected to said braking devices, a tubular shaft extending transversely of the vehicle and through which the cable extends, and a lever upon said shaft having a part in sliding engagement with the cable.

4. In a motor-vehicle, the combination with a pair of vehicle-wheels upon opposite sides of the vehicle, and a separate braking device for each wheel, of a tubular shaft extending transversely of the vehicle, an arm at one end of said shaft and a lever at the opposite end, said arm and lever each having an eye, and a rope or cable extending through said shaft and through said eyes, and having its ends connected to the braking devices.

5. In a motor-vehicle, the combination with a wheel-brake and a brake for the driving mechanism, of separate operating devices for each of said brakes, and means for detachably connecting said operating devices for the purpose of applying both brakes.

6. In a motor-vehicle, the combination with a wheel-brake and a brake for the driving mechanism, of levers separately connected to each brake, one of said levers having a pawl thereon and the other having a rack adapted to be engaged by said pawl.

7. In a motor-vehicle, the combination with a wheel-brake and a brake for the driving mechanism, of levers separately connected to each brake, one of said levers having a pawl thereon and the other having a rack adapted to be engaged by said pawl, and means for normally holding said pawl out of engagement with the rack.

8. In a motor-vehicle, the combination with a wheel-brake and a brake upon the driving mechanism, of separate operating-levers and connections for each brake, clutch-operating mechanism connected with one of said levers, and means for detachably connecting both of said brake-levers.

9. In a motor-vehicle, the combination with a wheel-brake, a brake upon the driving mechanism and levers arranged to operate the brakes separately, of an independent lever and connections arranged to operate both of said brakes.

10. In a motor-vehicle, the combination of a wheel-brake, a clutch, a brake upon the driving mechanism, a lever arranged to operate the wheel-brake and clutch, a lever arranged to operate the brake upon the driving mechanism and an independent lever arranged to operate both brakes and the clutch.

11. In a motor-vehicle, the combination of a wheel-brake, a clutch for connecting the power to the driving-wheels, a hand-lever for operating said clutch and brake, a brake upon the driving mechanism, a treadle for operating said latter brake independently, and means for detachably connecting the hand-lever with the mechanism for operating the brake upon the driving mechanism.

12. In a motor-vehicle, the combination of a wheel-brake, a clutch for connecting the power to the driving-wheels, a hand-lever for operating said clutch and brake, a brake upon the driving mechanism a treadle for operating said latter brake independently, means for detachably connecting the hand-lever with the mechanism for operating the brake upon the driving mechanism, and a separate treadle and connections thereto for operating both brakes and the clutch.

13. In a motor-vehicle, the combination of a wheel-brake, a clutch for connecting the power to the driving-wheels, a hand-lever for operating said clutch and brake, a brake upon the driving mechanism, a treadle for operating said latter brake independently, and a separate treadle and connections thereto for operating both brakes and the clutch.

In testimony whereof we affix our signatures in presence of two witnesses.

JAMES W. PACKARD.
WM. A. HATCHER.

Witnesses:
E. L. WARNER,
C. H. DUNLAP.

No. 741,365. PATENTED OCT. 13, 1903.

J. W. PACKARD.

ELECTRIC IGNITER FOR HYDROCARBON ENGINES.

APPLICATION FILED NOV. 14, 1902.

NO MODEL.

Fig. 1.

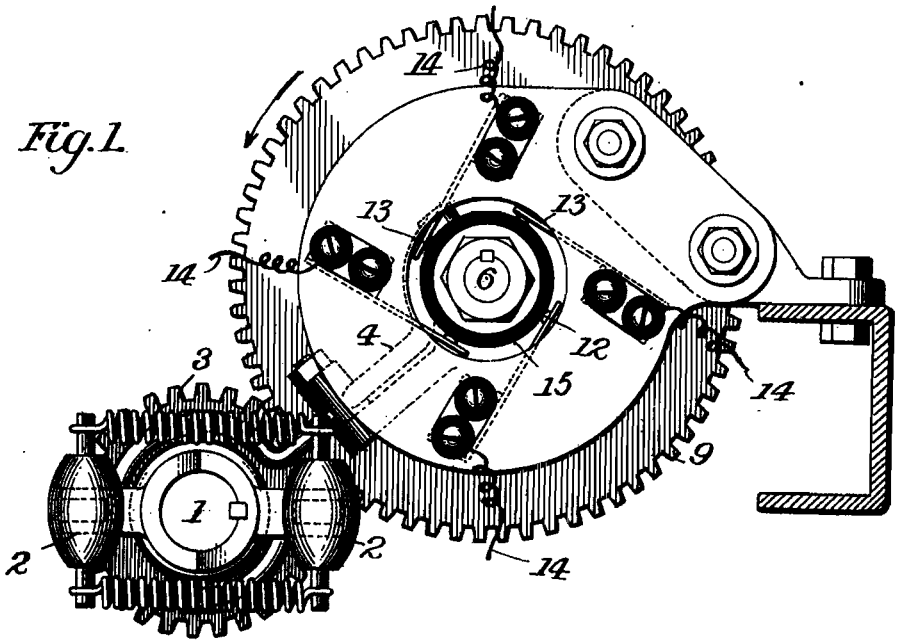
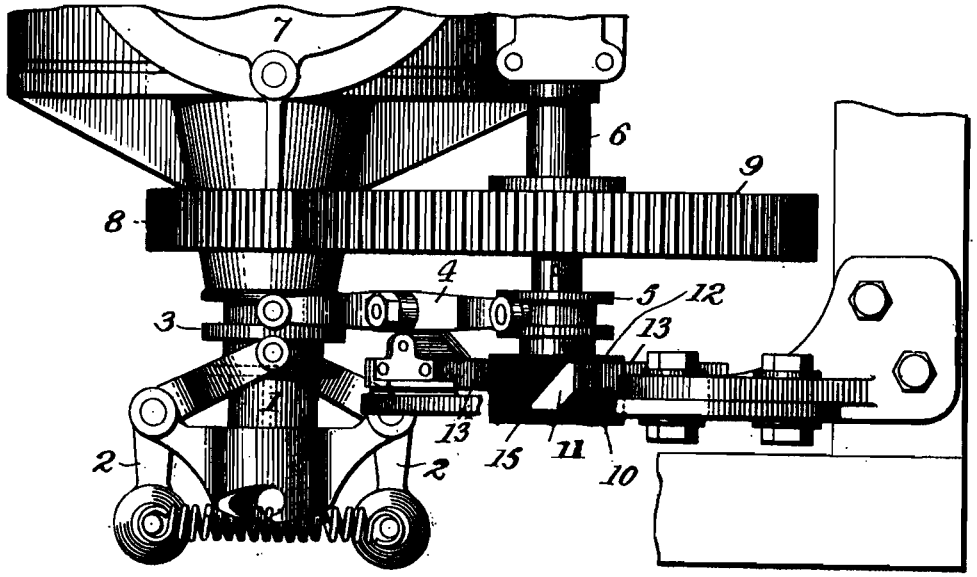


Fig. 2.



Witnesses
J. G. Hinkel
Arthur L. Bryant

Inventor
James W. Packard
by Watson & Watson
Attorneys

No. 741,365. Patented October 13, 1903.

UNITED STATES PATENT OFFICE.

JAMES W. PACKARD, OF WARREN, OHIO, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

ELECTRIC IGNITER FOR HYDROCARBON-ENGINES.

SPECIFICATION forming part of Letters Patent No. 741,365, dated October 13, 1903.

Application filed November 14, 1902. Serial No. 131,340. (No model)

To all whom it may concern:

Be it known that I, JAMES W. PACKARD, a citizen of the United States, residing at Warren, in the county of Trumbull, State of Ohio, have invented certain new and useful Improvements in Electric Igniters for Hydrocarbon-Engines, of which the following is a specification.

This invention relates to improvements in multiple-cylinder hydrocarbon-engines, and more particularly to such engines when used as motors for automobiles.

The improvement relates to devices for advancing the spark uniformly in each cylinder with reference to the time at which the piston is at the end of its stroke.

The invention will be described in detail with reference to the accompanying drawings, in which—

Figure 1 is an end view of the engine-shaft, governor, and the make-and-break device for the igniter-circuits; and Fig. 2 is a plan view of the same.

Referring to the drawings, 1 indicates the engine-shaft, and 2 a centrifugal governor mounted on said shaft. The governor may be of any approved pattern. Upon the shaft 1 is a sliding collar 3, having two grooves, one of which is engaged by the arms of the governor. The other groove in the collar 3 operates a lever 4, the opposite end of which engages a collar 5 on the shaft 6, which operates the inlet and exhaust valves of the engine. It is assumed that the engine, which is indicated at 7, has a plurality of cylinders, in the present instance four. The shaft 6 is operated by gears 8 9 from the engine-shaft, the gear 8 on said latter shaft being of half the diameter of the gear 9, which causes the shaft 6 to rotate at half the speed of the engine-shaft.

Connected to rotate and slide with the collar 5 is a cylinder 10, of fiber or other non-conducting material, and in the periphery of said cylinder is embedded a diagonal plate 11, of brass or other conducting material. When the engine is stopped, the parts occupy the position shown in Fig. 2. When the engine is running, the collar 5 and the cylinder 10 move inward as the speed increases, thus causing the plate 11 to reach the contact-points 12 earlier in the rotation of the shaft 6 and advance the sparks with relation to the movements of the pistons. The points 12 are carried on spring-fingers 13, to which the circuits 14 are connected. The contact-plate 11 is electrically connected in the usual manner.

The contact-plate 11 does not extend to the outer end of the cylinder 10, there being a plain ring 15, of insulating material, at said outer end upon which said contact-points may run, thus shutting off the igniters entirely when the speed of the engine reaches a certain maximum.

The operation of the invention will be apparent from the foregoing description.

Having described the invention, what is claimed as novel is—

1. In a multiple-cylinder hydrocarbon-engine, the combination with the engine-shaft and the governor thereon, of a second shaft operating at half the speed of the engine-shaft, a cylinder of non-conducting material arranged to slide on and turn with said second shaft, means for communicating the movement of the governor to said cylinder, a diagonally-arranged plate of conducting material upon said cylinder, a complete circle of non-conducting material at the outer end of said cylinder, and a plurality of conducting-fingers arranged to bear on said cylinder and conducting-plate, whereby the spark is advanced uniformly in all of the cylinders of the engine as the speed increases, and the igniters cease to operate when the engine reaches a certain maximum speed.

2. In a multiple-cylinder hydrocarbon-engine, the combination with the engine-shaft and the governor thereon, of a second shaft geared to and operating at half the speed of the engine-shaft, a collar arranged to slide on and to turn with said second shaft, a cylinder of non-conducting material connected to and moving with said collar, a lever connecting

said collar with the governor, a diagonally-arranged plate of conducting material upon said cylinder, said plate being shorter than the width of said cylinder, and a plurality of conducting-fingers arranged to bear on said cylinder and conducting-plate or on said cylinder beyond the outer end of said plate according as the position of said cylinder relative to the brushes is varied by the governor, as and for the purpose described.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES W. PACKARD.

Witnesses:
ARA C. HARRINGTON,
G. B. POST.

No. 804,971. PATENTED NOV. 21, 1905.

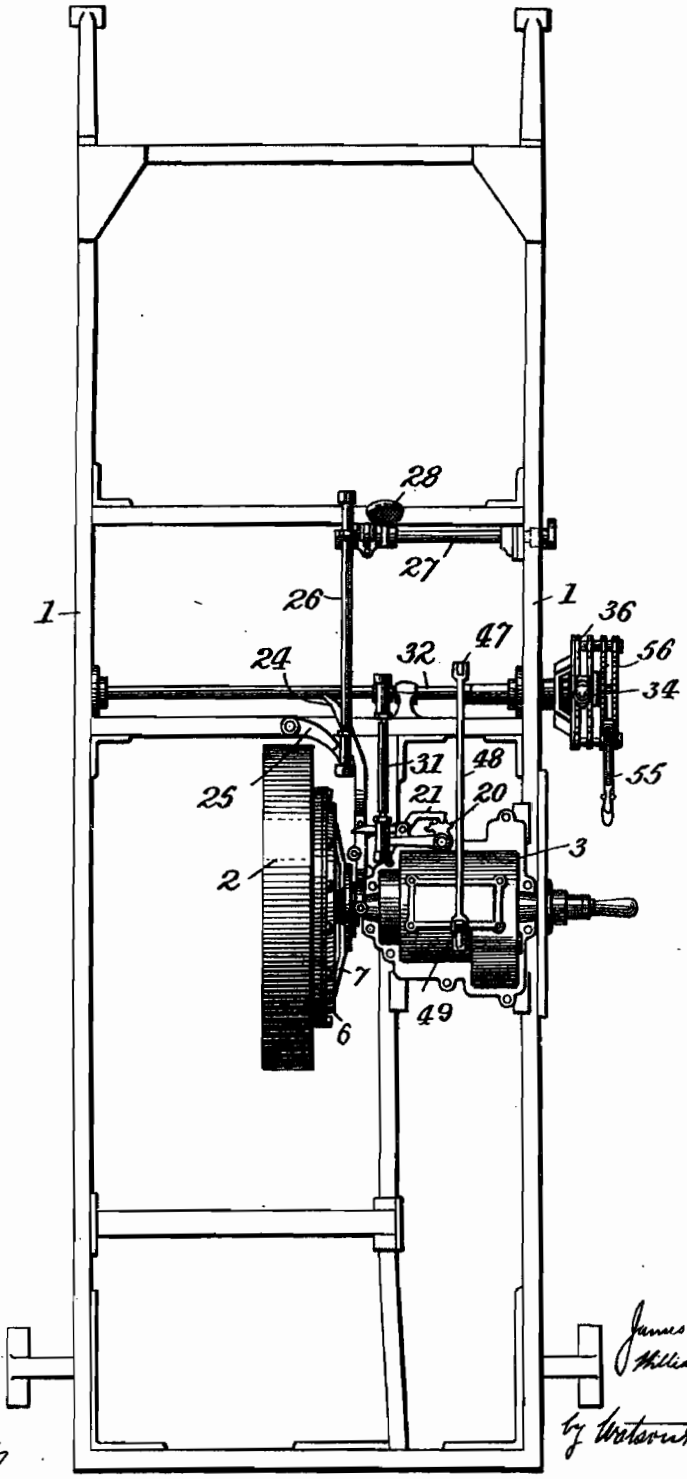
J. W. PACKARD & W. A. HATCHER.

LEVER MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED NOV. 14, 1902.

5 SHEETS—SHEET 1.

Fig. 1.



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No. 804,971. PATENTED NOV. 21, 1905.

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LEVER MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED NOV. 14, 1902.

5 SHEETS—SHEET 2.

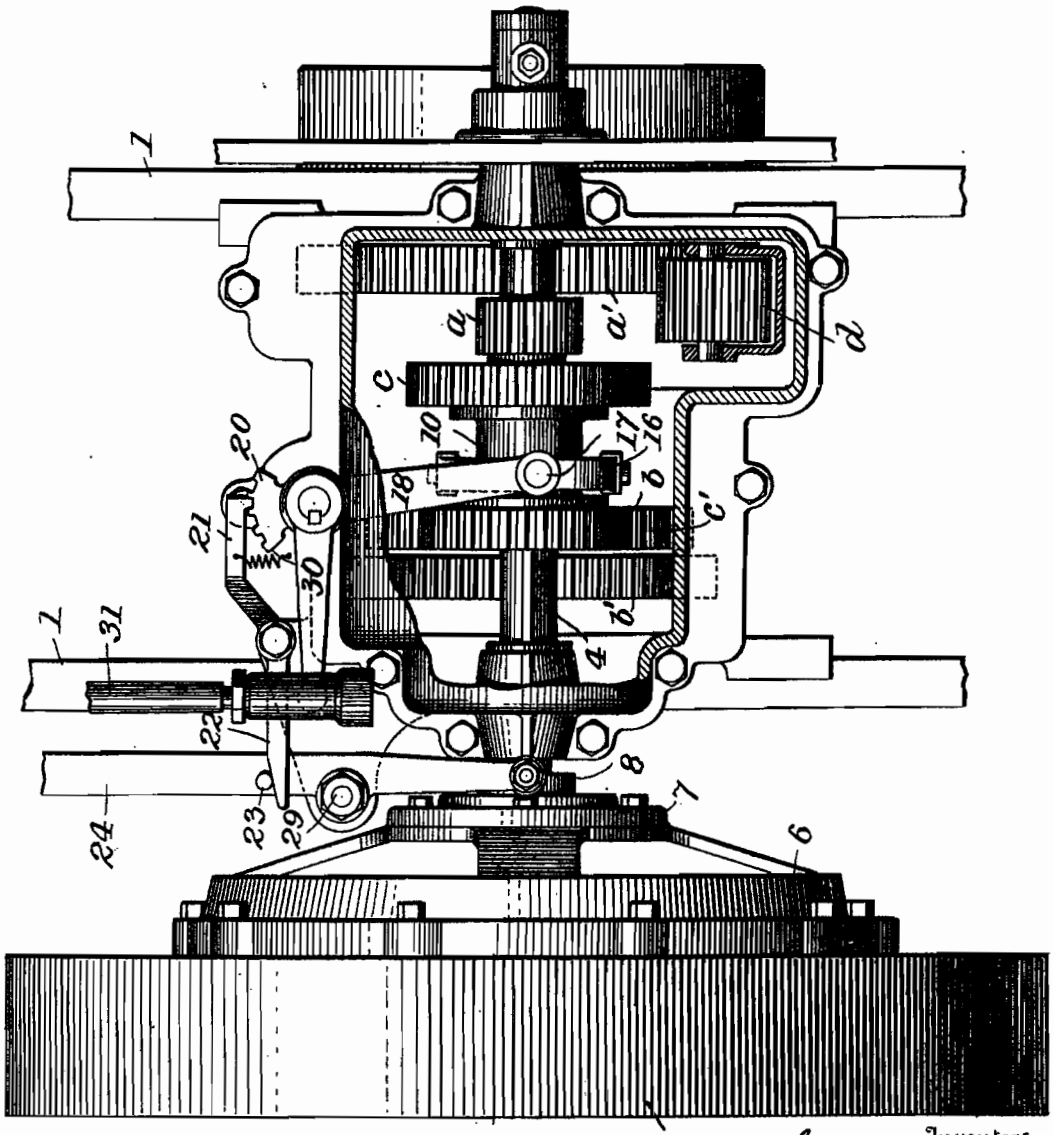

Fig. 2.

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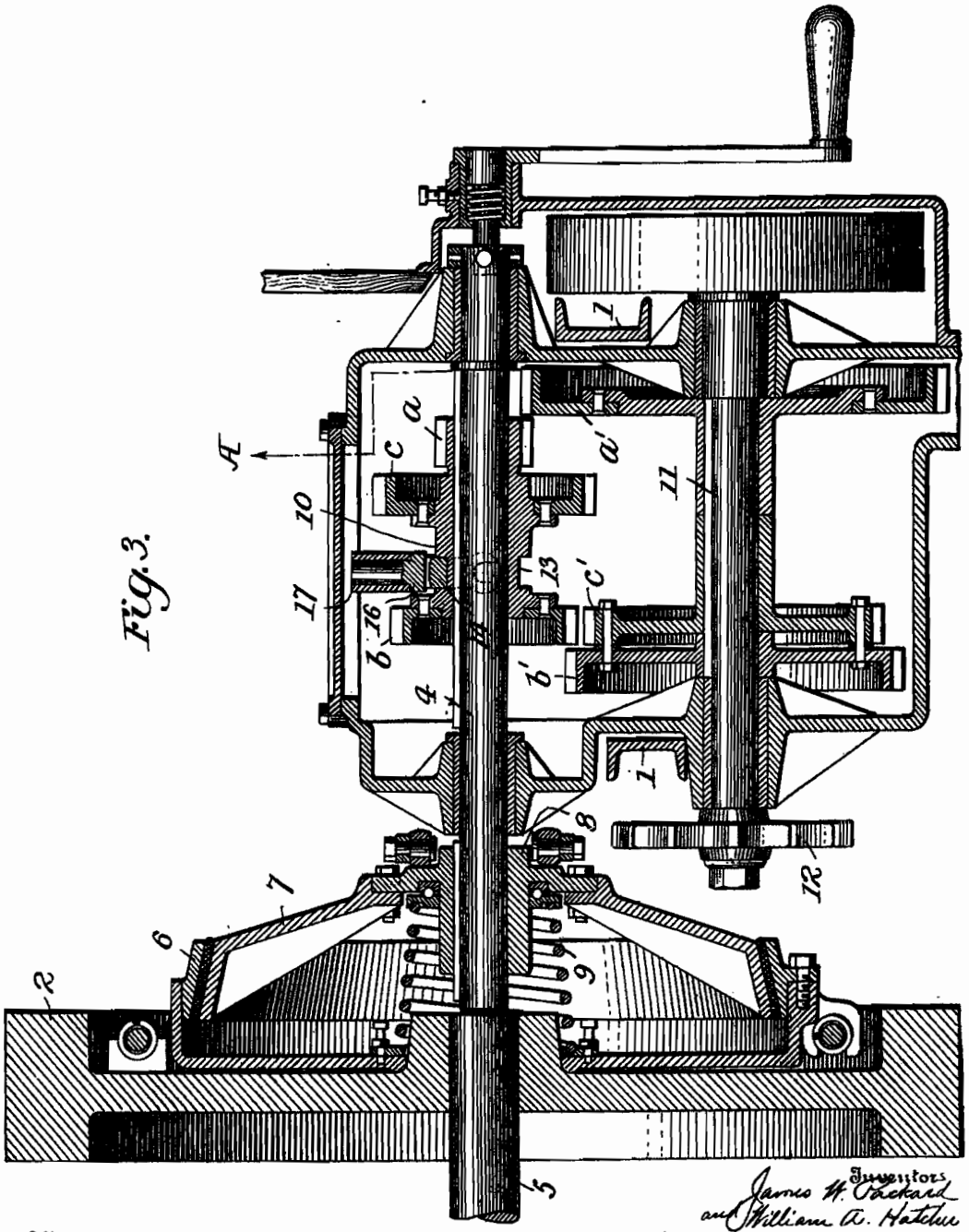
LEVER MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED NOV. 14, 1902.

5 SHEETS—SHEET 3.

Fig. 3.



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LEVER MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED NOV. 14, 1902.

5 SHEETS—SHEET 4.

Fig. 4.

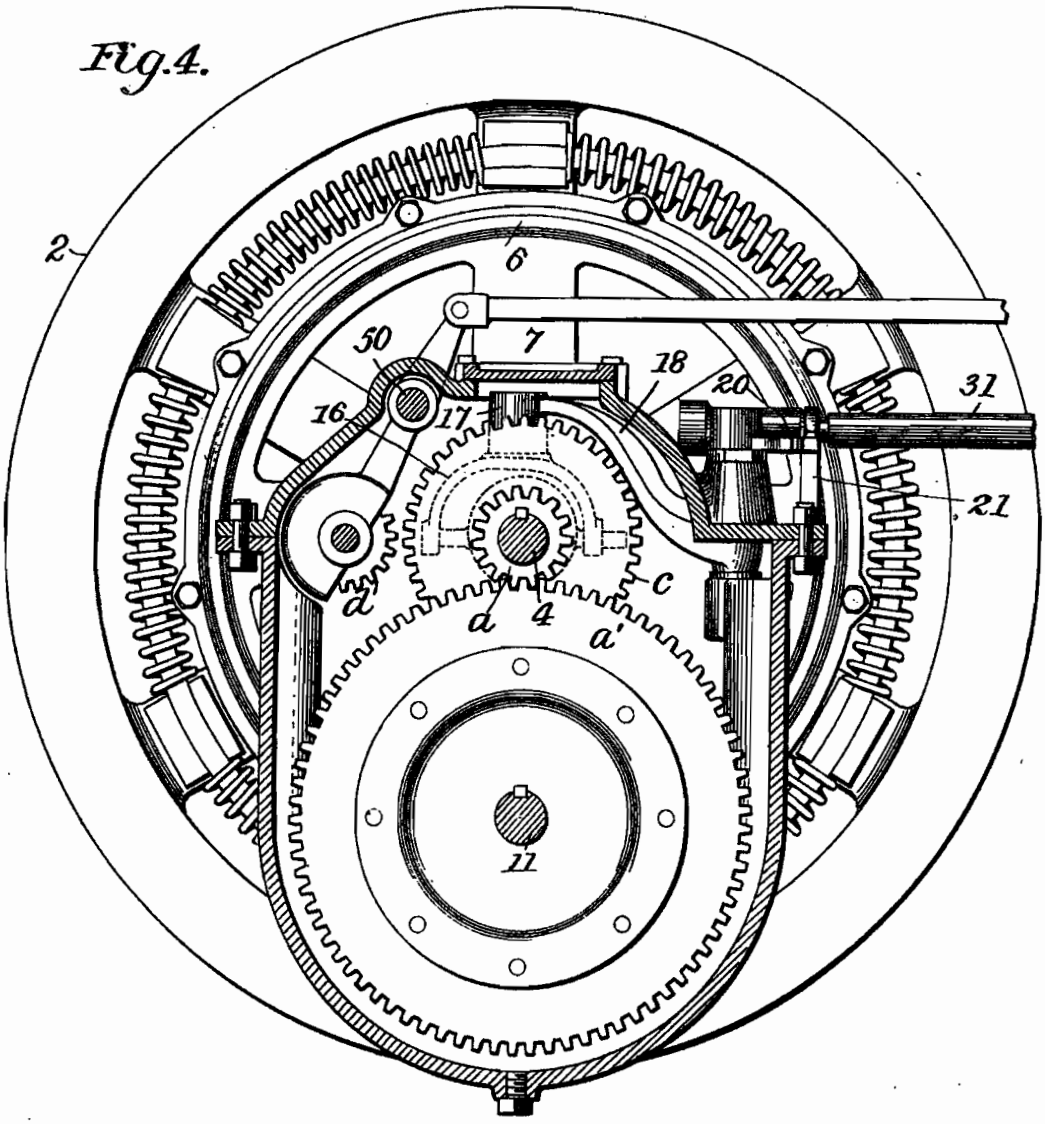
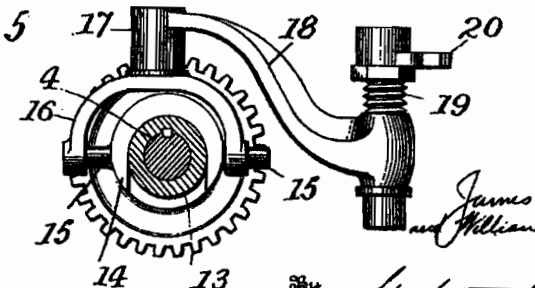


Fig. 5



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No. 804,971. PATENTED NOV. 21, 1905.

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LEVER MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED NOV. 14, 1902.

5 SHEETS—SHEET 5.

Fig. 7.

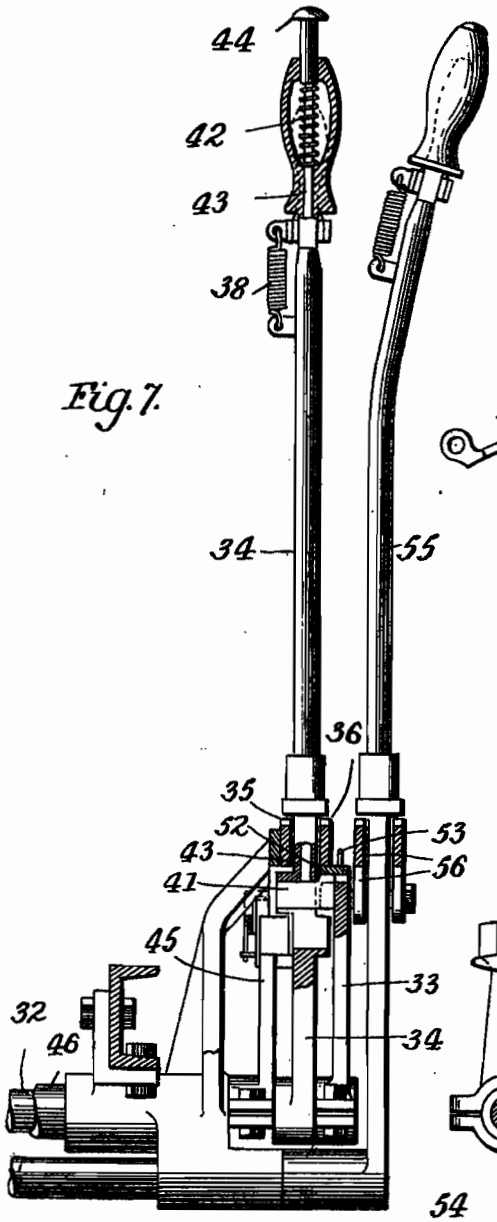


Fig. 10.

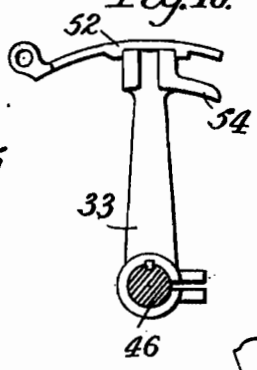


Fig. 6.

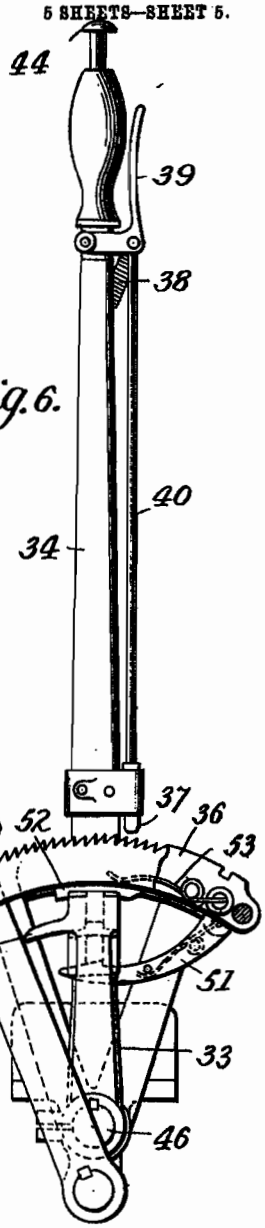


Fig. 8.

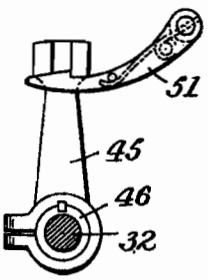
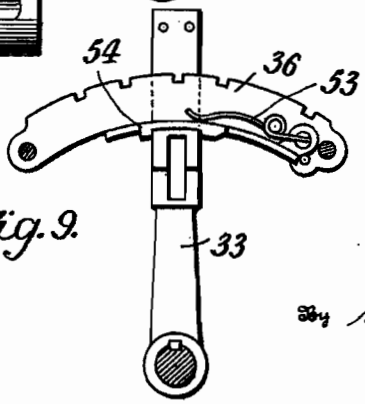


Fig. 9.



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UNITED STATES PATENT OFFICE.

JAMES W. PACKARD AND WILLIAM A. HATCHER, OF WARREN, OHIO, ASSIGNORS TO PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

LEVER MECHANISM FOR MOTOR-VEHICLES.

No. 804,971. Specification of Letters Patent. Patented Nov. 21, 1905.

Application filed November 14, 1902. Serial No. 131,327.

To all whom it may concern:

Be it known that we, JAMES W. PACKARD and WILLIAM A. HATCHER, citizens of the United States, residing at Warren, in the county of Trumbull, State of Ohio, have invented certain new and useful Improvements in Lever Mechanism for Motor-Vehicles, of which the following is a specification.

The present invention relates to improvements in motor-vehicles, and more especially to the devices for stopping, starting, and controlling the speed of such vehicles.

The object of the invention is to simplify and cheapen such constructions and to render them more durable and more effective in operation.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is a plan view of so much of the driving and controlling mechanism of a motor-vehicle as is necessary to illustrate the present invention. Fig. 2 is an enlarged view of part of Fig. 1, the top of the gear-casing being broken away. Fig. 3 is a longitudinally-vertical section through the gear-casing. Fig. 4 is a sectional view about on the line A of Fig. 3. Fig. 5 is a detail of the gear-shifting devices. Fig. 6 is a side view of the brake and speed levers. Fig. 7 is an elevation of the brake and speed levers, parts being shown in section; and Figs. 8 to 10 are details of the same.

Referring to the drawings, 1 indicates the frame, which supports the body and the mechanism of a motor-vehicle; 2, the fly-wheel of the engine, and 3 the casing containing the speed and back gearing. The shaft 4 is mounted in the casing in line with the engine-shaft 5. One member 6 of a friction-clutch is mounted on the wheel 2, and the other member 7 is mounted on a sliding hub 8 on shaft 4. A spring 9 normally holds the clutch members in engagement, thus normally connecting the shaft 4 with the engine-shaft 5.

On the shaft 4 is a sleeve 10, carrying three gears *a b c* of different sizes, which are adapted to intermesh with corresponding gears *a' b' c'*, fixed upon a counter-shaft 11, which shaft carries the sprocket-wheel 12 for transmitting power to the driving-wheels. The gears *a b c* may be engaged successively with the gears *a' b' c'* to effect three forward speeds of the vehicle, or they may all be disengaged, or the gears *a a'* may be engaged with a backing-gear *d*, Fig. 4, to effect a slow backward movement of the vehicle. The devices for effecting this adjustment of the gearing will now be described.

The gear-shifting devices and the clutch-operating devices are interlocked in such manner that the gears cannot be shifted when the clutch is closed. When the clutch is opened, the gears are automatically freed, so that they may be shifted to any desired position. As shown, this interlocking of the gears and the clutch is effected as follows: The sleeve 10, which carries the gears *a b c*, has a circumferential groove 13, which is engaged by a yoke 14, having pins 15 passing through eyes in a second yoke 16, which is pivoted in the free end 17 of a gear-shifting lever 18 Figs. 2 to 5. Upon the hub 19 of the lever 18 is rigidly attached a toothed sector 20, which is normally engaged by a spring locking-pawl 21, having a tail 22 in the path of a pin 23 on the clutch-shifting lever 24, Figs. 1 and 2. The lever 24 is operated by an arm 25, which is drawn forward by a link 26, connecting it with an arm on a shaft 27, which is operated by a foot-lever 28. When the treadle 28 is pressed forward, the lever 25 is thrown against lever 24, rocking the latter on its pivot 29 and throwing out the clutch. Simultaneously the pin 23 rocks the pawl 21 and unlocks the gear-shifting lever 18. On releasing the foot-lever the parts are returned to their normal position by suitable springs and the change-gears are again locked by the pawl 21.

The sleeve 10 is shifted by means of an arm 30 on the post 19, link 31, arm on shaft 32, and lever-arm 33 on said shaft. Upon the shaft 32 is loosely journaled a hand-lever 34, which is adapted to be swung back and forth between two notched sectors 35 36. The lever 34 carries a latch 37, which extends across the sectors and is normally pressed into engagement with them by a spring 38. The latch may be withdrawn by means of a lever 39 and connecting-rod 40. As shown, there are five notches in the sector-plates, the middle notch being a neutral point at which the lever stands when the gears are all out of mesh, the rear notch indicating the backing position and the other three notches three forward speed positions.

The lever 34 carries a sliding tongue 41, which engages with a notch in the arm 33 when the tongue is in its uppermost position, as shown in Fig. 7. The tongue 41 is normally held in this position by spring 42 surrounding the rod 43, which is connected to the tongue and passes up through the lever 34 to a push-button 44. When the parts are in this normal position, the lever 33 may be adjusted for each of the three forward speeds or to neutral position. It will be understood that these forward speeds are obtained by shifting the gears *a b c* by means of connections heretofore described. It will be understood that the main clutch must be thrown open before any change of gearing can be effected.

When it is desired to throw in the backing-gear *d*, lever 34 is brought to central position and the button 44 pressed down until the tongue 41 is disengaged from arm 33 and engaged with an arm 45 on a sleeve 46, surrounding the shaft 32. Sleeve 46 carries an arm 47, which is connected by link 48 with a lever 49, pivoted within the casing at 50 and carrying at its lower end the backing-gear *d*. When the tongue 41 is in engagement with the arm 45 and the lever 34 is then moved back to register with the rear notch in the sectors, the backing-gear will be thrown into engagement with the gears *a a'*, said gears being then in adjacent planes, as shown in Figs. 2 and 3.

Means are provided for locking the forward speed-gears in their normal inoperative positions, which is shown in Figs. 2 and 3, when the backing-gear is in use and for locking the backing-gear in its inoperative position when the forward speed-gears are in use. As shown, these means are constructed as follows:

A spring-latch 51, Figs. 6 and 8, engages the arm 45 and locks it in normal position, with the backing-gear thrown out, while the tongue 41 is in engagement with the arm 33. A latch 52 is provided with a notch adapted to engage the arm 33 and lock it in normal central position when the tongue 41 is out of engagement with said arm. The latch 52 has a curved portion overlying the tongue 41, and the spring 42, which elevates said tongue, is strong enough to overcome the spring 53, which operates the latch 52. Tongue 41 thus keeps 52 normally raised when said tongue is in engagement with the arm 33. When, however, the tongue is depressed into engagement with the arm 45, latch 52 engages and locks arm 33. One of the arms 33 and 45 must always be in normal central position, and the other arm must therefore be brought to normal central position to change from one to the other. In making the change to the backing-arm 45 tongue 41 pushes latch 51 out of engagement with said arm. On moving the lever rearward to throw in the backing-gear the outer edge of tongue 41 passes under the curved projection or guide 54, which is carried by the arm 33. This prevents the tongue from springing up so long as the backing-gear is in use, thus relieving the operator of the trouble of keeping the button 44 depressed. When the backing-gear is thrown out and the lever 34 moved to central position, the tongue 41 is released from the guide 54 and is automatically thrown up into engagement with the arm 33 by the spring 42. The drawings show the brake-lever 55 and locking-sectors 56 for said lever; but the parts connected with the brake do not pertain to the present invention.

It will be seen that the foregoing invention provides means for throwing in and out the main clutch, for effecting three forward speeds and one backward speed, and that all of the parts are so interlocked that the speed-gears cannot be shifted while the clutch is operative, the forward speed-gears cannot be moved while the backing-gear is in operation, and the backing-gear cannot be moved while the forward speed-gears are connected with the operating-lever.

Having fully described the invention, what is claimed is—

1. In a motor-vehicle, having relatively movable speed-changing and reversing gears adapted to vary the speed and direction of the vehicle, a hand-lever, two arms for shifting different sets of said gearing arranged adjacent to said lever, and means mounted on said lever and adapted to connect said lever with either of said arms.

2. In a motor-vehicle, having relatively movable speed-changing and reversing gears adapted to vary the speed and direction of the vehicle, a hand-lever, two arms for shifting different sets of said gearing arranged adjacent to said lever, and a locking-tongue mounted on and movable longitudinally of said lever and adapted to connect the lever with either of said arms.

3. In a motor-vehicle, having relatively movable speed-changing and reversing gears adapted to vary the speed and direction of the vehicle, two arms mounted to rock about a common axis for shifting different sets of said gearing, a hand-lever mounted to rock about the same axis as said arms, and means adjustably secured to said lever and adapted to connect the lever with either of said arms.

4. In a motor-vehicle, having relatively movable speed-changing and reversing gears adapted to vary the speed and direction of the vehicle, two pivotally-mounted arms for shifting different sets of said gearing, and each provided on its inner face with a laterally-projecting member, a hand-lever, and a locking means adjustably mounted on said lever and adapted to be moved into engagement with the projecting member of either of said arms but not to engage both said members simultaneously.

5. In a motor-vehicle, having relatively movable speed-changing and reversing gears

adapted to vary the speed and direction of the vehicle, two arms mounted to rock about a common axis, for shifting different sets of said gearing, and each provided with a member projecting laterally toward the other arm, said projecting members being arranged at different distances from the axis of said arms, a hand-lever arranged between said arms, and means mounted on and movable longitudinally of said lever and adapted to engage the projecting member of either arm.

6. In a motor-vehicle, having two series of complementary gears, and a backing-gear, a lever-arm for shifting one series of complementary gears, a second lever-arm for shifting the backing-gear, and a hand-lever carrying a part movable relative to said lever into engagement with either of said arms.

7. In a motor-vehicle, having two series of complementary gears, and a backing-gear, a lever-arm for shifting one series of complementary gears, a second lever-arm for shifting the backing-gear, a hand-lever arranged between said arms and a sliding tongue carried by said hand-lever and movable into engagement with either of said arms.

8. In a motor-vehicle, the combination of an arm arranged to control the forward speeds of the vehicle, and a second arm arranged to control the backward movement of the vehicle, a hand-lever arranged between said arms and provided with a tongue arranged to slide into engagement with either arm as may be desired, a spring tending to normally hold the tongue in engagement with the forward speed-arm, and a guide adapted to hold said tongue in engagement with the backing-arm when said arm is moved from its normal position.

9. In a motor-vehicle, the combination of an arm for controlling the forward speed movements of the vehicle, and a second arm movable about the same axis as the first said arm for controlling the backward movement of the vehicle, a hand-lever adapted to turn about the same axis as said arms, means for engaging said hand-lever with either of said arms, and means for locking either arm when not engaged in its normal central position.

10. In a motor-vehicle, having relatively movable speed-changing gears adapted to vary the speed of the vehicle, a pivoted lever, arms mounted to turn about the same axis as said lever, guides for said lever and arms, locking means for locking the arms at times in a stationary position, and locking means for connecting one or the other of the arms to the lever so that it may be vibrated in unison therewith while the other arm remains stationary.

11. In a motor-vehicle, having relatively movable speed-changing gears adapted to vary the speed of the vehicle, a pivoted lever, arms mounted on opposite sides of said lever to rock about the same axis as the lever, guides for said lever and arms, means for holding the arms stationary, and locking means for connecting either of the arms to the lever so that it may vibrate in unison therewith while the other arm remains stationary.

In testimony whereof we affix our signatures in presence of two witnesses.

JAMES W. PACKARD.
WM. A. HATCHER.

Witnesses:
ARA C. HARRINGTON,
G. B. POST.

No. 749,744. PATENTED JAN. 19, 1904.

J. W. PACKARD & W. A. HATCHER.

MOTOR VEHICLE.

APPLICATION FILED NOV. 14, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

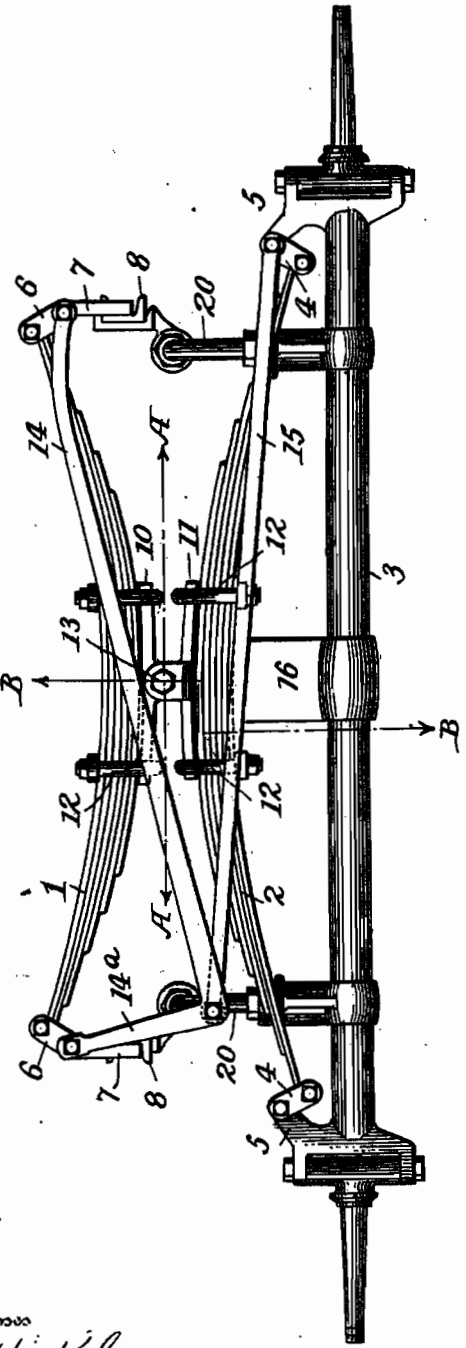
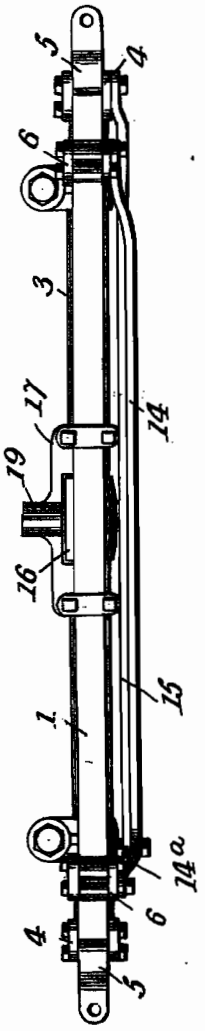


Fig. 2.



Witnesses:
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No. 749,744. PATENTED JAN. 19, 1904.

J. W. PACKARD & W. A. HATCHER.

MOTOR VEHICLE.

APPLICATION FILED NOV. 14, 1902.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

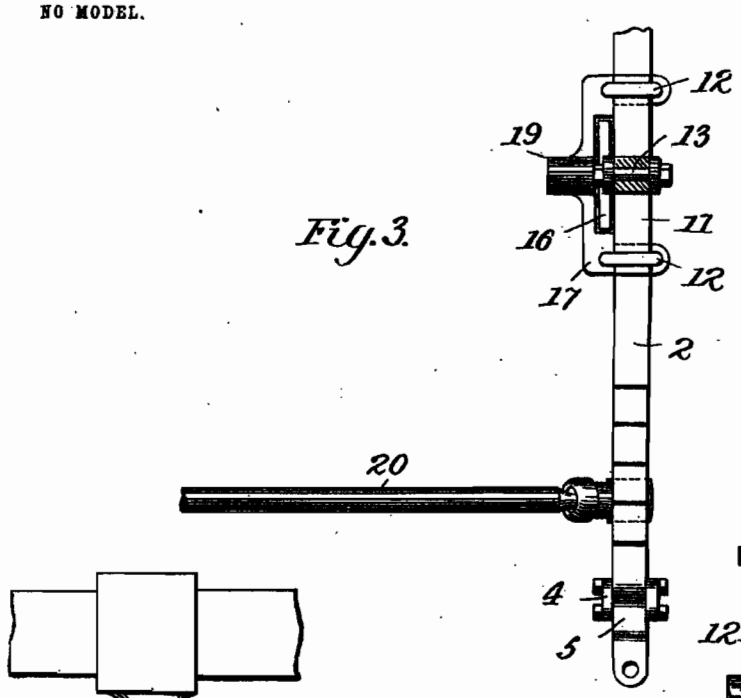


Fig. 4.

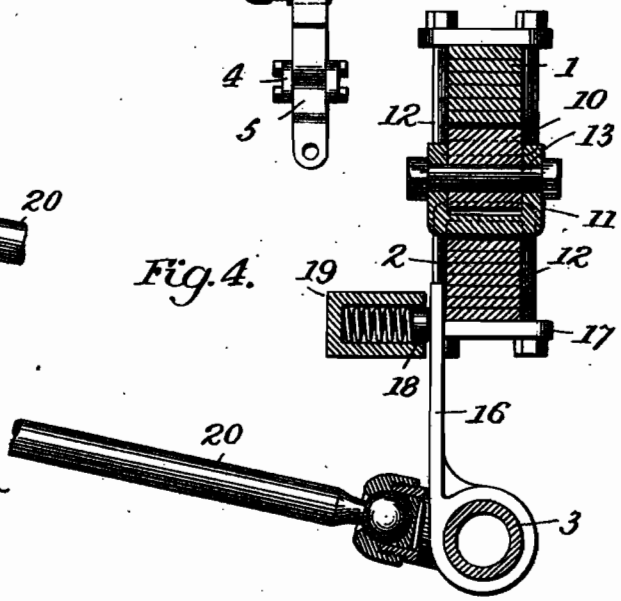
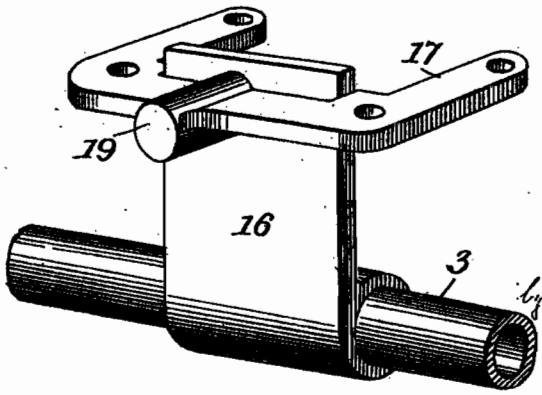


Fig. 5.



Witnesses
J. G. Hinkel
Arthur L. Bryant

Inventors
James W. Packard
William A. Hatcher
by Watson & Watson
Attorneys

No. 749,744. Patented January 19, 1904.

UNITED STATES PATENT OFFICE.

JAMES W. PACKARD AND WILLIAM A. HATCHER, OF WARREN, OHIO, ASSIGNORS TO PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

MOTOR-VEHICLE.

SPECIFICATION forming part of Letters Patent No. 749,744, dated January 19, 1904.

Application filed November 14, 1902. Serial No. 131,326. (No model.)

To all whom it may concern:

Be it known that we, JAMES W. PACKARD and WILLIAM A. HATCHER, citizens of the United States, residing at Warren, in the county of Trumbull, State of Ohio, have invented certain new and useful Improvements in Motor-Vehicles, of which the following is a specification.

This invention relates to means whereby the forward axle of an automobile or other vehicle is permitted to rock freely in a vertical plane to conform to the inequalities of the road without imparting its rocking movement to the vehicle-body and means for preventing undue lateral movement in the vehicle-body.

The invention will be described in detail with reference to the accompanying drawings, in which—

Figure 1 is a front view of the forward spring and axle of a motor-vehicle. Fig. 2 is a plan view of the same. Fig. 3 is a partial plan view below the line A A of Fig. 1. Fig. 4 is a vertical sectional view mainly on the line B B of Fig. 1, and Fig. 5 is a detail.

Referring to the drawings, 1 2 indicate the upper and lower semi-elliptical springs, which are supported upon the forward axle 3 of a motor-vehicle and which in turn support the body thereof. As shown, lower section 2 is connected to links 4, supported by brackets 5 on the ends of the axle, and the upper section is connected to links 6, which are supported by a bracket 7, connected to the side frames 8 of the vehicle-body. The upper and lower spring-sections are provided at their adjacent middle portions with plates 10 and 11, which are connected to the springs by clips 12. The plates 10 and 11 are pivotally connected by a bolt 13, forming an axis in the direction of the length of the vehicle about which the springs may rock freely. The position of the upper spring and the vehicle-body will be determined largely by the movements of the vehicle-body imparted from the rear axle, while the lower spring will rock in conformity with the movements of the forward axle.

To prevent the vehicle-body from having a lateral movement relative to the axle, the body is braced from the axle in the following manner: A bar 14 is pivotally connected with the vehicle-body at one end, and at its opposite end it is pivotally connected with one end of a link 15, the other end of said link being connected with the forward axle, the bar 14 and link 15 being approximately equal in length to the vehicle-body. As shown, the bar is connected pivotally to the bracket 7 at the left side (looking forward) of the vehicle-body, and it extends nearly to the right side thereof. The link 15 is pivotally connected to the bracket 5 at the left end of the forward axle. In order to sustain the bar 14 in proper position relative to the body, it is provided with an arm 14^a, which is connected to the bracket 7 at the right side of the vehicle. By means of the construction above described the forward axle is free to conform to any inequalities in the road by rocking about its pivot 13 without disturbing the poise of the vehicle-body, while at the same time the vehicle-body is prevented from undue lateral movement.

The forward axle 3 tends to rock or rotate when the wheels are turned to the right or left to steer the vehicle, and it also tends to move backward and forward relatively to the spring as the wheels meet obstructions on the road. The following devices effectively prevent these movements and hold the axle in its proper position. The rocking or rolling movement of the axle is prevented by a plate 16, located on and rigidly connected to the middle of the axle, which plate extends vertically upward and slides within a yoke 17, connected to the under spring 2. A spring-pressed plunger 18 bears on the plate 16 and prevents it from rattling, the spring for the plunger being carried within a cup 19 on the yoke 17.

To prevent the forward and backward movement of the axle bodily, it is connected with the body by a pair of links 20, one located near each end of the axle. The said links are connected with the axle and the body by ball-and-socket joints, permitting of universal movement.

Having described the invention, what is claimed as new is—

1. In a motor-vehicle, the combination with

the forward axle and the vehicle-body, of a semi-elliptic spring connected to the axle, and a second semi-elliptic spring connected with the body, said springs being centrally connected by a pivot-joint.

2. In a motor-vehicle, the combination with the forward axle of a semi-elliptic spring connected with the axle at its ends, a second semi-elliptic spring connected to the vehicle-body at its ends, a pivot located between and connecting said springs centrally, and a link and bar pivotally connected with the axle and the vehicle-body and with each other.

3. In a motor-vehicle, the combination with a forward axle, of a spring supported on said axle, a second spring supported on and pivotally connected to the first-named spring, a vehicle-body supported on said second spring, and lateral braces whereby lateral movement of the vehicle-body relatively to the axle is prevented.

4. In a motor-vehicle, the combination with a forward axle, the vehicle-body, the semi-elliptic springs connected respectively to said axle and vehicle-body, and the pivot-joints between said springs, of the bar 14 connected to the body at one side, the arm 14^a connecting said bar to the body at its opposite side, and the link extending across the vehicle and connecting said bar with the axle.

5. In a motor-vehicle, the combination with a body, the forward axle, and the intermediate spring, of the vertically-arranged plate 16 rigidly connected to said axle, means carried by the spring for guiding said plate, and supplemental means for preventing the plate from rattling in said guide, for the purpose set forth.

6. In a motor-vehicle, the combination with a body, the forward axle and the intermediate spring, of braces pivotally connecting said axle with the body, a vertically-arranged plate rigidly connected to said axle, and means for guiding said plate vertically, for the purpose set forth.

7. In a motor-vehicle, the combination with a body, the forward axle, and the intermediate spring, of the vertically-arranged plate, 16, rigidly connected to the axle, guiding means for said plate carried by the spring, and a yielding device bearing laterally against said plate and preventing the same from rattling, for the purpose set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

JAMES W. PACKARD.
WM. A. HATCHER.

Witnesses:
ARA C. HARRINGTON,
G. B. POST.

No. 770,392. PATENTED SEPT. 20, 1904.

C. SCHMIDT.

MOTOR VEHICLE BRAKE.

APPLICATION FILED NOV. 20, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

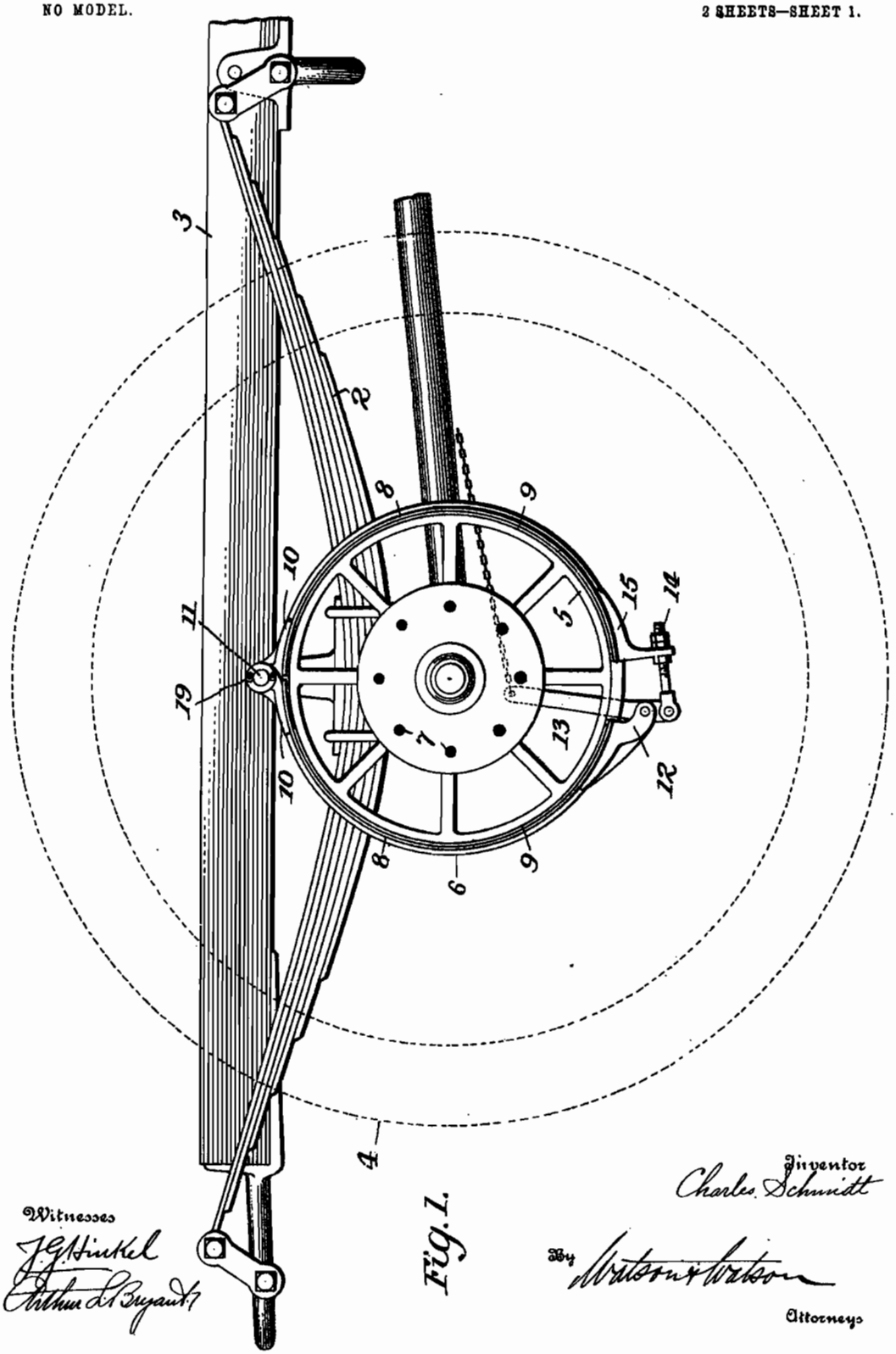


Fig. 1.

Witnesses
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No. 770,392. PATENTED SEPT. 20, 1904.

C. SCHMIDT.

MOTOR VEHICLE BRAKE.

APPLICATION FILED NOV. 20, 1902.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2

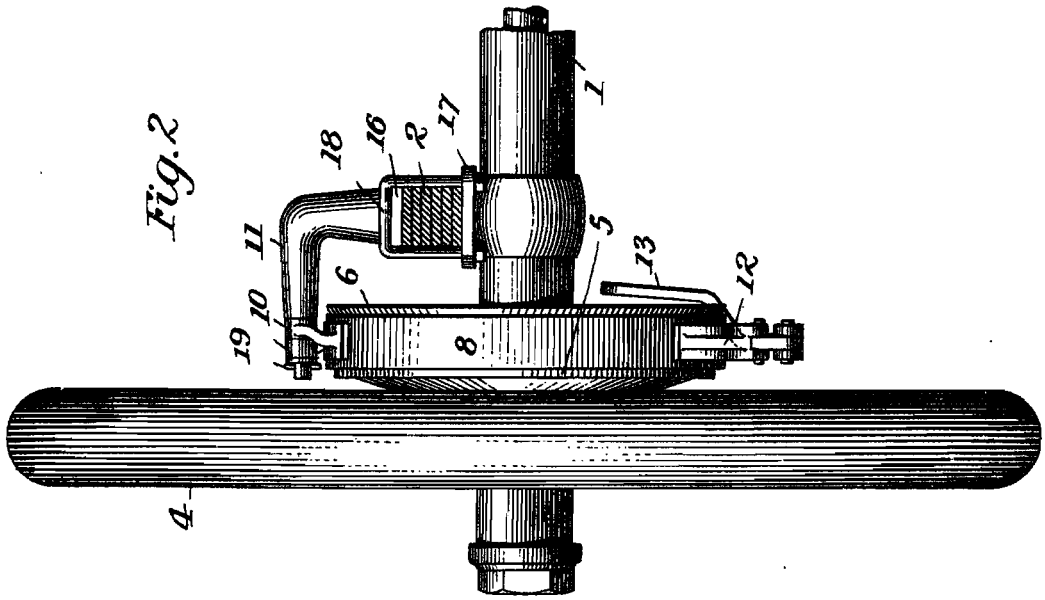
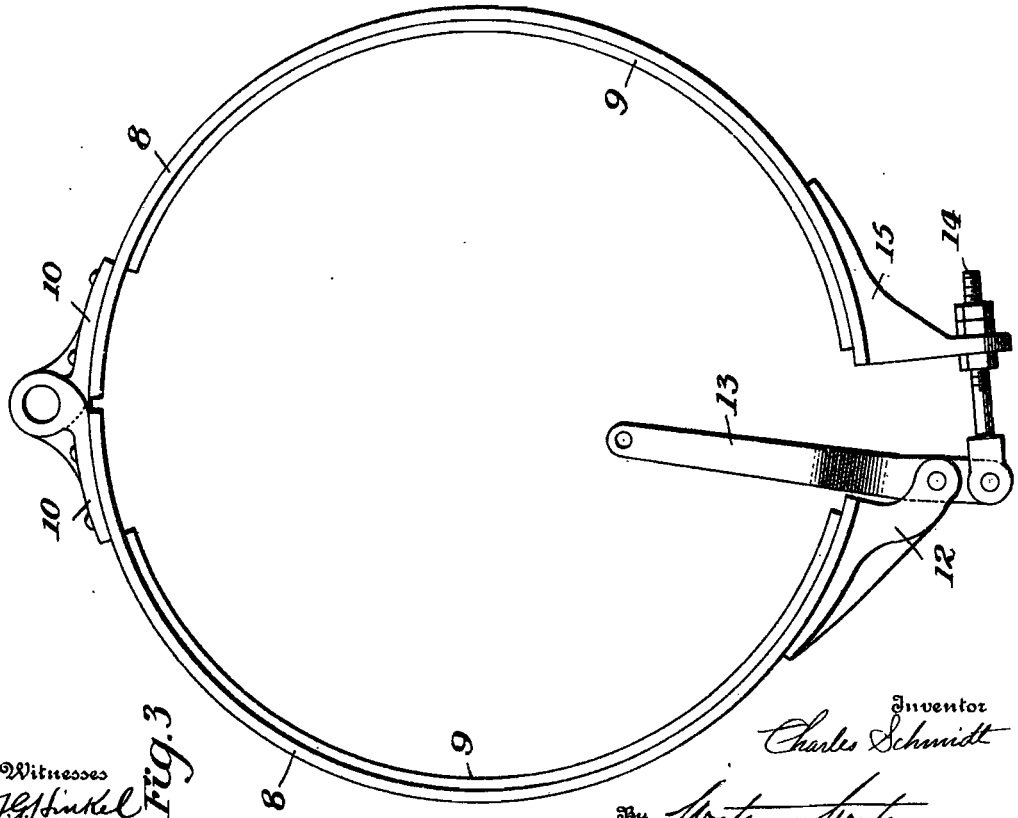


Fig. 3



Witnesses
J. G. Hinkel
Arthur L. Bryant

Inventor
Charles Schmidt
By Watson & Watson
Attorneys

No. 770,392. Patented September 20, 1904.

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF WARREN, OHIO, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

MOTOR-VEHICLE BRAKE.

SPECIFICATION forming part of Letters Patent No. 770,392, dated September 20, 1904.

Application filed November 20, 1902. Serial No. 132,114. (No model.)

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of France, residing at Warren, in the county of Trumbull, State of Ohio, have invented certain new and useful Improvements in Motor-Vehicle Brakes, of which the following is a specification.

This invention relates to motor-vehicles; and it has for its object to produce a brake which is simple, strong, and convenient in construction and reliable and powerful in operation.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation illustrating the brake in position on a motor-vehicle. Fig. 2 is an edge view of the vehicle-wheel with brake in position, and Fig. 3 is a detail.

Referring to the drawings, 1 indicates a fixed axle of a motor-vehicle, 2 a spring supported on said axle, and 3 a part of the vehicle-frame supported on the spring. To the wheel 4 is suitably connected a brake-wheel 5, preferably of brass or bronze, having a cylindrical surface upon which the brake-shoes bear. The brake-wheel 5 is preferably provided with a flange 6 at its inner edge. As shown, the brake-wheel is connected to the vehicle-hub by bolts or rivets passing through openings 7.

The brake proper consists of two semicircular metal bands 8, preferably of steel, with semicircular shoes 9, preferably of cast-iron, riveted thereto. The bands 8 have hinge-pieces 10 attached to their upper ends, and a bracket 11 passes through said pieces and supports the brake-bands. To the lower end of one of the brake-bands is connected a bracket 12, to which the brake-lever 13 is pivoted. An adjustable link 14 connects said brake-lever with a bracket 15 on the lower end of the other brake-band. It will be seen that by moving the brake-lever 13 the brake-bands may be powerfully contracted upon the brake-wheel 5. The bracket 11 is supported rigidly upon the axle 1. For simplicity and convenience it is preferably provided with a base 16, which rests upon the spring 2, the base and spring being connected to a plate 17 on the axle by means of clips 18. The brake-bands are removably secured on the bracket 11 by cotter-pins 19, and they may be easily detached and repaired or replaced.

It will be understood that this improved brake may be applied to any or all of the wheels of a motor-vehicle. It is usually applied to the two rear wheels. The combination of the steel bands, the cast-iron shoes, and the brass or bronze brake-wheel forms a braking device which is absolutely reliable, which does not cut or stick, and which is not rendered inoperative by oil or dirt.

Having described the invention, what is claimed is—

The combination of a vehicle-axle, a brake-wheel mounted on the axle, a bracket mounted on the axle, the upper end of said bracket projecting over the brake-wheel, a brake-band comprising two members pivotally connected to said bracket and extending downwardly therefrom around the brake-wheel, an adjustable connection between said members of the brake-band below the brake-wheel, a lever fulcrumed on one of the members of said brake-band and connected at one end with the adjustable connection between said members, and means for applying power to the other end of said lever.

In testimony whereof I affix my signature in presence of two witnesses.

CHAS. SCHMIDT.

Witnesses:

JOS. W. PACKARD,

W. D. PACKARD.

No. 769,840. PATENTED SEPT. 13, 1904.

C. SCHMIDT.

TRANSMISSION GEARING FOR MOTOR VEHICLES.

APPLICATION FILED NOV. 20, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

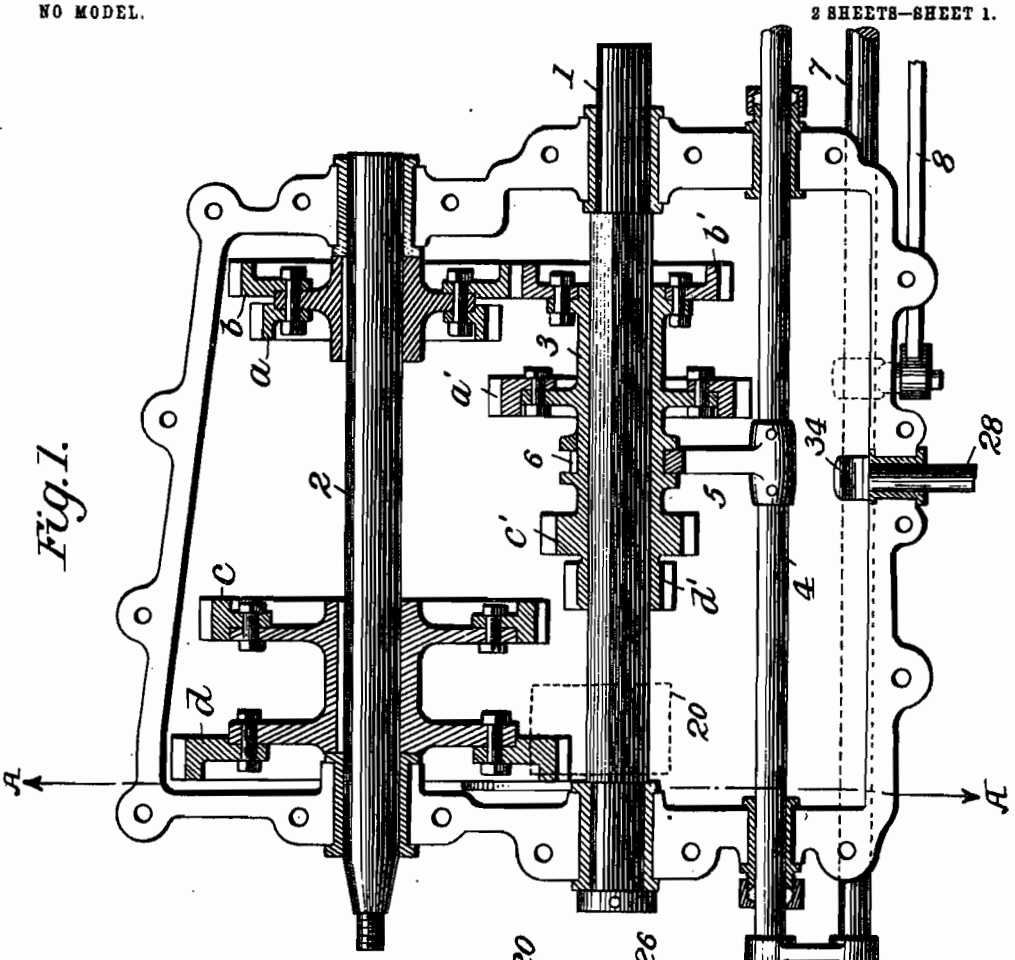
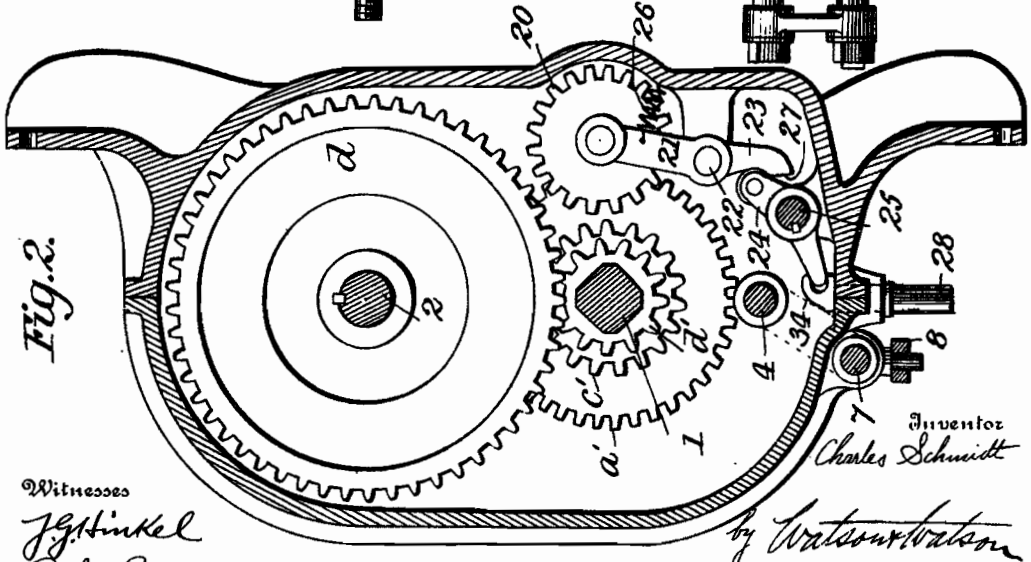


Fig. 2.



Witnesses

J. J. Finkel

Arthur L. Bryant.

Inventor

Charles Schmidt

by Watson & Watson

Attorneys

No. 769,840. PATENTED SEPT. 13, 1904.

C. SCHMIDT.

TRANSMISSION GEARING FOR MOTOR VEHICLES.

APPLICATION FILED NOV. 20, 1902.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

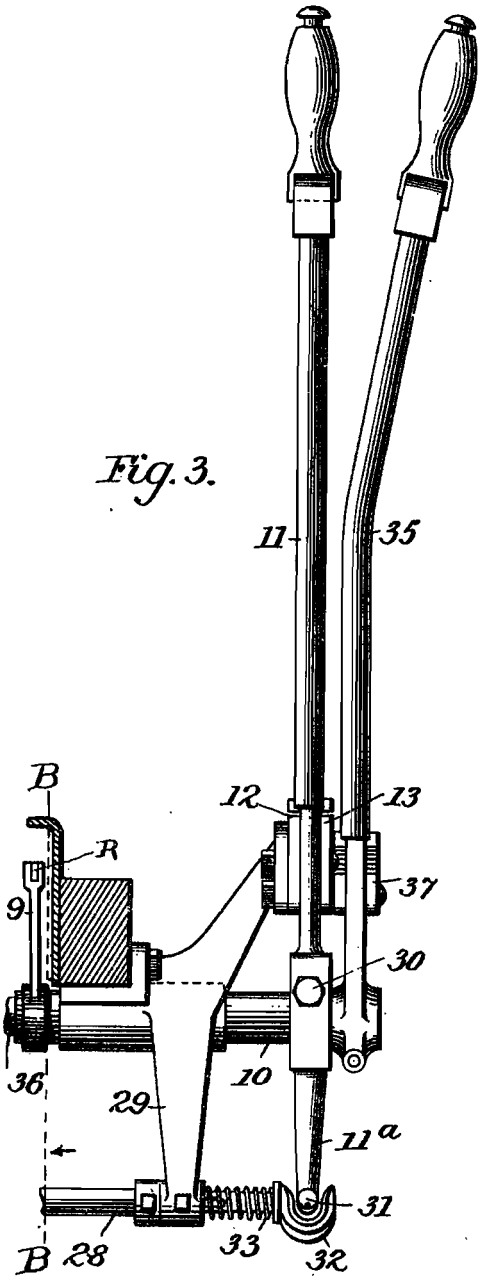


Fig. 4.

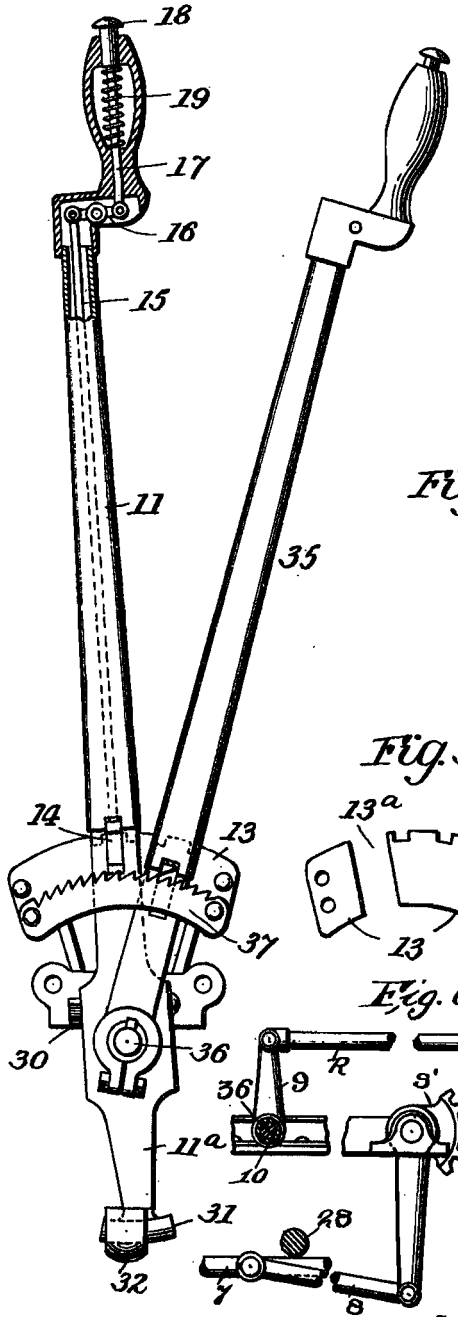


Fig. 5.

Fig. 6.

Witnesses

J. G. Thickel

Arthur L. Bryant

Inventor

Charles Schmidt

By Watson & Watson

Attorneys

No. 769,840. Patented September 13, 1904.

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF WARREN, OHIO, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

TRANSMISSION-GEARING FOR MOTOR-VEHICLES.

SPECIFICATION forming part of Letters Patent No. 769,840, dated September 13, 1904.

Application filed November 20, 1902. Serial No. 132,113. (No model.)

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of France, residing at Warren, in the county of Trumbull, State of Ohio, have invented certain new and useful Improvements in Transmission-Gearing for Motor-Vehicles, of which the following is a specification.

This invention relates to improvements in transmission-gearing for motor-vehicles, the object being to simplify the construction and render the operation of such gearing easy and positive.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal central section through a system of gearing. Fig. 2 is a transverse section about on the line A A of Fig. 1. Fig. 3 is an elevation of the controlling-levers. Fig. 4 is a side elevation of said levers, and Fig. 5 is a detail of the outside locking-plate. Fig. 6 is an elevation, partly in section, on the line B B of Fig. 3.

Referring to the drawings, 1 indicates the motor-shaft, and 2 the driven shaft, which latter shaft is suitably connected to the driving-wheels. Upon the driven shaft are rigidly mounted four gears *a*, *b*, *c*, and *d*, increasing in size in the order named. Mounted to turn with and slide on the motor-shaft is a sleeve 3, to which are rigidly secured four gears *a'*, *b'*, *c'*, and *d'*, each decreasing in size in the order named and which are of suitable diameters to intermesh, respectively, with the gears *a*, *b*, *c*, and *d*. The several gears above described are so related that they may be all disengaged or that the gears on the sleeve 3 may be engaged successively with the gears on the shaft 2 in the order of their sizes. Thus when the sleeve is moved to the extreme left the smallest gear, *d'*, will be engaged with the gear *d*, and the driven shaft will be operated at its slowest speed. Movement of the sleeve to the right will first disengage the gears *d d'* and then engage the gears *c c'*, operating the driven shaft at the next higher speed. Further movement of the sleeve to the right will next disengage the gears *c c'* and then engage the gears *b b'*, and finally a further movement to the right will first disengage the gears *b b'* and then engage the gears *a a'*. The sleeve 3 is shifted by means of a sliding rod 4, which has an arm 5 engaging an annular groove 6 in the sleeve. The rod 4 is operated by a second rod 7, link 8, arm 9, shaft 10, and lever 11, the arm 9 and link 8 being suitably connected—for instance, as shown in Fig. 6—by a rod or link R, extending from the arm 9 to an arm on a sector-gear S, which meshes with a second sector-gear S', having an arm with which the link 8 is attached. The lever operates between two notched sector-plates 12 13 and is provided with a spring-pressed latch 14, which tends to enter the notches. The latch is connected through rod 15, lever 16, and rod 17 with a button 18 on the end of the lever. A spring 19 within the handle tends to raise the button and throw the latch into the notches. By pressing the button 18 the latch may be withdrawn from the notches. Each plate is provided with four notches corresponding to the four forward speeds effected by the gearing above described.

The backward movement is obtained by a backing-gear 20, which is adapted to be thrown into mesh with the gears *d d'* when the latter are adjacent to but not in mesh with each other, the backing-gear being broad enough to engage both gears when they are out of mesh. The backing-gear 20 is mounted in a yoke 21, which swings on a fixed pivot 22. The yoke 21 has an arm 23, which is engaged by a roller on a short two-armed lever 24, mounted on a fixed pivot 25. The spring 26 tends to hold the backing-gear 20 out of mesh with the driving-gears, and said backing-gear can be thrown into mesh with the gears *d d'* by rocking the lever 24. Said lever 24 engages a flat surface 27 on the arm 23 and runs thereon slightly past the "dead-center" between said surface and the roller, thus locking them against the influence of the spring 26. The lever 24 is operated by a rod 28, which extends through a bracket 29 beneath the shaft 10. The lever 11 is mounted upon a pivot 30, connected to the shaft 10, whereby it is free

to swing sidewise, although the shaft 10 must turn with the lever. The lower arm 11^a of lever 11 has a T-piece 31, which swings in the hook-shaped extremity 32 of the rod 28. A spring 33 tends to throw the rod 28 outward to bring the hook 32 into the normal plane of the arm 11^a. On the inner end of the rod 28 is an open yoke or hook 34, which engages an arm of the lever 24 and operates said lever. The hand-lever 11 can only be rocked sidewise on the pivot 30 when it registers with the slot or opening 13^a in the two-part sector-plate 13. When the lever is in this position, the gears *d d'* are adjacent to each other and none of the gears *a b c d* are in mesh with their corresponding gears. When it is desired to back the vehicle, the lever 11 is brought to this middle position and then moved sidewise through the slot 13^a, which throws the backing-gear into mesh with the gears *d d'* by means heretofore described, thus backing the vehicle at the slowest speed.

In the drawings is shown a brake-lever 35, operating a brake-shaft 36 within the shaft 10, and a tooth-sector 37 for locking the brake-lever; but these brake devices are not included in the present invention.

It will be seen that the present invention provides for four speeds forward and one speed backward and that the mechanism involved is simple and positive in construction. The operation will be obvious from the preceding description.

Having described the invention, what is claimed as new is—

1. In a transmission-gearing for motor-vehicles, the combination with a motor-shaft, the driven shaft, and the gears of different sizes mounted thereon, of a hand-lever for throwing said gears into and out of mesh, a backing-gear, and means for operating said backing-gear by a side movement of said hand-lever to throw it into and out of operation.

2. In a transmission-gearing for motor-vehicles, the combination with a driven shaft, a motor-shaft, and relatively movable gears on said shafts, of a backing-gear, a lever constructed to swing in two directions, and means whereby when the lever is swung in one direction the relatively movable gears will be shifted and when it is swung in a direction transverse to that aforesaid the backing-gear will be thrown into and out of operation.

3. In a transmission-gearing for motor-vehicles, the combination with a driven shaft having gears fixed thereon, a motor-shaft having gears slidable thereon, and a backing-gear adapted and arranged to be moved in a circular path into and out of mesh with gears on both shafts, of a hand-lever for shifting the slidable gears, a sector for guiding said hand-lever, and a pivot upon which said hand-lever may be moved laterally, said sector having an opening or recess into which the hand-lever is moved laterally while moving the backing-gear to and from operative position.

4. In a transmission-gear for motor-vehicles, the combination with the driven shaft, the motor-shaft, and the relatively movable gears thereon, of the backing-gear arranged to swing in a circular path upon a pivotal support, a lever for operating said backing-gear, a sliding rod for operating said lever, and a hand-lever adapted to shift the gears by a movement in one direction and to operate said sliding rod and move the backing-gear by a movement in a second direction.

5. In a transmission-gearing for motor-vehicles, the combination with the driven shaft, the motor-shaft, the relatively movable gears thereon, and the backing-gear, of the shaft 10 having connections to said relatively movable gears, the lever 11 connected to said shaft by a pivot whereby it may swing laterally without turning said shaft, and connections between said lever and the backing-gear whereby the latter may be thrown into and out of operation by a movement of the lever upon its pivot.

6. In a transmission-gearing for motor-vehicles, the combination with the driven shaft, the motor-shaft, the relatively movable gears thereon, and the backing-gear, of a lever arranged to swing in a given plane to shift the relatively movable gears, a rod 28 adapted to be engaged by said lever in one of its positions, and connections between said rod and the backing-gear, said rod being operated by a lateral movement of the lever.

7. In a transmission-gearing for motor-vehicles, the combination with a driven shaft, a motor-shaft, relatively movable gears thereon, and a backing-gear, of a pivoted arm upon which said backing-gear is mounted, a lever 24 adapted to operate said arm and to lock said gear in operative position, an operating-lever and a connection between said operating-lever and said lever 24, the said operating-lever being adapted to shift the relatively movable gears by a movement in one direction and to shift the backing-gear by a lateral movement.

In testimony whereof I affix my signature in presence of two witnesses.

CHAS. SCHMIDT.

Witnesses:

JAS. W. PACKARD,

W. D. PACKARD.

No. 781,682. PATENTED FEB. 7, 1905.

C. SCHMIDT.

GEARING FOR MOTOR VEHICLES.

APPLICATION FILED NOV. 20, 1902.

Fig. 1.

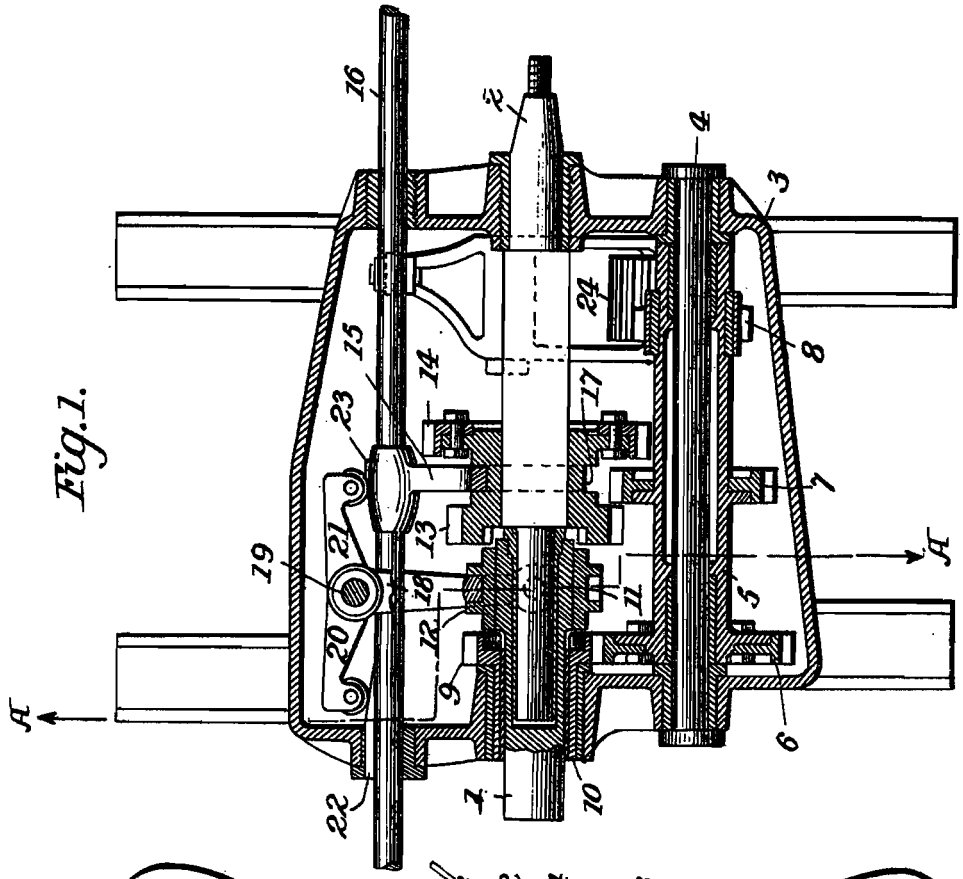
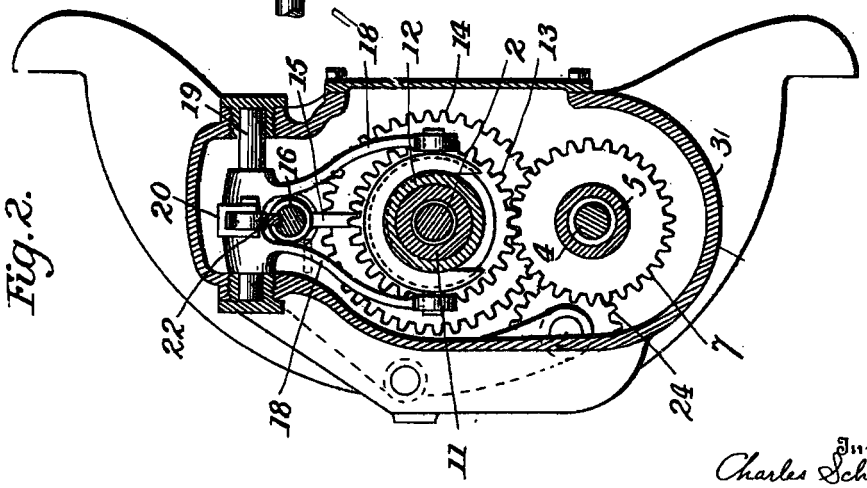


Fig. 2.



Witnesses

J. G. Hinkel

Arthur L. Bryant

Inventor

Charles Schmidt

By Watson & Watson

Attorneys

No. 781,682. Patented February 7, 1905.

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF WARREN, OHIO, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

GEARING FOR MOTOR-VEHICLES.

SPECIFICATION forming part of Letters Patent No. 781,682, dated February 7, 1905.

Application filed November 20, 1902. Serial No. 132,112.

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of France, residing at Warren, in the county of Trumbull, State of Ohio, have invented certain new and useful Improvements in Gearing for Motor-Vehicles, of which the following is a specification.

This invention relates to transmission-gearing for motor-vehicles, and has for its object certain improvements in such gearing and particularly to obtain a direct connection without gearing between the motor-shaft and the variable-speed shaft when the motor-vehicle is running at its highest speed.

In the accompanying drawings, forming a part of this specification, Figure 1 is a longitudinal sectional view through the change-gears of a motor-vehicle and their casing, and Fig. 2 is a transverse sectional view about on the line A A of Fig. 1.

Referring to the drawings, 1 indicates the shaft, which will be termed the "motor-shaft" and which is driven directly by the motor or through the medium of a clutch, and 2 indicates a second shaft which is in line with the motor-shaft and from which the vehicle is driven. The shaft 2 may be termed the "driven" shaft. Mounted in the casing 3 and parallel with the aforesaid shaft is a fixed shaft 4, carrying a revoluble sleeve 5, upon which are fixed gears of three different diameters, marked, respectively, 6, 7, and 8. The gear 6 is in mesh with the gear 9, which is carried by a sleeve 10, loosely journaled on the motor-shaft. On an enlarged end 11 of the motor-shaft, which projects within the casing, is splined a clutch-block 12. This block is provided on one end with a series of teeth which interlock with inwardly-projecting teeth on the gear 9 when the clutch-block is thrown to the left, thus positively driving the gear 9 and the counter-shaft 5.

Two gears 13 14 of different sizes are rigidly connected together and arranged to turn with and slide on the driven shaft 2. The gear 13 is provided with inwardly-projecting teeth adapted to interlock positively with the teeth on the adjacent end of the clutch-block 12. When the clutch-block and the gear 13 are thus connected, it will be seen that the driven shaft is directly connected with and must run with the motor-shaft. The gears 13 14 are moved along the driven shaft 2 by means of an arm 15, carried by a sliding rod 16, which arm engages a circumferential groove 17 between the gears.

The clutch-block 12 is operated by a yoke 18, which rocks on a pivot 19, said yoke being rocked by means of arms 20 21, having rollers which coöperate with cams 22 23, carried by the rod 16. The operation of the clutch-block is as follows: When the rod 16 is moved to the right, the arm 20 is raised by the cam 22, throwing the clutch-block into engagement with the gear 9. The cam 22 has a long straight portion which holds the clutch-block in engagement with the gear, while the rod 16 is moved a considerable distance to the right to adjust the gears 13 14, as will be hereinafter explained. The cam 22 thus effects the engagement of the gear 9 with the motor-shaft, causing the counter-shaft 5 to rotate. While the parts are thus engaged, the gear 13 may be slid into engagement with the gear 7, imparting a middle speed to the driven shaft, or the gear 14 may be slid into engagement with the gear 8, imparting a slow speed to the driven shaft, or the gear 14 may be slid beyond the gear 8 and the backing-gear 24 thrown into engagement with both of them, thus imparting a slow backward movement to the driven shaft. When the rod 16 is moved to the left, the cam 23 throws the clutch 12 out of engagement with gear 9 and then into engagement with gear 13. There is a middle position of the clutch 12, which is shown in Fig. 1 of the drawings, in which the clutch is not in engagement with any of the gears and all of the gears are stationary. As the rod 16 reaches the limit of its movement to the left the clutch 12 and the gear 13 are interlocked and the motor-shaft thus connected directly and rigidly with the driven shaft, imparting the full speed of the motor to the latter shaft. When the gears 13 14 are in this position, they are out of engagement

with the gears upon the counter-shaft, as will be apparent from an inspection of Fig. 1.

The mechanism above described provides in a simple manner for throwing the motor out of gear, for throwing the motor into direct positive connection with the driven shaft, and for two intermediate speeds, as well as for backing.

All of the mechanisms may be inclosed in a tight gear-casing, as shown.

Having described the invention, what is claimed is—

1. In a transmission-gearing for motor-vehicles, the combination of a motor-shaft, a driven shaft, a clutch-block arranged to turn with and slide on the motor-shaft, a counter-shaft provided with gears of different sizes, a clutch member geared to the counter-shaft and normally disconnected from the motor-shaft, gears mounted to slide on the driven shaft and to engage with the different-sized gears on the counter-shaft, a clutch member connected to said gears on the driven shaft, a rod adapted to slide said gears and their attached clutch member on the driven shaft, and means actuated by said rod for sliding the clutch-block on the motor-shaft.

2. In a transmission-gearing for motor-vehicles, the combination of a motor-shaft, a driven shaft, a clutch-block arranged to turn with and slide on the motor-shaft, a counter-shaft provided with different-sized gears, a clutch member for turning said counter-shaft, gears mounted to slide on the driven shaft and to engage the gears on the counter-shaft, a second clutch member connected to said gears, a lever for sliding the clutch-block on the motor-shaft to cause it to engage either of the said clutch members, and a rod connected to the gears on the driven shaft to slide them longitudinally thereof and provided with means for rocking said lever to adjust the clutch-block as desired.

3. In a transmission-gearing for motor-vehicles, the combination of the motor-shaft, the driven shaft in line with the motor-shaft, the change-gears splined on the driven shaft and provided with the clutch member, a clutch-block splined on the motor-shaft and provided with a corresponding clutch member, a counter-shaft, gearing on the counter-shaft adapted to connect the motor-shaft and change-gears, the rod for operating the change-gears, and the cams on said rod adapted to operate the clutch-block.

4. In a transmission-gearing for motor-vehicles, the combination with the motor-shaft and the gear loosely mounted thereon, of the counter-shaft driven from said gear, the clutch-block splined on the end of the motor-shaft and adapted to connect the motor-shaft with said gear, the driven shaft, gearing adapted to connect the counter and driven shafts, the three-armed lever for operating said clutch-block, and the rod provided with a cam for operating said three-armed lever, said cam having a straight portion for holding the clutch-block in engagement with the gear.

In testimony whereof I affix my signature in presence of two witnesses.

CHAS. SCHMIDT.

Witnesses:

JAS. W. PACKARD,

W. D. PACKARD.

No. 780,221. PATENTED JAN. 17, 1905.

J. W. PACKARD.

ELECTRIC IGNITER.

APPLICATION FILED JAN. 10, 1903.

2 SHEETS—SHEET 1.

Fig. 2.

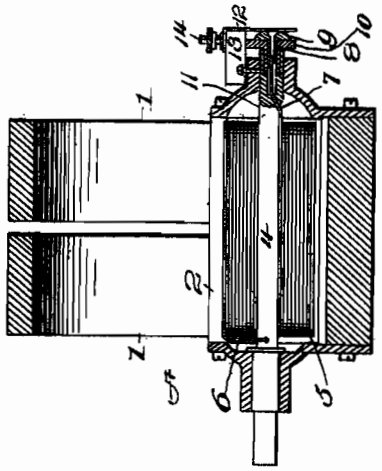


Fig. 3.

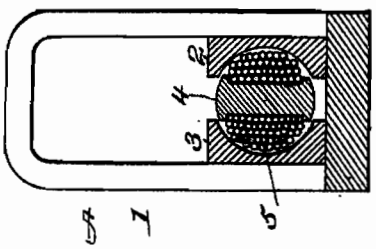
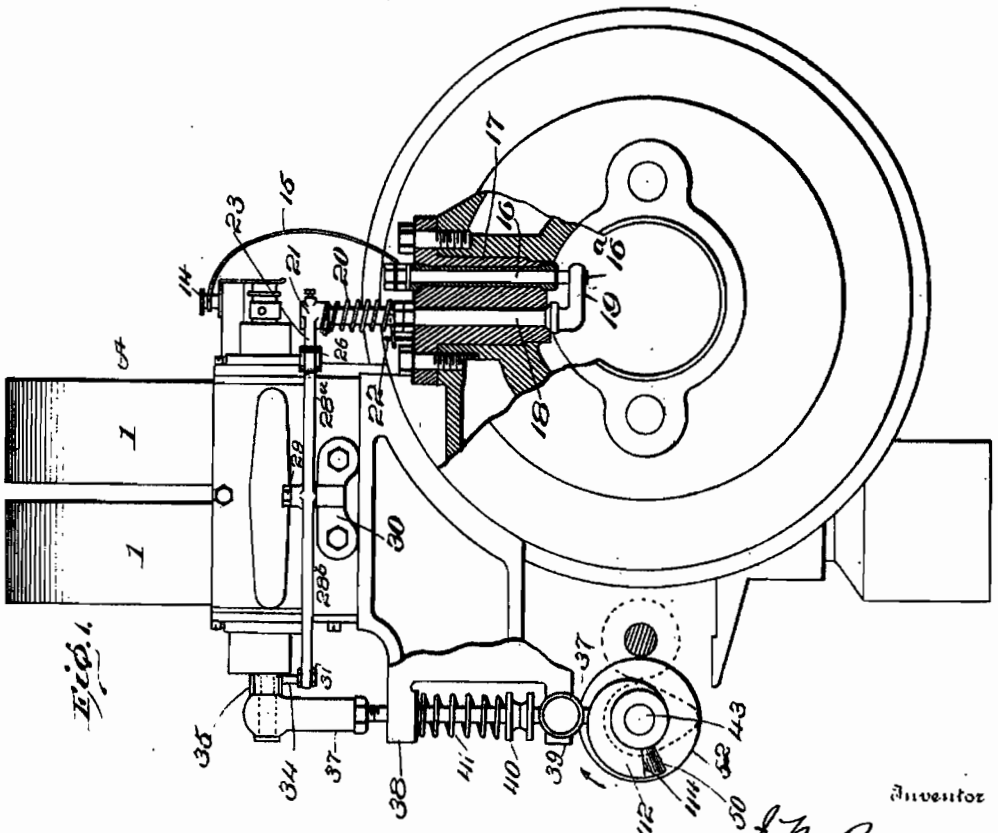


Fig. 1.



Witnesses
J. M. Fowler Jr.
C. W. Clement.

Inventor
J. W. Packard
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Attorneys

No. 780,221. PATENTED JAN. 17, 1905.

J. W. PACKARD.

ELECTRIC IGNITER.

APPLICATION FILED JAN. 10, 1903.

2 SHEETS—SHEET 2.

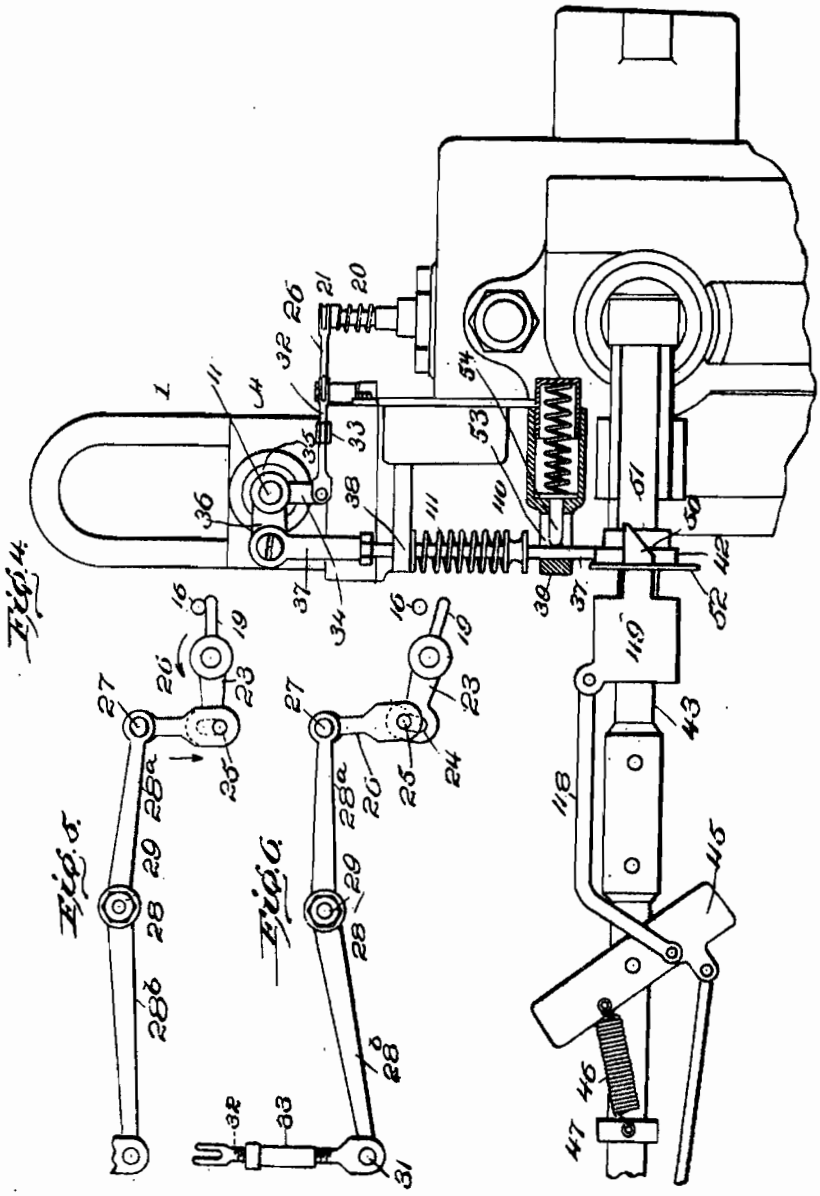

Fig. 4.

Fig. 5.

Fig. 6.

Witnesses
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Inventor
J. W. Packard
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Attorneys

No. 780,221. Patented January 17, 1905.

UNITED STATES PATENT OFFICE.

JAMES W. PACKARD, OF WARREN, OHIO, ASSIGNOR TO THE PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

ELECTRIC IGNITER.

SPECIFICATION forming part of Letters Patent No. 780,221, dated January 17, 1905.

Application filed January 10, 1903. Serial No. 138,501.

To all whom it may concern:

Be it known that I, JAMES W. PACKARD, a citizen of the United States, residing at Warren, in the county of Trumbull, State of Ohio, have invented certain new and useful Improvements in Electric Igniters, of which the following is a specification.

This invention comprises improvements in electric igniters for explosive-engines; and it includes an electric generator, means for intermittently operating said generator, means for separating the electrodes of the sparking device while the generator is in operation, and means for automatically varying the time of operation, and consequently of ignition, relative to the engine-stroke according to the speed of the engine.

In the accompanying drawings, Figure 1 is a rear end view of a gas-engine cylinder, partly in section, with the igniting apparatus applied thereto. Fig. 2 is a vertical longitudinal section through the center of the generator. Fig. 3 is a central transverse section through the same. Fig. 4 is a side view of the rear end of the cylinder with the igniting apparatus applied thereto and showing also the governor for controlling the time of ignition. Fig. 5 is a plan view of the levers for operating the movable electrode, said levers being shown in their normal position; and Fig. 6 is a similar view illustrating the manner in which the electrodes are separated when the current is being generated.

Referring to the drawings, A indicates an electric generator, preferably a magneto-generator, consisting of one or more permanent horseshoe-magnets 1, having internal pole-pieces 2 and 3, between which is arranged an H-armature 4, having insulated copper wire 5 coiled thereon. One end, 6, of the coil of wire is grounded upon the shaft, as shown in Fig. 2, and the opposite end, 7, is connected to a shank 8 upon a metal contact-disk 9. This shank extends into a tubular insulating-bushing 10, which fits into a socket in the end of the armature-shaft 11. A spring contact arm or brush 12, secured upon an insulating-block 13, bears upon the contact-disk 9 and conducts the current to a binding-post 14 upon said block. A wire 15 connects the binding-post 14 with a stationary electrode 16, secured within and insulated from an igniter-plug 17. The conducting-wire 15 is the only necessary wire external to the generator. The end 6 of the generating-coil is electrically connected, through the generator and engine-frames and the various metal parts of the apparatus, with a movable electrode 18, which is capable of oscillation about its vertical axis and is provided at its lower end with the contact-arm 19, which latter is normally held against the lower end 16^a of the stationary electrode by a spiral spring 20, which is coiled about the upper end of the movable electrode. The upper end of this spring is connected to a collar 21, which is secured upon the movable electrode, and the lower end of the spring is connected to a fixed pin 22, which is secured to the igniter-plug. The spring tends to turn the movable electrode in the direction indicated by the arrow, Fig. 5, and normally presses the contact-arm 19 of said electrode against the stationary electrode, as shown in said figure and also in Fig. 1. Connected with the collar or hub 21 is a short lever-arm 23, having a slot 24 at its outer end, into which extends a pin 25 upon a link 26, which link is connected by a pivot-pin to one arm, 28^a, of a lever 28. This lever is mounted upon a pivot-pin 29, which is supported by a bracket 30 at the rear of the generator, and the longer arm, 28^b, of the lever is connected by a pivot-pin 31 to a link 32, which is adjustable in length by means of a turnbuckle 33. The link 32 is connected to one arm, 34, of a bell-crank lever 35, which latter is secured upon the armature-shaft 11. The other arm, 36, of said bell-crank lever is pivotally connected to a rod 37, which is movable vertically in bearings 38 and 39. Between said bearings is arranged a collar 40, and between said collar and the bearing 38 is a compression-spring 41, which normally tends to force the rod 37 downwardly against a cam 42, which is secured upon a horizontal shaft 43. As shown in Fig. 1, the radius of the cam, starting near the shaft, gradually increases and the cam terminates abruptly at its highest point 44. Arranged upon the shaft 43 is a governor 45,

consisting of a block or bar of metal pivoted centrally to the shaft. The centrifugal force when the shaft is in motion tends to throw the metal block or bar at right angles to the shaft against the tension of a spring 46, which is connected to the bar 45 at one side of its pivot-point and to a collar 47. A link 48 is connected to the bar 45 at the opposite side of its pivotal point, and this link is pivotally connected with a collar 49, movable longitudinally of the shaft and having a part 50, which projects longitudinally of the shaft in front of the abrubtly-terminating end of the cam. The outer surface of the part 50, as shown in Fig. 1, is flush with the periphery of the cam, and said part forms a continuation of the cam. The rear face 51 of the projection 50 is beveled, as shown in Fig. 4, and it will be apparent that as the part 50 forms a continuation of the cam the position of said part will determine the time in the revolution of the shaft 43 when the rod 37 will drop from the higher onto the lower part of the cam. The projection 50 extends through a suitable guide-opening in a flange 52 at the side of the cam.

The shaft 43 is suitably geared to the engine and makes one revolution during each cycle of operations. The rotation of the cam raises the rod 37 slowly, and this rod in turn rocks the bell-crank lever 35, thereby moving the armature at a comparatively slow speed in one direction. At the same time the link 32 is drawn to the left in Fig. 4, thereby moving the lever 28 and forcing the link 26 in the direction indicated by the arrow, Fig. 5. This movement of the link 26 is not accompanied by a movement of the lever-arm 23 on account of the slot 24 in the link, which allows relative movement between said parts. The electrodes therefore are held in contact by the spring 20 during this movement of the parts. At the proper moment for the ignition of the charge in the engine-cylinder the rod 31 passes off of the elevated portion of the cam and is quickly depressed by the spring 41. The armature is thereby given a quick oscillation and an electric current is generated in its coils, the circuit being at the same time closed through the electrodes. While this current is being generated the electrodes are separated by the reverse movements of the link 32, lever 28, link 26, and lever 23. The movement of the lever 23 and the electrode does not take place until after the armature is in motion, so that a current of full intensity is generated before the electrodes are separated. The lost motion between the link 26 and lever 23, it will be seen, delays the separation of the electrodes, as the lever 23 will not be moved by the link until the pin 25 travels from one end of the slot to the other. Fig. 6 shows the relative positions of the parts at the time when the electrodes are separated to cause a spark.

The time of ignition is regulated according to the speed of the engine by the adjustable portion 50 of the cam; the position of which is controlled by the centrifugal governor. When the engine is operating slowly, the entire width of the part 50 will pass under the rod 37, and as this movable part of the cam is drawn to the left in Fig. 4 with an increase in speed it will be seen that the cam-surface will be shortened, thus permitting the rod 37 to drop at an earlier point in the revolution of the engine. The time of ignition is thus automatically controlled. I do not wish to confine myself to any particular form of generator or to any particular arrangement of levers and parts for operating the generator and separating the electrodes, as it will be evident that the parts may be variously constructed and arranged to accomplish the desired ends.

It will be evident that if it is desired to employ a jump-spark instead of a spark caused by separating the electrodes, the generator may be used to operate an induction-coil having its secondary winding connected to two separate electrodes in the combustion-chamber in the usual manner. Instead of operating the rod, which is tripped by the cam, with a spring, the said rod or member may be operated by a weight, which for all practical purposes is the equivalent of a spring.

The bearing 39 has a slot 53, through which the tripping-rod 37 extends, and the rod is normally held in position upon the cam-surface by a spring-pressed pin 54. In case of the reversal of the engine at any time the tripping-rod instead of being caught and bent or broken by the cam extension 50 will be moved laterally against the pressure of the pin 54 by the inclined face 51 of the cam extension.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an electric igniter for explosive-engines, a generator, a spiral cam having a transversely-adjustable extension at its rear end, said extension having one end inclined to the axis of the cam, and a spring-pressed member bearing upon said cam and operatively connected to the movable member of the generator.

2. In an electric igniter for explosive-engines, a generator, a spiral cam having a transversely-adjustable extension at its rear end, said extension having one end inclined to the axis of the cam, and a governor arranged to vary the position of said cam extension according to the speed of the engine.

3. In an electric igniter for explosive-engines, a generator, a cam-shaft, a spiral cam upon said shaft, a collar movable longitudinally upon the shaft and having a part projecting longitudinally of the shaft and forming an extension of the cam-surface, the end

of said part being inclined to the axis of the shaft, a centrifugal governor connected to said collar, and a spring-pressed member connected to the movable member of the generator and bearing upon said cam.

4. In an electric igniter for explosive-engines, a fixed electrode, an electrode movable about its axis and having an arm arranged to bear against the fixed electrode, a spring normally holding said electrodes in contact with one another, a generator having coils connected to said electrodes, a cam, a spring-pressed member arranged to be tripped periodically by said cam, a bell-crank lever connected with the movable element of the generator and having one arm connected to said member, a centrally-pivoted lever connected to the other arm of said bell-crank lever, a link pivoted to said arm, said link having a pin at its outer end, and a lever-arm connected with the movable electrode and having a slot engaged by said pin.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES W. PACKARD.

Witnesses:
EDITH GORTON,
G. B. PORT.

No. 826,365. PATENTED JULY 17, 1906.

C. SCHMIDT.

GEARING FOR MOTOR VEHICLES.

APPLICATION FILED JUNE 22, 1903.

2 SHEETS—SHEET 1.

Fig. 1.

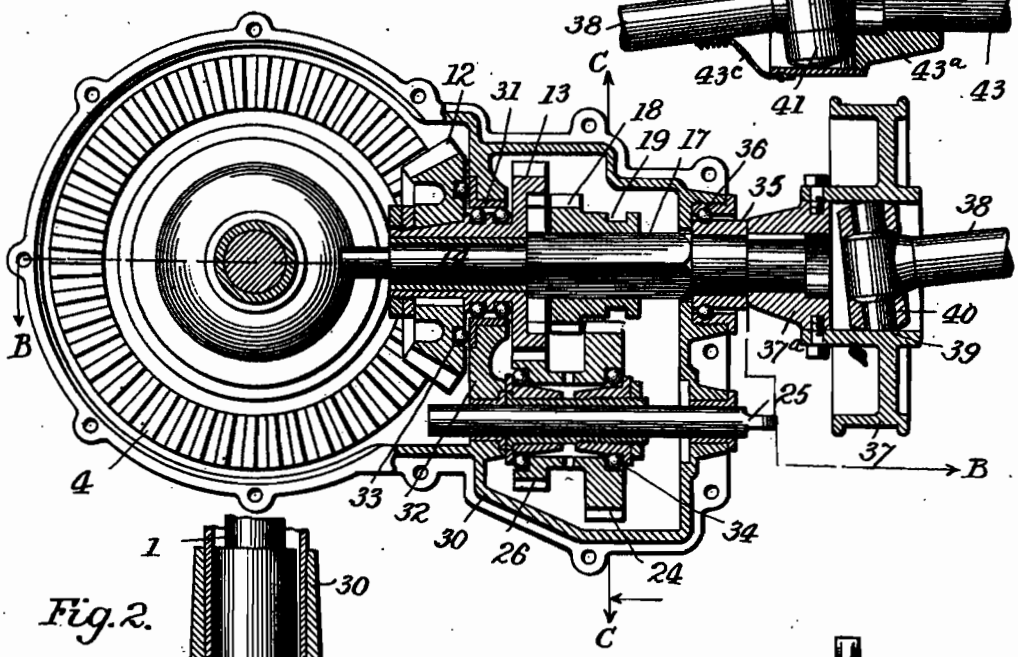
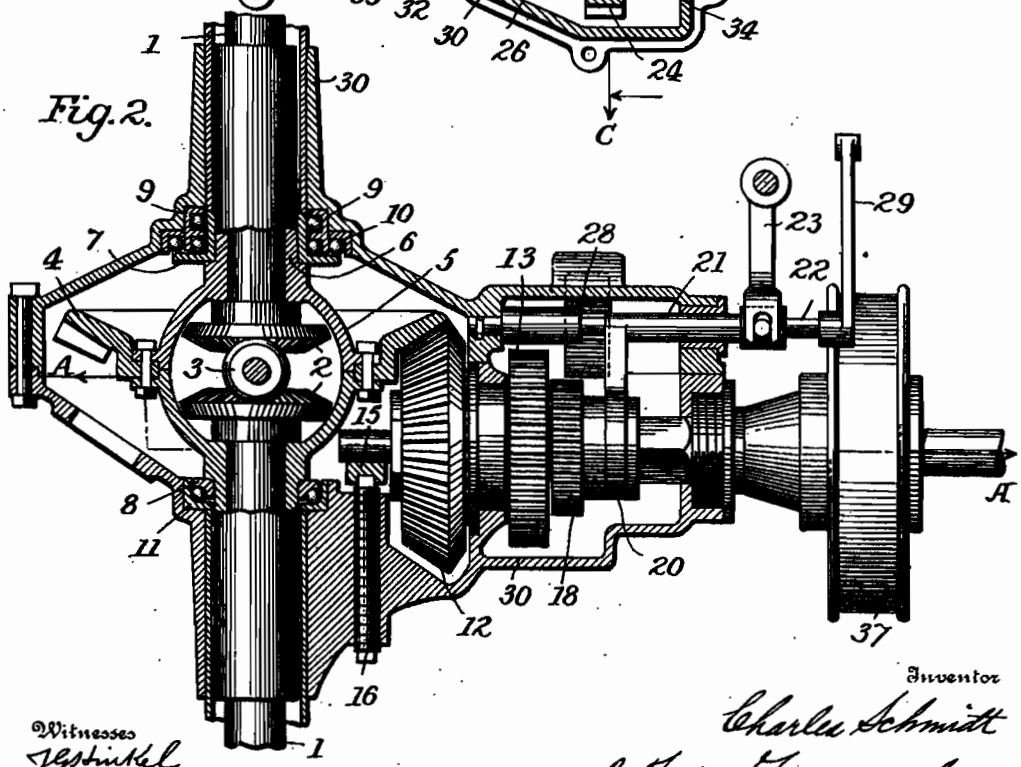


Fig. 1a

Fig. 2.



Witnesses

J. J. Stinkel

Thos. Gillman, Jr.

Inventor

Charles Schmidt

by Foster Freeman Watson

Attorneys

No. 826,365. PATENTED JULY 17, 1906.

C. SCHMIDT.

GEARING FOR MOTOR VEHICLES.

APPLICATION FILED JUNE 22, 1903.

2 SHEETS—SHEET 2.

Fig. 3.

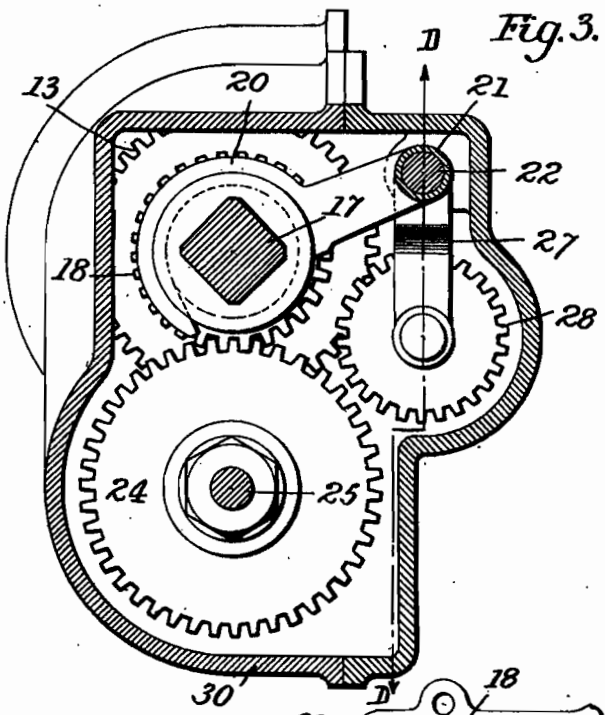


Fig. 5.

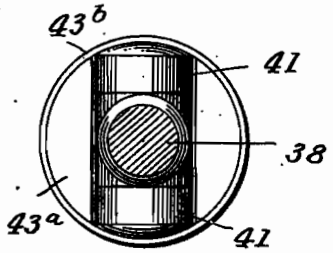


Fig. 6.

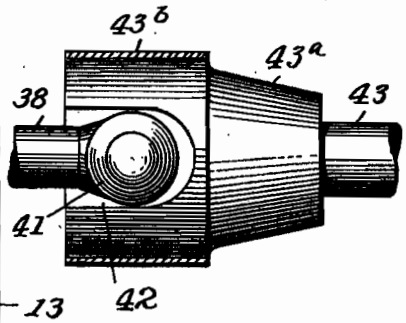
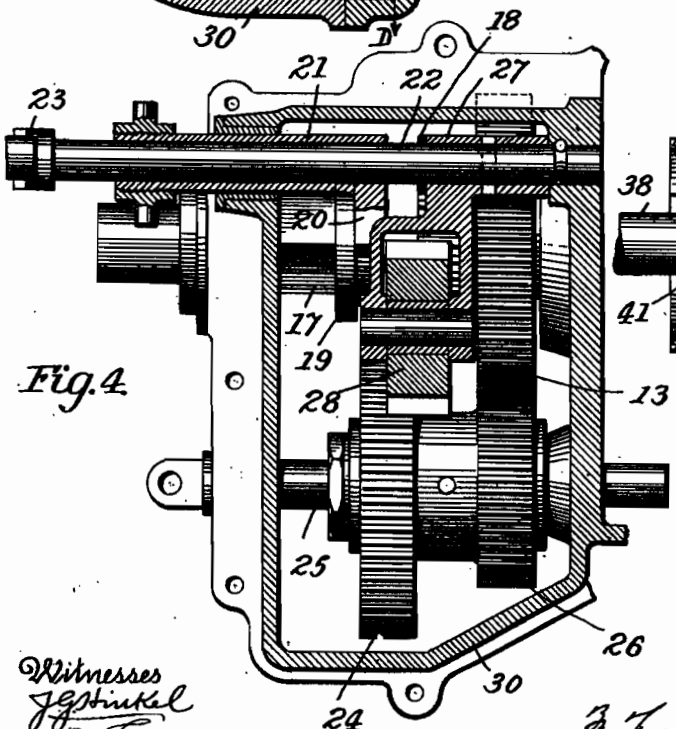


Fig. 4.



Witnesses
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Thos. Gillman, Jr.

Inventor
Charles Schmidt
By Foster Freeman Watson
Attorneys

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF WARREN, OHIO, ASSIGNOR TO THE PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

GEARING FOR MOTOR-VEHICLES.

No. 826,365. Specification of Letters Patent. Patented July 17, 1906.

Application filed June 22, 1903. Serial No. 162,631.

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of France, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Gearing for Motor-Vehicles, of which the following is a specification.

This invention relates to a construction in which the transmission-gearing of a motor-vehicle is connected intimately with the rear axle.

The invention will be described in connection with the accompanying drawings, in which—

Figure 1 is a central vertical section through the gearing and the middle of the rear axle, being taken about on the line A A of Fig. 2. Fig. 1ª illustrates the opposite end of the connecting-shaft shown in Fig. 1. Fig. 2 is a horizontal section taken about on the line B B of Fig. 1. Fig. 3 is a section about on the line C C of Fig. 1. Fig. 4 is a section about on the line D D of Fig. 3. Figs. 5 and 6 are views of the universal joint shown in Figs. 1 and 1ª.

Referring to the drawings, 1 indicates the two sections of the rear axle, 2 2 the bevel-gears which drive the rear axle, and 3 the equalizing-gears. The equalizing-gears are driven by a large bevel-gear 4, which is mounted upon a spherical shell or casing 5, surrounding and supporting the equalizing-gears, the said shell being provided with hollow shafts or hubs 6, which surround the rear-axle sections and which are provided with hardened annular bearings 7 8 of rectangular cross-section. The bearing 7, which is at the back of the gear 4, receives the greater thrust, and to resist the thrust and strain it is provided with three sets of balls running in three separate ball-races. As shown, two of these ball-races are in a hardened ring 9 and the third ball-race in a hardened ring 10. Two of the sets of balls bear on flat faces of the bearings 7 and the other set runs in the angle of the bearing. The end thrust and the lateral strain upon the hollow shaft 6 are each thus transmitted to two sets of ball-bearings. The bearing on the forward or face side of gear 4 has a single series of balls running between two angular rings 8 and 11.

The gear 4 is driven by a corresponding bevel-gear 12, which is rigidly connected to a sleeve consisting of a tubular extension or hub of a driving-gear 13, the said hub being arranged to revolve freely upon the main gear-shaft 14. Said gear 12 is therefore rotatably mounted on and coaxial with the main gear-shaft 14. The inner end of said shaft is supported by a bearing 15, which is provided with an adjustable support 16, by means of which the bearing may be adjusted to take up wear.

On an angular portion 17 of the main gear-shaft is a sliding pinion 18, provided with an annular groove 19, which is engaged by a yoke 20, carried by a sleeve 21. The sleeve 21 is mounted upon a short rock-shaft 22 and may be shifted lengthwise of said shaft by a lever 23 and suitable connections to the controlling-lever of the motor-vehicle. The gear 18 is adapted to mesh with internal teeth on the gear 13, thus directly connecting said gear 13 with the main gear-shaft 14, in which case the vehicle is driven directly from the engine without the aid of any transmission-gearing, giving a high speed with a minimum friction and loss of power.

As shown in Fig. 1, the gear 18 is not in mesh with any other gear, and the engine is thus disconnected from the driving-wheels. This is the intermediate position of the gear 18. When the gear 18 is shifted forward from the position shown in Fig. 1, it engages a gear 24, which rotates on ball-bearings on a non-rotating counter-shaft 25. The gear 24 is rigidly connected to or integral with a smaller gear 26, which is adapted to intermesh with the gear 13. When the gears 24 26 are in the position shown in Fig. 1 and gear 18 is in mesh with gear 24, the vehicle will be operated at a reduced forward speed. When gear 18 is engaged with the internal teeth of gear 13, the gear 26 is preferably disengaged from gear 13 by a forward movement of the shaft 25, suitable connections being provided for this purpose. This prevents the gears 24 26 from running idle and decreases the wear on them. On shaft 22, Figs. 2, 3, and 4, is a fixed arm 27, which carries the reverse-gear 28. This gear is broad enough to engage both of the gears 18 and 24 when said gears are in the position shown in Fig. 1. By rocking shaft 22 gear 28 is engaged and disengaged with gears 18 and 24. The rotation of gears 24, 26, and 13 and of the driving-

wheels is thus reversed, the vehicle being given a slow backward movement. The shaft 22 is provided with an operating-lever 29, which is suitably connected to the controlling mechanism of the vehicle.

All of the gears previously described are inclosed in a two-part casing 30, which casing is supported from the rear axle and in turn supports the gearing. The ball-races 9, 10, and 11 are seated in the casing, and the axles and equilizing-gears are thus supported. The hub of gear 13 is provided with ball-races and two series of balls running on an annular bearing 31, which is supported on an inwardly-projecting flange 32, integral with the casing. It will be noted that the flange 32 forms a partition which divides the casing 30 into two compartments, one compartment containing the variable-speed gears and the other compartment containing the differential gear and its driving-gears. The sleeve which carries the gears 12 and 13 has its bearing rigidly supported in this partition. The flange or partition 32 strengthens the casing and forms an excellent support for the variable-speed gears. The bearing 31 also supports the main gear-shaft 14, which turns in the hub of gear 13. The gear 12 is preferably provided with a ball-race 33, containing a series of balls which run on a flange of the bearing 31 and take the backward thrust of the gear. The gears 24 26 run on balls which encircle adjustable bearings 34, mounted on the sliding shaft 25. The forward end of the shaft 14 is provided with a hardened ring 35, which travels on ball-bearings 36, mounted in the forward end of the casing.

Upon the forward end of shaft 14 is rigidly fixed a brake-wheel 37, to which a brake may be applied by any suitable means. In the center of the hub 37^a of wheel 37 is a rectangular recess forming one part of the universal joint between a shaft 38 and shaft 14. The inner end of shaft 38 is provided with trunnions 39, upon which are hardened-steel rollers 40. The rollers are substantially of the same diameter as the width of the recess, and the trunnions 39 are curved and loosely fit the ends of the recess. The opposite end of the shaft-section 38 is provided with similar hardened rollers 41, fitting a similar rectangular recess 42 in a hub 43^a on the end of the engine or power-shaft 43. The recess in hub 43^a is closed at its ends by a sleeve 43^b, and the front of the recess may be closed by a flexible cover 43^c. This construction of rectangular recesses and rollers 40 and 41 has been found to form a very simple and efficient universal joint and is especially adapted for the flexible connection necessary to transmit power from the engine to the driving-wheels.

It will be seen that this invention provides for locating all of the transmission-gearing in fixed relation to the equalizing-gear and the rear axles and also provides for housing all of the gearing in a single casing. The location of the transmission-gearing immediately at the rear axle avoids the necessity of transmitting the heavy strains in climbing hills at slow speeds through a long line of shafting. The said strains are practically not transmitted through any shafting, but directly from the reducing-gears to the rear axles. The compact construction described is also light and economical as compared with other forms of gearing.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a motor-vehicle, the combination with a casing, of equalizing-gears mounted in bearings in said casing, axle-sections connected with said equalizing-gears, a pair of bevel-gears 4, 12 for operating the equalizing-gears, the gear 12 having a bearing in said casing, and variable-speed gears in said casing for operating the gear 12 at different speeds.

2. In a motor-vehicle, the combination with a casing, of equalizing-gears having hub-mounted in bearings in said casing, axle-sections connected with said gears and extending through said hubs, bevel-gears 4, 12, for operating the equalizing-gears, the gear 12 having a bearing in an internal flange of said casing, relatively shiftable variable-speed gears mounted in said casing, and means for shifting said gears and driving the same to impart different speeds to the axle-sections.

3. In a motor-vehicle, the combination with a common casing of rear axle-bearings and differential gears within the casing, a sleeve having a bearing in the casing, a driving-gear 13 and a beveled gear 12 rigidly connected with said sleeve, said gear 12 being arranged to drive the differential gears, a shaft 14 having bearings in said sleeve and in the casing respectively, and means for driving the said sleeve from said shaft at different speeds.

4. In a motor-vehicle, the combination with a main gear-shaft and a counter-shaft and suitable speed-gears thereon, of a sliding gear on the said main shaft, a rock-shaft, a backing-gear carried by an arm of the rock-shaft, a sleeve sliding on said rock-shaft and an arm on said sleeve engaging said sliding gear.

5. In a motor-vehicle, the combination with the rear axle, the equalizing-gears and the transmission-gears 4, 12, of the power-shaft, the speed and reverse gears, the clutch for connecting the power-shaft directly to the gear 12, and a common casing inclosing all of said gears and said clutch.

6. In a motor-vehicle, the combination of the main gear-shaft 14, the gear 13 free to rotate thereon and provided with external and internal teeth, the gear 12 rigidly con-

nected with the gear 13, the differential gears driven from the gear 12, the gear 18 turning with and sliding on said gear-shaft, the counter-shaft having gears adapted to mesh with said gears 13 and 18, and means for sliding the gear 18 on its shaft, for the purpose set forth.

7. In a motor-vehicle, the combination of the main gear-shaft 14, the gear 13 free to rotate thereon and provided with external and internal teeth, the gear 18 turning with and sliding on said shaft, the counter-shaft having gears 24, 26 adapted to mesh with said gears 13 and 18, means for sliding the gear 18 on its shaft, and means for moving the gears 24, 26 in the direction of their axis, for the purpose set forth.

8. In a motor-vehicle, the combination with the rear axle, the equalizing-gears and the transmission-gears 4, 12, of a power-shaft having a bearing coaxial with the bearing of the gear 12, said gear and shaft being independent, a clutch for connecting the power-shaft directly to the gear 12, a gear 13 rigidly connected with the gear 12 and gearing for connecting the power-shaft indirectly to the gear 13, whereby the gear 12 may be driven at different speeds.

9. In a motor-vehicle, the combination with the rear axle, the equalizing-gears and the transmission-gears 4, 12, of a power-shaft having a bearing coaxial with the bearing of the gear 12, said gear and shaft being independent, a clutch for connecting the power-shaft directly to the gear 12, a gear 13 rigidly connected with the gear 12, gearing for connecting the power-shaft indirectly to the gear 13, whereby the gear 12 may be driven at different speeds, and a common casing inclosing all of said gears and said clutch.

10. In a motor-vehicle, the combination with a casing having a transverse internal flange, of variable-speed gears arranged in the compartment on one side of said flange, equalizing-gears in the compartment upon the opposite side of said flange, and a part extending through and having a bearing in said flange for transmitting movement from the variable-speed gears to the equalizing-gears.

11. In a motor-vehicle, the combination with the casing having a transverse internal flange, of a pair of rigidly-connected gears arranged on opposite sides of said flange and having an intermediate bearing in said flange, variable-speed gears and a reverse-gear in the compartment on one side of said flange and adapted to drive one of said pairs of gears, and equalizing-gears in the compartment upon the opposite side of said flange and adapted to be driven by the other of said pairs of gears.

12. In a motor-vehicle, the combination with an inclosed casing having a transversely-arranged bearing, a pair of gears carried by said bearing and arranged respectively on opposite sides thereof, variable-speed gears and a reverse-gear within the casing at one side of said bearing and adapted to operate one of said pairs of gears, and equalizing-gears within the casing upon the opposite side of said bearing and adapted to be operated by the other of said pair of gears, the equalizing-gears being also supported in bearings in said casing.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES SCHMIDT.

Witnesses:
RUSSELL HUFF,
H. V. BATCHELLER.

No. 781,307. PATENTED JAN. 31, 1905.

C. SCHMIDT.

TRANSMISSION GEARING FOR MOTOR VEHICLES.

APPLICATION FILED JUNE 22, 1903.

Fig. 1.

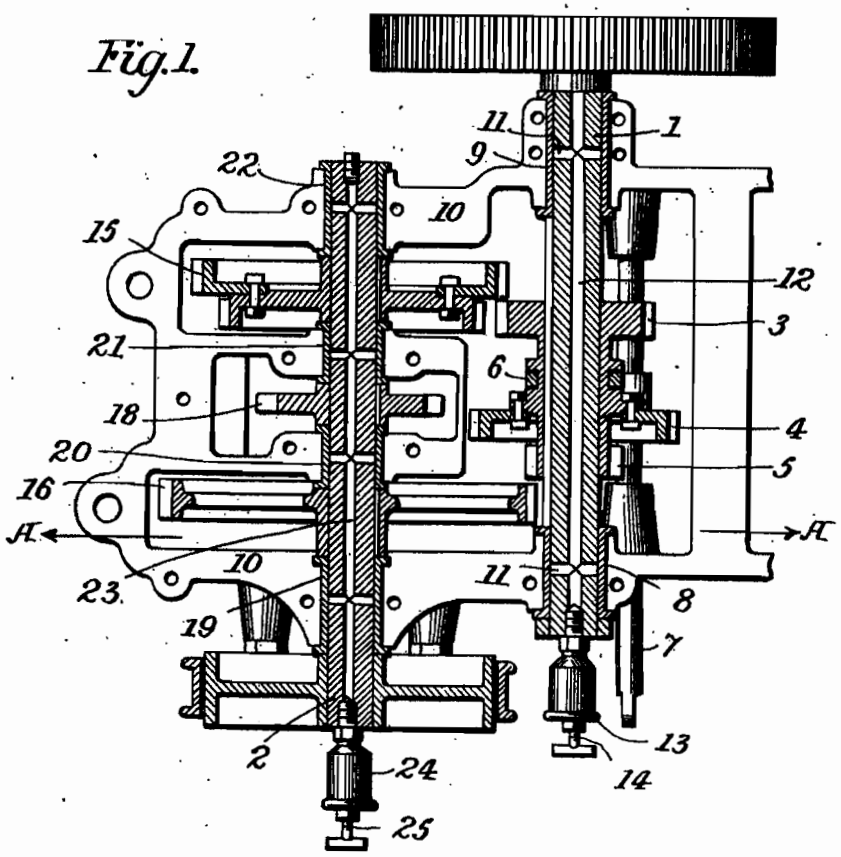
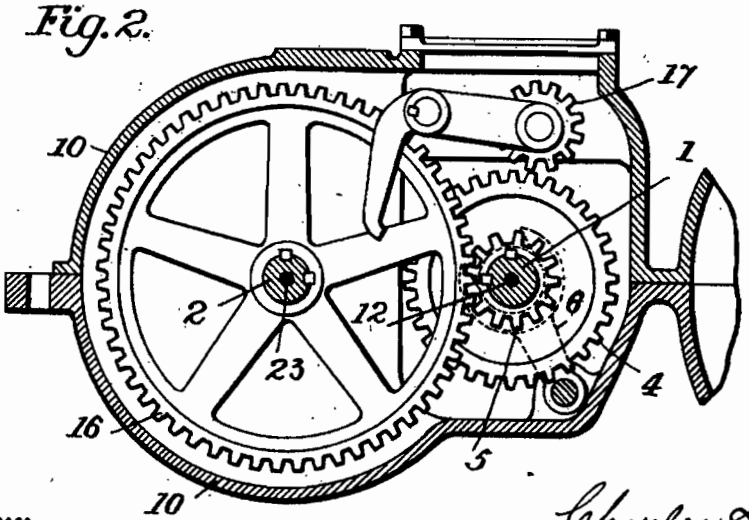


Fig. 2.



Witnesses

J. G. Stinkel

Wm. Fellman, Jr.

Inventor

Charles Schmidt

By Foster Freeman & Watson

Attorneys

No. 781,307. Patented January 31, 1905.

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF WARREN, OHIO, ASSIGNOR TO THE PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

TRANSMISSION-GEARING FOR MOTOR-VEHICLES.

SPECIFICATION forming part of Letters Patent No. 781,307, dated January 31, 1905.

Application filed June 22, 1903. Serial No. 162,630.

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of France, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Transmission-Gearing for Motor-Vehicles, of which the following is a specification.

The present invention relates particularly to the manner of mounting and lubricating the shafts of the transmission-gearing used in changing speed and in reversing the movement of motor-vehicles.

The invention will be described with reference to the accompanying drawings, in which—

Figure 1 is a plan view of the lower half of the gear-case, the gearing being shown in horizontal section; and Fig. 2 is a vertical section about on the line A A of Fig. 1.

Referring to the drawings, 1 indicates a power-driven shaft, which may be either the motor-shaft or one directly driven by it, and 2 indicates the counter-shaft. On the shaft 1 is a hub or sleeve carrying gears 3 4 5, said sleeve turning with and sliding on said shaft. The sleeve also has an annular groove in which is engaged a yoke 6, connected to a sliding rod 7. By moving rod 7 the gears may be shifted along shaft 1 to engage the several gears of the counter-shaft. The shaft 1 is mounted in bearings 8 and 9 in the casing 10, and these bearings are lubricated by transverse ducts 11, communicating with the central duct 12 in shaft 1. The duct 12 is closed at one end, and it communicates at the other end with an oil or grease cup 13. The oil or grease is forced in through the ducts of the bearings by a piston operated by a piston-rod 14, which may be screw-threaded and engage with threads in the end of the cup.

The counter-shaft 2 carries near one end a double spur-gear 15, adapted to engage with the gears 3 and 4, and toward its other end it carries a single spur-gear 16, adapted to engage with the gear 5. The gears are all disconnected simultaneously when in the position shown in Fig. 1. When in this position, the backing-gear 17 may be used to connect the gears 5 and 16 to effect a slow reverse movement of the counter-shaft. The counter-shaft is provided with bearings on each side of each gear and on each side of the sprocket-wheel 18, which communicates power to the driving-wheels of the vehicle. These bearings are all supported in the casing 10 and arranged between the upper and lower halves thereof. By supporting the counter-shaft close to each side of each gear and the sprocket-wheel all bending strain in said shaft is obviated, and consequently the shaft may be turned with less power and there is much less wear on the bearings than in cases where the shaft is simply supported at its ends, as heretofore. The bearings being all in the single casting prevents them from getting out of alinement.

The respective bearings for the shaft 1 are indicated by the numerals 19, 20, 21, and 22. These bearings are lubricated through transverse ducts in the shaft 1 communicating with the central duct 23, which is supplied by a grease-cup 24, having a piston and piston-rod 25, similar to the grease-cup 13, before described. By forcing in the piston 25 the bearings will be simultaneously supplied with a lubricant.

It will be seen that by means of the foregoing invention the counter-shaft is supported on each side of each point at which strain is applied to it and that in this manner its alinement is preserved, wear and tear of the bearings prevented, and the power required to drive it reduced to a minimum.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a motor-vehicle, the combination of a shaft, a sprocket-wheel centrally located on said shaft, gears upon each side of said sprocket-wheel for turning the shaft, and a casing having bearings for said shaft between the sprocket-wheel and the gears, and other bearings outside of said gears, for the purpose set forth.

2. In a motor-vehicle, the combination with a casing consisting of upper and lower sections, of a power-shaft mounted in bearings in the casing, a plurality of gears on said shaft, a counter-shaft, a sprocket-wheel centrally located on said counter-shaft, gears on opposite sides of said sprocket-wheel, bearings between the sprocket-wheel and the gears and bearings for the shaft outside of the gears, all of said bearings being rigidly supported in the casing, whereby they are kept in perfect alinement.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES SCHMIDT.

Witnesses:
RUSSELL HUFF,
H. V. BATCHELLER.

No. 783,547. PATENTED FEB. 28, 1905.

C. SCHMIDT.

MOTOR VEHICLE.

APPLICATION FILED JUNE 22, 1903.

2 SHEETS—SHEET 1.

Fig. 1.

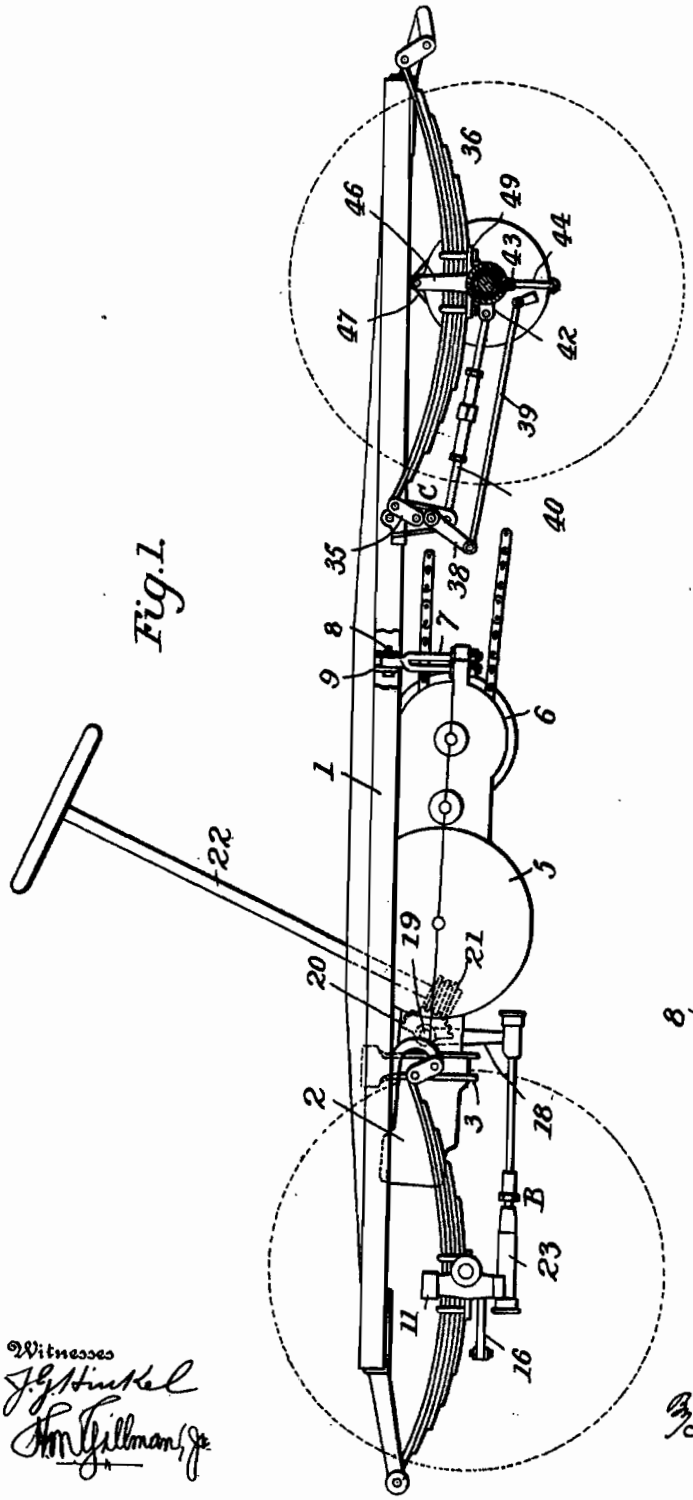
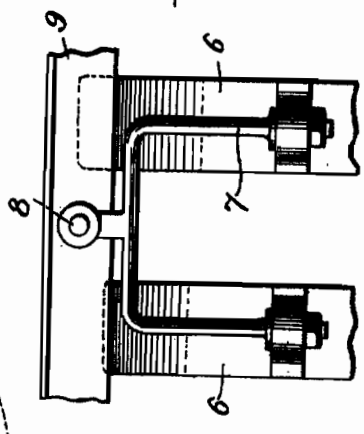


Fig. 2.



Witnesses

J. J. Stinkel

Thos. Gillman, Jr.

Inventor.

Charles Schmidt

By Foster Freeman Watson Coleman

Attorneys

No. 783,547. PATENTED FEB. 28, 1905.

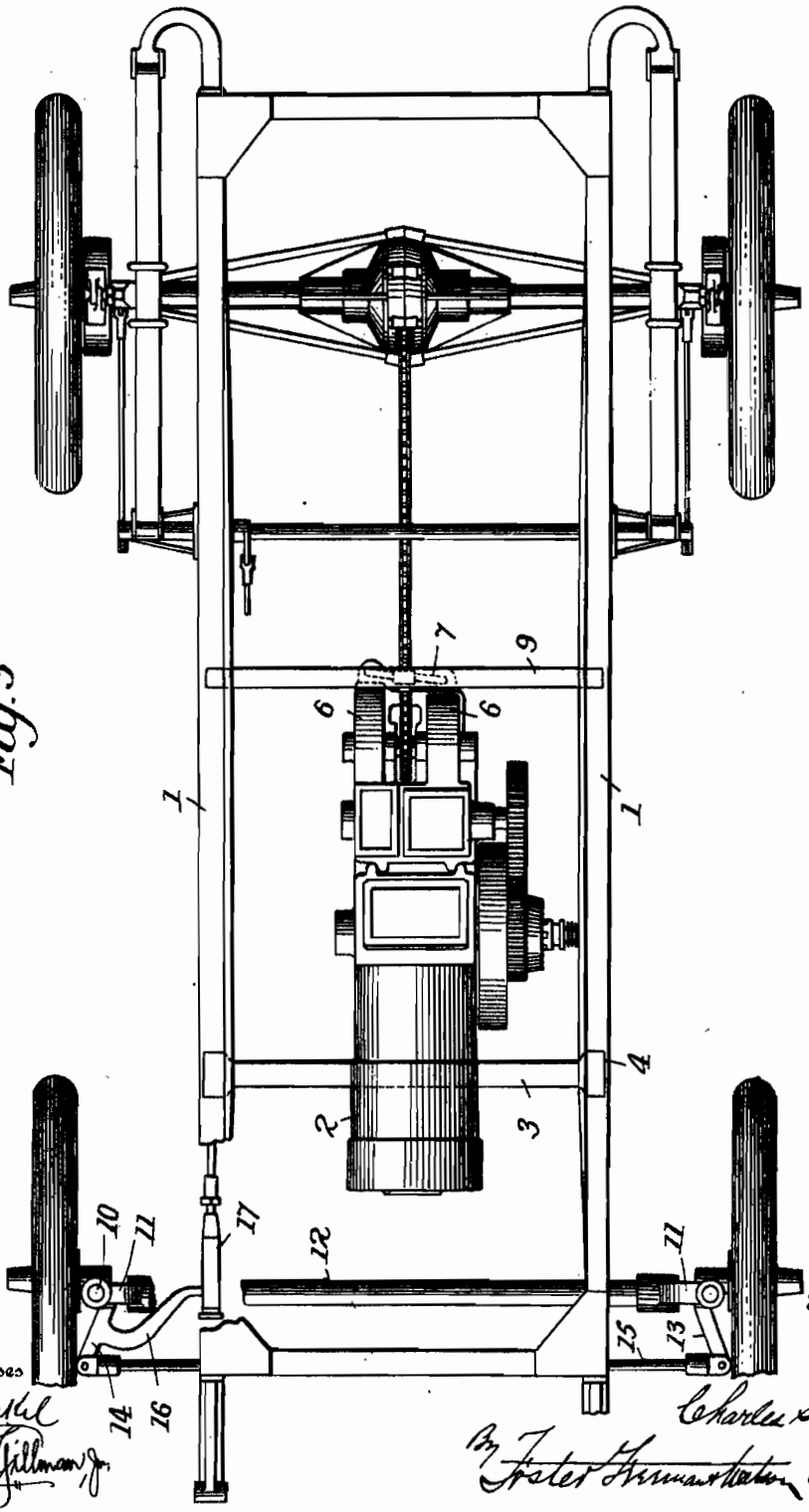
C. SCHMIDT.

MOTOR VEHICLE.

APPLICATION FILED JUNE 22, 1903.

2 SHEETS—SHEET 2.

Fig. 3



Witnesses

J. J. Stitzel

Wm. Gillmore Jr.

Inventor

Charles Schmidt

By Foster Freeman Watson Coleman

Attorneys

3 Point engine

No. 783,547. Patented February 28, 1905.

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF WARREN, OHIO, ASSIGNOR TO THE PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

MOTOR-VEHICLE.

SPECIFICATION forming part of Letters Patent No. 783,547, dated February 28, 1905.

Application filed June 22, 1903. Serial No. 162,632.

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of France, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Motor-Vehicles, of which the following is a specification.

This invention comprises various improvements in the art relating to the frame or running-gear of motor-vehicles.

The particular improvements will be described with reference to the accompanying drawings, in which—

Figure 1 is a side elevation, partly in section, of an automobile-frame. Fig. 2 is a detail of the rear motor-hanger. Fig. 3 is a plan view of the frame and running-gear.

Referring to the drawings, 1 indicates the frame proper, and 2 a motor. The frame when the machine is in operation is subjected to certain warping strains due to inequalities in the roads, and it is advisable to connect the motor with the frame in such a manner that it will not be strained by warping or twisting of the frame and will remain in proper relation to the driving-axle. With this end in view the motor is supported at three separate points upon the frame, the three points forming, preferably, the angles of an isosceles triangle. As shown, the motor 2 is supported near its forward end by a transverse bar 3, extending under the cylinder and connected to the frame-bars 1 at points 4. The motor mechanism in the present instance includes the crank-case 5 and a gear-case 6, the gear-case having two rearwardly-extending legs or branches, as shown in Fig. 3. The motor-cylinder, crank-case, and gear-case are all rigidly connected together and to the transverse bar 3. The two branches of the gear-case 6 are supported on the U-shaped hanger 7, which is centrally pivoted at 8 to a transverse bar 9 of the frame 1. It will thus be seen that the motor mechanism is supported from the frame at three points only—namely, the points 4 4 and 8—and that one of these supports is a pivotal connection, thus insuring the motor against strains due to the twisting or bending of the frame on uneven roads.

As shown in Figs. 1 and 3, the front wheel-hubs turn about vertical pivots 10, which are supported in yokes 11, fitted to the front axle 12. A pair of arms 13 14 are rigidly connected to the wheel-hubs and are connected together by a suitable connecting-rod 15 in the usual manner. For steering purposes the arm 15 has a branch arm 16, which arm 16 is connected by a link B with a vertical arm 18 upon a horizontal shaft 19, which is rocked by worm-gear 20, worm-wheel 21, and steering-shaft 22.

Certain features of the construction illustrated in the drawings and not herein specifically described or claimed form the subject of a divisional application, filed April 29, 1904.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a motor-vehicle, the combination with the frame, of a motor, a transverse beam or bar connected with the sides of the frame to which one end of the motor is rigidly connected, and a second transverse beam or bar to which the other end of the motor is pivotally connected.

2. In a motor-vehicle, the combination with the frame, of a motor, a transverse beam or bar connected with the sides of the frame and on which one end of the motor rests and is rigidly secured, and a second transverse beam or bar to which the other end of the motor is pivotally connected.

3. In a motor-vehicle, the combination with the frame, of a rigidly-connected motor, crank-case and gear-case, a transverse beam or bar connected with the sides of the frame to which one end of the motor is rigidly connected, and a second transverse beam or bar to which one end of the gear-case is pivotally connected.

4. In a motor-vehicle, the combination of a

motor-frame having two transverse bars or beams, a motor, crank-case and gear-case rigidly connected, and a U-shaped hanger pivotally connected to one of said bars and connected to opposite sides of said gear-case, the motor being rigidly connected to the other transverse bar.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES SCHMIDT.

Witnesses:
RUSSELL HUFF,
H. V. BATCHELLER.

No. 847,514. PATENTED MAR. 19, 1907.

C. SCHMIDT.

STARTING DEVICE FOR EXPLOSION ENGINES.

APPLICATION FILED JUNE 22, 1903.

Fig. 1

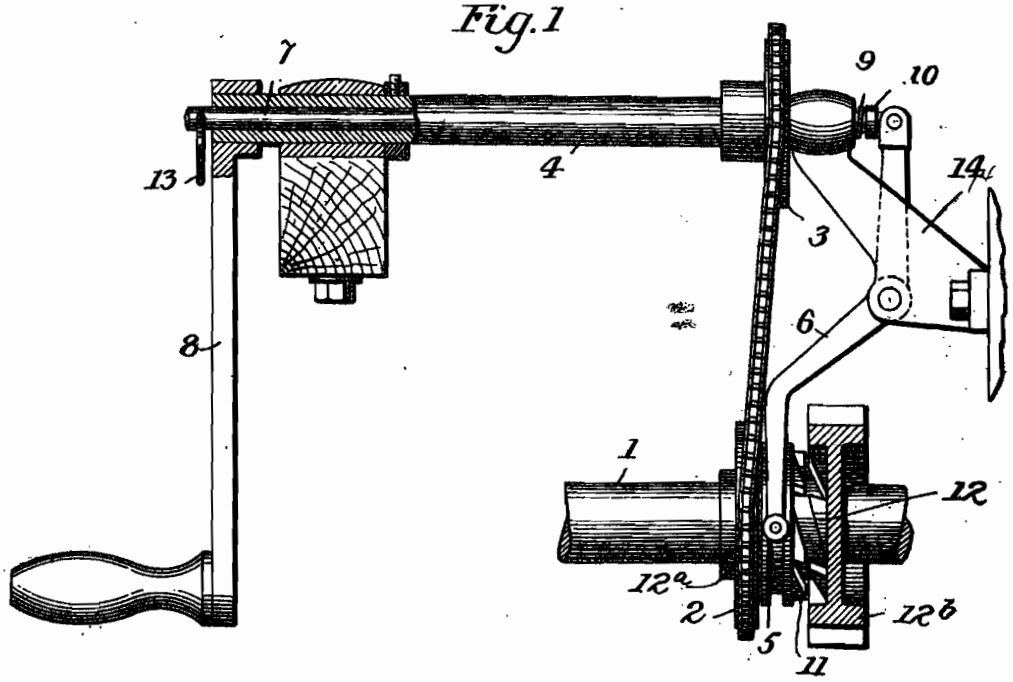


Fig. 2

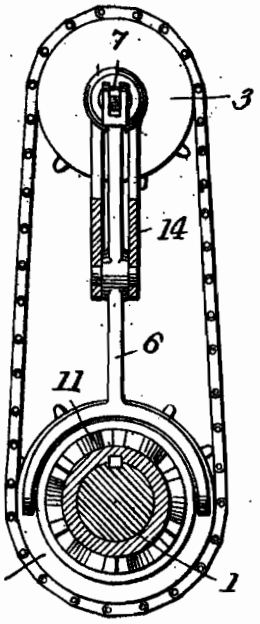
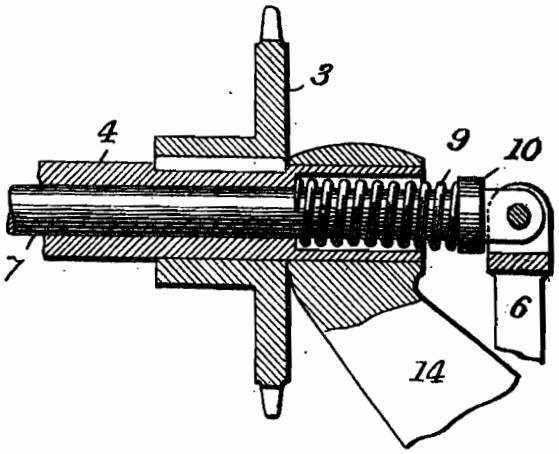


Fig. 3.



Witnesses

J. G. Stinkel

Thos. Fillman Jr.

Inventor

Charles Schmidt

By Foster Freeman Watson

Attorneys

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF WARREN, OHIO, ASSIGNOR TO THE PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

STARTING DEVICE FOR EXPLOSION-ENGINES.

No. 847,514. Specification of Letters Patent. Patented March 19, 1907.

Application filed June 22, 1903. Serial No. 162,629.

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of France, and a resident of Warren, in the county of Trumbull and State of Ohio, United States of America, have invented certain new and useful Improvements in Starting Devices for Explosion-Engines, of which the following is a specification.

This invention comprises a convenient and effective means for manually starting a hydrocarbon-motor, and is particularly applicable to motor-vehicles using such motors.

In the accompanying drawing, Figure 1 is a side view of the device embodying the invention, parts being shown in section. Fig. 2 is an end view, partly in section; and Fig. 3 is an enlargement of part of Fig. 1.

Referring to the drawing, 1 indicates the engine-shaft, and 2 a wheel, which is loose on said shaft. The wheel 2, as shown, is a sprocket-wheel; but it may be a gear or pulley or any suitable construction for receiving rotative motion from a similar wheel 3 on a crank-shaft 4. The wheel 2 is connected to a grooved collar 5, and a lever 6, mounted in a fixed bearing 14, has pintles which engage the groove on opposite sides of collar 5. The other arm of lever 6 is connected to a rod 7, extending through a hollow shaft 4 and beyond the crank 8 on said shaft and by which it is adapted to be rotated. The crank or manually-operated shaft is mounted in such a manner that it has no longitudinal movement, and a spring 9, abutting at one end against the crank-shaft and at the other against a collar 10 on the rod 7, holds the wheel 2 and collar 5 normally in left-hand position. On the right face of the collar 5 is a clutch member 11, which coöperates with a second clutch member 12, fixed on the motor-shaft 1. As illustrated, the wheel 2 and collar 5 are arranged on a hub 12^a of the clutch member 12, and a pinion 12^b is connected to said clutch member.

When it is desired to start the motor, the rod 7 is pulled out by means of a ring 13 or other suitable handle, thus engaging the clutch members 11 and 12. The crank 8 is simultaneously turned and movement communicated to the engine-shaft through the shaft 4 and the wheels 2 and 3. The teeth of the clutch members 11 12 are preferably undercut, as shown, so that they will remain interlocked while the crank 8 is being turned, thus rendering it unnecessary to pull on the rod 7 except for a moment to engage them. Immediately on releasing the crank 8 after starting the motor the spring 9 will separate the clutch members.

It will be evident that this invention may be embodied in various forms of mechanism. The form illustrated is the most convenient at present known; but other constructions will readily suggest themselves to the skilled mechanic. The invention is therefore not limited to the precise mechanism illustrated and described.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a mechanism for starting a hydrocarbon-motor, the combination with the engine-shaft and a normally open clutch for rotating said shaft, of a shaft adapted to be manually operated, connections between the latter shaft and one of the clutch members, and means for engaging and releasing the clutch including a part mounted coaxially with the manually-operated shaft.

2. In a mechanism for starting a hydrocarbon-engine, the combination with the engine-shaft and a normally open clutch for rotating said shaft, of a shaft adapted to be manually rotated, connections between said manually-operated shaft and one of said clutch members for rotating the latter, and a rod extending through said manually-operated shaft and adapted to close the clutch.

3. A starting device for hydrocarbon-engines comprising in combination with the engine-shaft, fixed and movable clutch members on said shaft, a shaft adapted to be manually operated, connections between the manually-operated shaft and the movable clutch member for r tating the latter, a rod extending through the manually-operated shaft, a lever connecting said rod with the movable clutch member, and means for normally holding said clutch open.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES SCHMIDT.

Witnesses:

RUSSELL HUFF,

H. V. BATCHELLER.

No. 775,932. PATENTED NOV. 29, 1904.

J. W. PACKARD.

SPARKING IGNITER DEVICE FOR HYDROCARBON ENGINES.

APPLICATION FILED JUNE 27, 1903.

NO MODEL.

Fig. 2.

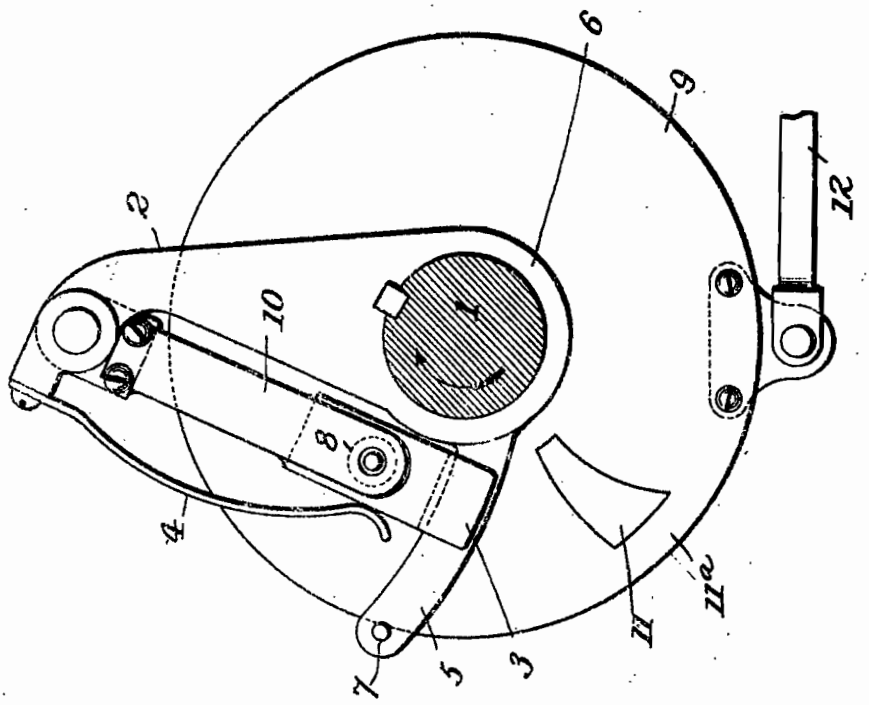
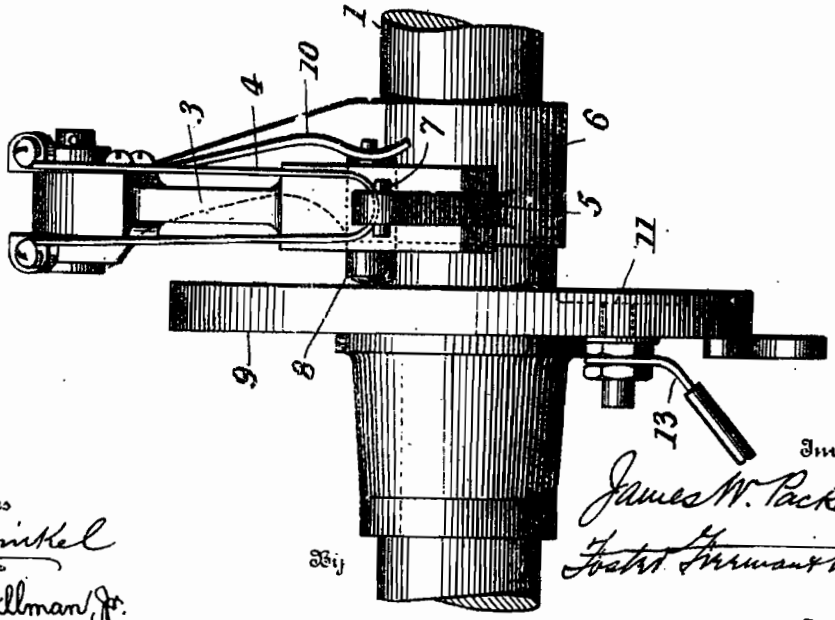


Fig. 1.



Witnesses

J. G. Hinkel

Wm. Fjellman, Jr.

Inventor

James W. Packard

Foster Freeman & Watson

Attorneys

No. 775,932. Patented November 29, 1904.

UNITED STATES PATENT OFFICE.

JAMES W. PACKARD, OF WARREN, OHIO, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

SPARKING IGNITER DEVICE FOR HYDROCARBON-ENGINES.

SPECIFICATION forming part of Letters Patent No. 775,932, dated November 29, 1904.

Application filed June 27, 1903. Serial No. 163,351. (No model.)

To all whom it may concern:

Be it known that I, JAMES W. PACKARD, a citizen of the United States, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Sparking Ignition Devices for Hydrocarbon-Engines, of which the following is a specification.

This invention comprises an improvement in sparking igniting devices for hydrocarbon-engines of the class illustrated in my United States Patent, No. 667,792, issued February 12, 1901.

The invention comprises means for advancing the spark automatically as the speed of the engine increases, for advancing it by hand, if desired, and for producing a spark of substantially uniform duration while the engine is running at different speeds.

The invention will be described with reference to the accompanying drawings, in which—

Figure 1 is an edge view of an apparatus embodying the invention, and Fig. 2 is a side view thereof.

Referring to the drawings, 1 indicates the motor-shaft, 2 an arm rigidly connected to and revolving with said shaft, and 3 a governor-lever pivotally connected to the outer end of the arm and extending inward substantially parallel thereto. A spring 4 holds the lever to its innermost position when the engine is not running and permits it to swing outward more or less as the speed varies when running, the lever being suitably weighted to cause it to act as a governor. As shown, the lower end of the lever is forked and it embraces a guide-arm 5, extending outward from the hub 6 of arm 2. At the outer end of the guide-arm is a pin or projection 7, which prevents the governor-lever from swinging out beyond its proper range of movement. The governor-lever carries a contact-pin 8, which is pressed continuously into contact with a disk 9 by a suitable spring 10, fixed to said lever. The disk 9 is constructed of insulating material and is provided with a contact-plate 11 flush with the face upon which the pin 8 travels. The disk is mounted free on the shaft 1, and it is adjusted to properly time the igniting spark by means of a connection 12. The pin 8 is electrically connected with one terminal of the igniting circuit through the governor-lever 5, arm 2, and shaft 1, while the contact-plate 11 is directly connected with the other terminal of the circuit by a wire 13, as shown. The shape of the contact-plate 11 is preferably as shown in Fig. 2—that is, it increases in width as the radius increases, and its forward edge advances or is inclined forward with respect to a radial line as the radius increases. The increase in width insures a spark of substantially constant duration for different speeds, and the inclined forward edge advances the spark as the speed increases. The form of contact-plate shown is that preferred; but it may be varied to suit other conditions, if desired. When the speed of the motor exceeds the desired limit, the contact-point 8 moves out beyond the plate 11, and no further ignition takes place until the speed is reduced within the said limit. For this purpose the disk 9 extends beyond the plate 11, as shown at 11ª.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. An igniting device for hydrocarbon-engines comprising, in combination, a sparking circuit, a rotating shaft, a governor device on said shaft, a disk of insulating material arranged transversely of the shaft, a contact-plate carried by said disk, and a contact-point carried by the governor device and arranged to travel over said disk and contact-plate, said disk having a portion of insulating material extending radially outward from said contact-plate whereby the ignition is discontinued when the speed exceeds a given limit.

2. In an igniting device for hydrocarbon-engines, the combination of a shaft, two arms secured to said shaft and projecting radially therefrom at an angle to each other, a governor-lever pivotally connected to one of said arms and loosely engaging the other arm, a contact-point carried by said lever, a disk of insulating material arranged transversely of

the shaft, a contact-plate carried by said disk and lying in the path of said contact-point on the lever, and a sparking circuit having terminals electrically connected, respectively, to said contact point and plate.

3. In an igniting device for hydrocarbon-engines, the combination of a shaft, an arm projecting radially from said shaft, a governor-lever pivotally mounted on said arm, a guide and stop carried by the shaft and acting to guide the governor-lever and limit its movement in one direction, a spring acting to move said lever in the opposite direction, a disk of insulating material arranged transversely of the shaft, a contact-plate carried by said disk, a contact-point carried by the governor-lever and adapted to contact with said plate and disk as the shaft rotates, and a sparking circuit including said point and plate.

4. In an igniting device for hydrocarbon-engines, the combination of a shaft, two arms projecting radially from said shaft at an angle to each other, a governor-lever pivotally mounted on one of said arms and having a guide-slot formed therein through which the other of said arms extends, a spring acting to hold the free end of said lever adjacent the shaft, a disk of insulating material arranged transversely of the shaft, a contact-plate carried by said disk, a pin mounted in said governor-lever in position to cross said plate as the shaft rotates, a spring acting to force said pin against said plate, and a sparking circuit including said plate and pin.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES W. PACKARD.

Witnesses:
S. D. WALDON,
RUSSELL HUFF.

No. 787,212. PATENTED APR. 11, 1905.

J. W. PACKARD.

SPARKING IGNITING DEVICE FOR HYDROCARBON ENGINES.

APPLICATION FILED JUNE 27, 1903.

Fig. 1.

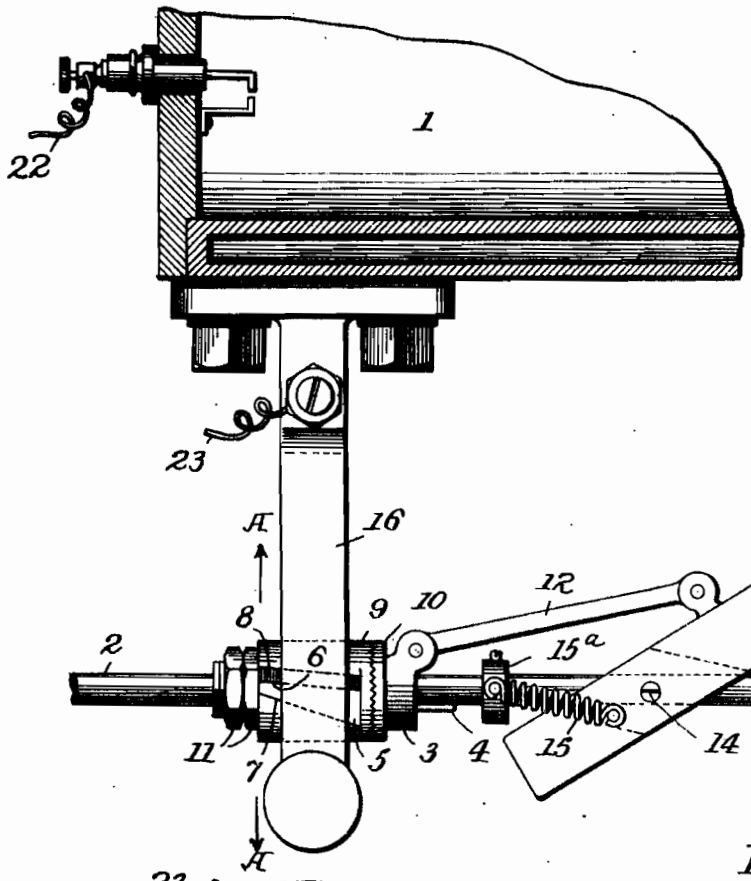


Fig. 2.

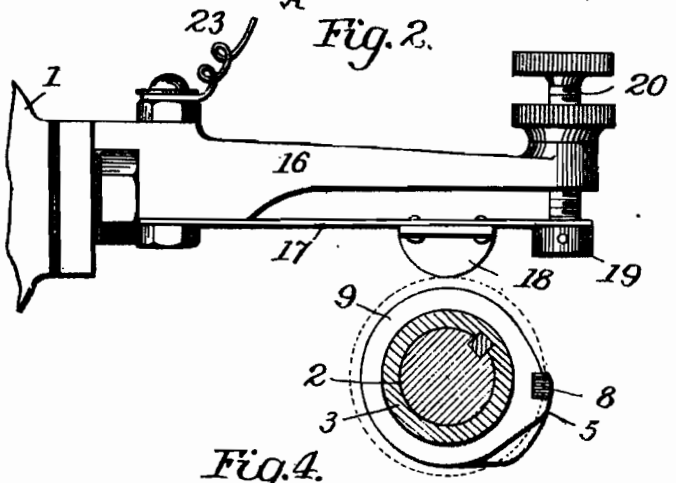


Fig. 3.

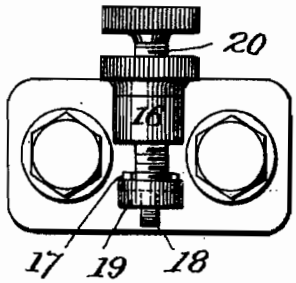
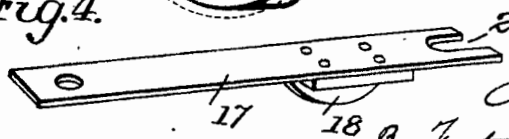


Fig. 4.



Witnesses

J. G. Stinkel

Wm. T. Gillman, Jr.

Inventor

J. W. Packard

By Foster Freeman Watson

Attorneys

No. 787,212. Patented April 11, 1905.

UNITED STATES PATENT OFFICE.

JAMES W. PACKARD, OF WARREN, OHIO, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

SPARKING IGNITING DEVICE FOR HYDROCARBON-ENGINES.

SPECIFICATION forming part of Letters Patent No. 787,212, dated April 11, 1905.

Application filed June 27, 1903. Serial No. 163,352.

To all whom it may concern:

Be it known that I, JAMES W. PACKARD, a citizen of the United States, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Sparking Igniting Devices for Hydrocarbon-Engines, of which the following is a specification.

This invention comprises improvements in the igniting device for hydrocarbon-engines patented to me in Letters Patent No. 667,792, issued February 12, 1901.

The object of the present invention is to improve the electric contacts, so as to insure certainty of operation, it having been found that in the patented device the contacts occasionally became dirty and for that reason inoperative or inefficient.

In the present invention one of the contact-points is adjustable and at the same time spring-pressed against the other, and the contact is a sliding instead of an impinging one, thereby insuring clean contact-surfaces.

Referring to the accompanying drawings, Figure 1 is a sectional view of part of a cylinder with the contact device shown in plan. Fig. 2 is a section on the line A A, Fig. 1. Fig. 3 is an end view of the bracket carrying the contact-spring, and Fig. 4 is a detail of said spring.

Referring to the drawings, 1 indicates the cylinder of a hydrocarbon-engine, and 2 a shaft arranged parallel with the cylinder, said shaft being connected with the crank-shaft of the engine in some suitable manner, so as to rotate in fixed relation therewith. Upon the shaft 2 is a sleeve 3, which is free to slide longitudinally on the shaft, but compelled to turn therewith by means of a spline 4 or other equivalent device. The sleeve 3 has on it a contact-cam 5, the operative face of which is tapered, said cam having a rear edge 6, which is approximately parallel with the shaft, and an inclined forward edge 7 for a purpose to be presently explained. In the rear of the edge 6 and flush with the highest surface of the cam is a block of insulating material 8. The cam 5 and the insulating material are preferably carried on a cylindrical shell 9, which is adjustably mounted on the sleeve 3. As shown, the sleeve has a head 10, which is serrated on its inner surface, and the cam-cylinder 9 is clamped against said serrated head by nuts 11. By loosening the nuts 11 the cam may be set forward or rearward with respect to the shaft.

The sleeve 3 is connected by a link 12 to a suitable governor 13, pivoted at 14 to the shaft and operated in one direction by centrifugal force and in the other direction by a spring 15.

Connected to the cylinder or other suitable support is a bracket 16, said bracket being insulated from its support. Connected to the under surface of the bracket is a spring contact-plate 17, carrying a contact-piece 18. The spring 17 is under tension to move toward the shaft 2, and its outer end bears on a head 19 of an adjusting-screw 20. As shown, the end of the spring has a notch 21, through which the screw passes. By raising and lowering the screw the contact 18 may be adjusted to and from the cam. The spring is always free to move upward under the influence of the cam. The contact-point 18 may therefore be readily adjusted to take up wear and also to give it the desired pressure on the cam. The cylinder and the shaft 2 are electrically connected through the machinery or frame and the return-circuit passes from the terminal 22 on the cylinder through the usual spark-coil and battery to a terminal 23, connected with the spring 17.

It will be evident that the spark is advanced with respect to the position of the piston within the cylinder as the speed increases, due to the inclined forward edge 7 of the cam. It will also be evident that the extent of contact-surface increases as the speed increases, due to the tapered formation of the cam 5. This tapered surface of the cam is preferably so proportioned that the actual time of contact will be substantially uniform regardless of the speed, thus producing a uniform spark at different speeds. The circuit is broken as the contact passes from the cam-surface 5 to the

insulating-surface 8. When the contact-point 18 is properly adjusted, it touches only the tapered surface of cam 5 during the rotation of the shaft. The proper adjustment of the contact-point is shown in Fig. 2 and its path relative to the cam is shown by dotted circle in said figure. When the motor exceeds the desired limit of speed, the cam 5 passes beyond the contact-point 18 and thereafter there is no ignition, and consequently no additional power supplied, until the speed falls to said limit. By adjusting the collar 15ª upon the shaft 2 the speed at which ignition will cease may be varied.

The operation of the foregoing invention will be evident from the illustration and description. As in my previous patent, the duration of the spark will be substantially constant at different speeds, due to the tapered formation of the cam 5, and the spark will be advanced as the speed increases, due to the inclined foward edge 7 of the cam, which will close the circuit earlier at high speeds than at low speeds. It will be evident that the invention may be embodied in different forms of apparatus, and for that reason the present invention is not limited to the precise construction and arrangement of parts illustrated.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. An igniting device for hydrocarbon-engines, comprising in combination, a sparking circuit, a rotating shaft, a contact-cam adapted to rotate with and slide on said shaft, said cam being adjustable about the shaft, means for securing the cam to the shaft in any desired position to advance or delay the spark, and a governor controlling the sliding movement of said cam.

2. An igniting device for hydrocarbon-engines, comprising in combination, a sparking circuit, a rotating shaft, a part arranged to slide on and turn with said shaft, a governor controlling the sliding movement of said part, a sleeve on said part having a contact-cam, means for adjusting the sleeve relatively to the shaft to advance or delay the spark, and a contact-point arranged in the path of said cam.

3. An igniting device for hydrocarbon-engines comprising in combination, a sparking circuit, a rotating shaft, a tapered contact-surface arranged to rotate with and slide on said shaft, a governor controlling the sliding movement of said surface, a spring supporting a contact-point, and means for adjusting said spring and contact-point to and from the shaft.

4. An igniting device for hydrocarbon-engines comprising in combination, a sparking circuit, a rotating cam having a tapering contact-surface, a strip of insulating material in the rear of said cam, and a spring-supported contact-point in the path of said cam.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES W. PACKARD.

Witnesses:
S. D. WALDEN,
RUSSELL HUFF.

No. 806,830. PATENTED DEC. 12, 1905.

J. W. PACKARD.

MIXER AND VAPORIZER FOR HYDROCARBON ENGINES.

APPLICATION FILED JUNE 29, 1903.

3 SHEETS—SHEET 1.

Fig. 1.

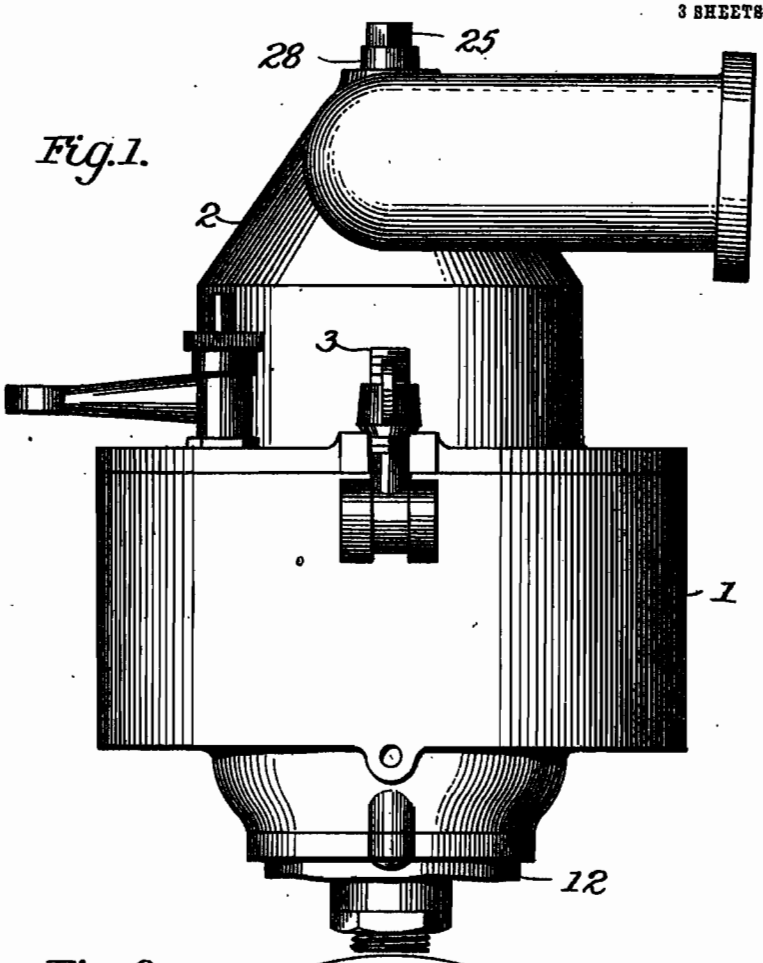
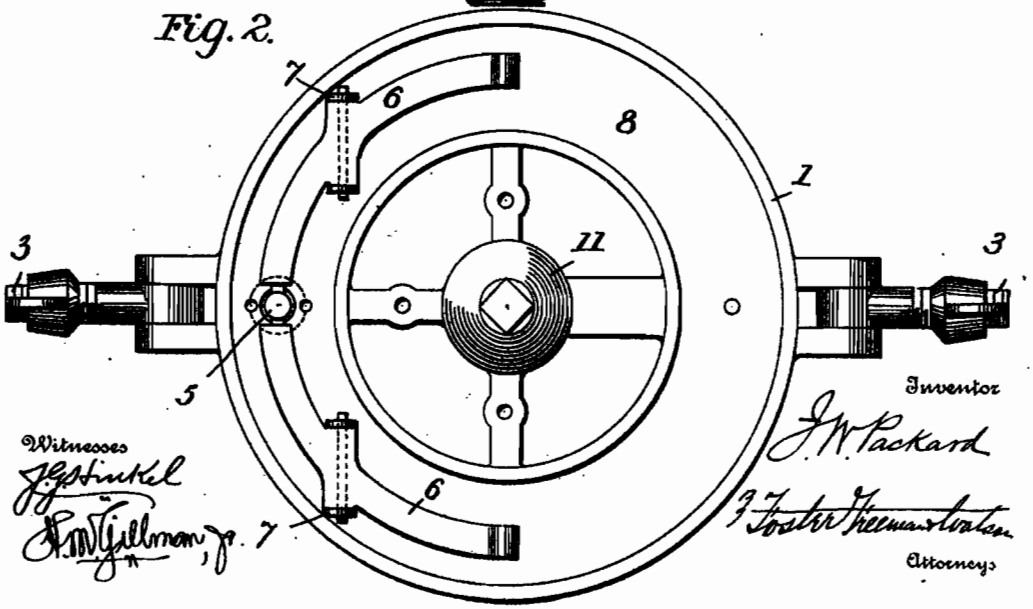


Fig. 2.



Witnesses
J. J. Stinkel
H. W. Gillman, Jr.

Inventor
J. W. Packard
By Foster Freeman Watson
Attorneys

No. 806,830. PATENTED DEC. 12, 1905.

J. W. PACKARD.

MIXER AND VAPORIZER FOR HYDROCARBON ENGINES.

APPLICATION FILED JUNE 29, 1903.

3 SHEETS—SHEET 2.

Fig. 3.

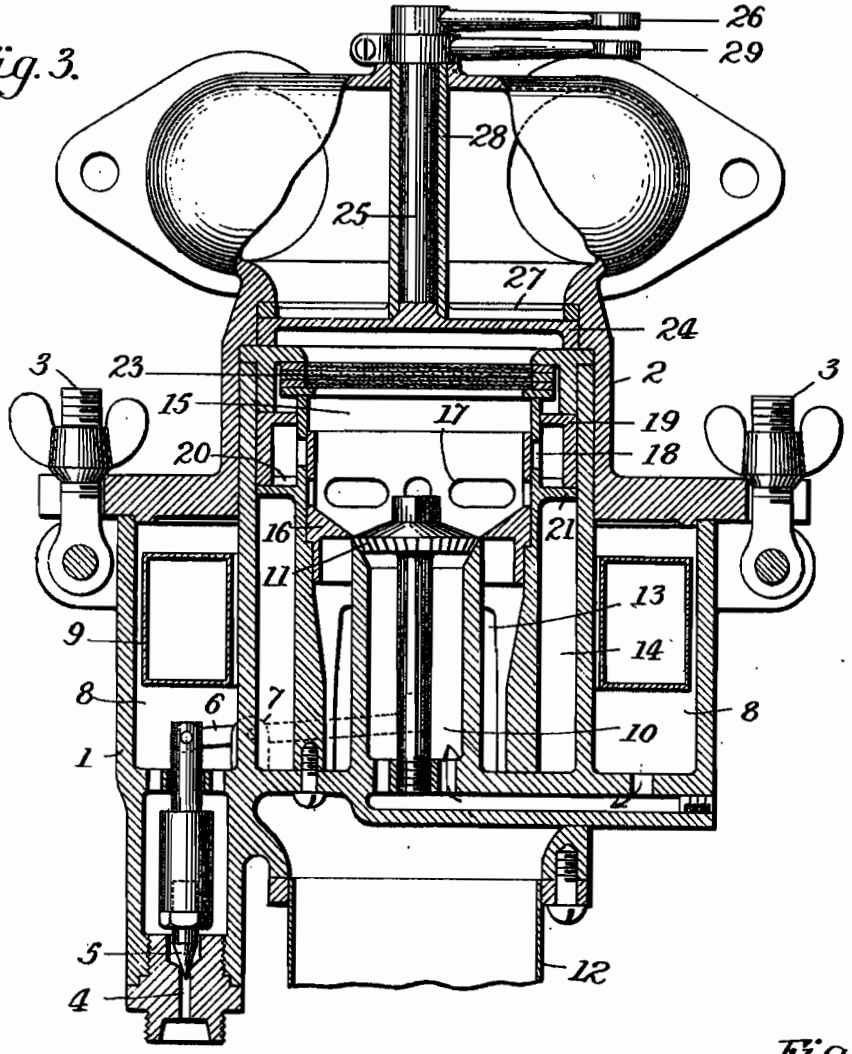


Fig. 4.

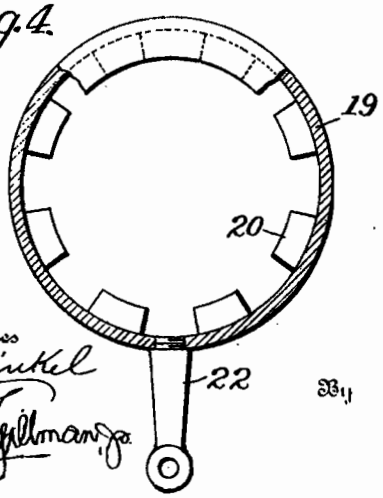
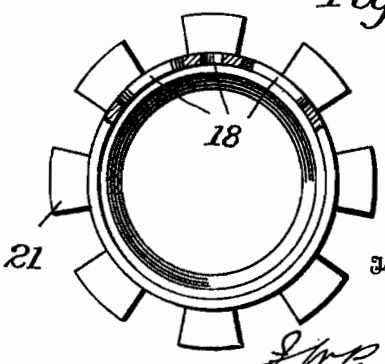


Fig. 5.



Witnesses
J. J. Stinkel
Thos. Tillman, Jr.

Inventor
J. W. Packard

By Foster Freeman Watson & Coit, Attorneys.

No. 806,830. PATENTED DEC. 12, 1905.

J. W. PACKARD.

MIXER AND VAPORIZER FOR HYDROCARBON ENGINES.

APPLICATION FILED JUNE 29, 1903.

3 SHEETS—SHEET 3.

Fig. 6.

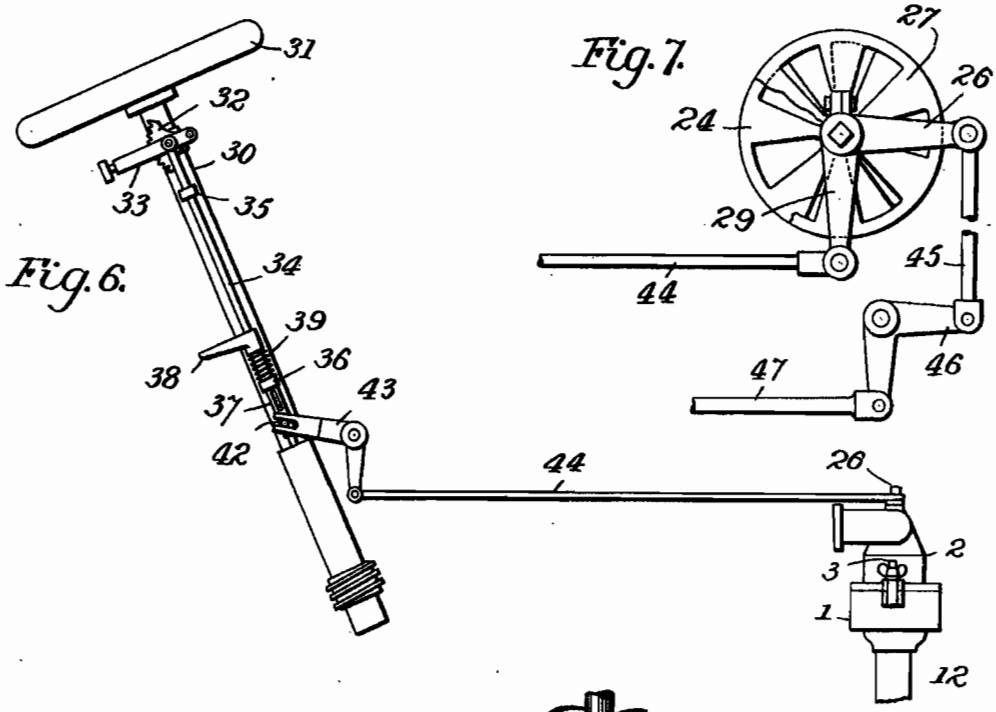


Fig. 7.

Fig. 8.

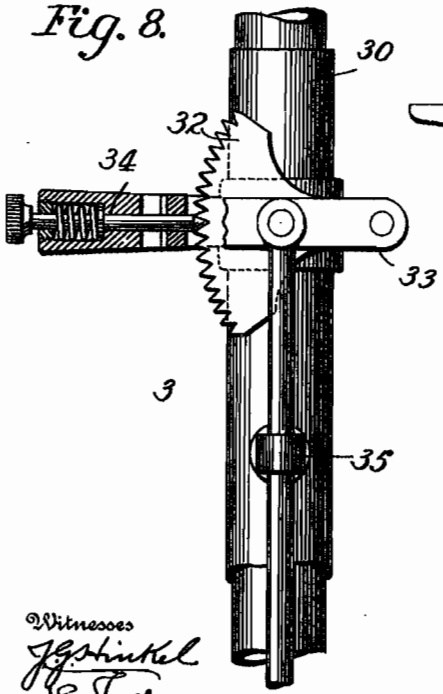
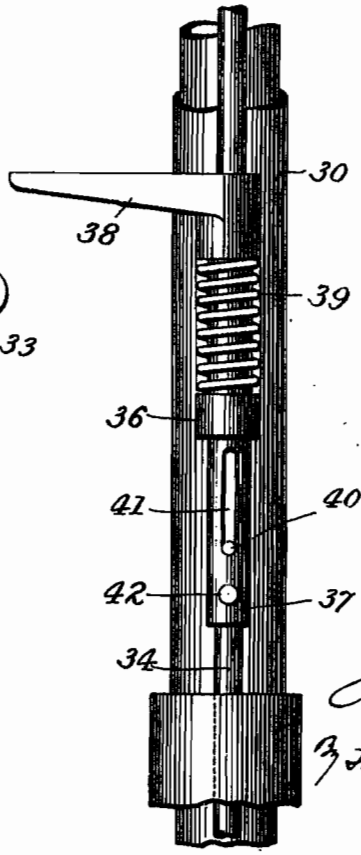


Fig. 9.



Witnesses

J. G. Stinkel

Wm. Tillman, Jr.

Inventor

J. W. Packard

By Foster Freeman Watson

Attorneys

UNITED STATES PATENT OFFICE.

JAMES W. PACKARD, OF WARREN, OHIO, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

MIXER AND VAPORIZER FOR HYDROCARBON-ENGINES.

No. 806,830. Specification of Letters Patent. Patented Dec. 12, 1905.

Application filed June 29, 1903. Serial No. 163,590.

To all whom it may concern:

Be it known that I, JAMES W. PACKARD, a citizen of the United States, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Mixers and Vaporizers for Hydrocarbon-Engines, of which the following is a specification.

This invention comprises various improvements in carbureters for hydrocarbon-engines used on motor-vehicles of the class illustrated in United States Letters Patent No. 667,910, dated February 12, 1901.

It is often desirable, on account of varying atmospheric and climatic conditions, to vary the quantity of air admitted to the mixing-chamber with relation to the quantity of hydrocarbon, and it is also desirable to be able to vary the quantity of mixture passing to the engine both automatically and by hand.

The present invention relates to these regulating devices and also to novel means for regulating the gasolene-inlet valve.

The invention will be fully described in connection with the accompanying drawings, in which—

Figure 1 is a side view of a carbureter embodying the invention. Fig. 2 is a plan view of the lower part of the carbureter. Fig. 3 is a section taken on the middle vertical line of Fig. 1. Fig. 4 is a plan view of the auxiliary air-valve. Fig. 5 is a plan view of the seat of said valve. Fig. 6 is a side view of the means for operating the mixture-valve manually. Fig. 7 is a plan view of the mixture-valve, showing connections for operating it manually and automatically; and Figs. 8 and 9 are details of part of Fig. 6.

Referring to the drawings, 1 indicates the lower part of the casing of the carbureter, and 2 the upper part of the casing, these parts being connected by bolts 3 when the apparatus is assembled. The gasolene enters from a suitable reservoir through an opening 4, controlled by valve 5. This valve is connected to a lever 6, which is in the form of a semicircle and is mounted to rock on bearings 7. The free ends of the lever are preferably located in a diametrical line passing through the center of the apparatus, as shown in Fig. 2. The lever 6 is located in the float-chamber 8, and in said chamber is an annular float 9, normally resting upon the free ends of the lever. Gasolene passes from the chamber 8 to an inner chamber 10 by passages indicated by arrows and stands substantially at a common level in both chambers. The object of using the annular float is to bring the center of the float as nearly as possible coincident with the chamber 10, so that the level of the gasolene in said chamber will not fluctuate on account of inequalities in the road over which the automobile travels. When the float is to one side of the carbureter, it is found that the level in the compartment 10, from which the gasolene is drawn, will be higher or lower, depending upon whether the vehicle is going uphill or downhill and depending upon other inequalities in the road. This defect is largely corrected by the construction above described. The gasolene is drawn from the compartment 10 through the valve 11 by the suction created by the engine in the usual manner.

The air for the carbureter enters through pipe 12 and passes through openings in the bottom of the casing 1 into inner air-passages 13 and outer air-passages 14. The air passing through the passages 13 enters the mixing-chamber 15 at the upper edge of the circular wall of the gasolene-compartment 10, at which edge it mingles with the gasolene. The upper opening of the compartment 13 is controlled by a sliding valve 16, the opening of which depends upon the speed of the engine—that is, upon the suction created by the cylinders, the valve 16 being free to slide vertically. The valve 16 has lateral openings 17, which register with openings 18 in the inner wall of the compartment 14 when the valve is raised to its extreme limit by suction, in which case additional quantities of air are drawn in from the compartment 14. In order to regulate the quantity of air which may be drawn from the compartment 14, a circular air-valve 19 is provided. As shown in Figs. 3 and 4, this valve has a series of inwardly-projecting plates 20, which coöperate with a series of plates 21, projecting from the inner wall of compartment 14. These plates 20 21 form a multiple valve, which is opened and closed by means of a lever 22, connected to the ring 19. The ring 19 is set to open the valve to the necessary degree to provide a proper mixture of air and hydrocarbon, and it only requires to be readjusted when

atmospheric or climatic conditions affect the quality of the mixture.

Above the mixing-chamber are a series of screens 23 to more effectually mix the air and gasolene, and above the screens is a mixture-valve having two movable parts of similar construction. As shown, these parts are circular plates having radial openings and rotating about a common center, and they may be said to constitute two valves. The under valve 24 is provided with a spindle 25 and a lever 26. The upper valve-section 27 is connected with a hollow spindle 28, surrounding the spindle 25 and is operated by a lever 29.

In Figs. 6 to 9, inclusive, is shown apparatus for setting the valve 27 for the opening required for any desired speed. On the sleeve 30, which carries the shaft of the steering-wheel 31, is mounted a toothed sector 32. Pivoted to this sector is a lever 33, carrying a spring locking-pawl 33^a, coöperating with the teeth of the sector. By means of the locking-pawl the lever 33 can be set at any desired angle. Connected to the lever 33 is a rod 34, extending through fixed guides 35 36. Sliding upon the rod is a sleeve 37, surrounding the rod 34 and sliding within the guide 36. On the upper end of the sleeve 37 is fixed a handle or pedal 38, and between the hub of 38 and the guide 36 is a spring 39, which normally holds the sleeve 37 in its uppermost position, which position is determined by a pin 40, extending from rod 34 through a slot 41 in sleeve 37. On lower end of sleeve 37 is a pin 42, which engages the forked arm of an elbow-lever 43, the other arm of which is connected by a rod 44 with the lever 29, which operates the valve 27. It will be evident that the valve 27 may be set to any desired opening by the lever 33. When it is desired to open the valve temporarily to a greater extent for a temporary increase of speed or power, the pedal 38 is pushed down, compressing spring 39 and rocking the lever 43. When the pedal is released, the spring 39 immediately restores the parts to the position determined by the lever 33.

The operating-arm 26 of the under valve 24 may be operated either by hand or by a governor. As shown, it is operated through link 45, elbow-lever 46, and a link 47. As stated, it may be connected to a governor, in which case the amount of mixture admitted to the cylinder will be regulated automatically by a governor. If desired, the valve 24 may be manually controlled or in some instances it may be locked in position.

It will be evident that the construction and arrangement of parts herein described may be varied to some extent without departing from the scope and spirit of the invention, and hence it is to be understood that the invention is not limited to the precise construction illustrated and described.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a hydrocarbon-engine, a mixer and vaporizer comprising a gasolene-inlet, a casing surrounding said inlet, an air-valve, adapted to be operated by suction, arranged about the gasolene-inlet within said casing, a second air-valve arranged outside of said casing, and means for manually operating said second air-valve, said air-valves being arranged to control independent supplies of air to the mixing-chamber.

2. In a hydrocarbon-engine, a mixer and vaporizer comprising a gasolene-inlet, a cylindrical casing surrounding said inlet and provided with air-ports, an air-valve, arranged within the casing to move longitudinally thereof, a second air-valve surrounding said casing, and means for rotating said second valve, said air-valves being arranged to control independent supplies of air to the mixing-chamber.

3. In a hydrocarbon-engine, a mixer and vaporizer comprising a gasolene-inlet, a casing surrounding said inlet and having an outwardly-projecting annular flange, a suction-valve arranged within the casing and having an apertured section adapted to control the admission of air through ports formed in said casing between the inner end thereof and the annular flange thereon, and a manually-operated valve for controlling the passage of air through ports formed in said flange.

4. In a hydrocarbon-engine, a mixer and vaporizer comprising the gasolene-inlet valve 11, the annular suction-valve 16 having a lateral opening 17, and the annular valve 19 surrounding said suction-valve and controlling the supply of air to said lateral openings.

5. In a hydrocarbon-engine, the combination with the mixer and vaporizer of a mixture-valve, means for locking said valve in a given position, and means whereby said valve may be temporarily shifted without disturbing said locking means.

6. In a hydrocarbon-engine, the combination with a mixer and vaporizer, of a mixture-valve, a locking device for said valve, connections between said locking device and said valve including a spring portion and means for compressing the spring to temporarily shift the valve without disturbing the locking means.

7. In a hydrocarbon-engine, the combination with the vaporizer and mixer, of a mixture-valve, means for locking said valve normally in any desired position, and means whereby the valve may be temporarily opened without disturbing the locking means comprising the rod 34, sleeve 37, spring 39, stop 40, and means for compressing the spring and moving the sleeve.

8. In a hydrocarbon-engine, the combination with a mixer and vaporizer, of a mix-

ture-valve comprising two independently-movable parts, means for locking one of said parts in any desired position, and connections for moving the other part as desired.

9. In a hydrocarbon-engine, the combination with a mixer and vaporizer, of a mixture-valve comprising two relatively movable parts, means for locking one of said parts in any desired position, means whereby said part may be temporarily shifted without disturbing said locking means, and independent means for moving the other part of said valve.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES W. PACKARD.

Witnesses:
S. D. WALDON,
RUSSELL HUFF.

No. 830,099. PATENTED SEPT. 4, 1906.

J. W. PACKARD.

HYDROCARBON ENGINE FOR MOTOR VEHICLES.

APPLICATION FILED JUNE 29, 1903.

3 SHEETS—SHEET 1.

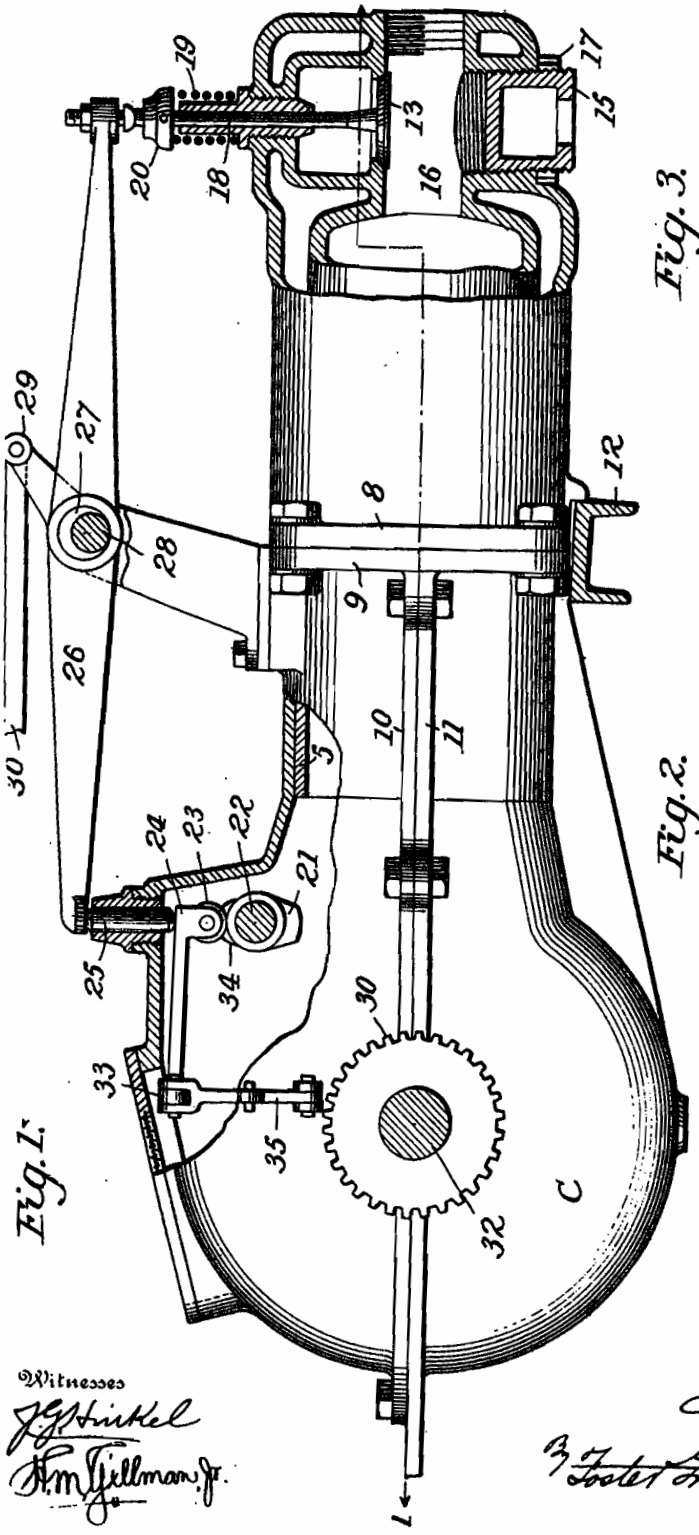


Fig. 1.

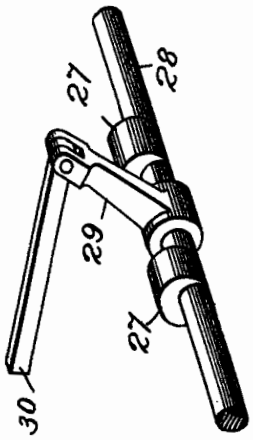


Fig. 3.

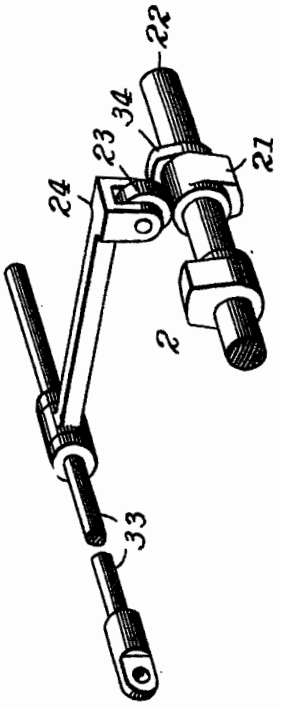


Fig. 2.

Witnesses

J. J. Stinkel

H. M. Gillman, Jr.

Inventor

J. W. Packard

By Foster Freeman Watson Attorneys

No. 830,099. PATENTED SEPT. 4, 1906.

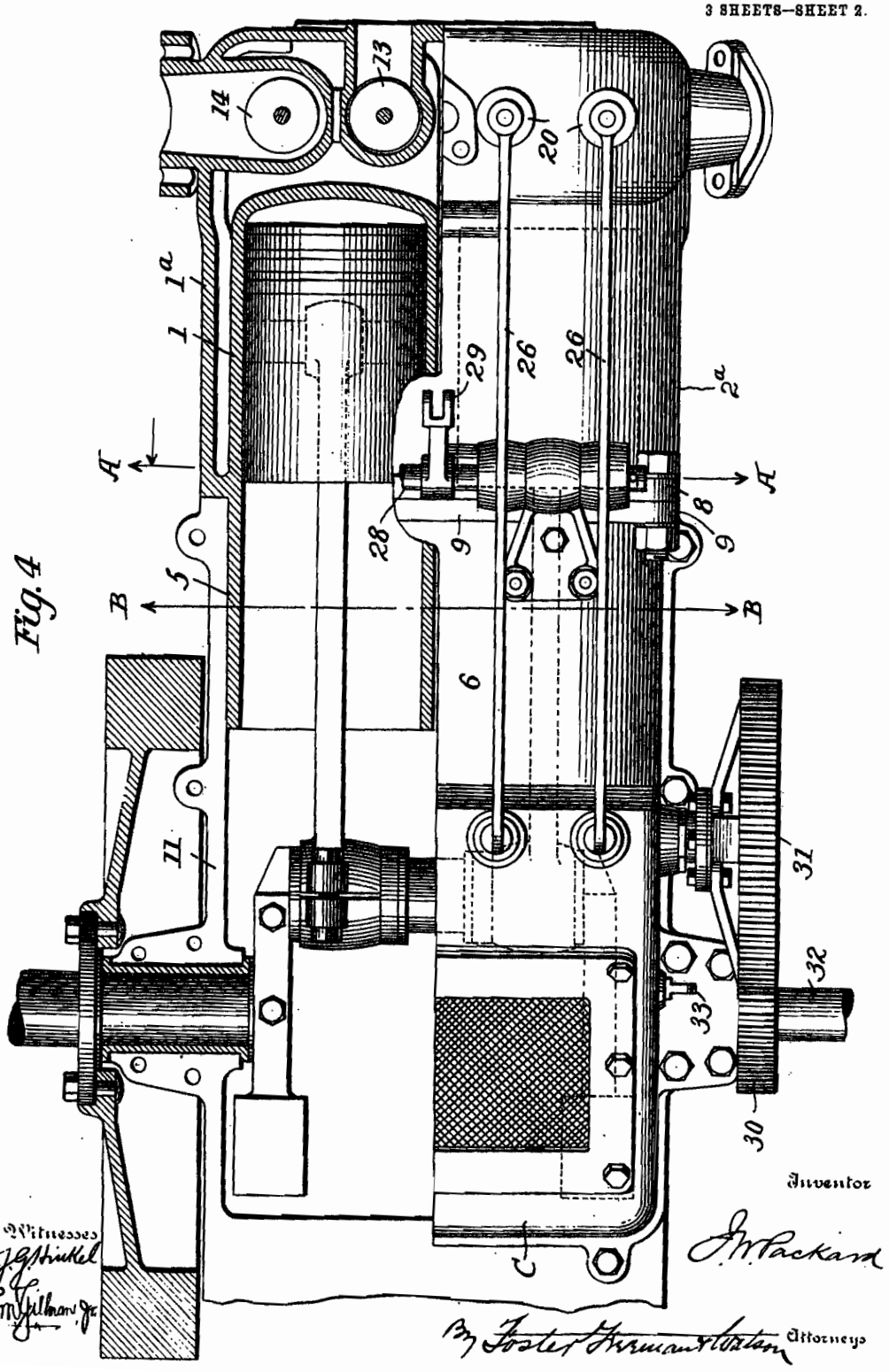
J. W. PACKARD.

HYDROCARBON ENGINE FOR MOTOR VEHICLES.

APPLICATION FILED JUNE 29, 1903.

3 SHEETS—SHEET 2.

Fig. 4



Witnesses
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H. M. Gilman Jr.

Inventor
J. W. Packard

By Foster Freeman & Watson Attorneys

No. 830,099. PATENTED SEPT. 4, 1906.

J. W. PACKARD.

HYDROCARBON ENGINE FOR MOTOR VEHICLES.

APPLICATION FILED JUNE 29, 1903.

3 SHEETS—SHEET 3.

Fig. 5.

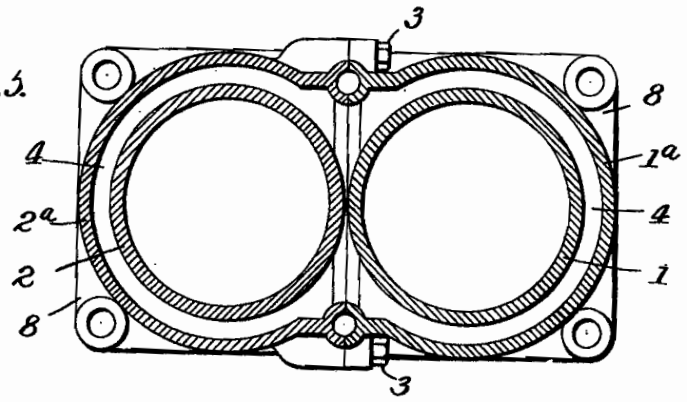
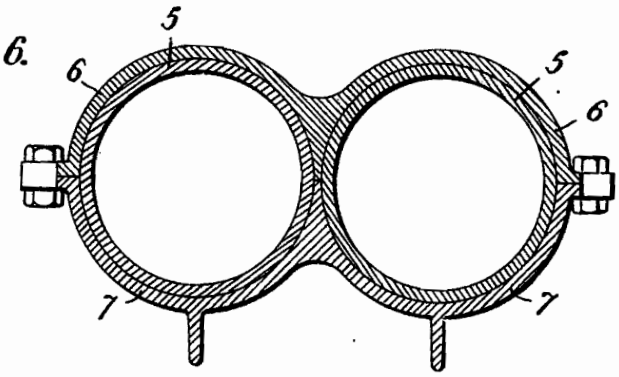


Fig. 6.



Witnesses

J. J. Stinkel

Wm. Gillman Jr.

Inventor

J. W. Packard

By Foster Freeman & Watson

Attorneys

UNITED STATES PATENT OFFICE.

JAMES W. PACKARD, OF WARREN, OHIO, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

HYDROCARBON-ENGINE FOR MOTOR-VEHICLES.

No. 830,099. Specification of Letters Patent. Patented Sept. 4, 1906.

Application filed June 29, 1903. Serial No. 163,589.

To all whom it may concern:

Be it known that I, JAMES W. PACKARD, a citizen of the United States, residing at Warren, in the county of Trumbull and State of Ohio, have invented certain new and useful Improvements in Hydrocarbon-Engines for Motor-Vehicles, of which the following is a specification.

This invention comprises various improvements in hydrocarbon-engines which are especially intended to adapt this class of engines to motor-vehicles.

In the accompanying drawings, Figure 1 is a side view of a hydrocarbon-engine embodying this invention, parts being broken away. Figs. 2 and 3 are details. Fig. 4 is a plan view, partly in section. Fig. 5 is a view on the line A A of Fig. 4. Fig. 6 is a view on the line B B of Fig. 4.

The engine illustrated in the accompanying drawings is a double-cylinder engine having a single crank, to which both connecting-rods are jointed.

One feature of the invention relates to the manner of connecting the cylinders to form a single water-jacket. As illustrated, the right-hand cylinder 1 is surrounded by a section of water-jacket 1^a and the left-hand cylinder is surrounded by a similar section of water-jacket 2^a. In order to facilitate the water circulation and to set the cylinders close together, so that their connections to the crank may be close, the water-jackets 1^a 2^a are open at their inner sides and the inner edges abut and are fastened by bolts 3. This provides a continuous water-space 4 extending about both cylinders and having a sectional form similar to a figure 8. It will be seen that this permits of the cylinders being placed close together without sacrificing any cooling-surface.

A second improvement consists in fitting or telescoping the cylinders into the crank-case in such a manner as to strengthen both and stiffen the connection between them. As shown, each of the cylinders has a cylindrical extension 5, Figs. 1, 4, and 6, which is clamped between the upper section 6 and the lower section 7 of the crank-case C. The crank-case is made in two parts divided along a substantially horizontal line passing through the crank-shaft, and each of these parts has two semicircular portions at its front end adapted to fit closely to the cylinder extensions 5. The cylinders are also cast with flanges 8, which fit corresponding flanges 9 on the front end of the crank-case.

It will be seen that when the flanges 8 and 9 are bolted together and the meeting flanges 10 11 of the crank-case are also bolted together the crank-case and cylinders become virtually a single piece. The engine is preferably supported from the motor-vehicle frame by a transverse bar 12, extending beneath the flanges 8 9.

Each cylinder is provided with an inlet-valve 13 and an exhaust-valve 14. Beneath each valve is a removable plug 15, closing an opening through which the valve may be removed. The inlet and exhaust valves 13 and 14 are located above the explosion-chamber 16, and the plugs 15 below said chamber are made adjustable and provided with check-nuts 17 for locking them in any desired position. The object in making the plugs adjustable is to permit of increasing or decreasing the size of the explosion-chamber, and thereby decreasing or increasing the intensity of the explosion.

The valves 13 and 14 are provided with stems 18, and they are normally closed by springs 19, abutting against heads 20 on said stems. The valves are positively opened by means of cams 21 on a cam-shaft 22, said cams operating through rollers 23, arms 24, pins 25, and levers 26, said levers bearing at one end upon the pins 25 and at the opposite end upon the valve-stems 18. In order to vary the degree of opening of the inlet-valves 13, the levers 26 which operate the inlet-valves are mounted on eccentrics 27, which are carried by a rock-shaft 28. The levers 26 which operate the exhaust-valves have bearings which are concentric with shaft 28. As shown in Figs. 1 and 3, the rock-shaft 28 is operated by an arm 29 and a link 30, connecting said arm to any suitable operating lever or governor. This device provides a very cheap and efficient means for regulating the power and speed of the engine. The cam-shaft 22 is driven by suitable gearing 30 31 from the crank-shaft 32. The arms 24 are loosely carried by a rod 33, which has a sliding movement. The sliding movement is intended to permit the cam-rolls 23, which operate the exhaust-valves, to ride upon the

cams 34, which are opposite in effect, or substantially so, to the cams 21. When it is desired to reduce the charge in the explosion-chamber, the rod 33 is moved over by a lever 35, so that the rollers travel on both cams 21 and 34. This causes the exhaust-valves 14 to open normally during the exhaust-stroke of the piston and then to open again during the compression-stroke sufficiently to let a portion of the charge escape through the exhaust-passages before ignition takes place. By this means the power and speed of the engine can be regulated either by hand or by governor.

The valve-operating mechanism herein described forms the subject-matter of a divisional application, Serial No. 282,646, filed October 13, 1905.

What I claim, and desire to secure by Letters Patent, is—

1. In a hydrocarbon-engine, the combination with two parallel cylinders formed separately, a casing for each cylinder partially surrounding the same, the two casings being joined to form a continuous water-jacket about the two cylinders, of a crank-case formed of two parts suitably connected together, the parts of the crank-case being joined on a plane passing through the axes of the two cylinders, and said cylinders and crank-case having telescoping portions.

2. In a hydrocarbon-engine, the combination with two parallel cylinders formed separately, each cylinder being partially surrounded with a casing at its rear end and having a telescoping portion at its forward end, and said casings being joined to form a continuous water-jacket about the rear ends of the cylinders, of a crank-case formed of two parts which are joined on a plane at right angles to the plane of joining of the said casings, the said crank-case being adapted to telescope with the said cylinders.

3. In a hydrocarbon-engine, the combination with two parallel cylinders formed separately and connected together, of a crank-case formed of two parts which are joined together on a plane at right angles to the plane of the joining of the cylinders, said cylinders and crank-case having telescoping portions, whereby their connection is strengthened.

4. In a hydrocarbon-engine, the combination of two parallel cylinders formed separately and connected on a vertical line with a crank-case formed of two parts connected on a horizontal line, and means for connecting said cylinders and crank-case, said cylinders and crank-case having telescoping portions, whereby their connection is strengthened.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JAMES W. PACKARD.

Witnesses:
S. D. WALDON,
RUSSELL HUFF.

No. 775,991. PATENTED NOV. 29, 1904.

C. SCHMIDT.

STEERING GEAR AND MOTOR CONTROLLING MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED MAR. 21, 1904.

NO MODEL.

FIG. 1.

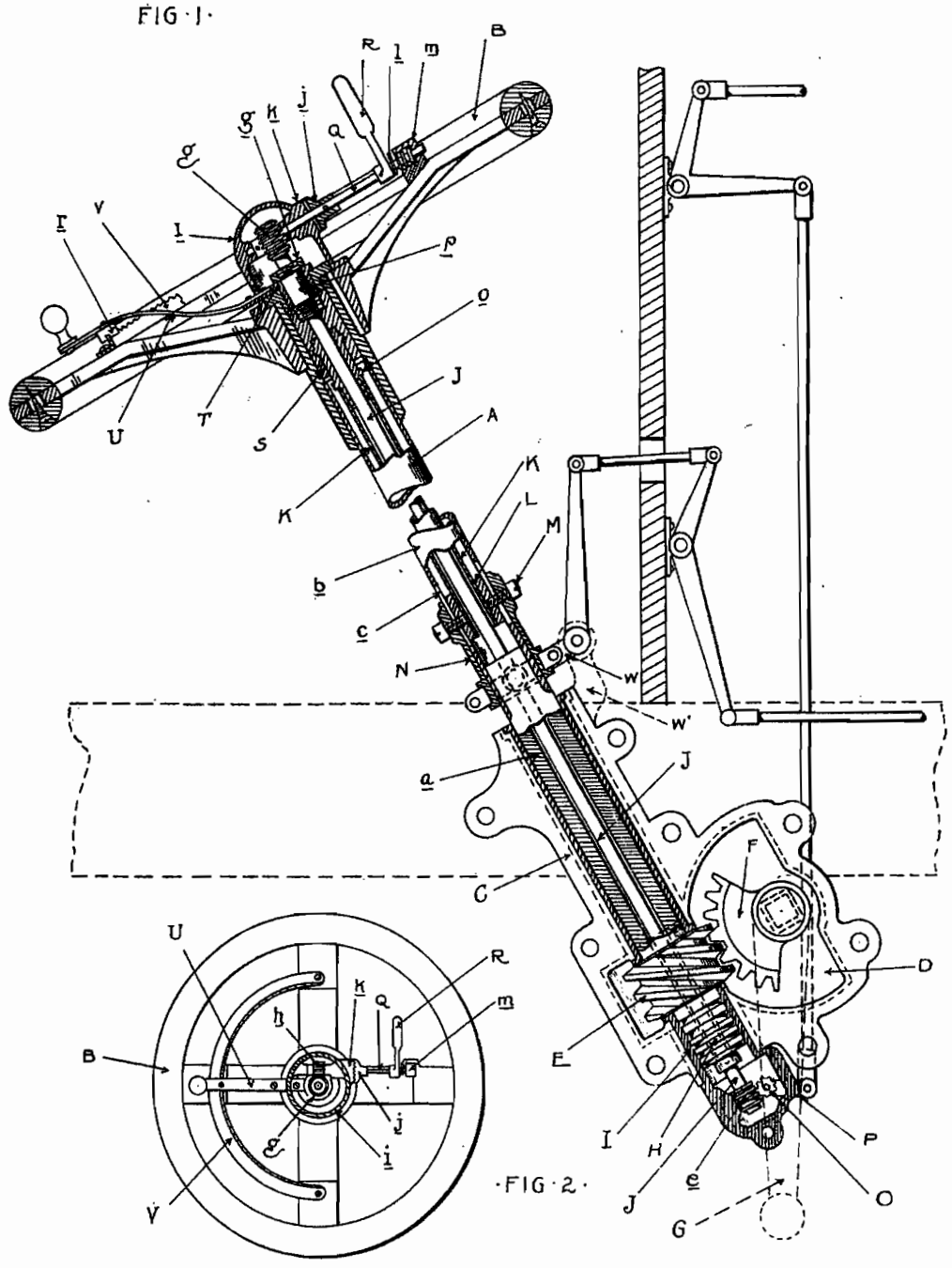


FIG. 2.

WITNESSES

Geo. H. Graves

H. C. Smith

INVENTOR

CHARLES SCHMIDT

BY James Whittemore

ATT'Y.

No. 775,991. Patented November 29, 1904.

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF DETROIT, MICHIGAN, ASSIGNOR TO THE PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN.

STEERING-GEAR AND MOTOR-CONTROLLING MECHANISM FOR MOTOR-VEHICLES.

SPECIFICATION forming part of Letters Patent No. 775,991, dated November 29, 1904.

Application filed March 21, 1904. Serial No. 199,275. (No model.)

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Steering-Gear and Motor-Controlling Mechanism for Motor-Vehicles, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to the steering-gear and motor-controlling mechanism for motor-vehicles; and it consists in the construction as hereinafter set forth.

In the drawings, Figure 1 is a longitudinal section through the steering-stem and connected mechanism. Fig. 2 is a sectional plan view of the stem and hand-wheel for operating the same.

A is a revoluble steering-stem which is provided at its upper end with a hand-wheel B, fixedly secured thereto. At its lower end this stem is journaled in a suitable bearing C, which is preferably formed integral with the housing D for inclosing the gearings E and F, connecting the stem with the rock-arm G, which is connected by rods to the steering-wheels. The gears E and F are preferably a worm and sector, and the stem A is preferably provided below the worm with a stepped portion H, engaging the corresponding bearing I and forming a thrust-bearing. As shown, the stem A comprises a lower section *a*, which is journaled in the bearing C and has mounted thereon or formed integral therewith the worm E. This section is also hollow, having an axial passage therethrough of sufficient size to receive a rod J. The upper section *b* of the stem A is preferably formed of a tube which is brazed or otherwise secured to the upper end of the section *a* and has secured at its upper end the hand-wheel B. The bore of the tube *b* is larger than that of the section *a*, so that it is adapted to receive in addition to the rod J a tubular rod K. This tubular rod is sleeved upon the rod J and at its lower end is secured to a collar L, slidingly fitted within the tube *b*. The collar L is attached by screws or pins M passing through longitudinal slots *c* in the tube *b*, with a collar or sleeve N at the side of the stem A. The rod J extends completely through the stem A, and at its lower end has secured thereto below the bearing I a cylindrical rack *e*. This rack is in mesh with the pinion O, secured to a rock-arm P, which is connected by suitable rods and levers with a throttle or controlling valve (not shown) for the engine. The racks *e* and pinion O are preferably housed in a suitable casing formed at the lower end of the bearing I. At the upper end of the rod J is secured a corresponding cylindrical rack *g*, which meshes with a pinion *h* on a rock-shaft Q. This rock-shaft is provided with an operating-handle or finger-piece R and is journaled in bearings upon the hand-wheel B and in a housing *i*, which incloses the rack and pinion. The shaft also has secured thereto the notched collar *j*, which is adapted to engage with a correspondingly-notched bearing *k* on the housing *i* and is normally held in engagement therewith by the tension of a spring *l*. This spring is preferably arranged in a recess in the bearing *m* for the upper end of the shaft Q and operates to brace the shaft longitudinally, so as to hold the collar *j* and bearing *k* in engagement. At the same time the spring is sufficiently yielding to permit of the rocking of the shaft by the handle R and a disengagement of the collar *j* from the bearing *k*.

The tubular rod K, which is sleeved upon the rod J, has secured to its upper end a worm or screw *o*, which is adapted to engage with a correspondingly-threaded bearing in a nut S, revolubly fitting within the stem A. This nut has a shouldered engagement with the cap T for the stem, preferably formed by a shank *p*, passing through said cap and secured to the nut, and a lever U, secured on said stem by the clamping-nut *q*. Thus the lever U is arranged outside of the cap T and is adapted when rocked to impart a corresponding rotary movement to the nut S within the stem. The lever U passes outward through a slot in the housing *i* and has at its outer end a detent *r*, which is adapted to engage with a notched segment V on the hand-wheel B.

The sleeve N on the outside of the stem A

is suitably connected by intermediate rods and levers with the sparking mechanism (not shown) for the motor. The connection shown comprises a forked rock-arm W, which engages a groove in the sleeve N and is fulcrumed in a bearing W′ on the bearing C.

The parts being constructed as shown and described, in operation the stem A may be revolved in either direction by a suitable movement imparted to the hand-wheel B and through the intermission-gears E and F will correspondingly move the rock-arm G, thereby effecting the turning of the steering-wheels. To effect adjustment of the throttle or engine controlling valve, the handle R, which is carried by the wheel B, may be moved to rock the shaft Q, which through the pinion *h* engaging with the cylindrical rack *g* will move the rod J longitudinally within the stem A. This movement will cause the cylindrical rack *e* at the opposite end of said rod to effect the corresponding rotation of the pinion O and through the rock-arm P and its connections will operate the controlling-valve. The mechanism just described is equally operated in all positions of adjustment of the hand-wheel B, which carries the handle R and rock-shaft Q. This is for the reason that the cylindrical racks *g* and *e* will permit of a rotary movement of the rod J without effecting the engagement of either of said racks with their respective pinions O and *h*.

To adjust the sparking mechanism, the lever U may be moved over the segment V and through its connection with the nut S will revolve the latter, thereby causing a longitudinal movement of the tubular rod K. This rod being connected, through the collar L and screws M, with the sleeve N will cause a longitudinal movement of the latter upon the stem A and through the connection with the rock-arm W will cause the actuation of the mechanism leading to the sparker.

It will be understood that the rotation of the hand-wheel B will not in any way affect the adjustment of either of the mechanisms respectively controlled by the handle R and the lever U, and, as has already been stated, these mechanisms are freely adjustable in all positions of said wheel. Thus the operator has complete control over both the steering mechanism and the motor-controlling device.

What I claim as my invention is—

1. The combination with a hollow rotary steering-stem, of a reciprocatory rod passing therethrough, said rod being supported at one end in a bearing revolving with said stem, and at its opposite end in a bearing independently revoluble from said stem, a cylindrical rack at one end of said rod and a pinion meshing therewith, permitting of the independent rotation of said rod.

2. The combination with a hollow rotary steering-stem, of a reciprocatory rod passing therethrough, and connections at opposite ends of said stem, each comprising a cylindrical rack on the stem, and a pinion meshing therewith.

3. The combination with a hollow rotary steering-stem, of a reciprocatory rod passing centrally through said stem, a tubular reciprocatory rod surrounding said central rod within said stem, means for holding said tubular rod in rotary fixed relation to said stem, an operating-handle having a screw engagement with said tubular rod and independently rotatable from said stem, said handle member forming a supporting-bearing for one end of said central rod; cylindrical racks at opposite ends of said central rod, and pinions meshing with said racks permitting of the independent rotation thereof.

4. The combination with a hollow rotary steering-stem, of a reciprocatory rod passing therethrough, a cylindrical rack on said rod, a hand-wheel on said stem, a rock-shaft journaled in bearings on said hand-wheel, and a pinion on said rock-shaft meshing with said cylindrical rack and permitting of the independent rotation of the latter.

5. The combination with a hollow rotary steering-stem, of a reciprocatory rod passing therethrough, a rack at the upper end of said rod, a hand-wheel at the upper end of said stem, a rock-shaft journaled in bearings on said hand-wheel, a pinion on said rock-shaft meshing with said cylindrical rack, a notched collar on said shaft engaging a detent on said wheel, a spring for yieldingly pressing said shaft longitudinally to hold said collar in engagement with said detent, and a handle on said rock-shaft for operating the same.

6. The combination with a hollow rotary steering-stem, of a reciprocatory rod passing centrally through said stem, a tubular reciprocatory rod sleeved upon said central rod, a lever pivoted in said stem and having a screw engagement with said tubular rod, a cylindrical rack on said central rod beyond said lever, a pinion meshing therewith, a rock-shaft on which said pinion is mounted, a handle for rocking said shaft, and a housing inclosing said pinion and rack, having a slot for the operation of said lever.

7. The combination with a hollow rotary steering-stem, of a reciprocatory rod passing through said stem, a tubular reciprocatory rod surrounding said central rod within said stem, means for holding said tubular rod in rotary fixed relation to said stem, an operating-handle having a screw engagement with said tubular rod and independently rotatable from said stem, said handle member and supporting member bearing on said central rod.

8. The combination with a hollow rotary steering-stem, of a reciprocatory rod passing therethrough, a rack at the upper end of said rod, a hand-wheel at the upper end of said stem, a rock-shaft journaled in bearings on said hand-wheel, a pinion on said rock-shaft

meshing with said cylindrical rack, and a handle on said rock-shaft for operating the same.

9. The combination with a hollow rotary steering-stem, of a reciprocatory rod passing centrally through said stem, a tubular reciprocatory rod sleeved upon said central rod, a lever pivoted in said stem and having a screw engagement with said tubular rod, a cylindrical rack on said central rod beyond said lever, a pinion meshing therewith, a rock-shaft on which said pinion is mounted, and a handle for rocking said shaft.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES SCHMIDT.

Witnesses:

A. CHAMPION,

HENRY B. JOY.

No. 788,605. PATENTED MAY 2, 1905.

C. SCHMIDT.

MOTOR VEHICLE.

APPLICATION FILED MAR. 21, 1904.

3 SHEETS—SHEET 1.

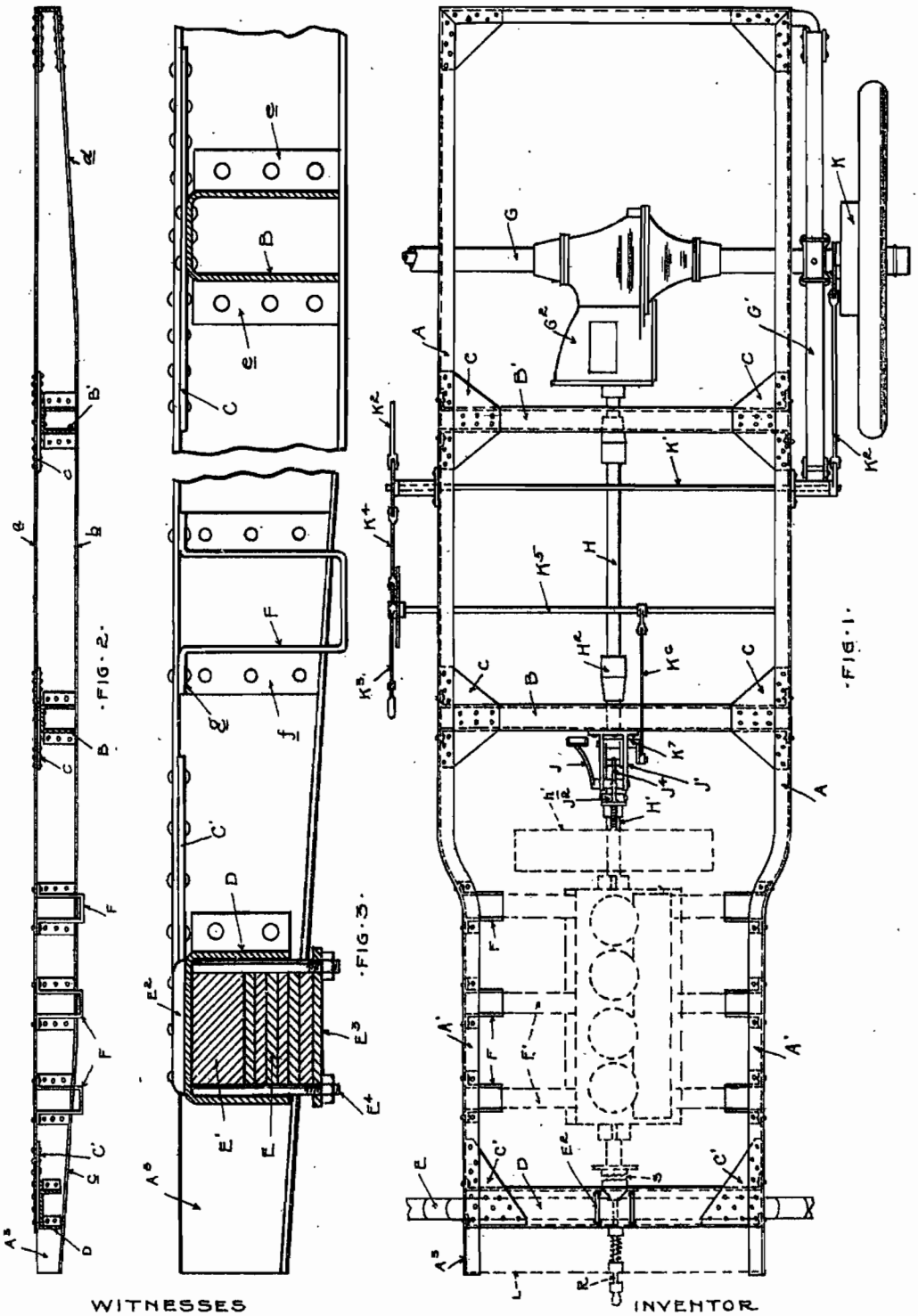


FIG. 2.

FIG. 3.

FIG. 1.

WITNESSES

Geo. H. Graves

W. C. Smith

INVENTOR

CHARLES SCHMIDT.

BY James Whittemore

ATT'Y.

No. 788,605. PATENTED MAY 2, 1905.

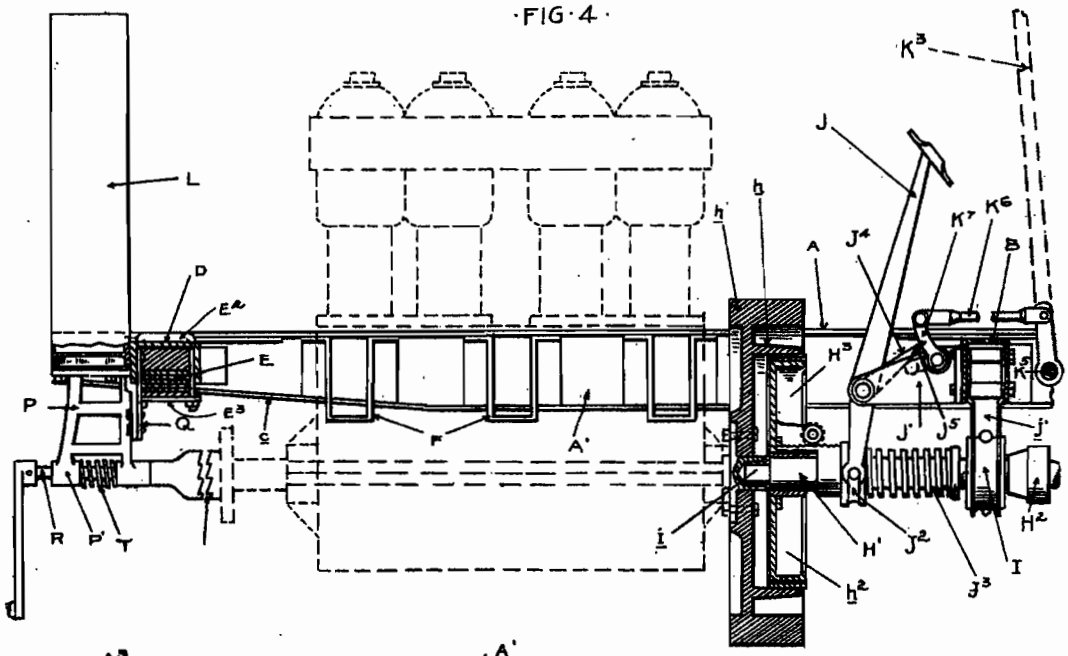
C. SCHMIDT.

MOTOR VEHICLE.

APPLICATION FILED MAR. 21, 1904.

3 SHEETS—SHEET 2.

FIG. 4.



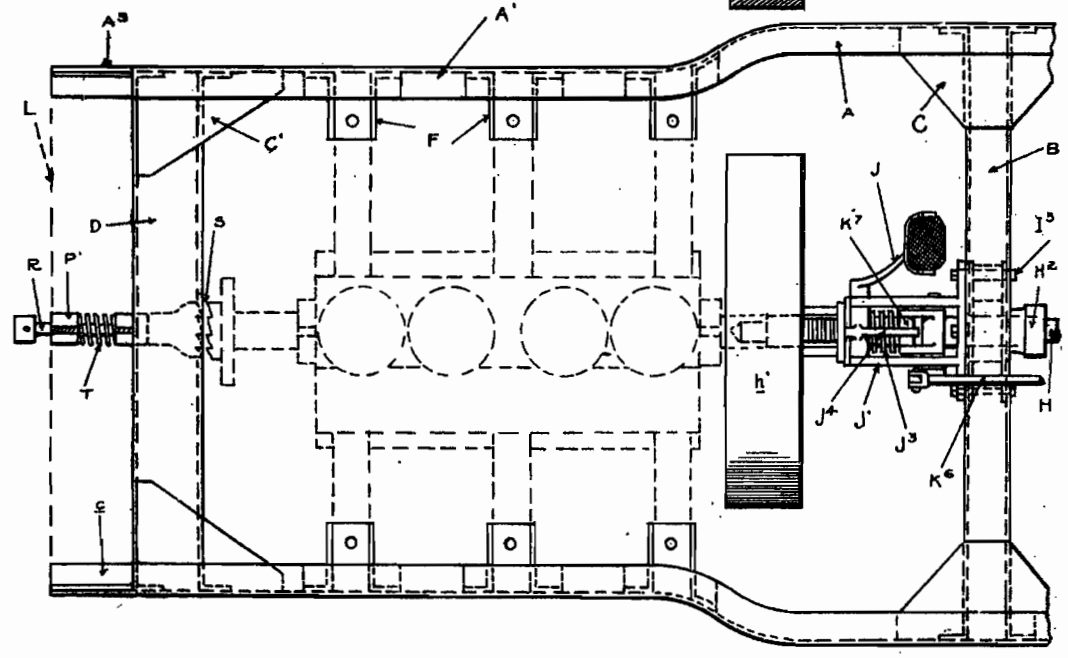


FIG. 5.

WITNESSES

Geo. H. Graves

B. C. Smith

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James Whittemore

ATT'Y.

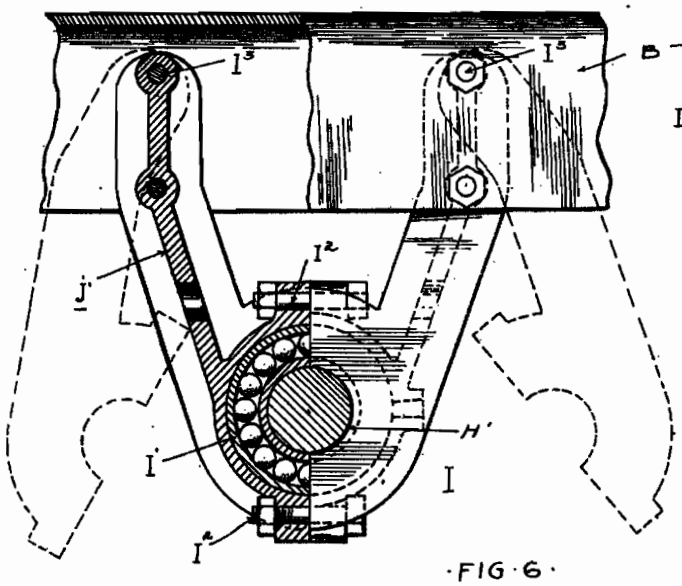
No. 788,605. PATENTED MAY 2, 1905.

C. SCHMIDT.

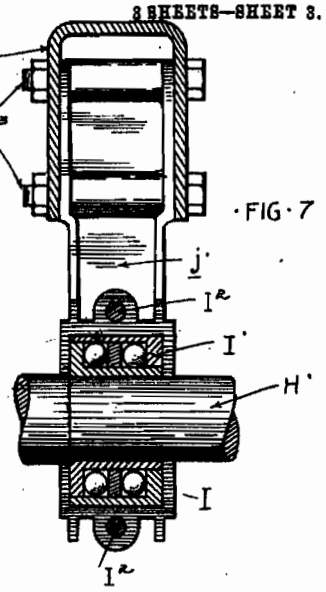
MOTOR VEHICLE.

APPLICATION FILED MAR. 21, 1904.

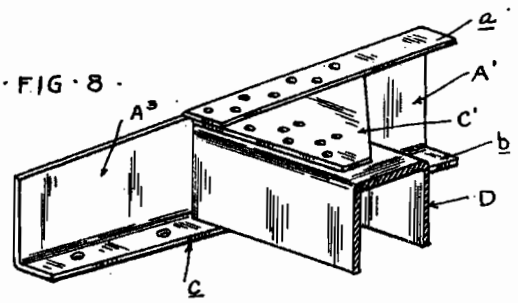
3 SHEETS—SHEET 3.



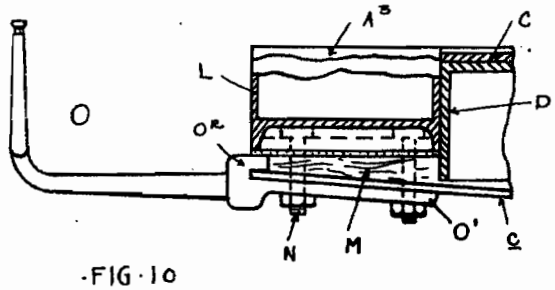
·FIG·6·



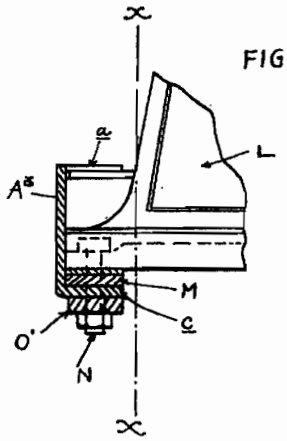
·FIG·7



·FIG·8·



·FIG·10



FIG·9·

WITNESSES

Geo. H. Graves

F. C. Smith

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CHARLES SCHMIDT.

BY James Whittemore

ATT'Y.

No. 788,605. Patented May 2, 1905.

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF DETROIT, MICHIGAN, ASSIGNOR TO THE PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN.

MOTOR-VEHICLE.

SPECIFICATION forming part of Letters Patent No. 788,605, dated May 2, 1905.

Application filed March 21, 1904. Serial No. 199,274.

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Motor-Vehicles, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention relates to motor-vehicles, and has particular reference to certain features of construction, as will be hereinafter set forth.

In the drawings, Figure 1 is a plan view of the frame and some of the mechanism of the vehicle. Fig. 2 is a longitudinal section through the frame. Fig. 3 is an enlarged view of a portion of Fig. 2. Fig. 4 is a longitudinal section through the forward portion of the frame and mechanism supported thereby. Fig. 5 is a plan view thereof. Fig. 6 is a sectional elevation of the hanger-bearing for the transmission-shaft. Fig. 7 is a central section therethrough. Fig. 8 is a perspective view of a forward corner of the frame, showing the supporting-bracket for the cooler. Fig. 9 illustrates the connection of the cooler and lamp-bracket to the frame. Fig. 10 is a section on line x x, Fig. 9.

The frame of the vehicle is formed of longitudinal side bars and cross-bars, which are preferably of channel cross-section. The longitudinal bars A are formed with a central portion having parallel top and bottom flanges a and b and an end portion in which the lower flanges c and d taper upward toward the ends. Extending between the central portions of the bars A are the cross-bars B and B′, which are channel-bars having downwardly-parallel flanges and at their ends fitting within the channel of the side bars A. The connections between the side bars and cross-bars are formed by gusset-plates C, which are arranged above the web of the cross-bars and below the upper flange of the side bar, being secured thereto preferably by riveting. The side flanges of the cross-bars also preferably extend beyond the web portion and are turned to form angles e, riveted to the web portion of the side bars. Thus a strong and rigidly-braced connection is formed between the side bars and cross-bars. Forward of the front cross-bar B the side bars A are offset inwardly to form the contracted parallel portions A′. These forward portions of the side bars are cross-connected near their ends by the cross-bar D, preferably of similar construction to the channel-bars B, but of somewhat greater width. This cross-bar is also similarly connected to the side bars by triangular gussets C′. The cross-bar D forms not only a strut for the frame, but also a connection for the forward cross-spring E, which supports the frame upon the front-axle.

As shown, E′ is a block fitting within the channel of the bar D and forming a bar for the central portion of the spring E. E^2 represents clips which pass through apertures in the web of the bar D and embraces the spring E within the channel, said clips having at their lower ends the clip-plates E^3, clamped upon the spring by the nuts E^4. With this construction the spring is firmly secured to the bar D and is held from lateral movement by the side flanges of the channel.

The space between the portion A′ of the side bar A is designed to contain the motor, which latter is directly supported from said side bars. To this end each of the side bars has attached thereto a plurality of hangers F, preferably in the form of stirrups or U-shaped parts. These are secured to the side bars by means of angle-flanges f, riveted to the web of the bar A, and also the angle-flanges g at the upper end of the stirrup, which are riveted to the upper flange of the bar A. These stirrups form supports for the motor, which has projecting from the side thereof a series of arms or lugs F′, engaging with the stirrups.

The rear end of the frame is supported upon the drive-axle G, preferably by side spring G′. Between the axle G and the motor is the transmission-shaft, which comprises the section H, connecting with the variable-speed gear, preferably inclosed in a housing G^2, adjacent to the axle G, and also a section H′, which is connected to the section H by a universal joint H^3. This section is connected to the engine by a clutch H^4, which may be of any suitable construction, but, as shown,

comprises a flange h on the fly-wheel h' of the engine and an expansible head h^2, secured to the shaft H, adapted to internally engage the flange h. The section H' is preferably stepped into the engine-shaft, as shown at i, and at its opposite end is supported in a hanger I, depending from the cross-bar B of the frame. The hanger I is preferably formed in two sections, each comprising a shank j and a box or bar j', the latter being adapted to hold a ball-bearing I' for supporting the shaft. The two sections of the hanger are secured together by suitable means, such as the bolts I^2, and the shanks are attached to the cross-bar B by projecting between the flanges of the latter and having securing-bolts I^3. The bearing I' is sleeved upon the shaft H', having a shoulder engagement therewith, and preferably remains permanently thereon; but this bearing may be engaged or disengaged with the shaft from the hanger I by loosening the bolts I^2 and separating the sections of the hanger. The shanks j of each section of the hanger are preferably secured to the bar by a pair of bolts I^3; but whenever it is desired to detach the bearing I from the hanger one of the bolts I^3 may be removed, after which the sections of the hanger may be swung upon the other bolt I^3, as indicated in dotted lines, Fig. 6. Thus to engage or disengage the section H' of the shaft it is only necessary to disengage the hanger I and then move the shaft-section longitudinally a sufficient distance to disengage its end from the stepped bearing in the engine-shaft.

The clutch H^3 is normally operated by a foot-lever J, which is pivotally secured to a bracket J', projecting laterally from the cross-bar B. This bracket is preferably secured in position by the same bolts I^3 which are employed for securing the sections of the hanger to the said cross-bar. The lever J engages with the sliding collar J^2 on the shaft-section H', which is adapted to operate the expansible head h^2 by suitable mechanism.

J^3 is a spring sleeved upon the shaft H' and acting to press the collar J^2 into position for engaging the clutch. Thus the clutch is normally held in engagement by the spring J^3, but may at any time be released by pressure on the foot-lever J. The shoulder on the shaft H' transmits its thrust to the bearing I'.

The vehicle is provided with a suitable hand-controlled brake mechanism, which comprises the brake-head K on the drive-wheel, the rock-shaft K', having an operating connection K^3 between it and the brake-head and being itself actuated from a lever K^3 through the medium of a link K^4. The lever K^3 is secured to a rock-shaft K^5, which is connected by a link K^6 with a bell-crank lever K^7. This lever K^7 is preferably fulcrumed in the bracket J' and is adapted to coöperate with an arm J^4, connected with the foot-lever J, so that whenever the brake is applied the clutch H^3 will be released. The releasing of the clutch H^3 is effected in the initial movement of the brake-lever K^3, which through the mechanism described rocks the bell-crank lever K^7 and operates the arm J^4 to actuate the lever J, so as to press the spring J^3 and release the expansible head h^2. When the clutch is released, the further movement of the lever K^3 will cause the operation of the brake through the rock-shaft K' and connection K^2. This movement is permitted by providing the arm J^4 with a segmental portion J^5, which in the released position of the clutch is concentric with the axis of the bell-crank lever K^7 and permits the engaging arm of said lever to travel around the segment without moving the lever J. Thus the clutch H^3 may be released either by the direct actuation of the lever J or automatically whenever the brake is applied.

At the forward end of the frame is arranged the cooler L of any suitable construction. This cooler is supported upon projecting portions of the side bars A, which extend beyond the front cross-bar D. These projecting portions A^3 have the upper flange thereof cut away, so as to form an L-shaped cross-section on the lower flange of this L, and thus forms a ledge for supporting the opposite ends of the cooler L. As shown in Figs. 10 and 9, the cooler is supported upon this ledge by first inserting a bevel-block M, the inclination of which is such so as to compensate for the inclined lower flange c of the side bars. Thus the upper face of the block forms a level bearing for the cooler, which is secured thereto by studs or bolts N passing through the apertures in the block M and flange c and also hooks O^2, which engage with the ends of the flange c and form a support for the bracket independent of the securing-bolts M. These bolts after passing through the shank O' should serve to lock it into position.

The engine is provided with a starting-crank, the shaft of which is in alinement with the engine-shaft and extends forwardly therefrom. This starting-crank is secured in a hanger P, which is attached to a plate Q, extending into the channel of the cross-bar D between the flange thereof and the spring E. Additional support for the hanger P is provided by securing it to the under side of the cooler L, as shown in Fig. 4. By this arrangement the bearings P' on the hanger P are located beneath the cooler L and serve to support the starting-shaft R in position for engagement with the engine-shaft by an endwise movement. The engagement between the shafts is effected by a ratchet-clutch of any suitable construction, such as indicated at S, and a spring T serves to move the starting-shaft to disengage said clutch when pressure on the crank is released.

The construction described is designed with a view of simplifying and reducing the num-

ber of parts and at the same time to obtain the requisite strength.

What I claim as my invention is—

1. In a motor-vehicle, a frame comprising a longitudinally-extending side bar of channel cross-section, with the flanges thereof turned inward, a cross channel-bar having a laterally-turned flange at its end integral with a side flange thereof and secured to the web of the side channel.

2. In a motor-vehicle, a frame comprising a longitudinally side bar of channel cross-section, having the flanges thereof turned inward, a channel cross-bar having downwardly-turned flanges and extending at its end between the flanges of said side channel, and a gusset-plate arranged between the web of said cross-channel and the flange of said side channel, and riveted to each.

3. In a motor-vehicle, a frame comprising a longitudinally-extending side bar of channel cross-section, having the flanges thereof turned inward, and a channel cross-bar having downwardly-turned flanges, said flanges being provided at the end of the cross-bar with angle-bends secured to the web of the side channel, and a gusset-plate fitting between the cross-channel and the upper flange of the side channel, and riveted to each.

4. In a motor-vehicle, the combination with a frame, of a cross-bar on said frame of channel cross-section, having downwardly-turned flanges, a transmission-shaft extending longitudinally of the frame beneath said cross-bar, and a hanger secured between the flanges of said cross-bar and depending therefrom, having a bearing at its lower end for said transmission-shaft.

5. In a motor-vehicle, the combination with a frame having a cross-bar of the transmission-shaft extending longitudinally of said frame beneath said cross-bar, and a two-part hanger secured to said cross-bar embracing said shaft and forming a bearing therefor.

6. In a motor-vehicle, the combination with a frame having a channel cross-bar with downturned flanges, a transmission-shaft extending longitudinally of the frame beneath said cross-bar, and a two-part hanger having the sections thereof secured at their upper ends between the flanges of said channel, and at their lower ends embracing said transmission-shaft and forming a bearing therefor.

7. In a motor-vehicle, the combination with a frame having a channel cross-bar with downturned flanges, of a transmission-shaft extending longitudinally of the frame beneath said cross-bar, and a two-part hanger having the sections thereof secured between the flanges of said cross-bar and depending therefrom, the lower ends of said sections embracing said shaft, an annular bearing surrounding said shaft and embraced by said hanger-sections, and means for clamping said sections together and securing said bearing.

8. In a motor-vehicle, the combination with a frame having a channel cross-bar with downturned flanges, of a transmission-shaft extending longitudinally of the frame beneath said cross-bar, an annular ball-bearing surrounding said shaft beneath said cross-bar, a two-part hanger having the sections thereof extending between the bolt to the flanges of said cross-bar, and at their lower ends forming complementary boxes for embracing said annular bearing, and means for clamping said complementary boxes together to secure said bearing and support said shaft.

9. In a motor-vehicle, the combination with a frame, of a channel cross-bar therefor having downturned flanges, a transmission-shaft extending longitudinally of the frame beneath said cross-bar, a hanger for supporting said shaft, extending between the flanges of said cross-bar, a foot-lever, a fulcrumed bracket for said foot-lever, projecting laterally from the side of said cross-bar, and clamping means for securing said bracket and hanger to the flanges of said cross-bar.

10. In a motor-vehicle, a frame comprising separate side bars, and cross-bars, a motor arranged centrally between said side bars and spaced therefrom said motor having oppositely-projecting supporting-lugs and hangers rigidly secured to said side bars forming bearings for said lugs.

11. In a motor-vehicle, the combination with a frame comprising longitudinal channel side bars, and cross-bars, of a motor arranged between said side bars and having oppositely-extending supporting-lugs, and stirrups rigidly secured to the web of said channel side bars, and depending therefrom, forming supports for said lugs.

12. In a motor-vehicle, the combination with a frame having channel side bars, with the flanges thereof extending inward, of motor-supporting stirrups secured to said channel-bar, and comprising a U-shaped portion having angle-flanges at its upper end secured to the upper flange of said channel-bar, and angle-flanges on the sides of the U secured to the web of said channel-bar.

13. In a motor-vehicle, the combination with a frame, of a channel-bar extending across said frame, and having downturned flanges, and a supporting-spring for said frame secured to said cross-bar between the flanges thereof.

14. In a motor-vehicle, the combination with a frame, of a channel-bar having downturned flanges extending across said frame and secured thereto, an upwardly-bowed spring for supporting said frame and centrally supporting said cross-bar, and embraced by the flanges thereof, and clips for securing said spring to said bar.

15. In a motor-vehicle, the combination with a frame, of a channel cross-bar therefor, having downturned flanges, an upwardly-

bowed spring for supporting said frame, a seat for the central portion of said spring arranged between the flanges of said channel-bar, and a clip for securing said spring to its seat, passing through apertures in the web of said bar and embracing said spring within the flanges of said bar.

16. In a motor-vehicle, a frame comprising channel side bars, having inwardly-turned flanges, and an end cross-bar, said side bars having portions projecting beyond said end cross-bar, having their upper flanges cut away to form angle supporting-brackets.

17. In a motor-vehicle, a frame comprising longitudinal side bars of channel cross-section, with the flanges thereof turned inward, and an end cross-bar, said side bars projecting beyond said cross-bar, and having the upper flange thereof cut away to form an angle-bracket, and a cooler extending across the frame and supported on said angle-brackets.

18. In a motor-vehicle, a frame comprising side bars of channel cross-section, with the flanges thereof extending inward, and an end cross-bar, said side bars extending beyond said cross-bar and having their upper flanges cut away to form angle supporting-brackets, in combination with a cooler extending across said frame and supported on said brackets, a lamp-bracket having its shank extending beneath said angle-bracket, and securing-screws for clamping said cooler and lamp-bracket to said angle-bracket.

19. In a motor-vehicle, a frame comprising an end cross-bar, and a side bar projecting beyond the same, a cooler supported on said projection, a lamp-bracket extending forwardly from said projection and having its shank extending beneath the same, a hook on said shank overlapping said forward projection of said side bar, and a clamping-bolt for securing said shank and cooler to said projection.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES SCHMIDT.

Witnesses:

A. CHAMPION,

HENRY B. JOY.

C. SCHMIDT.

TRANSMISSION GEARING FOR MOTOR VEHICLES.

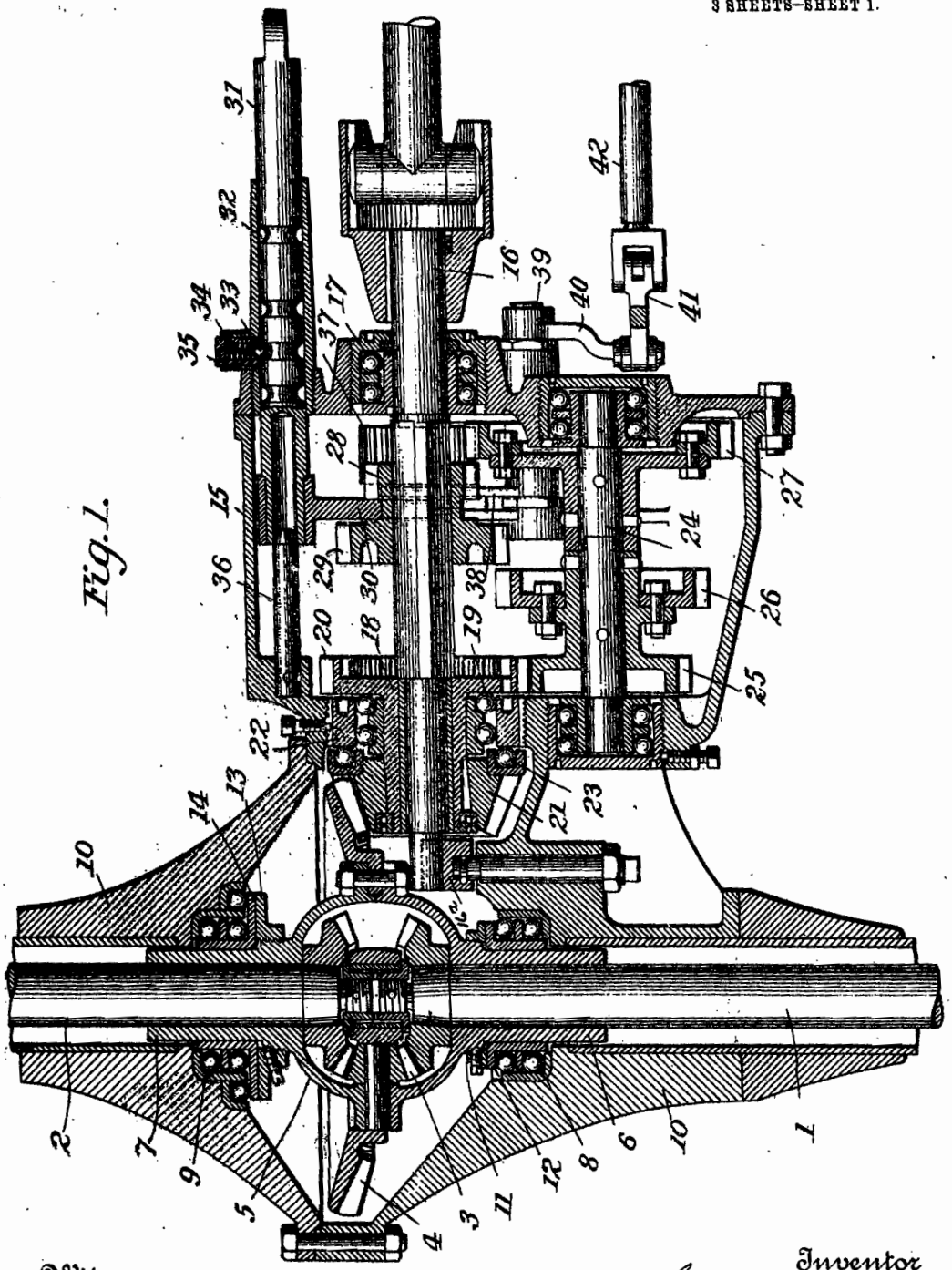
APPLICATION FILED APR. 28, 1904.

1,013,450.

Patented Jan. 2, 1912.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses
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Attorneys

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TRANSMISSION GEARING FOR MOTOR VEHICLES.

APPLICATION FILED APR. 28, 1904.

1,013,450.

Patented Jan. 2, 1912.

3 SHEETS—SHEET 2.

Fig. 2.

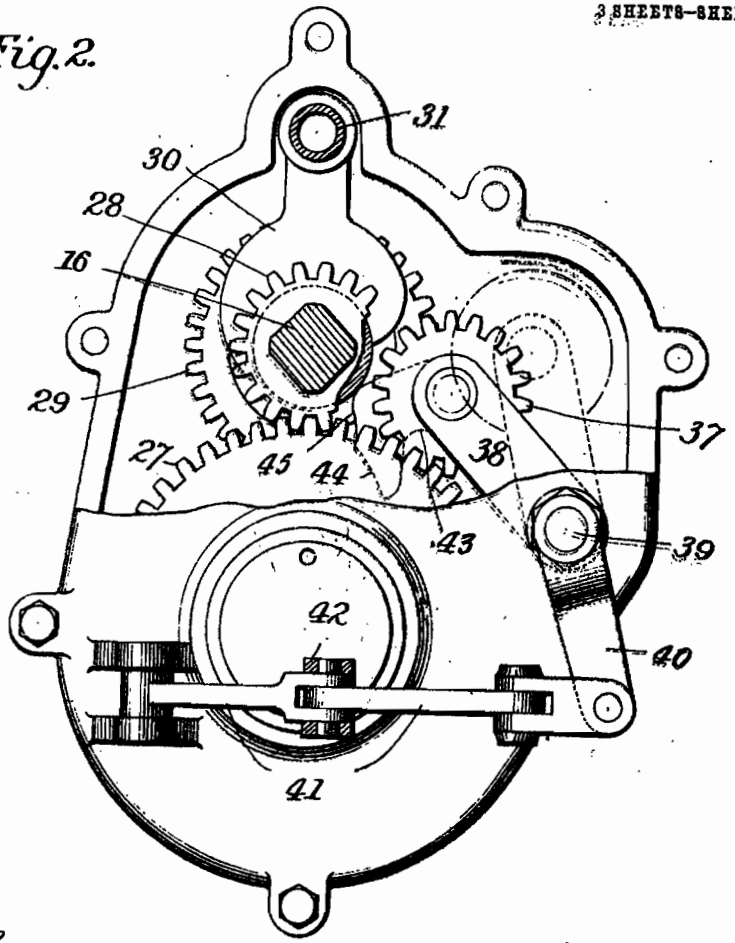
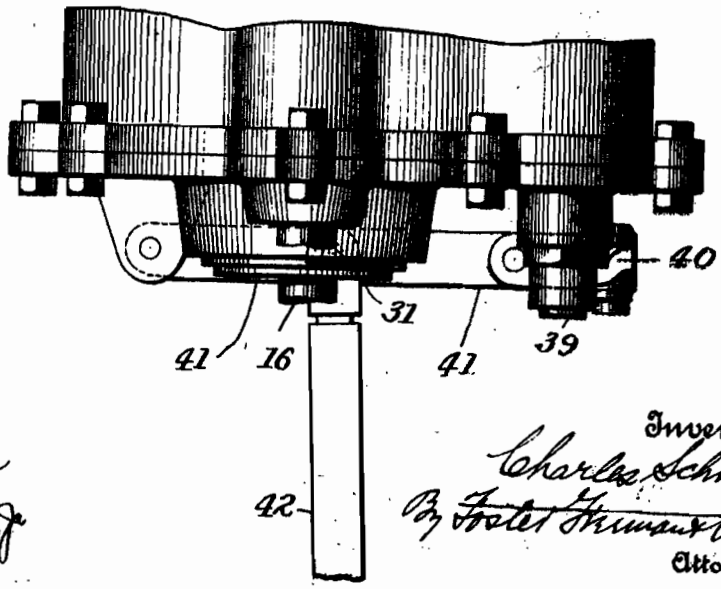


Fig. 3.



Witnesses

J. G. Stinkel

Wm. Fehlmann Jr.

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C. SCHMIDT.

TRANSMISSION GEARING FOR MOTOR VEHICLES.

APPLICATION FILED APR. 28, 1904.

1,013,450.

Patented Jan. 2, 1912.

3 SHEETS—SHEET 3.

Fig. 4.

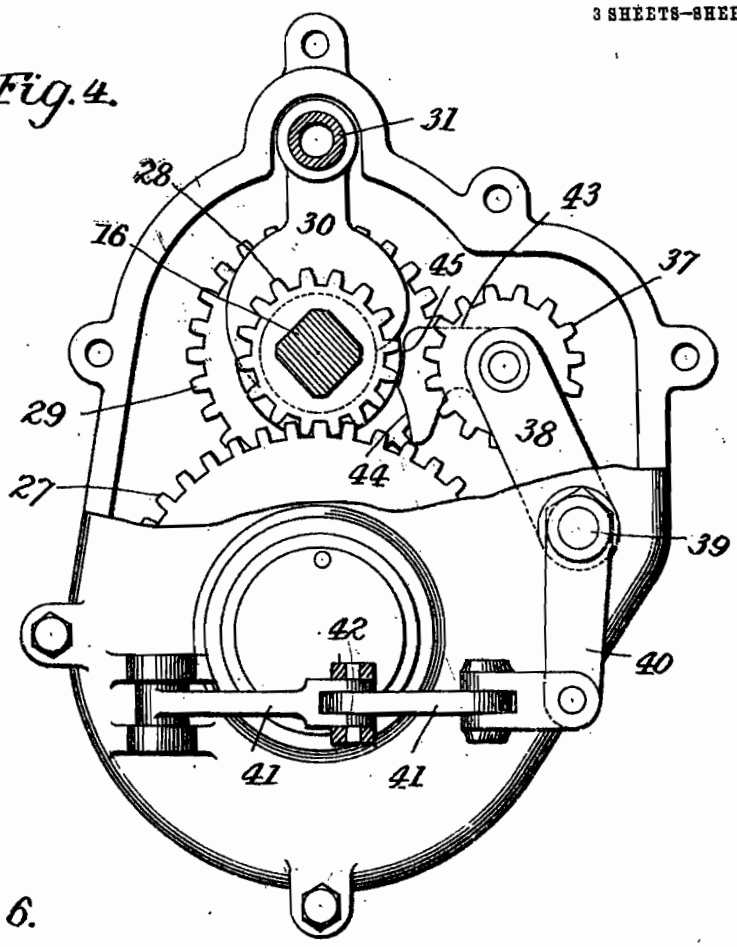


Fig. 6.

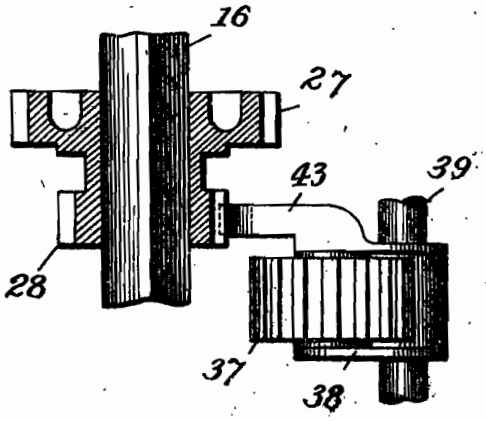
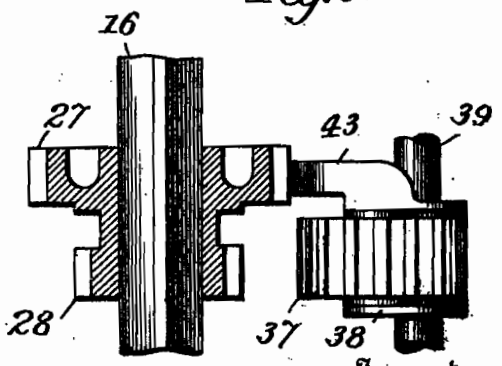


Fig. 5.



Witnesses

J. G. Strickel

H. Fellman, Jr.

Inventor

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Attorneys

See Patent 826,365

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF DETROIT, MICHIGAN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

TRANSMISSION-GEARING FOR MOTOR-VEHICLES.

1,013,450. Specification of Letters Patent. Patented Jan. 2, 1912.

Application filed April 28, 1904. Serial No. 205,325.

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of France, residing in the city of Detroit, county of Wayne, and State of Michigan, have invented certain new and useful Improvements in Transmission-Gearing for Motor-Vehicles, of which the following is a specification.

The present invention relates to various improvements in transmission gearing for motor vehicles and more especially to a transmission gearing which is located adjacent to and directly geared with the rear axle.

The invention will be described in detail in connection with the accompanying drawings, in which,

Figure 1 is a horizontal section through the rear axle and the gearing; Fig. 2 is an end view looking from the front of the machine; Fig. 3 is a side view of part of Fig. 2; Fig. 4 is a view showing the interlocking device for preventing operation of the reverse gear while the forward speed gears are in mesh; Fig. 5 shows the interlocking shoe in engagement with the larger shifting gear; and Fig. 6 shows the interlocking shoe in engagement with the smaller shifting gear.

The present invention comprises various improvements in the gearing which is the subject matter of my pending application, Serial Number 162,631, filed June 22, 1903.

Referring to the drawings, 1, 2 indicate the two sections of the driving axle. These sections are suitably connected by differential gearing 3 which is driven by a beveled gear 4. The gear 4 is supported on a casing 5 which incloses the differential gears and which has two diametrically opposite sleeves, 6, 7 which form bearings for the driving axle sections. The casing 5 and the sleeves 6, 7 generally turn with the driving axle and they are supported in ball bearings 8, 9 within a fixed frame or casing 10. Threaded on the sleeve 6 is a ring 11 which serves to adjust the differential gearing relatively to the ball bearings, the ring bearing against an angular bearing ring 12 which forms a part of the ball races. On the sleeve 7 is another threaded adjustable ring 13 which bears against an angular ring 14. The ring 14 is supported on three sets of balls, as more fully described in said previous application. By means of the threaded rings 11 and 13 the differential gearing may be properly adjusted with respect to the transmission gearing and may also be adjusted to take up wear of the beveled gears.

Adjacent to and suitably connected to the fixed casing 10 is another casing 15 adapted to support and inclose the transmission gearing. A driving shaft 16, suitably connected to the engine shaft, has suitable ball bearings 17 in one end of the casing 15. Said driving shaft is also rotatably supported in a sleeve or hollow shaft 18 which rotates in a suitable bearing in the opposite end of the casing, adjacent to the differential gearing. The extreme end of the shaft 16 is supported in an adjustable bearing 16^a. On one end of shaft 18 is a gear 20 having both external and internal teeth and on the opposite end of the sleeve is fixed a bevel gear 21 which is in mesh with the beveled gear 4 which drives the differential gears. The gears 20 and 21 and the shaft 18 are carried by a ring 22 which is threaded and adjustable in an opening in the end of the casing. The shaft 18 turns in the ring 22, preferably in ball bearings 19, and the gear 21 has a bearing on the end of said ring, also preferably a ball bearing as shown at 23. This construction is very convenient both for assembling the machinery and for afterward adjusting the gear 21 properly to the gear 4. The ring 22 and the gears 20 and 21 are assembled and suitably adjusted with relation to each other outside of the casing and are then collectively adjusted in the casing by screwing the ring 22 into the circular opening. This is effected by passing a key or spanner or other suitable device through suitable openings in the gear 20 and into one or more openings in the ring 22. The ring 22 may be held in any desired adjustment by a set screw or other suitable device, and the shaft, it will be observed, is held against endwise movement in the ring.

In the casing 15 is a counter shaft 24, which is preferably supported in ball bearings. Upon the counter shaft are three gears 25, 26, 27, of different diameters and all locked to said shaft. The gear 25 is in mesh with the external teeth of the gear 20.

Two connected gears 28, 29 of different sizes are mounted to slide on and turn with the shaft 16. As shown these gears are upon an angular portion of said shaft. The

gear 29 is adapted to mesh with the gear 26 when brought to register with it and the gear 28 is likewise adapted to mesh with the gear 27. The gears 28, 29 are arranged to be moved along shaft 16 by a yoke 30 which is carried by a sliding rod 31. The rod 31 is provided with a series of annular grooves 32 and a spring latch 33 coöperates with said grooves to lock the rod in these different operative positions. The latch 33 as shown consists of a ball which is pressed by a spring 34 inclosed in a cap 35. The inner end of rod 31 is stiffened and guided by a fixed pin 36 which enters an axial opening in said rod.

The different forward speeds are obtained by shifting the gears 28, 29 to different positions. When the gears 28, 27 intermesh the lowest speed is obtained. The gears 26, 29 produce an intermediate speed, and to obtain the highest speed the gear 29 is moved into mesh with the internal teeth of the gear 20. In this manner the beveled gear 21 is turned at the same speed as the engine shaft. The gears of the counter shaft 24 run idle when the machine is running at full speed.

The backing or reverse gear 37 is carried by an arm 38 within the casing, said arm being mounted on a rock shaft 39 having a second arm 40 outside of the casing. As shown the arm 40 is connected to toggle levers 41 which are operated by a suitable connection 42 extending to the front of the vehicle. When the toggle levers are brought approximately into line with each other, the gear 37 is thrown into mesh with the gears 27 and 28, as shown in full lines in Fig. 2. When the toggle levers are thrown out of alinement the backing gear is thrown into the dotted position as illustrated in Fig. 2.

I provide for preventing the backing gear from being thrown into action excepting when the sliding gears 28, 29 are exactly in the proper position, that is, between the gears 26 and 27 and not in mesh with either of them. For this purpose a shoe or extension 43 is carried by the arm 38. This shoe projects beyond the reverse gear 37 and prevents it from engaging with the gear 28 when it is not properly registered therewith. When the gear 28 is in proper position for engagement with the reverse gear the shoe 43 will register with and enter the annular groove between gears 28, and 29. To permit it to enter said groove freely one arm of the yoke 30 is shorter than the other arm. If the reverse lever be operated while the shoe 43 is opposite the gear 29 its surface 44 will strike said gear and prevent engagement of the backing gear and if the reverse lever is operated while the shoe is opposite the gear 28, the surface 45 will engage said gear and prevent the backing gear from being thrown in. It will be evident that this interlocking device is adapted to absolutely prevent the reverse gear from being thrown into operation while the machine is running at any of the forward speeds or while the forward speed gears are in mesh. The stripping of gears or any sudden reversal of the movement of the vehicle is thus prevented.

Having thus fully described my invention what I claim and desire to secure by Letters Patent, is:—

1. In a motor vehicle, the combination of a shaft, a driving gear wheel thereon, a driven shaft, differential gearing thereon, a driven gear wheel connected to the differential gearing, a casing containing said gear wheels, a ring having screw thread connection with said casing and in which the said shaft is revolubly held, means for adjusting said ring in said casing and means for adjusting the driven gear on the driven shaft.

2. In a motor vehicle, the combination with two series of relatively movable gears, and a reverse gear adapted to connect a gear of one series with a gear of the other, of means movable with the reverse gear to prevent it from reaching operative position when any of the forward speed gears are operative.

3. In a motor vehicle, the combination of a sliding gear, a non-sliding gear and a reverse gear, of a shoe movable with the reverse gear and adapted to contact with one of said other gears to prevent the reverse gear from reaching operative position, except when said sliding gear is in proper relation to the reverse gear.

4. In a motor vehicle, the combination with a pair of sliding gears having an intermediate annular groove, of a reverse gear and a shoe movable with said gear and adapted to enter said groove when the sliding gears are in position for reversing, and to contact with said gears when they are out of position for reversing.

5. In a motor vehicle, the combination with variable speed gears, of a reverse gear, a rocking arm carrying said reverse gear and toggle levers for rocking said arm.

6. In a motor vehicle, the combination with variable speed gears and a backing gear, of a rocking arm upon which said backing gear is mounted, and a shoe carried by said arm and provided with surfaces 44, 45 for engaging with the variable speed gears to prevent the backing gear from interlocking therewith excepting when said variable speed gears are in proper relation.

7. In a motor vehicle, the combination with the two-part driving axle and the differential gearing, of a casing surrounding said gearing and provided with extensions forming bearings for the axle, the bevel gear supported on said casing, a second bevel gear for driving the first named bevel gear,

and threaded adjustable rings on said extensions for adjusting the mesh of said bevel gears.

8. In a motor vehicle, the combination with the two-part driving axle, the differential gearing, the bevel gear connected to said differential gearing for driving the latter, a second bevel gear for driving the first named bevel gear, rotatable adjusting rings for adjusting each of said bevel gears with respect to the other, and means for locking said rings in any desired adjustment.

9. In a motor vehicle, the combination with the two-part driving axle, the differential gearing, the bevel gear connected to said differential gearing for driving the latter, a second bevel gear for driving the first named bevel gear, threaded adjusting rings for adjusting each of said bevel gears with respect to the other, and means for locking said rings in any desired adjustment.

10. In a motor vehicle, the combination with a two-part driving axle, the differential gearing, a housing therefor, a bevel-gear on the differential housing for driving the latter, a second bevel-gear for driving the first named bevel-gear, rotatable adjusting rings for adjusting each of said bevel-gears with respect to the other, and means for locking said rings in any desired adjustment.

11. In a motor vehicle, in combination with the variable speed gearing, a casing, a shaft driven by said gearing, a gear on said shaft and driven thereby, a ring provided with a bearing and having threaded engagement with an opening in said casing, and said shaft and gear being adapted to be moved through said opening into said casing when said ring is disengaged therefrom.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES SCHMIDT.

Witnesses:
RUSSELL HUFF,
HENRY B. JOY.

PACKARD

No. 777,548. PATENTED DEC. 13, 1904.

C. SCHMIDT.

MOTOR VEHICLE.

APPLICATION FILED APR. 29, 1904.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

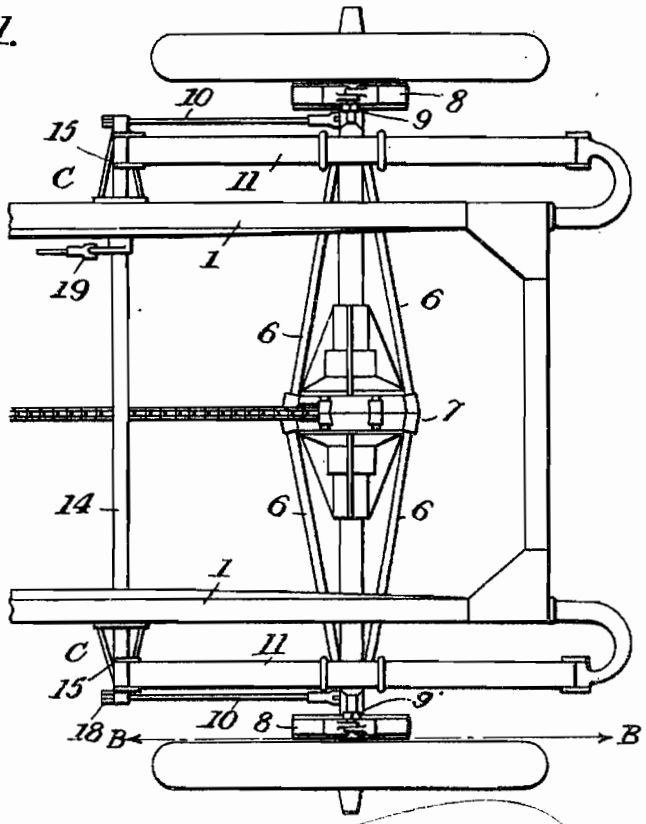
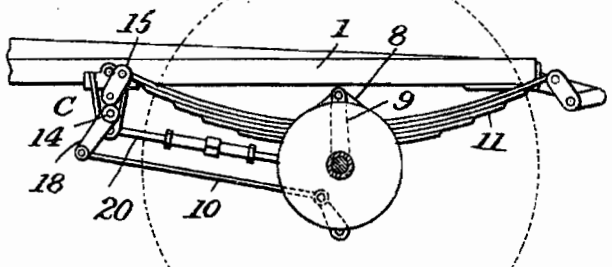


Fig. 2.



Witnesses

J. G. Strickel

Arthur L. Bryant

Inventor

Charles Schmidt

By Foster, Freeman & Watson

Attorneys

No. 777,548. PATENTED DEC. 13, 1904.

C. SCHMIDT.

MOTOR VEHICLE.

APPLICATION FILED APR. 29, 1904.

NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3

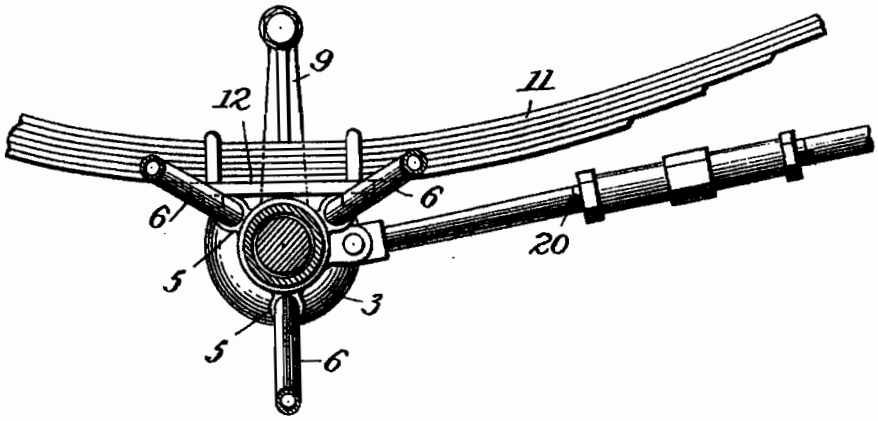


Fig. 4.

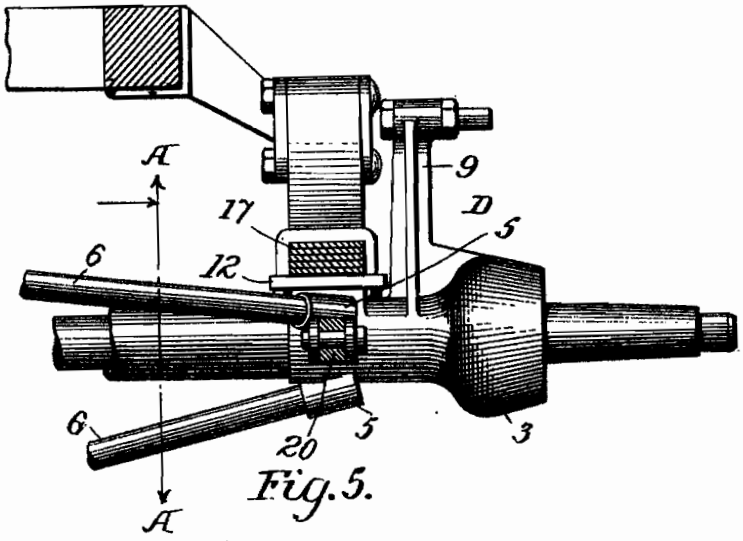
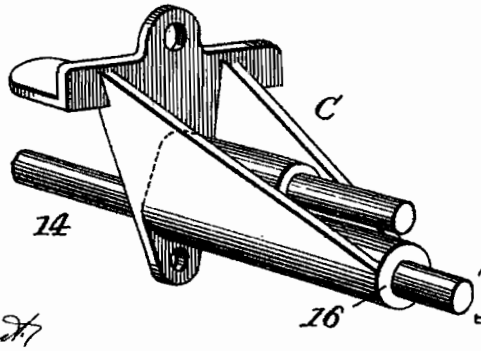


Fig. 5.



Witnesses
J. J. Stinkel
Arthur L. Bryant

Inventor
Charles Schmidt
By Foster Freeman & Watson
Attorneys

No. 777,548. Patented December 13, 1904.

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF DETROIT, MICHIGAN, ASSIGNOR TO THE PACKARD MOTOR CAR COMPANY, OF WARREN, OHIO, A CORPORATION OF WEST VIRGINIA.

MOTOR-VEHICLE.

SPECIFICATION forming part of Letters Patent No. 777,548, dated December 13, 1904.

Original application filed June 22, 1903, Serial No. 162,632. Divided and this application filed April 29, 1904. Serial No. 205,594.

(No model.)

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of France, residing in the city of Detroit, county of Wayne, and State of Michigan, have invented certain new and useful Improvements in Motor-Vehicles, of which the following is a specification.

The present invention relates to improvements in frames or running-gear for motor-vehicles, and particularly to an improved means for supporting the rear wheels and brake-actuating parts of such a vehicle.

In the accompanying drawings, Figure 1 is a plan view of the rear end of a motor-vehicle frame having the present improvements applied thereto. Fig. 2 is a side elevation, partly in section, on the line B B of Fig. 1. Figs. 3, 4, and 5 are detail views on an enlarged scale, Fig. 3 being a section on the line A A of Fig. 4.

Referring to the drawings, in the several figures of which like reference characters designate corresponding parts, the side bars of the frame of the vehicle are designated by the reference character 1.

D designates suitable brackets or castings, each including a bearing 3 for a rear wheel 4 of the vehicle. Said brackets are also provided with suitable sockets 5 to receive brace-rods 6, which act to stiffen the rear axle and serve as supports for the equalizing-gear case 7. Brake-bands 8 are supported by arms 9, rising from the brackets D, and are suitably connected with forwardly-extending rods 10. The rear springs 11 of the vehicle are supported by plates 12 on said castings or brackets.

To the frame-bars 1, in advance of the brackets D, are attached brackets C, which support the forward ends of the springs 11, the brake-shaft 14, and to which the rear-axle brace-rods 20 are connected. Each of said brackets C supports a clevis 15, to which the forward end of one of the springs 11 is attached, and below the point of attachment of the clevis to the bracket is formed an extended bearing 16 for the brake-shaft 14. This shaft extends across the frame and is provided at its ends with arms 18, to which the forward ends of the rods 10 are secured. By means of a suitable power device (conventionally illustrated at 19) the said brake-shaft 14 can be rocked to apply or release the brakes, as desired. It will be seen that the shaft 14 serves to strengthen and stiffen the brackets C, which brackets support a considerable part of the weight of the machine. The brace-rods 20, connecting said brackets C D, prevent any fore-and-aft movement of the rear axle.

The present application is a division of my application, Serial No. 162,632, filed June 22, 1903, and no claim is herein made to any of the features illustrated in the accompanying drawings and specifically described and claimed in said earlier application.

Having thus described the invention and without intending to limit the claims to exactly the embodiment of the invention illustrated, what is claimed is—

1. In a motor-vehicle, the combination with the frame, the rear axle, and the rear springs, of a pair of brackets D each comprising a bearing for a rear wheel, a brake-supporting arm, a spring-supporting plate, and means for engaging the brace-rods for the rear axle.

2. In a motor-vehicle, the combination with the frame, the rear axle, and the rear springs, of a pair of brackets D each comprising a bearing for a rear wheel, a brake-supporting arm, a spring-supporting plate, sockets for receiving brace-rods for the rear axle, and a clevis for receiving a longitudinal brace.

3. In a motor-vehicle, the combination with the frame, the rear springs, the rear longitudinal brace, and the brake, of a pair of side brackets C, each bracket comprising a support for a spring-clevis, a bearing for the brake-shaft, and a connection for the longitudinal brace.

4. In a motor-vehicle, the combination with the frame, of a transverse brake-shaft, brackets secured to the frame and having elongated

bearings for said shaft, springs supported on the rear axle and connected to said brackets, and longitudinal braces connected to said brackets and to the rear axle, the said brake-shaft serving to stiffen and strengthen said brackets.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES SCHMIDT.

Witnesses:
RUSSELL HUFF,
HENRY B. JOY.

No. 781,789. PATENTED FEB. 7, 1905.

C. SCHMIDT.

BRAKE AND MOTOR CONTROLLING MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED JULY 5, 1904.

2 SHEETS—SHEET 1.

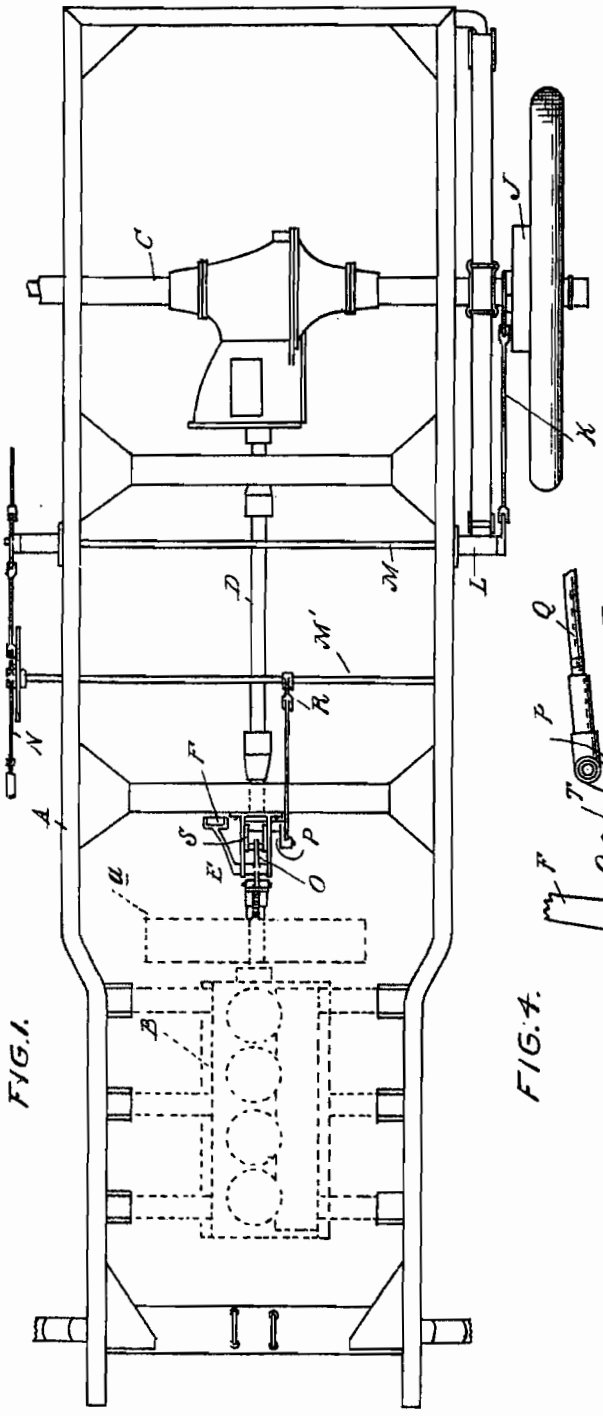


FIG. 1.

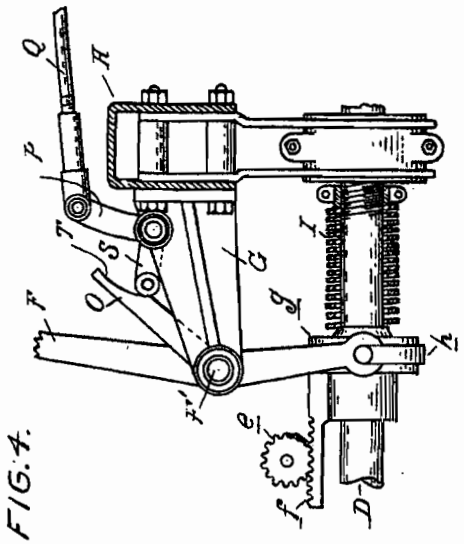


FIG. 4.

WITNESSES

Geo. H. Graves

Jas. B. Barry.

INVENTOR

CHARLES SCHMIDT.

BY James Whittemore

ATTY.

No. 781,789. PATENTED FEB. 7, 1905.

C. SCHMIDT.

BRAKE AND MOTOR CONTROLLING MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED JULY 5, 1904.

2 SHEETS—SHEET 2.

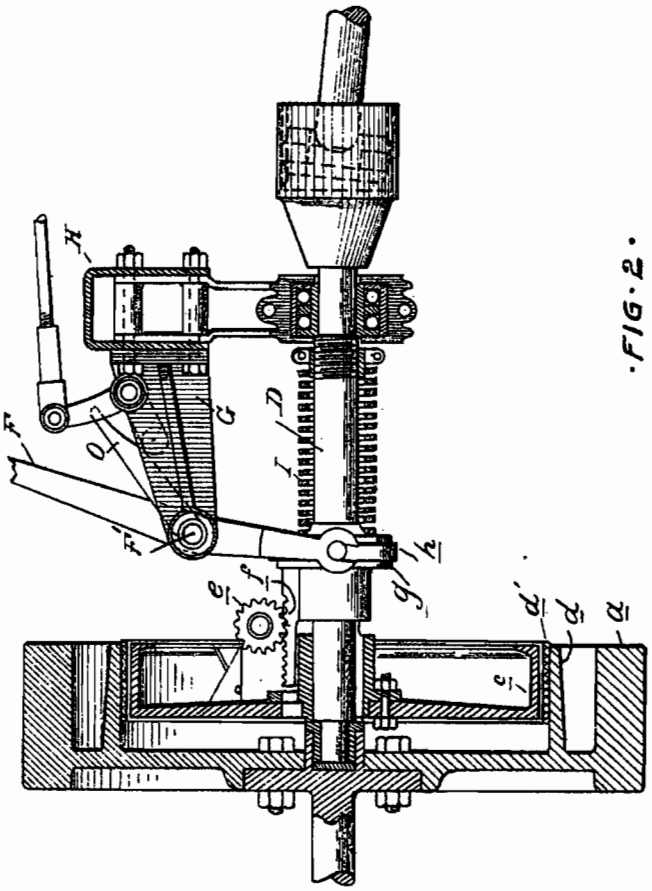


FIG. 2.

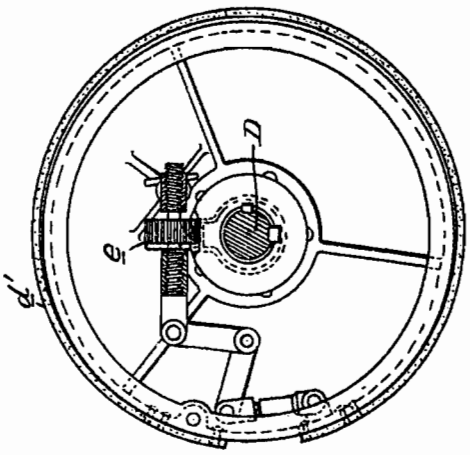


FIG. 3.

WITNESSES

Geo. H. Graves

Jas. P. Barry

INVENTOR

CHARLES SCHMIDT

BY James Whittemore

ATT'Y.

No. 781,789. Patented February 7, 1905.

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF DETROIT, MICHIGAN, ASSIGNOR TO THE PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

BRAKE AND MOTOR CONTROLLING MECHANISM FOR MOTOR-VEHICLES.

SPECIFICATION forming part of Letters Patent No. 781,789, dated February 7, 1905.

Application filed July 5, 1904. Serial No. 215,272.

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Brake and Motor Controlling Mechanism for Motor-Vehicles, of which the following is a specification, reference being had therein to the accompanying drawings.

The invention consists in the peculiar construction of the brake and power-transmission mechanism whereby the application of the brake automatically releases a clutch in the transmission mechanism, said clutch being also operable independently of the brake.

In the drawings, Figure 1 is a plan of a motor-vehicle to which my improvement is applied. Fig. 2 is a section through a portion of the transmission mechanism, illustrating its connection with the brake mechanism. Fig. 3 is a transverse section; and Fig. 4 is a view similar to Fig. 2, showing the parts in different positions of adjustment.

A is the frame of the vehicle, B is a motor supported thereon, and C the drive-shaft.

D is a transmission-shaft extending between the motor and drive-shaft, and E is a clutch for connecting said shaft to the drive-shaft. The clutch shown comprises the fly-wheel *a* of the engine, which is preferably provided with the annular flange *d*, within which is arranged a circular head *c*, mounted upon the transmission-shaft D. Between the head *c* and the flange *d* is an expansible ring *d'*, which is connected through suitable mechanism comprising a pinion *e* and rack *f* with a longitudinal slidable sleeve *g* on the shaft D. This sleeve *g* is grooved to receive the collar *h*, which is pivotally connected to the bifurcated end of a foot-lever F, fulcrumed in the bracket G on the cross-bar H of the frame. The arrangement is such that by operating the foot-lever F the sleeve *g* is moved to contract the expansible ring and release the clutch, said clutch being again engaged automatically by the operation of a spring I when the lever is released.

The vehicle is provided with a suitable brake mechanism, which, as shown, comprises the brake-head J on the axle, connected by the links K with rock-arms L on the rock-shaft M. This rock-shaft is operated by a controlling-lever N, by means of which the brake may be set or released. As it is desirable to disconnect the motor from the drive-axle whenever the brake is applied, I have provided automatic means for effecting this result, which is of the following construction: O is a rock-arm which is connected to the rock-shaft F' of the foot-lever F. P is a rock-arm journaled in the bracket G and connected by the link Q with the rock-arm R on the rock-shaft M, to which the lever N is attached. The rock-arm P is connected to the rock-arm S, which swings in the path of the rock-arm O and is adapted to actuate the latter, so as to move the foot-lever F and release the clutch. The construction of parts is such that in the initial movement of the lever N and before the brake has been set thereby the rock-arm S will be actuated to move the arm O and release the clutch, as just described. During the continued movement of the lever N the lever F is maintained in its releasing position, and this is effected by providing the rock-arm O with the segmental portion T, which after the initial movement of the rock-arm S is arranged concentric with the axis of said rock-arm, so that the latter is free to move without imparting further movement to the rock-arm O. This rock-arm O is, however, held from being returned by the spring I as long as the rock-arm S is in engagement with the segmental portion T.

From the description above given it will be understood that every time the brake is operated the clutch E is released, so as to disconnect the motor from the drive-axle, and upon the releasing of said brake the spring I will automatically reëngage the clutch. It will be also understood that the connections which cause this operation of the clutch do not interfere with its independent operation through the actuation of the foot-lever F.

What I claim as my invention is—

1. In a motor-vehicle, the combination with

a frame and a motor supported thereon, a drive-axle and a transmission-shaft extending between said motor and said drive-axle, of a clutch for coupling said motor to said transmission-shaft, a foot-lever for operating said clutch, a brake mechanism, an operating-lever therefor, a connection between said brake-operating mechanism and said foot-lever, whereby the operation of the brake will release said clutch, and means for limiting the movement imparted to said clutch to the initial movement of said brake-operating mechanism.

2. In a motor-vehicle, the combination with a frame and a motor supported thereon, a drive-axle and a transmission-shaft extending between said motor and drive-axle, of a clutch for coupling said motor to transmission-shaft, a foot-lever for releasing said clutch, a brake mechanism, a rock-arm actuated thereby, an arm on said foot-lever extending into the path of said rock-arm, whereby the operation of said brake will automatically actuate said foot-lever to release said clutch, and means for limiting the movement imparted to said clutch to the initial movement of said brake-operating mechanism.

3. In a motor-vehicle, the combination with a frame and a motor supported thereon, a drive-axle, a transmission-shaft extending between said motor and said drive-axle, of a clutch for coupling said motor to said transmission-shaft, a foot-lever for releasing said clutch, a brake mechanism, a rock-arm actuated thereby, and an arm on said foot-lever having a segmental portion and extending into the path of said rock-arm whereby the initial movement of said brake mechanism will arrange said segmental portion concentric with the radius of said rock-arm.

4. In a motor-vehicle, the combination with a frame and a motor supported thereon, a drive-axle and a transmission-shaft extending between said motor and drive-axle, of a clutch for coupling said motor to said transmission-shaft, a foot-lever for releasing said clutch, a brake mechanism, a rock-arm actuated thereby, and an arm on said foot-lever having a segmental portion and extending into the path of said rock-arm whereby the initial movement of said brake mechanism will release said clutch and arrange said segmental portion of said arm concentric with the radius of said rock-arm.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES SCHMIDT.

Witnesses:
JAS. P. BARRY,
E. D. AULT.

No. 824,747. PATENTED JULY 3, 1906.

C. SCHMIDT.

MOTOR VEHICLE RUNNING GEAR.

APPLICATION FILED NOV. 5, 1904.

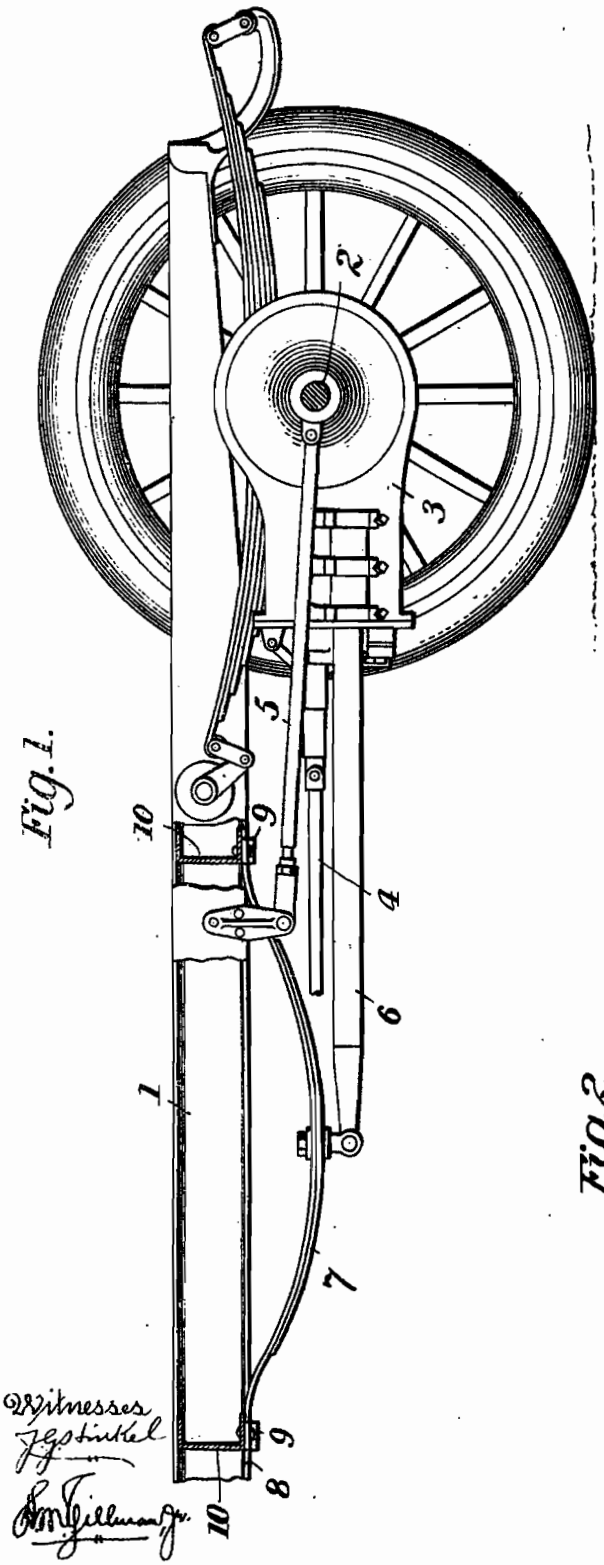


Fig. 1.

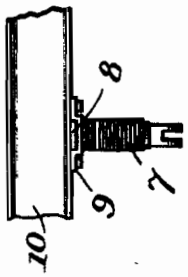


Fig. 3.

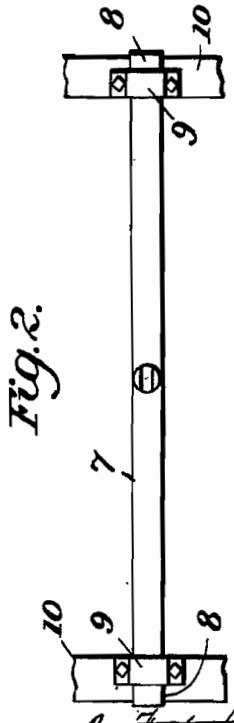


Fig. 2.

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Inventor
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Attorneys

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF DETROIT, MICHIGAN, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

MOTOR-VEHICLE RUNNING-GEAR.

No. 824,747. Specification of Letters Patent. Patented July 3, 1906.

Application filed November 5, 1904. Serial No. 231,571.

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of the Republic of France, and a resident of Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Motor-Vehicle Running-Gear, of which the following is a specification.

In automobile running-gear the rear or driving-axle reacts upon the gearing which turns it, tending to rotate said gearing about the axle, or, in other words, the driving-gear which operates upon the differential gear of the driving-axle tends to revolve bodily about the rear axle. To prevent this action, the casing or frame in which the gearing is mounted must be connected with the main frame of the running-gear, and on account of the relative movement between the frame and the axle this connection must be through some yielding medium.

The present invention relates to the particular form of connection between the driving-gear case and the main frame whereby the gear-case is held in proper relation to the rear axle.

The invention will be described in detail in connection with the accompanying drawings, in which—

Figure 1 is a side elevation of so much of an automobile as is necessary to illustrate the invention, parts being shown in section. Fig. 2 is a bottom plan view of the cushioning-spring, and Fig. 3 is an end view thereof.

Referring to the drawings, 1 indicates the main frame, 2 the rear axle; 3, the gear-case in which the speed-changing and reverse gears are contained, and 4 the driving-shaft which transmits power from the motor to the gears. As usual, adjustable braces 5 connect the frame 1 with the rear axle to prevent forward and backward movement of the axle relative to the main frame and to transmit the propelling power of the axle to the frame.

To prevent the gear-case from "climbing" or rotating about the rear axle, it is provided with an arm 6, projecting forwardly and connected with the main frame by means of a suitable spring. It is desirable that this spring should be flexible vertically and should be adapted to permit a slight longitudinal and lateral movement of the arm 6 relative to the frame to avoid a too rigid construction, which might strain the machine on rough roads. To permit of this range of movement, the outer end of the arm is pivotally connected with the middle of a semi-elliptical spring 7, depending from the main frame and extending longitudinally of the vehicle. As shown, the ends 8 of the spring are arranged to slide in guides 9, connected with cross-bars 10 of the frame 1. These guides are slightly wider than the spring ends to allow a small lateral movement to the arm, which takes place when one rear wheel mounts a higher obstacle than the other. Any other suitable sliding connection between the spring 7 and the main frame may be substituted.

It will be observed that the sliding connection between the spring 7 and the main frame permits the arm 6 to rise and fall slightly and also permits it to move slightly longitudinally and laterally. The rising and falling movement of the arm is limited by the rigidity of the spring, while its longitudinal movement is limited by the braces 5, of which there is one at each side of the machine. The arm 6 is necessarily arranged between the driving-wheels and approximately at the middle of the machine. It is connected rigidly with the gear-case in any suitable manner.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a motor-vehicle, the combination with the rear axle and the gear-case arranged at the rear axle, of the main frame, a semi-elliptical spring depending from said main frame and arranged longitudinally of the vehicle, and a forwardly-extending arm rigidly connected with said gear-case and having its free end connected with said spring, for the purpose set forth.

2. In a motor-vehicle, the combination with the rear axle and the gear-case arranged at the rear axle, of the main frame, a semi-elliptical spring depending from said main frame and arranged longitudinally of the vehicle and having sliding connections therewith, and a forwardly-extending arm rigidly connected with said gear-case and pivotally connected with said spring.

3. In a motor-vehicle, the combination with the driving-axle, the gear-case arranged

at the driving-axle and an arm rigidly connected with said gear-case, of a main frame having transverse members, a semi-elliptical spring arranged longitudinally of the vehicle and having its ends in sliding connection with said members, and a pivotal joint between said semi-elliptical spring and said arm.

4. In a motor-vehicle, the combination with the rear axle, the gear-case and the arm rigidly connected to said gear-case and extending forward therefrom, of the main frame, braces connecting the rear axle with the main frame, a semi-elliptical spring arranged longitudinally of the vehicle and having its ends in sliding connection with the main frame, and a pivotal joint between said arm and said spring, for the purpose set forth.

5. In a motor-vehicle, the combination with the rear axle and the gear-case, of the main frame, a semi-elliptical spring arranged longitudinally of the vehicle depending from said main frame and connected therewith with freedom to move laterally and longitudinally, and an arm rigidly connected with said gear-case and extending forwardly therefrom and having its forward end connected with said spring.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES SCHMIDT.

Witnesses:
JNO. J. RAMSEY,
RUSSELL HUFF.

No. 824,151. PATENTED JUNE 26, 1906.

C. SCHMIDT.

MOTOR VEHICLE BRAKE.

APPLICATION FILED FEB. 4, 1905.

3 SHEETS—SHEET 1.

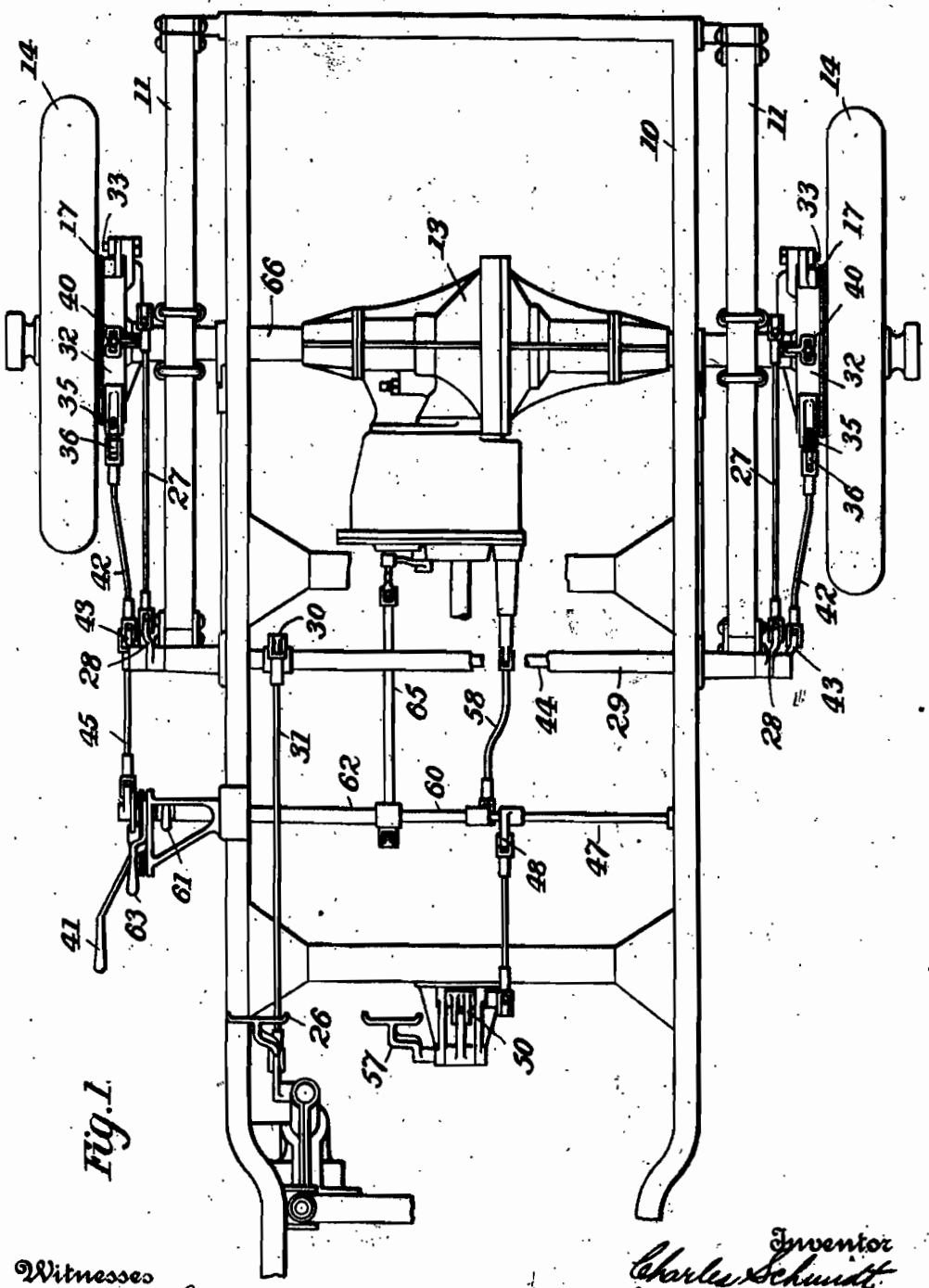

Fig. 1.

Witnesses
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No. 824,151. PATENTED JUNE 26, 1906.

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MOTOR VEHICLE BRAKE.

APPLICATION FILED FEB. 4, 1905.

3 SHEETS—SHEET 2.

Fig. 5.

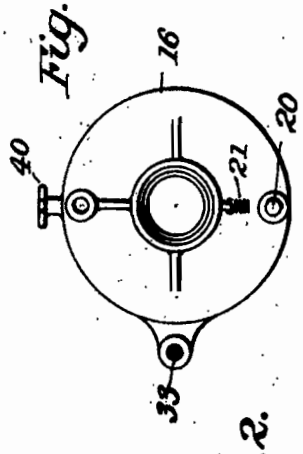

Fig. 2.

Witnesses

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Wm. Fellmann Jr.

Inventor

Charles Schmidt

By Foster Freeman & Watson

Attorneys

No. 824,151. PATENTED JUNE 26, 1906.

C. SCHMIDT.

MOTOR VEHICLE BRAKE.

APPLICATION FILED FEB. 4, 1905.

3 SHEETS—SHEET 3.

Fig. 3.

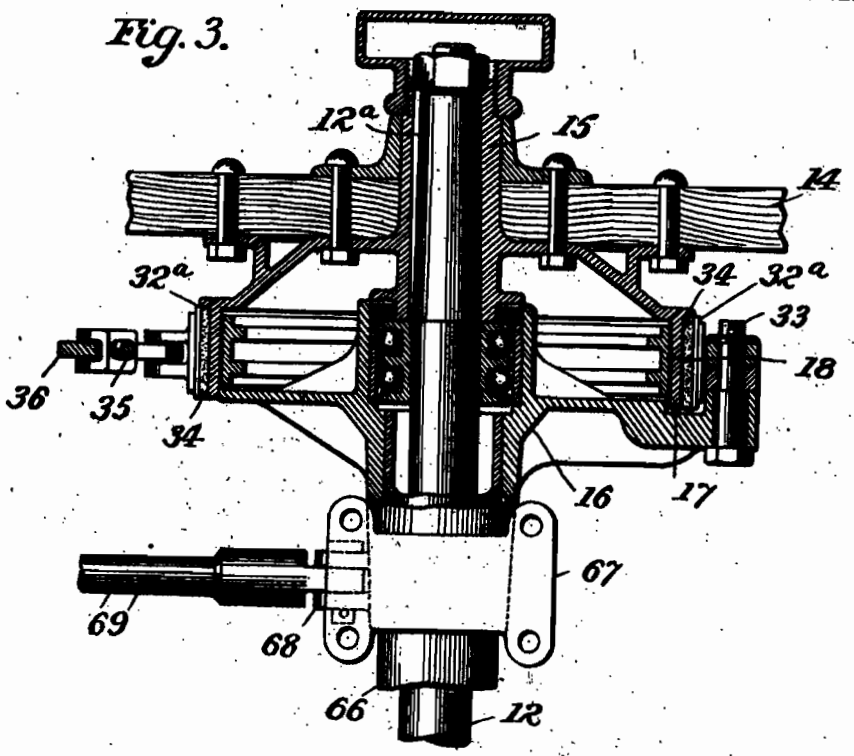
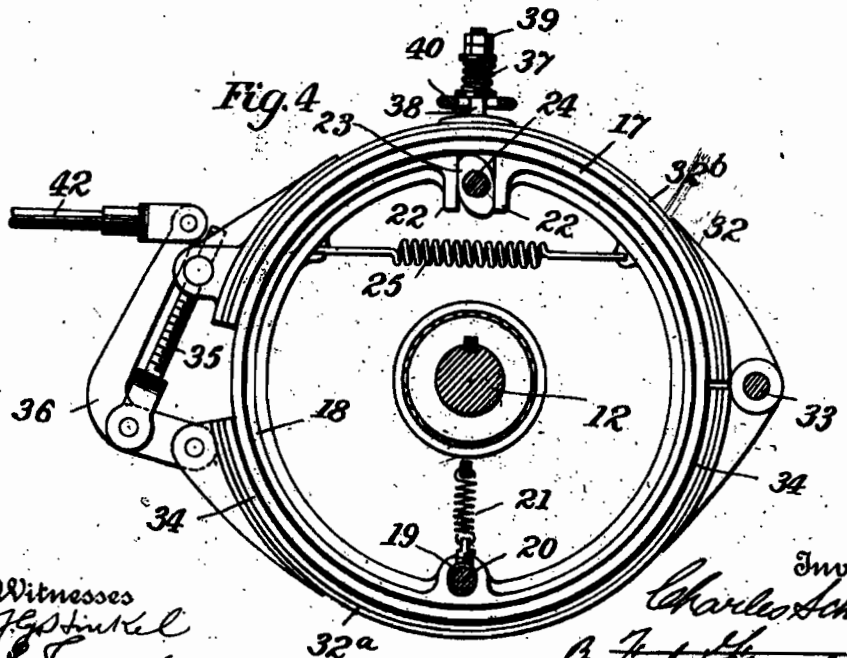


Fig. 4



Witnesses

J. G. Stinkel

Wm. Gillman Jr.

Inventor

Charles Schmidt

By Foster Freeman Watson

Attorneys

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF DETROIT, MICHIGAN, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

MOTOR-VEHICLE BRAKE.

No. 824,151. Specification of Letters Patent. Patented June 26, 1906.

Application filed February 4, 1905. Serial No. 244,202.

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of the Republic of France, and a resident of Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Motor-Vehicle Brakes, of which the following is a specification.

The present invention relates to improvements in braking mechanism for automobiles; and it comprises two sets of braking devices for each of the driving-axle sections and means for operating said devices either independently or simultaneously.

The invention will be described in connection with the accompanying drawings, in which—

Figure 1 is a plan view of a portion of a motor-vehicle frame, showing the driving-axle, the brake mechanism, and the gear-case mounted thereon. Fig. 2 is a side elevation of the apparatus shown in Fig. 1, one of the rear wheels being broken away to disclose the brake proper. Fig. 3 is a horizontal section through one of the rear hubs. Fig. 4 is a side elevation of a brake proper, and Fig. 5 is an inside view of the bracket which supports the brake-shoes and their operating cams and levers.

Referring to the drawings, 10 indicates the main frame of the vehicle, said frame being supported on suitable springs 11, which rest on the rear axle 12. The rear axle is preferably constructed in two sections in the usual manner, said sections being connected and driven by gearing inclosed in a gear-case 13. The construction of the rear axle and the mechanism for driving it have no bearing upon the present invention, and therefore they will not be described in detail.

Each rear wheel 14 has a hub 15, which is fast on a rear-axle section 12. The rotatable rear-axle sections 12 are carried in fixed cylindrical rear axle-casings 66, the inner ends of which are rigidly connected to the gear-case and the outer ends of which are provided with integral disk-like brackets 16, to be hereinafter referred to. Rigidly connected with the hubs 15 are cylindrical flanges 17. These flanges rotate with the wheels, and brake-shoes coöperate with both their inner and outer surfaces. Each inner brake-shoe 18 consists in a ring which is pivotally connected with the bracket 16 at one side and which is open at the opposite side and receives between its ends a cam adapted to expand the ring. As shown in Figs. 3 and 4, the ring 18 is provided with an elongated opening 19, which receives a fixed stud 20, mounted on the bracket 16. As shown, the stud 20 is at the lower side of the brake-shoe, and when released the shoe would tend to drop into contact with the flange 17. To counteract this tendency, a spring 21 connects the brake-shoe with the bracket 16 and constantly tends to raise it. The elongated opening 19 permits the shoe to be raised sufficiently to clear the rotating flange 17. The ends 22 of the ring 18 are broad and constitute bearing-surfaces for a double cam 23, mounted on a rock-shaft 24. A spring 25 holds the ring ends in contact with the cam, and the cam is of such shape that when partially turned it will expand the ring against the flange 17. By reason of the elongated opening 19 the ring can be expanded so that every portion of it will bear with uniform pressure against the flange. The stud 20 and the shaft 24 prevent the brake-shoe from turning, and hence a powerful resistance to the rotation of the wheel is obtained.

The shaft 24 is mounted in the bracket 16 and at its inner end carries an arm 25. This arm 25 is connected with a pedal 26 for operating the inner brake by means of link 27, arm 28, hollow shaft 29, arm 30, and link 31. When the pedal 26 is pushed forward, the shaft 24 is rocked and the inside brake applied. When the pedal is released, the springs 21 and 25 throw off the brake. An additional spring may be used to draw the pedal forward to its normal position. There are arms 28 at opposite ends of the hollow shaft 29 and connections from said arms to two inside brakes, as shown in Fig. 1.

Referring again to Figs. 3 and 4, 32 indicates the outside brake, which consists of two approximately semicircular bands 32^a 32^b, hinged at one side to a stud 33, fixed to the bracket 16. These sections 32^a 32^b are preferably provided with linings 34, of felt, leather, or other suitable fabric. The free ends of the brake-sections 32^a 32^b are connected by toggle-levers 35 36, one of said levers being screw-threaded and adjustably connected with one of the brake-sections, while the other lever is pivotally connected

with the other brake-section. The upper brake-section 32^b tends normally to rest upon the rotating flange 17, and to hold the brake normally free from the flange a spring 37 is provided, Fig. 4. A post 38 is connected with the brake-shoe 32^b and provided at its upper end with an adjustable head or nut 39. The spring 37 is interposed between the head 39 and an extension 40 of the bracket 16. The lower brake-shoe 32^a separates from the rotating flange 17 by gravity, while the upper brake-shoe 32^b is raised by the spring 37 when the toggle-levers are in position to throw off the brake, as illustrated in Fig. 4. The head 39 should be adjusted so that the separation of the shoes 32^a 32^b from the flange shall be substantially equal. The toggle-levers 36 are in the form of elbow-levers, and they are connected to operate the brake with a hand-lever 41 by means of links 42 and arms 43 on shaft 44. One of the arms 43 is connected by a link 45 with an arm 46 on a shaft 47. The brake-lever 41 is rigidly connected with said shaft 47. The operation of the brake-lever 41 rocks the shaft 47, and through the connections mentioned it applies the outer brake 32 to the rotating flange 17. Upon the shaft 47 is an arm 48, which is connected by a link 49 with an elbow-lever 50. The elbow-lever 50 carries a roll which is adapted to rock an arm 51 when the brake is applied. The arm 51 is mounted on a clutch-operating shaft 52. On this shaft is an arm 53, which engages a sliding collar 54. This collar is connected with the clutch (not shown) by means of a rack 55 or any other suitable connection. The clutch is normally closed by means of a spring 56 and it can also be thrown out by means of a pedal 57.

In Figs. 1 and 2 of the drawings is shown a link 58 for operating the speed-gears, said link being connected to an arm 59 on a hollow shaft 60, which shaft is rocked by means of a hand-lever 63. The shaft 60 surrounds a portion of the shaft 47. On the shaft 60 is a second hollow shaft 62, operated by a lever 61. An arm 64 on shaft 62 is connected by a link 65 with means for shifting the reverse-gear.

In the ordinary operation of the brake mechanism the hand brake-lever 41 and the outer brake-shoes are employed. As these outer brakes are applied the clutch is opened and the motive power cut out. The inner brakes are used on very steep hills or in making emergency stops. The arm 51 has a notch or recess 51^a, Fig. 2, into which the roll on the elbow-lever 50 fits. This interlocking of the roll and the notch assists in holding the clutch open until the brake is released.

The brackets 16 are preferably integral portions of the stationary rear-axle casing 66. The rear-axle casing has integral supports 67 for the springs 11 and integral lugs 68 for the brace-rod 69. The stationary axle-casing 66 therefore provides supports or connections for the springs, the brace-rods, the inner and outer brakes, the springs for throwing off the inner and outer brakes, and in addition provides bearings for the rotating axle-sections 12.

It will be evident that various changes in the details of construction and arrangement of the foregoing apparatus may be made without departing from the spirit and scope of my invention. For instance, it is immaterial whether the inner or the outer brakes be operated from the hand-lever. Any suitable lever or equivalent device may be used to operate either brake.

Without limiting myself to the precise construction and arrangement of parts illustrated and described, I claim—

In a motor-vehicle, the combination with the fixed rear-axle casing, the rear-axle sections rotating in said casing and the wheels connected to said sections and provided with inner and outer braking-surfaces, of brackets 16 integral with said rear-axle casing, inner and outer brakes supported by each of said brackets, springs supported by said brackets for raising both the inner and outer brake-shoes from the braking-surfaces of the wheel, studs upon said brackets for carrying said inner and outer brake-shoes, and means for applying said inner and outer brake-shoes independently.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES SCHMIDT.

Witnesses:
RUSSELL HUFF,
F. E. PAINE, Jr.

C. SCHMIDT.

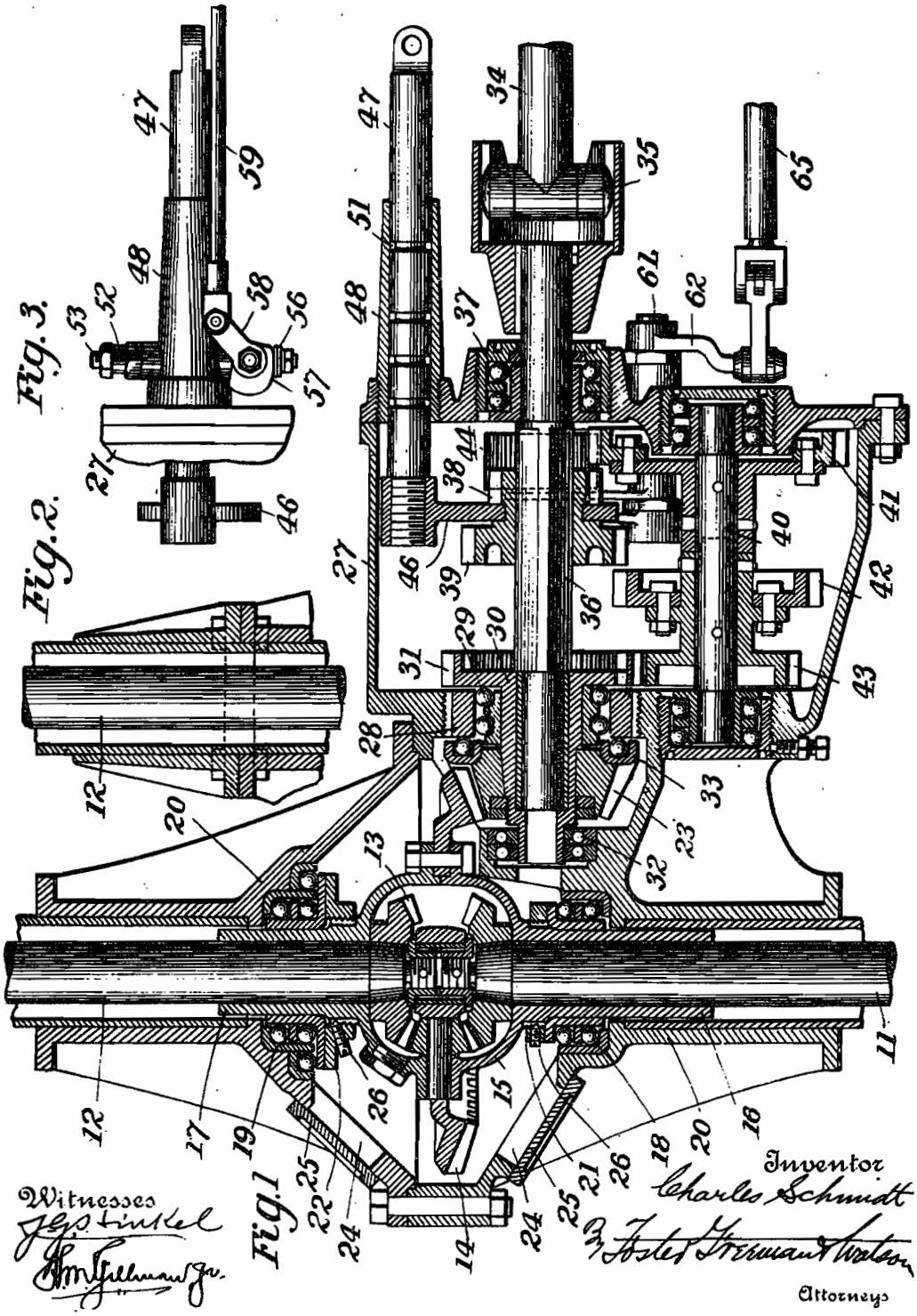
GEARING FOR MOTOR VEHICLES.

APPLICATION FILED FEB. 6, 1905.

950,191.

Patented Feb. 22, 1910.

3 SHEETS—SHEET 1.



Witnesses

J. G. Stinkel

Wm. Fellman Jr.

Inventor

Charles Schmidt

By Foster Freeman & Watson

Attorneys

C. SCHMIDT.

GEARING FOR MOTOR VEHICLES.

APPLICATION FILED FEB. 6, 1906.

950,191. Patented Feb. 22, 1910.

3 SHEETS—SHEET 2.

Fig. 4.

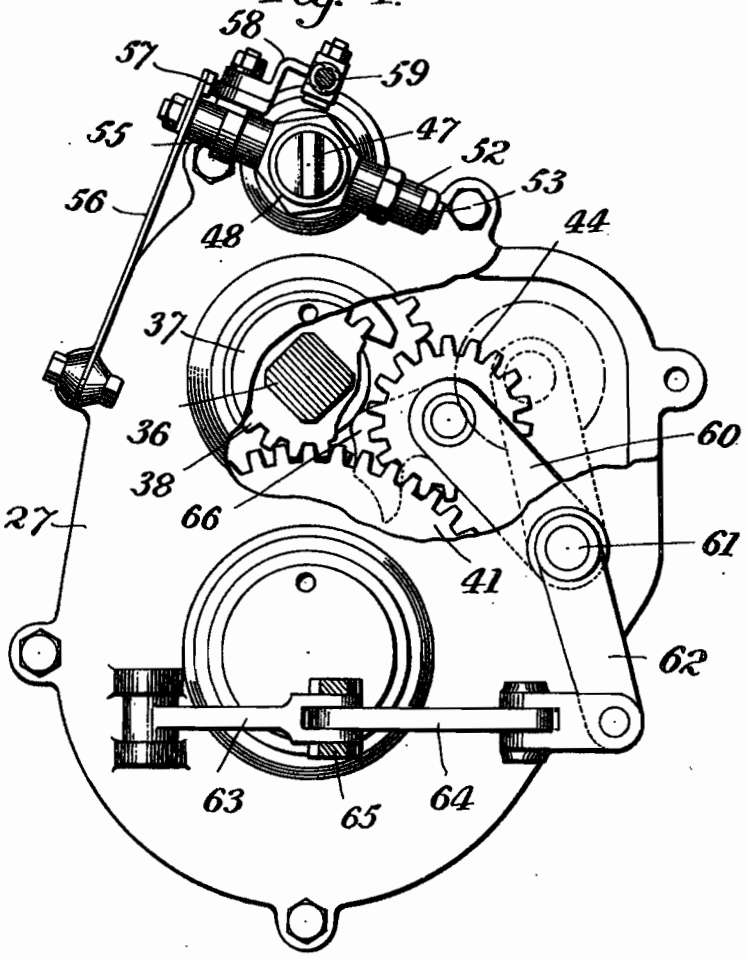
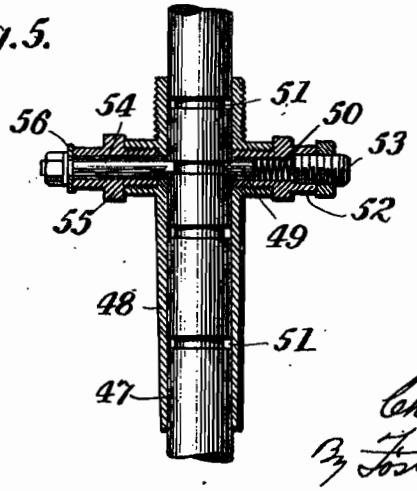


Fig. 5.



Witnesses

J. G. Stinkel

C. M. Gillman, Jr.

Inventor

Charles Schmidt

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Attorneys

C. SCHMIDT.

GEARING FOR MOTOR VEHICLES.

APPLICATION FILED FEB. 6, 1905.

950,191.

Patented Feb. 22, 1910.

3 SHEETS—SHEET 3.

Fig. 6.

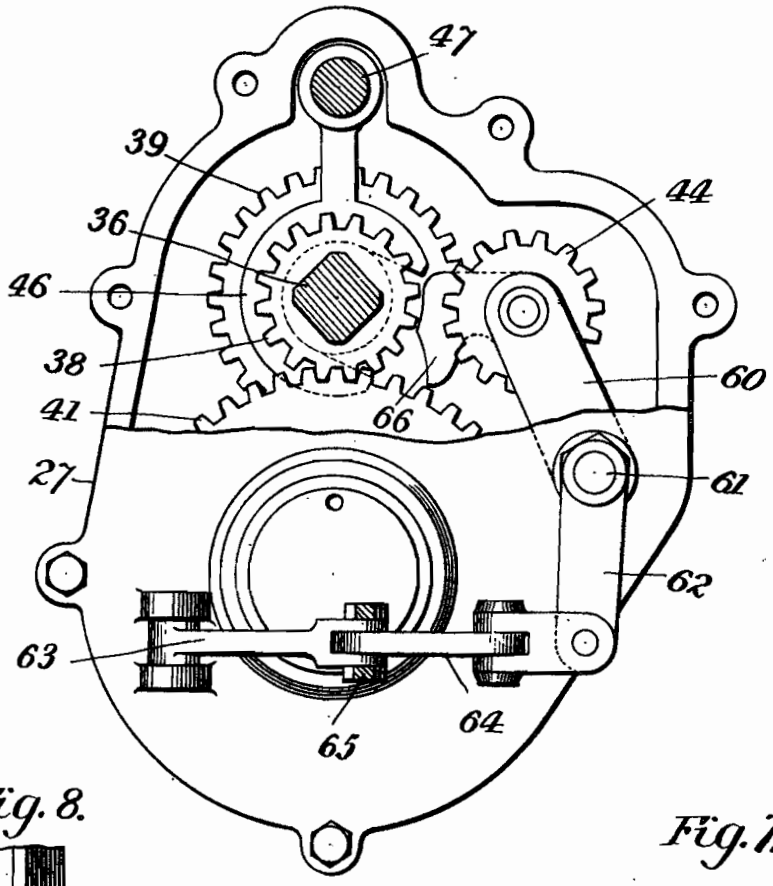


Fig. 8.

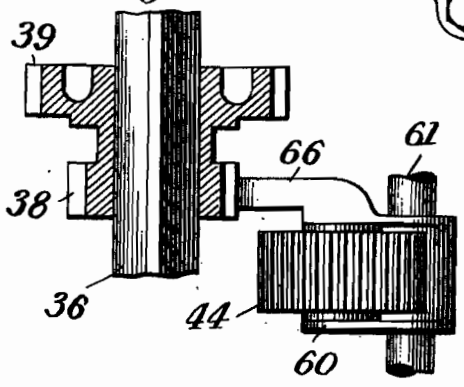
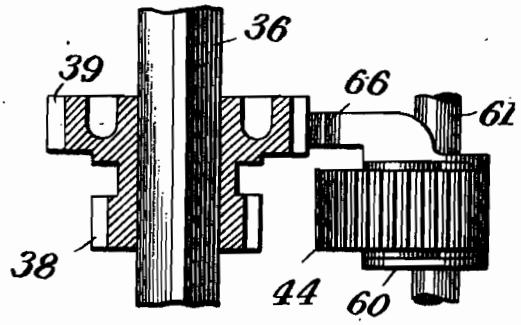


Fig. 7.



Witnesses

J. G. Stinkel

Wm. Gillman, Jr.

Inventor

Charles Schmidt

By Foster Freeman & Watson

Attorneys

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF DETROIT, MICHIGAN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

GEARING FOR MOTOR-VEHICLES.

950,191. Specification of Letters Patent. Patented Feb. 22, 1910.

Application filed February 6, 1905. Serial No. 244,437.

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of the Republic of France, and resident of Detroit, Wayne county, State of Michigan, have invented a new and useful Improvement in Gearing for Motor-Vehicles, of which the following is a specification.

The present invention relates to improvements in transmission gearing for motor vehicles, and particularly to the improvements in the mechanism illustrated in application Serial No. 205,325, filed by me on April 28, 1904.

The invention will be described in detail in connection with the accompanying drawings, in which,

Figure 1 is a horizontal section through the rear axle and the gearing of a motor vehicle; Fig. 2 is a continuation of Fig. 1 showing an additional portion of the axle; Fig. 3 is a detail of the speed gear shifting means; Fig. 4 is an end view of the gear case illustrated in Fig. 1; Fig. 5 is a sectional view of the locking device for the gear shifting means; Fig. 6 is a view showing the interlocking device for preventing operation of the reverse gear while the forward speed gears are in mesh; Fig. 7 shows the interlocking shoe in engagement with the larger shifting gear; and Fig. 8 shows the interlocking shoe in engagement with the smaller shifting gear.

Referring to the drawing, 11 and 12 indicate the two sections of the driving axle. These sections are suitably connected by differential gearing 13 which is driven by a beveled gear 14 supported on the casing 15 which incloses the differential gears. The casing 15 has two diametrically opposite trunnions 16, 17 which form bearings for the driving axle sections. The casing 15 and the trunnions 16 and 17 generally turn with the driving axle and hence there is not much wear or friction between these parts. The trunnions 16, 17, are supported in ball bearings 18, 19, in the fixed frame or gear case 20. Threaded on the trunnions 16, 17, are adjusting rings 21, 22, by means of which the ball bearings 18, 19, are properly adjusted. The rings 21, 22, also serve to adjust the beveled gear 14 with respect to its driving pinion 23. Openings 24 are provided in the casing 20 through which access may be had to the adjusting rings 21, 22 without disturbing the casing or the gearing. These openings are normally closed by covers 25, bolted or otherwise secured to the casing. The adjusting rings are locked in any desired position by screws 26 which are threaded into the rings and enter grooves or slots in the trunnions 16, 17. Each of the trunnions is provided with several slots to receive the set screws 26. By means of the rings 21, 22, the axle sections and the differential gearing are bodily adjustable and the mesh of the gears 14 and 23 may therefore be adjusted quickly and with the greatest accuracy. Furthermore, as will be evident, this adjustment may be made without disturbing any of the casings or gearing by simply removing the covers 25.

Adjacent to and suitably connected to the casing 20 is a second gear case 27 containing the speed gears and the backing gear. Adjustably mounted in one end of the case 27 is a threaded ring 28 forming one member of a ball bearing 29 which supports a shaft 30. Mounted on the shaft 30 at one end is a gear 31 having internal and external teeth. On the other end of the shaft 30 is mounted the driving pinion 23, previously referred to. The outer end of the shaft 30 is supported in ball bearings 32 seated in a part of the casing 20. The ball bearings 32 consist of inner and outer rings with intermediate balls, the outer rings being fixed in the casing and the inner rings fixed on the shaft 30. The bevel pinion 23 is preferably provided on its back with a ball bearing 33 which coöperates with the ring 28 to take the thrust which the bevel pinion receives in driving the gear 14. The function of the adjustability of the ring 28 is to adjust the bevel-gear 23 with respect to the gear 14. When the ring 28 is adjusted it carries with it the shaft 30 and the gears thereon, and it will be evident that the shaft must move longitudinally in the bearing 32, which is seated in the bracket forming part of the casing.

Power is communicated through a shaft 34 and a universal joint 35, to the gear shaft 36. The inner end of the gear shaft is mounted in ball bearings 37 in the inner end of the casing 27, while the outer end of the shaft 36 has a bearing in the shaft 30. The portion of the shaft 36 within the casing 27 is polygonal and on it slides a pair of gears 38, 39. The gear 39 is adapted to fit the internal teeth of the gear 31 and when these two gears are in engagement, the shaft 36

drives the pinion 23 directly and at the same speed as the motor shaft 34.

Mounted in suitable ball bearings in the case 27 is a counter shaft 40 provided with two speed gears 41, 42, and a transmission gear 43 in mesh with the gear 31. When the gears 38 and 41 are in mesh the vehicle is driven at a slow speed. When the gears 39 and 42 are in mesh the machine is driven at an intermediate speed, and when the gears 39 and 31 are engaged the vehicle is driven at the highest speed. When the gears 38, 39, are in the position shown in Fig. 1, the motor is disconnected from the driving gear 14. While the gears are in this position the backing gear 44 may be thrown into mesh with the slow speed gears 38, 41 and the machine may thus be driven backward at a slow speed.

Means for shifting the gears 38, 39, are illustrated in Figs. 1, 3, 4 and 5. 46 indicates a yoke which engages an annular groove between the gears 38, 39. The yoke 46 is mounted on the inner end of a rod 47 which slides in a tubular extension 48 of the casing 27. Means are provided for locking the rod 47 yieldingly in its several adjustments and also for locking it positively. The yielding lock serves to locate the rod and the connected shift gears in their several positions with accuracy and the positive lock serves to hold them and prevent any possible shifting until it is desired to shift them. The yielding lock or latch comprises a tongue 49 which is pressed by a spring 50 into engagement with either one of a series of transverse grooves 51 in the rod 47. The spring is contained in a cup 52 and its tension may be adjusted by a lock 53.

Coöperating with the grooves 51 on the rod 47 is a bolt 54 sliding in an arm 55 of the tube 48. Connected to the bolt 54 is a flat spring 56 which tends at all times to force the bolt into the grooves or recesses 51. As shown the bolt passes through an opening in the spring and the spring projects beyond the bolt and into the path of a cam 57, (Figs. 3 and 4), which is adapted to withdraw the bolt 54. The cam is operated by a lever 58 (Fig. 3) and a link or rod 59 which is preferably connected to the clutch operating mechanism in such manner that the rod 47 will be unlocked when the clutch is open and locked when the clutch is closed. In this respect the present invention resembles the construction in Patent No. 773.097.

The backing gear 44 is mounted on an arm 60 carried by a shaft 61 extending through the inner end of the casing 27. On the outer end of the shaft 61 is an arm 62 by means of which the shaft is rocked. This arm is connected to toggle levers 63, 64, which are operated by a connection 65 extending to a lever or other manually operated means suitably located on the vehicle. Rigidly connected with the arm 60 is a safety device adapted to prevent the backing gear from being thrown into mesh with either the gear 38 or the gear 41, except when said gears are out of engagement as shown in Fig. 1. This device consists of a shoe 66 arranged close to the gear 44. When the gears 38, 39, are in such position that the shoe 66 may enter the annular groove between them, the backing gear 44 is permitted to engage the gears 38 and 41. When the gears 38, 39, are not exactly in this position, the shoe 66 will engage with the teeth of one or other of said gears if it is attempted to throw in the backing gear. It is thus impossible to use the backing gear excepting when the forward speed gears are disconnected.

It will be evident that various changes in details of construction and arrangement may be made without departing from the spirit of the invention and hence I do not desire to be limited to the precise construction and arrangement of parts illustrated and described.

What I claim and desire to secure by Letters Patent is,

1. In a motor vehicle, the combination with the gear case, of a shaft rotatably mounted in said case, a driven gear on one end of said shaft and a driving pinion on the other end thereof, a bearing for the shaft intermediate said gears, and a bearing for the end of the shaft beyond the driving pinion, said latter bearing comprising an outer ring secured in a bracket of the casing, an inner ring upon the shaft, and intermediate balls.

2. In a motor vehicle, the combination with the gear case, of a bearing ring adjustably mounted in said case, a shaft 30 rotatably mounted in said ring and provided with a gear at one side of said ring, and a beveled driving pinion at the other side thereof, one end of said shaft projecting beyond said beveled pinion, a bearing for said projecting end of the shaft secured in a portion of said casing, a shaft 36 having a bearing in said shaft 30, and an operative connection between the shaft 36 and the gear.

3. In a motor vehicle, the combination with a gear case, of a ring adjustably mounted in said case, a shaft rotatably mounted in said ring and having a driving gear at one end and a driving pinion at the other end thereof, and a bearing for the end of the shaft beyond the driving pinion, said bearing being arranged in a bracket of the casing.

4. In a motor vehicle, a plurality of speed gears in combination with means for sliding a portion of said gears into and out of engagement with other gears, means for locking said slidable gears in different positions, said means comprising a slidable rod, a device for holding said rod yieldingly in

different positions, and a yieldingly operated device for locking said rod positively in different positions.

5. In a motor vehicle, a plurality of speed gears in combination with means for sliding a portion of said gears into and out of engagement with other gears and locking said slidable gears in different positions, said means comprising a slidable rod, a spring latch coöperating with recesses in said rod to hold the same yieldingly in different positions, and a yieldingly operated bolt coöperating with recesses in said rod to hold the rod positively in different positions.

6. In a motor vehicle, a plurality of speed gears in combination with means for sliding a portion of said gears into and out of engagement with other gears and locking said slidable gears in different positions, said means comprising a slidable rod, a spring latch coöperating with recesses in said rod to hold the same yieldingly in different positions, a bolt coöperating with recesses in said rod to hold the rod positively in different positions, and means for moving the bolt yieldingly into and positively out of operative position.

7. In a motor vehicle, a plurality of speed gears in combination with means for sliding a portion of said gears into and out of engagement with other gears and locking said slidable gears in different positions, said means comprising a slidable rod, a spring latch coöperating with recesses in said rod to hold the same yieldingly in different positions, a bolt coöperating with recesses in said rod to hold the rod positively in different positions, a spring for throwing the bolt into operative position and a cam for withdrawing the bolt.

8. In a motor vehicle, a plurality of speed gears in combination with means for sliding a portion of said gears into and out of engagement with other gears, a device for locking said slidable gears yieldingly in different positions, and a yieldingly operated device for locking said gears positively in different positions.

9. In a motor vehicle, the combination with a plurality of speed gears, of means for sliding a portion of said gears into and out of engagement with other gears, a device for locking said means yieldingly in different positions, a device for locking said means positively in different positions, a spring for operating said positive device, and means for unlocking said positive device.

10. In a motor vehicle, the combination with a plurality of speed gears, of a rod for sliding a portion of said gears, a casing for said gears, a bushing for said rod forming an extension of said casing and provided with a transverse arm, a device mounted in said arm constructed to hold said rod yieldingly in different positions, and a device for locking said rod positively in different positions.

11. In a motor vehicle, the combination with a plurality of speed gears, of a rod for sliding a portion of said gears, a casing for said gears, a bushing for said rod forming an extension of said casing and provided with oppositely arranged arms, a device mounted in one of said arms constructed to hold said rod yieldingly in different positions, and a device mounted in the other arm constructed to lock the rod in different positions.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES SCHMIDT.

Witnesses:
F. E. Paine, Jr.
Russell Huff.

C. SCHMIDT.

FRAME FOR MOTOR VEHICLES.

APPLICATION FILED MAR. 10, 1905.

924,941. Patented June 15, 1909.

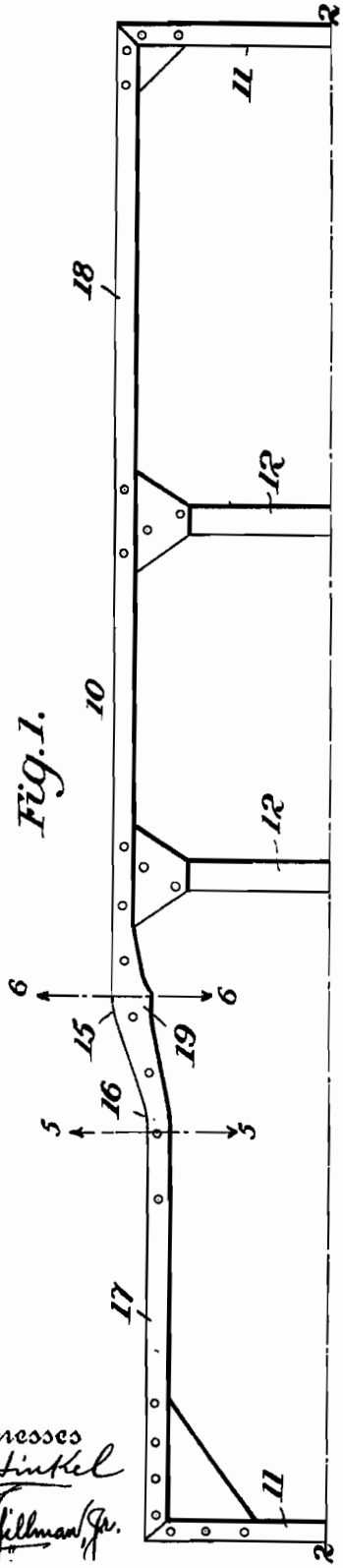


Fig. 1.

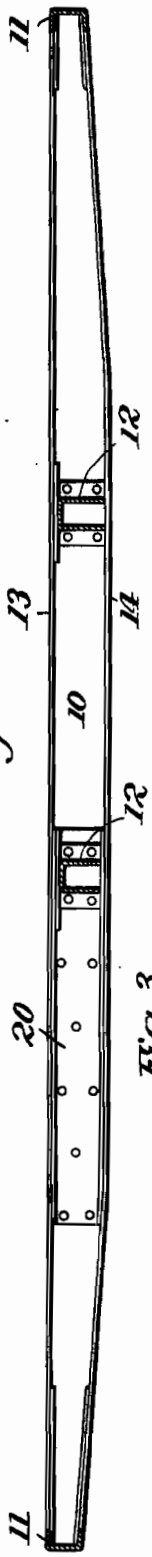


Fig. 2.

Fig. 6.

Fig. 5.

Fig. 3.

Fig. 4.

Witnesses
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Inventor
Charles Schmidt
By Foster Freeman Watson
Attorneys

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF DETROIT, MICHIGAN, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

FRAME FOR MOTOR-VEHICLES.

No. 924,941. Specification of Letters Patent. Patented June 15, 1909.

Application filed March 10, 1905. Serial No. 249,442.

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of France, residing at Detroit, in the county of Wayne, State of Michigan, have invented certain new and useful Improvements in Frames for Motor-Vehicles, of which the following is a specification.

This invention relates to improvements in motor vehicle frames and it consists in a frame in which each of the side bars has a reverse curve or offset and a reinforce coincident with said curve or offset whereby the frame is equally rigid throughout its length.

The invention will be described in connection with the accompanying drawing, in which,

Figure 1 is a half plan view of a motor vehicle frame embodying the invention; Fig. 2 is a sectional view on the line 2—2 of Fig. 1; Figs. 3 and 4 are plan and side views of the reinforce, and Figs. 5 and 6 are sections respectively on the lines 5—5 and 6—6 of Fig. 1.

Referring to the drawing the frame consists of side bars 10, end bars 11 and transverse bars or braces 12. The side and end bars are of channel-section, having upper flanges 13 and lower flanges 14. They have preferably a uniform depth at the middle portion and taper toward the ends, as shown in Fig. 2, the lower flange 14 being preferably inclined upward while the upper flange 13 is horizontal. Toward one end of the frame the side bars are offset, being curved inward at 15 and outward at 16, the general contour being that of a reverse curve and the forward portion 17 being parallel with the rear portion 18. At the offset portion the upper and lower flanges of the side bars are increased in width as shown at 19 and the offset portion is reinforced by a corresponding piece or reinforce 20. The reinforce is preferably of channel-section of such size as to fit snugly within the side bar proper and having its flanges enlarged at the middle as shown at 21, to correspond with the enlargement 19 of the side bar flanges. The reinforce is suitably connected to the side bar by rivets. A frame thus constructed is practically of uniform strength throughout its length and is not weakened by the offset or reversely curved outline which is necessary to adapt it to the vehicle body.

Having described my invention what I claim and desire to secure by Letters Patent is,

1. A motor vehicle frame having its side bars reversely curved or offset as shown, each side bar having parallel front and rear portions and having upper and lower flanges which are wider at the offset portion than at the front and rear portions.

2. A motor vehicle frame comprising end bars and side bars having upper and lower flanges, the side bars having intermediate offset or reversely curved portions, and channeled reinforcing pieces secured to said side bars at the offset portions and between the upper and lower flanges thereof, the flanges being wider at the offset portions of the side bars than elsewhere, for the purpose set forth.

3. A motor vehicle frame comprising channeled side bars, the lower flanges of said side bars being inclined upwardly at each end and the upper flanges of said side bars being substantially horizontal, said side bars having offset portions intermediate their ends, and reinforcing pieces secured within the flanges of the side bars at the offset portions, the flanges being wider at the offset portions of the side bars than elsewhere, for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES SCHMIDT.

Witnesses:
RUSSELL HUFF,
MARK C. TAYLOR.

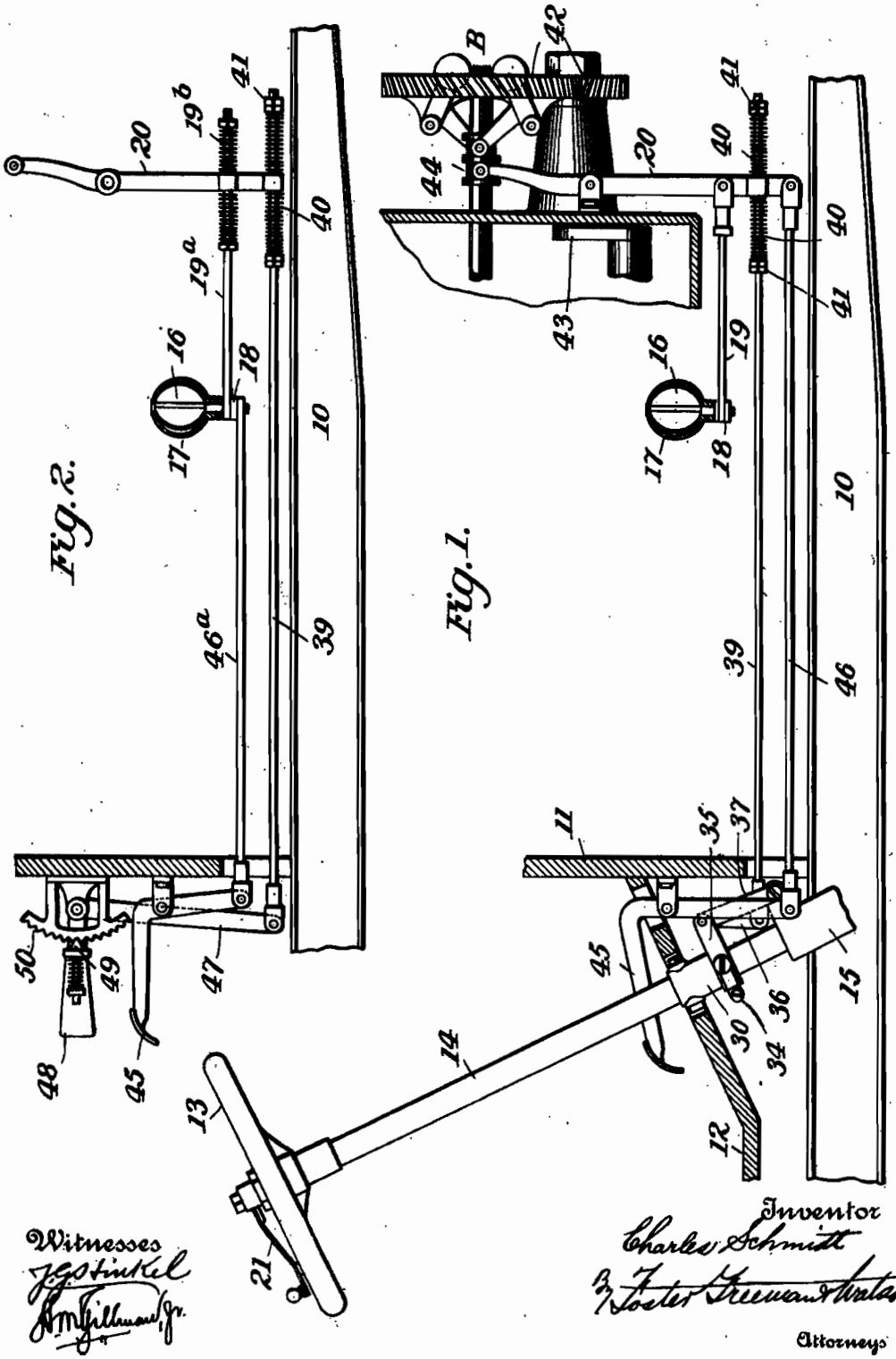
No. 823,742. PATENTED JUNE 19, 1906.

C. SCHMIDT.

CARBURETER CONTROL MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED MAR. 10, 1906.

3 SHEETS—SHEET 1.



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No. 823,742. PATENTED JUNE 19, 1906.

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CARBURETER CONTROL MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED MAR. 10, 1905.

3 SHEETS—SHEET 2.

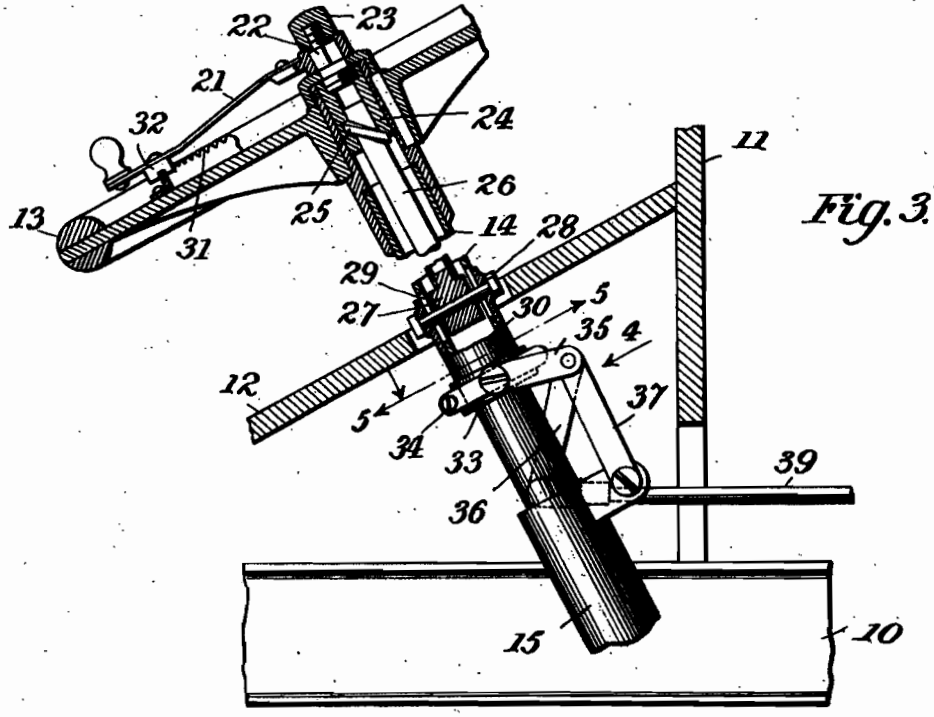


Fig. 3.

Fig. 4.

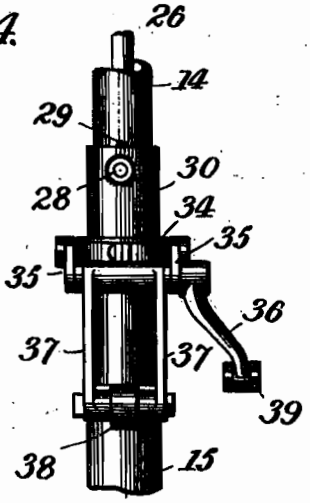
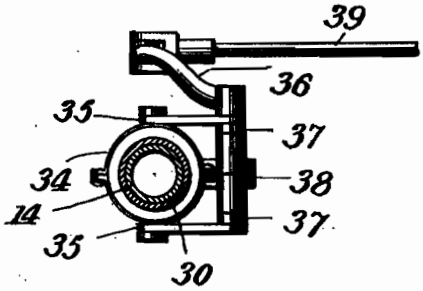


Fig. 5.



Witnesses
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No. 823,742. PATENTED JUNE 19, 1906.

C. SCHMIDT.

CARBURETER CONTROL MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED MAR. 10, 1905.

3 SHEETS—SHEET 3.

Fig 7.

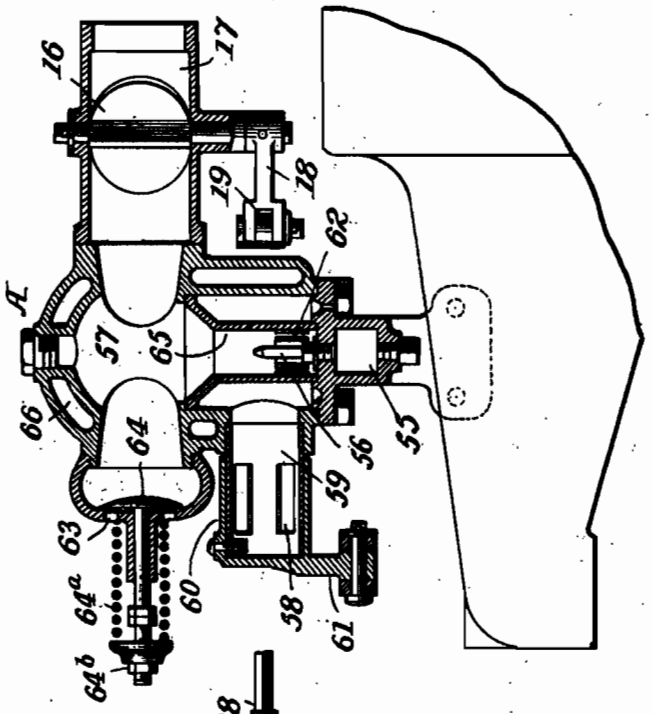
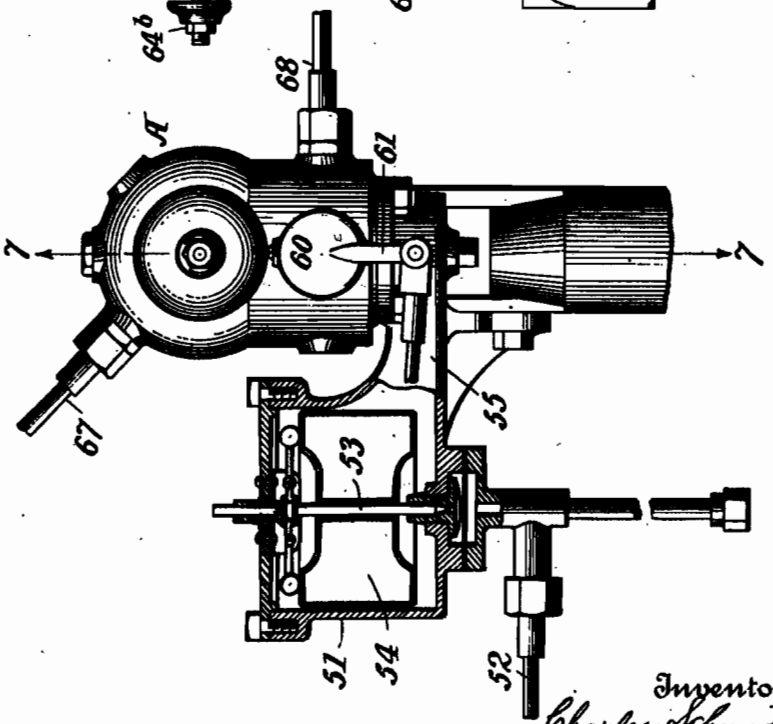


Fig. 6.



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UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF DETROIT, MICHIGAN, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

CARBURETER-CONTROL MECHANISM FOR MOTOR-VEHICLES.

No. 823,742. Specification of Letters Patent. Patented June 19, 1906.

Application filed March 10, 1905. Serial No. 249,441.

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of the Republic of France, and a resident of Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Carbureter-Control Mechanism for Motor-Vehicles, of which the following is a specification.

This invention comprises various improvements in carbureters for hydrocarbon-engines such as are used on motor-vehicles, and in means for controlling automatically and otherwise the flow of mixture from the carbureter to the engine. It is often desirable on account of varying atmospheric and climatic conditions to vary the quantity of air which is admitted to the mixing-chamber, and it is also desirable to be able to vary the quantity of mixture of air and hydrocarbon passing to the engine.

The present invention relates to these regulating devices, including means for varying or throttling the mixture passing to the engine both automatically and manually.

The invention will be fully described in connection with the accompanying drawings, in which—

Figure 1 is a side view, partly in section, of the means for regulating the mixture-valve. Fig. 2 is a similar view illustrating a different form of regulating means. Fig. 3 is an enlarged sectional view of a portion of the mechanism shown in Fig. 1. Fig. 4 is a front view of the same looking in the direction of the arrow 4, Fig. 3. Fig. 5 is a section on the line 5 5, Fig. 3. Fig. 6 is a side elevation of the carbureter, the float-chamber being shown in section; and Fig. 7 is a section on the line 7 7, Fig. 6.

Referring to the drawings, 10 indicates a portion of the frame of an automobile, 11 the dashboard, and 12 the footboard. The steering-handle 13 is of usual form and rigidly carried on a hollow shaft 14, which is mounted in a suitable bearing 15.

Referring to Figs. 1 and 7, 16 indicates the mixture-controlling valve, which is located in the pipe 17, leading from the carbureter A to the engine. (Not shown.) The valve 16 is operated by means of an arm 18 and a link 19, the other end of which is connected to a lever 20. Means are provided for setting the lever 20, and consequently the valve 16, in a given position, which may be termed a "normal" position, and additional means are provided for automatically controlling the valve to vary its position from the normal according to the speed of the vehicle or the engine, such means being preferably controlled by a governor. Additional manually-operated means are also provided for shifting the valve from the normal when it is desired to temporarily increase or decrease the speed of the vehicle by opening or closing the throttle. Means for setting the valve at any desired normal position will first be described.

Referring to Figs. 1, 3, 4, and 5, 21 indicates a lever which is rigidly connected to a stud 22 and retained in position thereon by a nut 23. The stud 22 is also rigidly connected to a sleeve 24, which rotates in the upper end of the tube 14 and is provided with a spiral groove 25. Within the sleeve 24 is a rod 26, having a spiral thread adapted to engage the groove 25. The lower end of the rod 26 is provided with a head 27, and a pin 28 passes transversely through said head and through the slots 29 in the tube 14 and is engaged with a sleeve 30, sliding upon the outer surface of the tube 14. When the lever 21 is turned relatively to the handle 13, it rotates the sleeve 24 relatively to the tube 14, and by means of the spiral groove 25 it raises or lowers the rod 26 and the sleeve 30. Suitable means, such as the rack 31 and the tooth 32, are provided for holding the lever 21 in any desired adjustment. As shown, the lever has a spring-arm which normally holds the tooth in engagement with the rack. The sleeve 30 has a circumferential groove 33, in which is fitted a ring 34, having trunnions. 36 indicates an elbow-lever, which is pivotally carried upon the upper end of a link 37, which link is supported on a stationary bracket 38. Horizontal arms 35 of the elbow-lever 36 are connected to the trunnions of the ring 34, while a depending arm of said lever 36 is connected with a rod 39. The rod 39 passes through an eye or opening in the lever 20, and it is normally held in a given relation to said lever by means of opposing springs 40, which are mounted on the rod and held in engagement with the lever 20 by nuts 41. It will be evident that a movement of the lever or arm 21 will raise or lower the rod 26 and the sleeve 30. This movement will rock the

elbow-lever 36 and will be communicated through the rod 39, the springs 40, lever 20, and link 19 to the throttle-valve 16, thus setting the throttle-valve in a desired normal position. It will also be evident that the lever 20 may be moved relatively to the rod 39 by reason of the yielding connection between them. Means are provided for effecting temporary adjustment of the valve as follows: The lever 20 is connected with a governor device B, which is operatively connected with the engine. As shown, it is connected by gears 42 with the engine crank-shaft 43, and the governor is provided with a grooved collar 44, engaging directly with an arm of the lever 20. As the speed of the engine increases the lever 20 will be operated in one direction, and as it decreases it will be operated in the opposite direction by the governor in a well-known manner. The tendency of the springs 40, however, will always be to bring the throttle-valve to the normal position, which is controlled by the hand-lever 21. It is desirable to be able to control the speed of the motor to produce a quick temporary increase or decrease of speed in case of emergency and to do this without changing the normal position of the throttle-valve. To accomplish this, the controlling-lever 20 is connected with a lever 45 by a link 46. As the governor is a yielding device, it is possible by raising or lowering the horizontal arm of the lever 45 by the foot or otherwise to adjust the throttle-valve 16 at will. As soon as the lever 45 is released the springs 40 will readjust the throttle-valve 16 to normal position subject to the control of the governor.

In Fig. 2 is shown a different form of the means for setting the throttle-valve. Referring to this figure, it will be seen that the link 39 is connected directly to an elbow-lever 47, having an operating-handle 48. The lever is provided with a suitable spring-pawl 49, which engages with a stationary toothed sector 50 to hold the lever in any desired position. As shown in Fig. 2, the lever 45 is connected directly with the valve-operating arm 18 by the rod 46^a, and the valve-arm 18 is connected by a link 19^a with the lever 20. The connection between link 19^a and the lever 20 is a yielding connection consisting of springs 19^b, confined on the rod 19^a and bearing on opposite sides of the lever 20.

In operating the devices shown in Fig. 2 the valve is set to normal position by the lever 47. The foot-lever 45 is pivoted freely and does not affect the position of the valve 16 except when it is positively operated. The spring connection 19^b permits the valve 16 to be operated to some extent by the foot-lever 45 without moving the lever 20, which is controlled by the governor and by the locking device 49 50. This prevents in a measure interference between the movements of the governor and the operation of the valve 16 by the foot-lever 45.

Referring to Figs. 6 and 7, 51 indicates the gasolene "float-chamber," into which the gasolene is delivered through a pipe 52. The supply of gasolene is regulated in the usual manner by a valve 53, controlled by a float 54. The gasolene passes from the float-chamber through a conduit 55 to the nozzle 56 in the carbureter proper. From the nozzle 56 it is drawn by suction into the mixing-chamber 57. Air is admitted to the mixing-chamber from inlets 58 in a cylindrical arm or projection 59. The openings 58 are controlled by a cylindrical rocking valve 60, having an arm 61. The valve 60 may be operated either manually or automatically, as desired. The air entering through the valve 60 passes into the mixing-chamber 57 through openings 62, which surround the nozzle 56. This air is drawn in by suction and mingles with the gasolene-spray from the nozzle. When the engine is working at high speed, an additional supply of air is drawn directly into the mixing-chamber 57 through openings 63, which are controlled by a spring-actuated puppet-valve 64. It will be noted that the openings 63 and valve 64 are in direct line with the mixture-discharge conduit 17. The air from the openings 63 is therefore drawn directly through the middle of the mixing-chamber, which insures an effective mingling of the air with the mixture coming from the nozzle 56 and the air-inlets 62. The puppet-valve is controlled by a spring 64^a, the tension of which is adjustable by means of a nut 64^b. To prevent direct passage of air from the valve-openings 58 to the mixing-chamber, the nozzle is surrounded by a wall or casing 65, in the lower portion of which the openings 62 are formed. The casing of the carbureter A is preferably provided with passages 66, through which hot gases or hot water may be circulated to warm the carbureter and assist in vaporizing the hydrocarbon. The passages 66 are shown as having an inlet 67 and an outlet 68.

It will be evident that the various means described may be embodied in other mechanical forms than those shown without departing from the spirit and scope of the present invention. The forms illustrated are those deemed best at the present time; but it will be understood that the invention is not limited to the precise mechanism illustrated and described.

No claim is herein made to the carbureter described and illustrated, as the same forms the subject-matter of a divisional application.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination with a mixer and vaporizer, of a mixture-valve, means for locking

said valve yieldingly against movement in either direction from a given position, and means governed by the speed of the engine for regulating the opening and closing of said valve without disturbing said locking means.

2. The combination with a mixer and vaporizer, of a mixture-valve, means for locking said valve yieldingly against movement in either direction from a given normal position, a governor, and means connecting said governor with said valve whereby the valve is automatically moved in either direction from its normal position without disturbing said locking means.

3. The combination with a mixer and vaporizer, of a mixture-valve, means for locking said valve yieldingly against movement in either direction from a given normal position, means controlled by the speed of the engine for adjusting said valve in either direction from its normal position without disturbing said locking means, and manually-operated means for adjusting said valve without disturbing said locking means.

4. The combination with a mixer and vaporizer, of a mixture-valve controlling the discharge from said mixer and vaporizer, means including an elastic connection for locking said valve against movement in either direction from a given normal position, a governor, and connections for adjusting said valve automatically without disturbing said locking means, said elastic connection permitting the valve to be moved in either direction from its normal position.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES SCHMIDT.

Witnesses:

RUSSELL HUFF,

MARK C. TAYLOR.

No. 821,751. PATENTED MAY 29, 1906.

C. SCHMIDT.

MUD GUARD FOR MOTOR VEHICLES.

APPLICATION FILED MAR. 10, 1905.

2 SHEETS—SHEET 1.

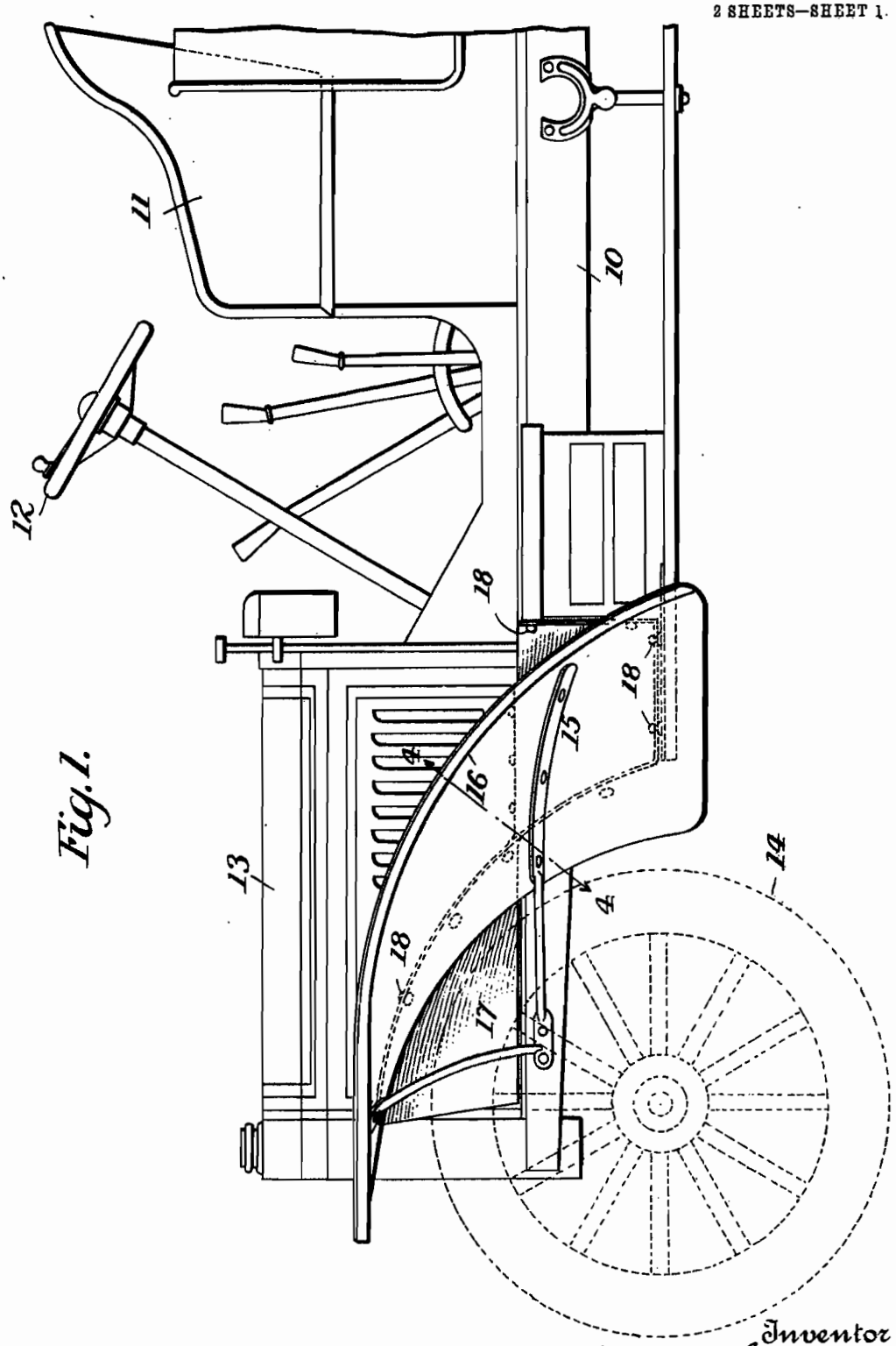

Fig. 1.

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No. 821,751. PATENTED MAY 29, 1906.

C. SCHMIDT.

MUD GUARD FOR MOTOR VEHICLES.

APPLICATION FILED MAR. 10, 1905.

2 SHEETS—SHEET 2.

Fig. 2.

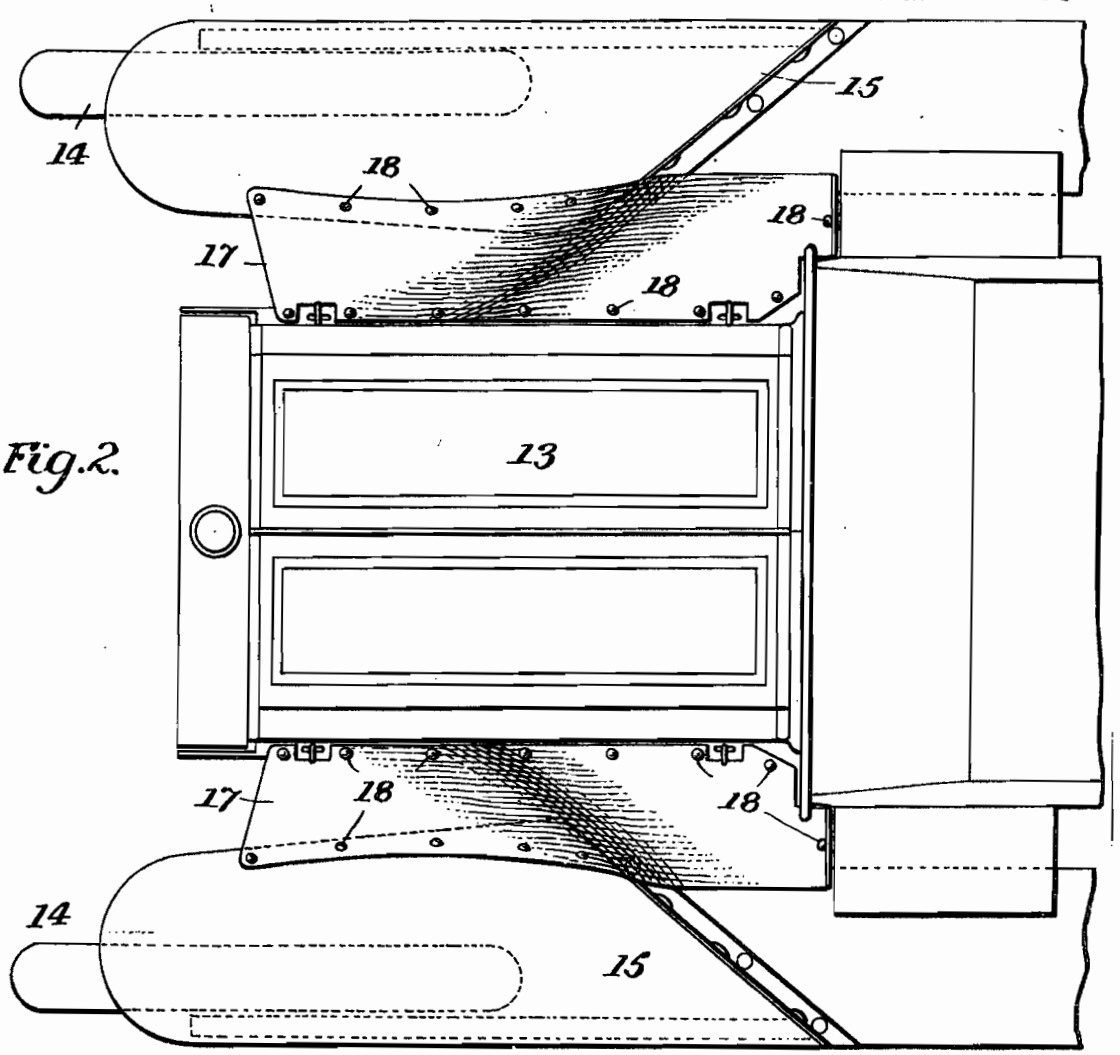


Fig. 3.

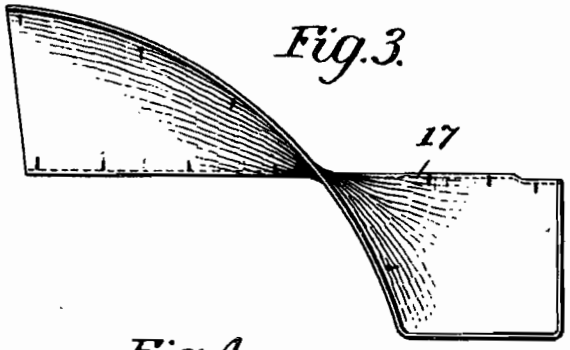
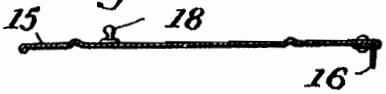


Fig. 4.



Witnesses
H. M. Gillman Jr.
J. J. McCarthy.

Inventor
Charles Schmidt
By Foster Freeman Watson
Attorneys

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF DETROIT, MICHIGAN, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

MUD-GUARD FOR MOTOR-VEHICLES.

No. 821,751. Specification of Letters Patent. Patented May 29, 1906.

Application filed March 10, 1905. Serial No. 249,443.

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of France, residing at Detroit, in the county of Wayne, State of Michigan, have invented certain new and useful Improvements in Mud-Guards for Motor-Vehicles, of which the following is a specification.

This invention comprises improvements in mud-guards for motor-vehicles; and its object is to prevent the mud which is thrown up by the wheels from being blown into the vehicle or upon the occupants thereof.

The invention will be described in connection with the accompanying drawings, in which—

Figure 1 is a side elevation of the forward part of a motor-vehicle, one of the front wheels being shown in dotted lines. Fig. 2 is a plan view of a portion of the front of the vehicle. Fig. 3 is a side view of a flexible and detachable mud-guard; and Fig. 4 is a section through the rigid guard on the line 4 4, Fig. 1.

Referring to the drawings, 10 indicates the body of the vehicle; 11, the seat; 12, the steering-handle; 13, the housing for the engine, which is usually placed in the front of the vehicle, and 14 the wheels. Over the wheels are relatively fixed rigid mud-guards 15, which are preferably permanently connected to the frame of the machine. When the vehicle is moving rapidly, fluid which strikes the mud-guards tends to move laterally toward the inner and outer edges of the guards and a considerable portion of the mud and water which is thrown against the end surfaces of the mud-guards is forced laterally by the air-pressure to the edges of the mud-guards and is then caught by the wind and carried back into the vehicle. To prevent the mud and water from thus escaping freely from the outer edges of the guards, a vertical depending flange 16 is provided at the outer edge of each guard. This flange collects the mud and water and guides it rearwardly and also gives it a tendency to drop instead of blowing out laterally.

Between the vehicle-body and the inner sides of the mud-guards 15 I provide flexible guards 17, constructed of leather or other suitable light fabric. These flexible guards can be detached and stored away during dry weather, and in wet or muddy weather they can be readliy connected to the vehicle. They are preferably united to the vehicle-body and to the fixed mud-guards by buttons or knobs 18, which engage buttonholes in the fabric. Any other suitable fastening devices may be employed.

The flexible mud-guards are preferably constructed to conform at their outer edges to the fixed mud-guards and at their inner edges to the straight lines of the vehicle-body. The flexible guards when in use have therefore a warped surface, as indicated in Fig. 3.

The flexible guards described cover the entire space between the fixed guards and the vehicle-body and effectually prevent any mud or water from being thrown into the vehicle or upon its occupants, thus avoiding the great annoyance heretofore experienced by automobile users in wet weather.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a motor-vehicle, the combination with the vehicle-body and the wheels, of the relatively fixed mud-guards extending over said wheels, and the flexible and detachable mud-guards extending between the fixed mud-guards and the vehicle-body.

2. In a motor-vehicle, the combination with the vehicle-body and the wheels, of the relatively fixed mud-guards extending over the wheels, and the flexible mud-guards between the fixed mud-guards and the vehicle-body, the outer edges of said flexible guards being detachably connected to the fixed guards, and the inner edges of said flexible guards being detachably connected with the vehicle-body, for the purpose set forth.

3. In a motor-vehicle, the combination with the vehicle-body and the vehicle-wheels, of the fixed mud-guards extending over the wheels, and the warped flexible mud-guards

between the fixed guards and the vehicle-body, the said flexible guards being detachably connected at their outer edges by suitable fastenings with the fixed mud-guards and at their inner edges by suitable fastenings with the vehicle-body, for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES SCHMIDT.

Witnesses:

RUSSELL HUFF,

MARK C. TAYLOR.

C. SCHMIDT.

CONTROLLING MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED OCT. 12, 1905.

994,428. Patented June 6, 1911.

2 SHEETS—SHEET 1.

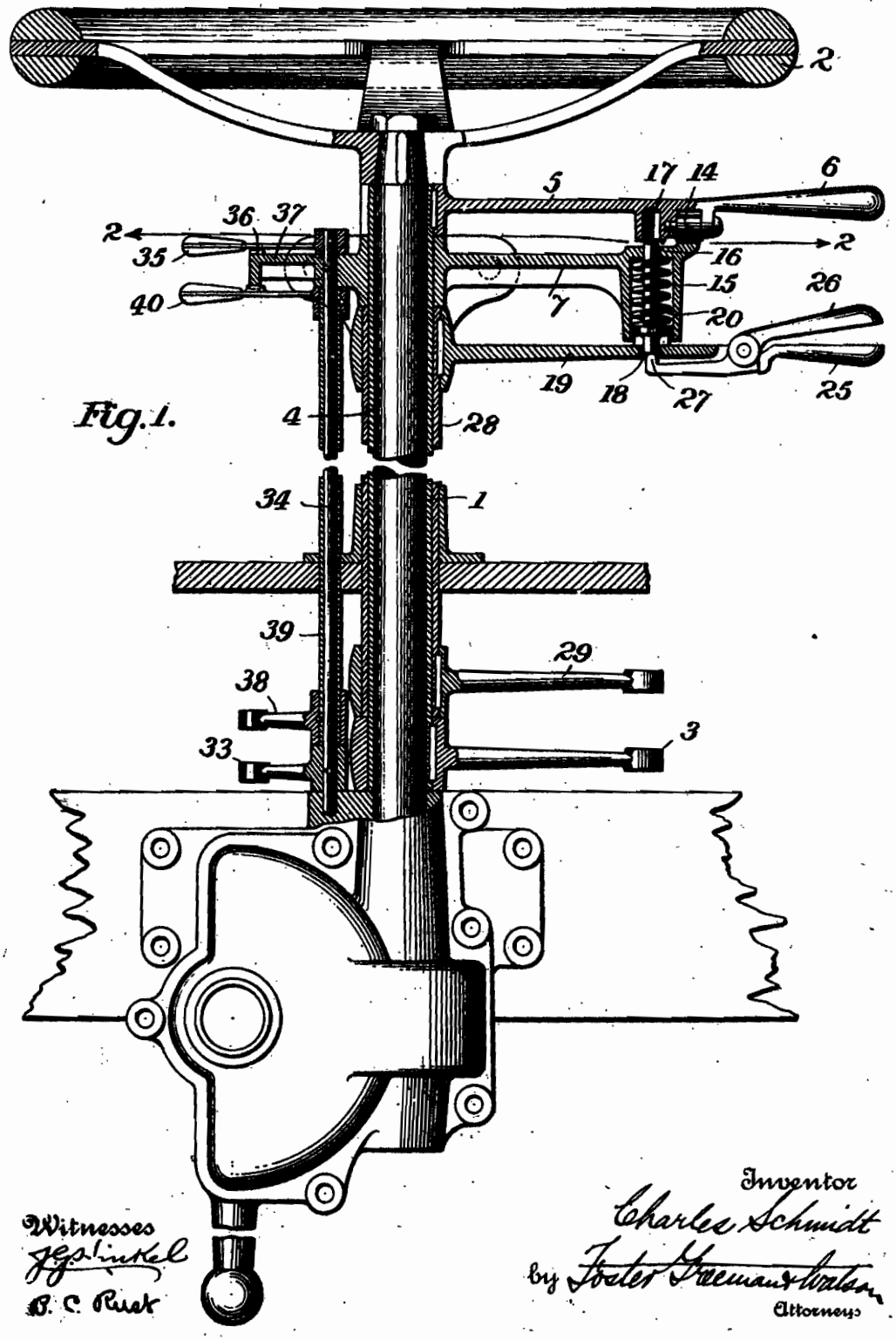


Fig. 1.

Witnesses
J. G. Winkel
S. C. Rust

Inventor
Charles Schmidt
by Foster Freeman & Watson
Attorneys

C. SCHMIDT.

CONTROLLING MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED OCT. 12, 1905.

994,428. Patented June 6, 1911.

2 SHEETS—SHEET 2.

Fig. 2.

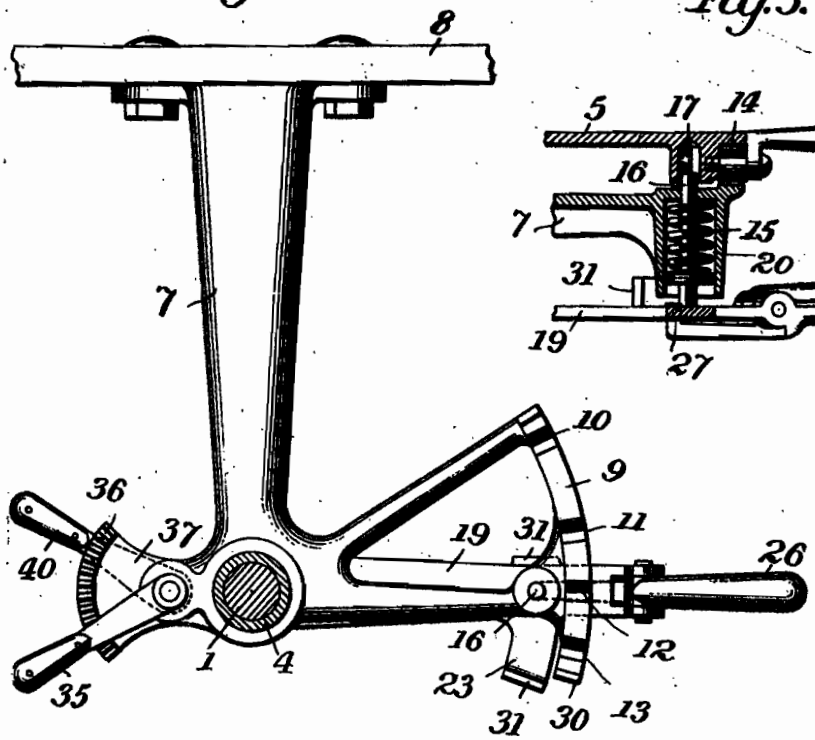


Fig. 3.

Fig. 4.

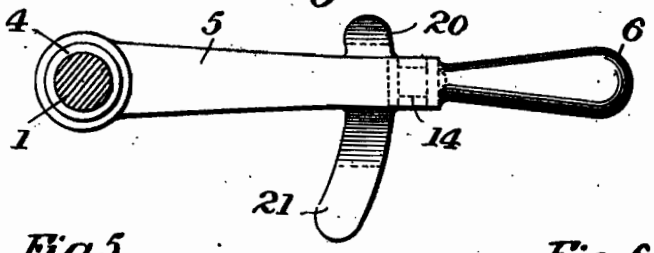
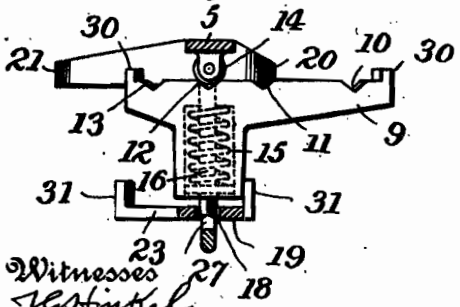
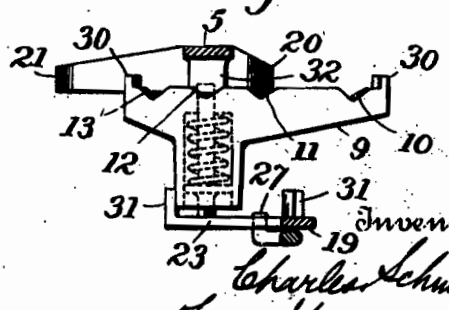


Fig. 5



Witnesses
J. G. Stinkel
C. C. Rust

Fig. 6.



Inventor
Charles Schmidt
by Foster Freeman & Watson
Attorneys

UNITED STATES PATENT OFFICE.

CHARLES SCHMIDT, OF CLEVELAND, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

CONTROLLING MECHANISM FOR MOTOR-VEHICLES.

994,428. Specification of Letters Patent. Patented June 6, 1911.

Application filed October 12, 1905. Serial No. 282,512.

To all whom it may concern:

Be it known that I, CHARLES SCHMIDT, a citizen of the Republic of France, and resident of Cleveland, Cuyahoga county, State of Ohio, have invented certain new and useful Improvements in Controlling Mechanism for Motor-Vehicles, of which the following is a specification.

My present invention relates to a controlling mechanism for motor vehicles which is conveniently located in connection with the steering means.

The invention will be described in connection with the accompanying drawings, in which,

Figure 1 is a longitudinal sectional view through the steering column or shaft of a motor vehicle provided with my invention; Fig. 2 is a section on the line 2—2 of Fig. 1; Fig. 3 is similar to a portion of Fig. 1, but showing the parts in another position; Fig. 4 is a plan view of the change speed lever; and Figs. 5 and 6 are details.

Referring to the drawings, 1 indicates the steering shaft of a motor vehicle, the upper end of which is provided with the usual steering handle 2 and the lower end of which is connected by suitable gearing with the steering wheels. This connection does not form a part of the present invention and need not be referred to in detail.

I arrange conveniently about the steering shaft the levers or handles for controlling the change-speed gears, the throttle, the spark, and the reverse gear. The change-speed gears are adjusted by means of an arm 3 carried at the lower end of a hollow shaft 4 surrounding the steering shaft 1. At the upper end of the shaft 4 is a controlling arm 5 provided with a handle 6. The hollow shaft 4 has a bearing in a bracket 7 which is secured to the dash board 8 of the vehicle. On the bracket 7 is a sector 9 having notches 10, 11, 12, 13, corresponding to the positions of the arm 5 for the several speeds and the neutral position, in which the gears are disconnected. As shown in Figs. 1, 3 and 5, the arm 5 is provided with a roller 14 adapted to cooperate with the notches to hold the arm in any desired position. The arm is sufficiently flexible to permit the roller to ride from one notch to the other.

In the bracket 7 adjacent to the sector 9 is a pocket 15, in which there is a vertically movable pin or plunger 16. The upper end of the pin is adapted to enter a socket 17 in the arm 5, while the lower end is adapted to enter an opening 18 in the arm 19 which operates the reverse gear. A spring 20 surrounding the pin 16 tends normally to press said pin downwardly and into the opening 18 when said opening registers with the pin. The arm 5 is provided with wing-like guards 20, 21, which prevent the pin 16 from rising, excepting when the opening 17 registers with it. Likewise the arm 19 is provided with a wing-like guard 23, which prevents the pin from dropping out of the socket 17 excepting when the opening 18 registers with the pin. The reversing lever 19 is provided with a handle 25 and with a small hand lever 26 having an up-turned point 27 adapted to pass into the opening 18 to raise the pin 16. The arm 19 is mounted on a hollow shaft 28 surrounding the shaft 4 and the lower end of shaft 28 is provided with an arm 29 which is suitably connected with the backing gear for throwing the same into and out of mesh, in the usual manner.

The operation of the parts described is as follows: The reverse lever 19 is normally held in its neutral position, illustrated in Figs. 1 and 2, by means of the pin 16 and the change-speed arm 5 is normally free to be moved to shift the gears for different speeds. When it is desired to reverse the direction of the vehicle by throwing in the backing gear, the change-speed lever 5 must first be brought to its neutral position, illustrated in Figs. 1 and 3. The arms or levers 5 and 19 being both in neutral position, the pin 16 may be raised by the lever 26 to engage it with the arm 5 and free it from the arm 19. The reverse arm 19 may then be turned to throw in the backing gear and the slow speed gear, and when so turned its guard 23 prevents the pin 16 from releasing the arm 5. It will be evident that the arms 5 and 19 are so interlocked that each must be locked in neutral position while the other is operative.

In Figs. 5 and 6, the guards 20, 21 and 23 and the sector 9 are shown in side view. It will be observed that the sector has projections 30 at its ends to limit the movement of the arm 5 and that the guard 23 has projections 31 to limit the movement of the arm 19. In Fig. 6 the arm 5 is shown locked in neutral position and the arm 19 in the position in which the reverse gear

is operating. In this figure also a tooth 32 is substituted for friction roll 14.

Referring to Figs. 1 and 2, 33 indicates an arm which is suitably connected to control the throttle of the motor. This arm is fixed on a shaft 34 and adjusted by means of a handle 35 on the upper end of said shaft. The handle 35 is arranged to engage a toothed segment 36, whereby it may be automatically locked in any desired position, the sector being formed on an arm 37 of the bracket 7. Adjacent to the arm 33 is an arm 38 for controlling the spark. This arm is mounted on a hollow shaft 39, upon the upper end of which is an operating arm 40 which engages teeth on the under surface of the sector 36.

It will be seen that the four operating levers are very conveniently located about the steering shaft near its handle. They are all mounted upon a common bracket, which bracket also serves to support the dash board and the steering shaft.

Having described my invention what I claim and desire to secure by Letters Patent is,

1. In a motor vehicle, the combination with a fixed bracket, of two levers arranged on opposite sides of the bracket, a part carried by the bracket and adapted to interlock with each lever, and means for normally holding said part in engagement with one of said levers, whereby the other lever is normally free.

2. In a motor vehicle, the combination with a fixed bracket, of two levers arranged on opposite sides of the bracket, a part carried by the bracket and adapted to interlock with each lever, and means carried by one of said levers and movable independently thereof for shifting said interlocking part.

3. In a motor vehicle, the combination with a fixed bracket, of two levers arranged on opposite sides of the bracket, a part carried by the bracket and adapted to interlock with each lever, a spring for moving said interlocking part normally toward one of said levers, and means for shifting said part positively against the tension of the spring to release said lever.

4. In a motor vehicle, the combination with a fixed bracket and a steering shaft having a bearing in said bracket, of two arms arranged respectively above and below said bracket and adapted to swing around said steering shaft, a part movably mounted in said bracket and adapted to interlock with either of said arms when the latter are in a middle or neutral position, a spring for normally pressing said part toward one of said arms, and means carried by the last mentioned arm for releasing it from the said interlocking part.

5. In a motor vehicle, the combination of two movable arms for shifting respectively the change-speed gears and the backing gear, a fixed part or bracket between said arms, a movable part mounted in said bracket and adapted to engage with either of said arms when in their neutral position, a spring for normally pressing said part into engagement with the arm for operating the backing gear, and means for yieldingly holding the arm for shifting the change-speed gears in any one of several positions.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CHARLES SCHMIDT.

Witnesses:
H. R. SULLIVAN,
W. L. MCGARRELL.

TRUCK ✓

R. HUFF.

MOTOR VEHICLE.

APPLICATION FILED OCT. 12, 1905.

920,142. Patented May 4, 1909.

2 SHEETS—SHEET 1.

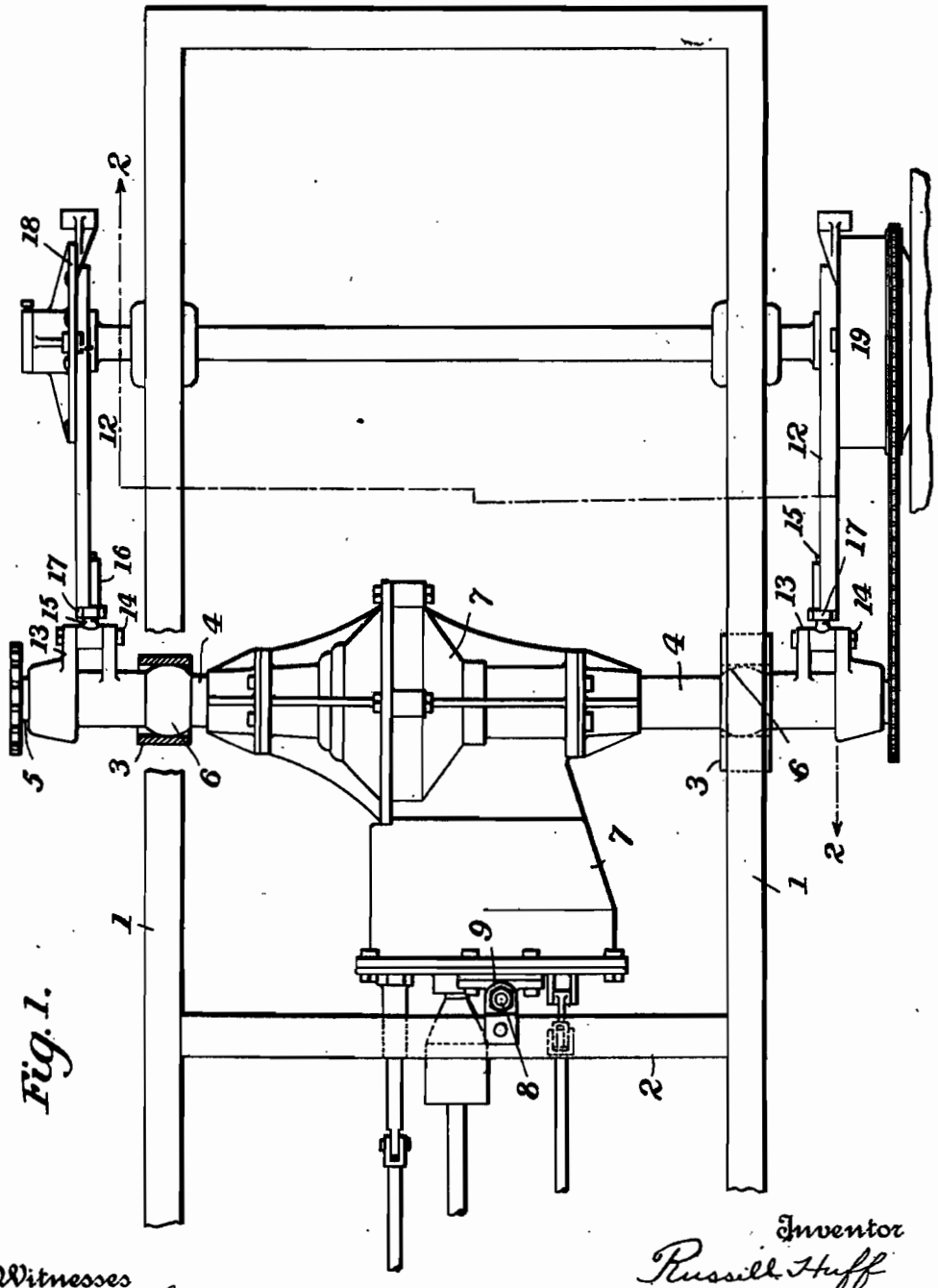


Fig. 1.

Witnesses
J. G. Stinkel
B. C. Rust

Inventor
Russell Huff
by Foster Freeman & Watson
Attorneys

R. HUFF.

MOTOR VEHICLE.

APPLICATION FILED OCT. 12, 1905.

920,142.

Patented May 4, 1909.

2 SHEETS—SHEET 2.

Fig. 2.

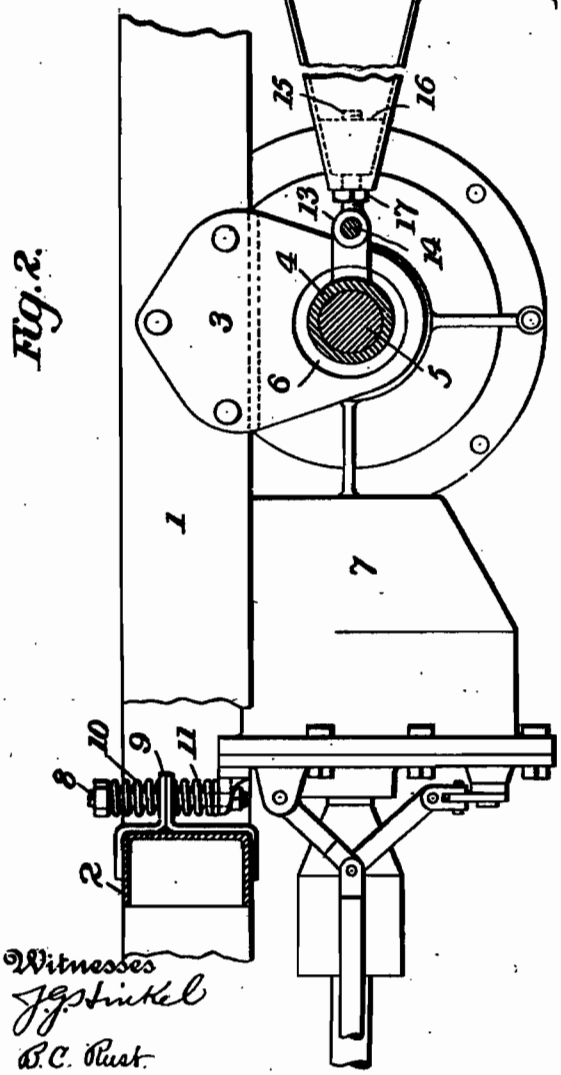
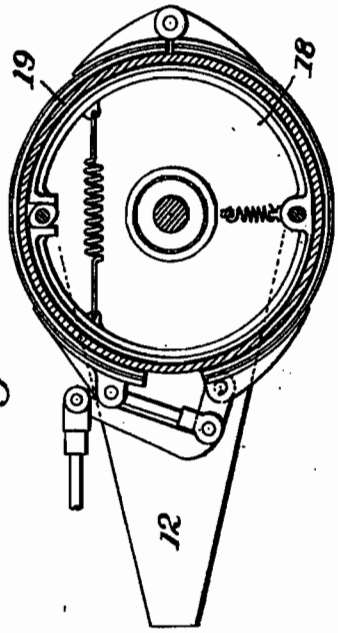


Fig. 3.



Witnesses

J. G. Stinkel

B. C. Rust

Inventor

Russell Huff

by Foster Freeman & Watson

Attorneys

UNITED STATES PATENT OFFICE.

RUSSELL HUFF, OF DETROIT, MICHIGAN, ASSIGNOR TO THE PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

MOTOR-VEHICLE.

No. 920,142. Specification of Letters Patent. Patented May 4, 1909.

Application filed October 12, 1905. Serial No. 282,482.

To all whom it may concern:

Be it known that I, RUSSELL HUFF, a citizen of the United States, residing at Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Motor-Vehicles, of which the following is a specification.

The present invention relates to the running gear of motor vehicles, and more particularly to means for connecting the gear case with the frame and rear axle.

The invention will be described in connection with the accompanying drawing, in which,—

Figure 1 is a plan view of the rear portion of a motor vehicle frame and connected parts embodying the present invention; Fig. 2 is a side elevation of the same partly in section on the line 2—2 of Fig. 1; and Fig. 3 is a detail of one form of brake mechanism which may be used in connection with the present invention.

Referring to the drawing, 1 indicates the side bars of a motor vehicle frame, and 2 a transverse bar thereof, both being preferably constructed of steel channel bars.

The present invention relates to that class of motor vehicles in which there is a transverse shaft, commonly called a jack-shaft, which is driven by the motor and from which power is transmitted to the driving wheel by means of chains or belts.

On the under side of the side bars 1, are bearing brackets 3, in which the casings 4 of the jack-shaft 5 are carried. The casings 4 have swelled or ball-like portions 6, which fit the yokes 3 and permit the frame to warp or twist slightly in going over rough roads without straining or cramping the shaft or its casing. The passages in the yokes 3 which receive the ball-like portions 6 of the jack-shaft casings are of cylindrical form, that is of the same diameter from end to end. By this particular form of bearing the jack-shaft casings are adapted to have a limited movement in the direction of the length of the jack-shaft as well as the universal movement obtained by the use of the spherical bearing portions 6. The shaft casings 4 are rigidly connected with the gear case 7, and the forward end of the gear case is hung upon a bolt 8, which is suitably connected to the gear case, and which passes vertically through a bracket 9 on the transverse frame bar 2. The bolt is provided with suitable heads, and between the heads and the bracket are stout coiled springs 10, 11. This connection permits the gear case to swing laterally and move up and down to a limited extent. In fact it constitutes a flexible universal joint and, together with the ball joints 6, it permits the frame to yield freely to the irregular surface of the road without straining the gear case or cramping the bearings of its contained mechanism. The gear case contains the usual change-speed and reverse gears, which may be controlled in any desired manner.

The rear axle is connected with the jack-shaft casing by adjustable radius rods 12, consisting of substantially triangular metal plates, which are flanged at the upper and lower edges to stiffen them, and which are semi-circular at their rear ends, the flange being carried around the semi-circle. The forward ends of the radius rods 12 are hinged to the jack-shaft casing. As shown the casing has two lugs 13 at each end, and a bolt 14 passes through said lugs and through the head of a threaded rod 15. The rod 15 is screwed into a block 16, which is rigidly connected with the radius rod 12 and it is secured in any desired adjustment by a nut 17.

The rear circular end of the radius rod is arranged concentric with the rear axle and securely connected, by riveting or otherwise, to the disk 18 which carries the brake shoes and their operating devices. The radius rods may be lengthened or shortened to adjust the chains to the sprocket wheels by removing the bolts 14 and turning the threaded rods 15. It will be seen that the radius rods or plates constructed as above, are very strong in proportion to their weight, and that they stiffen and strengthen the disks or foundation plates 18 for the brakes, and securely hold them from turning.

Any suitable brake may be used in connection with the foundation plates 18. In the drawing, I have shown inner and outer brake shoes adapted to operate upon flanges 19 which are securely connected to the vehicle wheels.

Having described my invention, what I claim and desire to secure by Letters Patent is,—

1. In a motor vehicle, the combination with a frame having longitudinal side pieces and a transverse bar, of jack-shaft casings having universal joint connections with the

side pieces of the frame, and also adapted to move longitudinally, and a gear case rigidly connected to said jack-shaft casings, said gear case having a yielding universal joint connection with the transverse bar.

2. In a motor vehicle, the combination with a frame having side pieces and a transverse bar, of brackets depending from the side pieces, a jack-shaft having casings provided with spherical portions seated in said brackets, a gear case rigidly connected with said shaft casings, a bracket connected with the transverse frame bar, a bolt or rod having a spring connection with said bracket, said bolt or rod being connected to the forward end of the gear case.

3. In a motor vehicle, the combination with a frame, having cylindrical bearings supported by its side pieces, of jack-shaft casings having spherical portions mounted in said bearings, and a gear case rigidly connected to the jack-shaft casings and having an independent yielding connection with a transverse bar of the frame.

4. In a motor vehicle, the combination with a frame, of a gear case, jack shaft casings projecting laterally from the gear case and each having at an intermediate point in its length an enlarged spherical portion, brackets depending from the side pieces of the frame and having therein cylindrical bearings adapted to receive the spherical portions of the jack-shaft casings, a transverse bar connecting the side pieces of the frame, and a yielding universal joint connection between the gear case and said transverse bar.

5. In a motor vehicle, the combination with a frame having side pieces and a transverse bar, of yoke shaped brackets each having parallel ears at its upper end, between which a side piece of the frame extends, and having a portion depending from the side frame piece and having a cylindrical passage or bearing formed therein, a gear case, jack-shaft casings rigidly connected with the gear case and having spherical portions fitting said cylindrical bearings, and a yielding universal joint connection between the gear case and the transverse bar of the frame.

6. In a motor vehicle, the combination with a jack-shaft and its casing, and with the rear axle and the foundation plates for the brakes mounted thereon, of radius rods pivotally connected with the jack-shaft casings and rigidly connected with said foundation plates for the brakes, said radius rods comprising substantially triangular metal plates, as set forth.

7. In a motor vehicle, the combination with a jack-shaft and its casing, and with the rear axle and the foundation plates for the brakes mounted thereon, of radius rods pivotally connected with the jack-shaft casings and rigidly connected with said foundation plates for the brakes, said radius rods comprising substantially triangular metal plates flanged at their edges and having semi-circular flanged rear ends concentric with the rear axle, as set forth.

8. In a motor vehicle, the combination with the frame having longitudinal side pieces and a transverse bar, of a non-rotating casing for the jack-shaft having universal joint connections with the side pieces of the frame, a gear case rigidly connected to and supported by said jack-shaft casing, and a universal joint connection between said gear case and the said transverse bar.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RUSSELL HUFF.

Witnesses:
MARK C. TAYLOR,
L. RODMAN MACK.

J. W. PACKARD.

VALVE OPERATING MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED OCT. 13, 1905.

1,050,288. Patented Jan. 14, 1913.

2 SHEETS—SHEET 1.

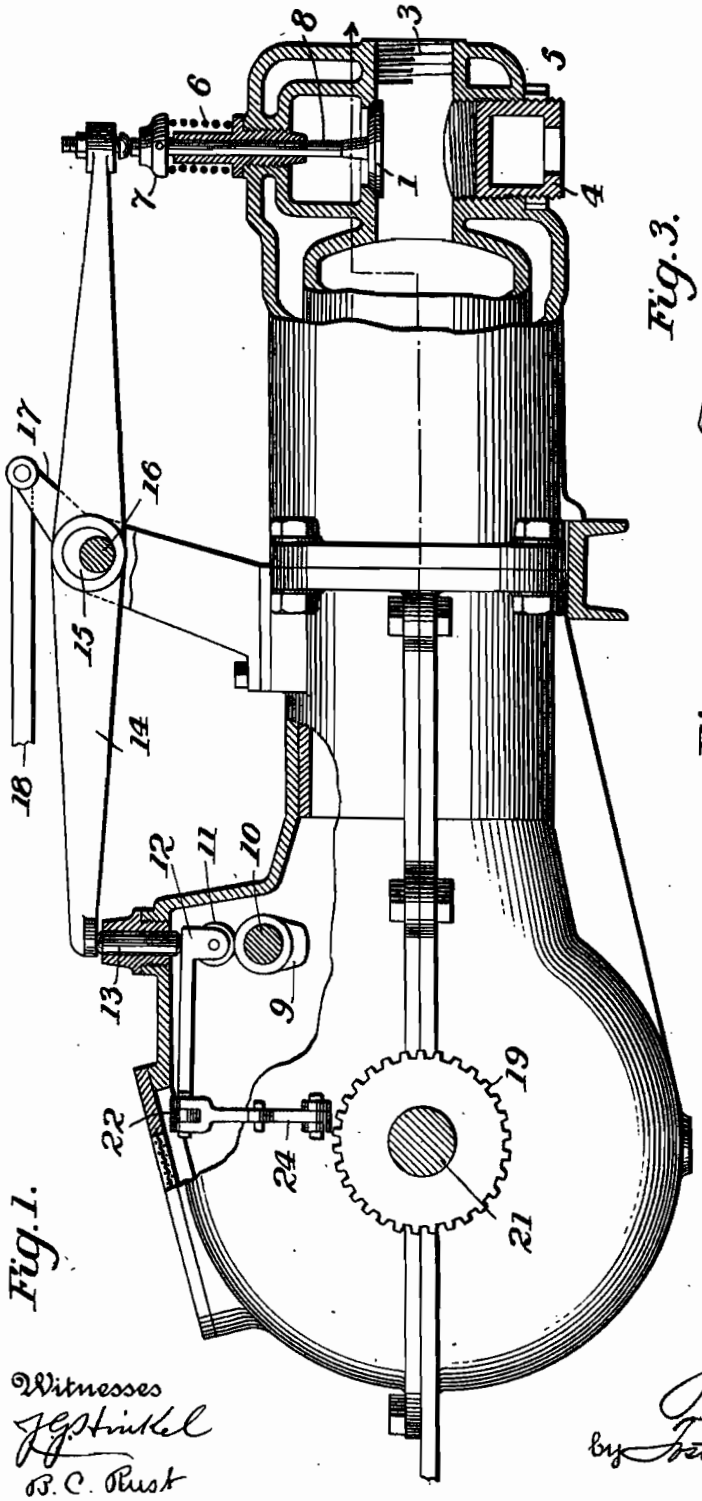


Fig. 1.

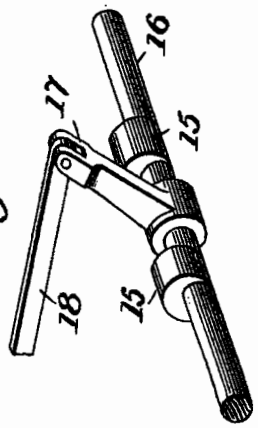


Fig. 3.

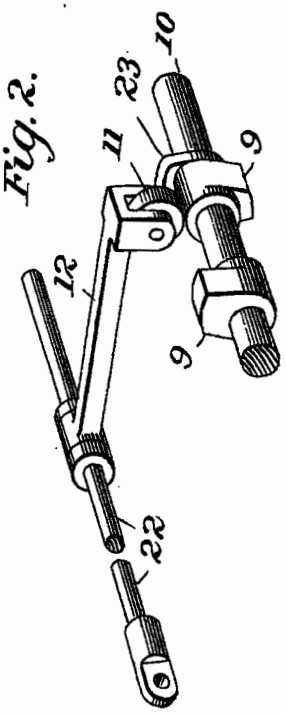


Fig. 2.

Witnesses

J. G. Hinkel

B. C. Rust

Inventor

James W. Packard

by Foster Freeman & Watson

Attorneys

2 CYL

J. W. PACKARD.

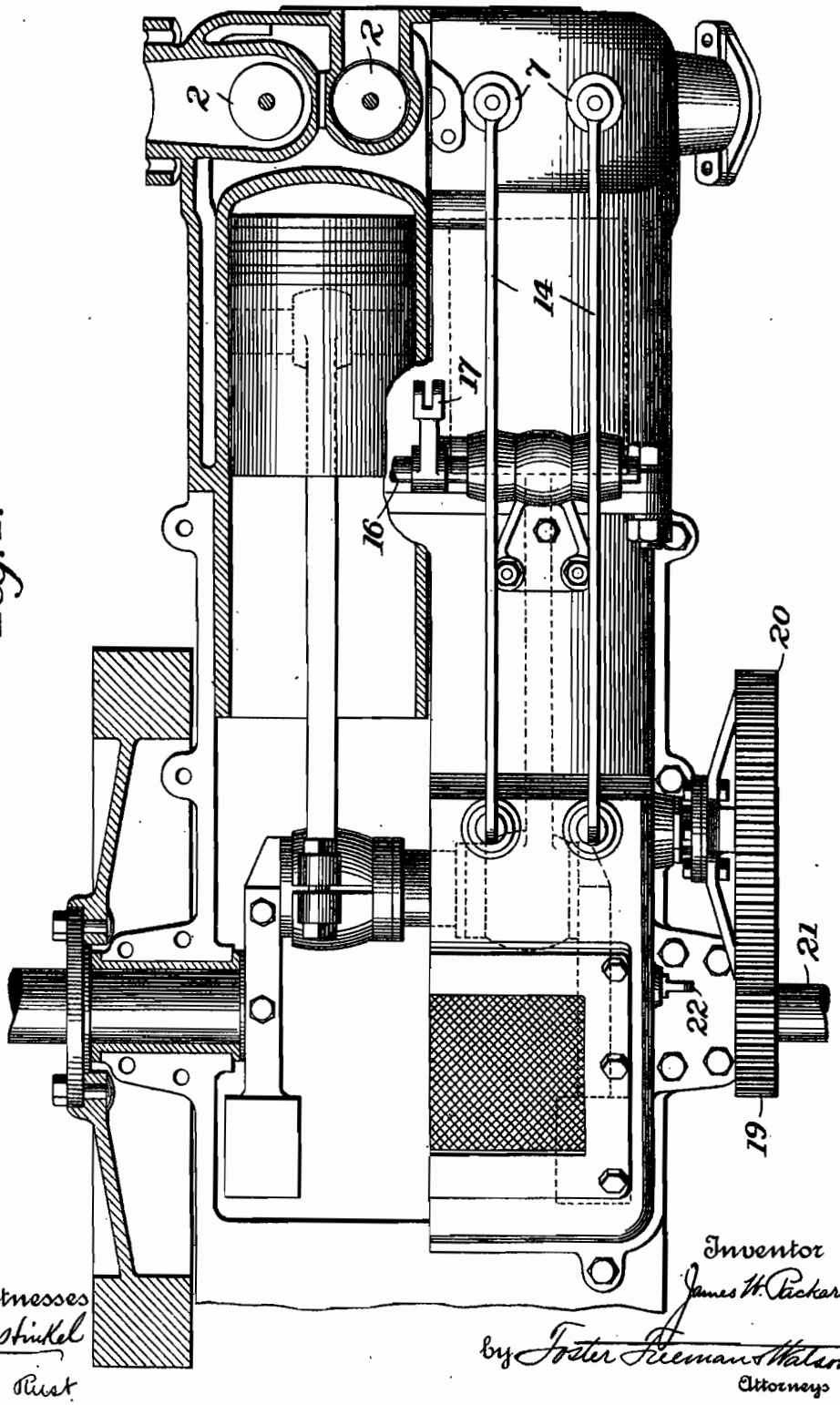
VALVE OPERATING MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED OCT. 13, 1905.

1,050,288. Patented Jan. 14, 1913.

2 SHEETS—SHEET 2.

Fig. 4.



Witnesses
J. G. Stinkel
B. C. Rust

Inventor
James W. Packard
by Foster Freeman & Watson
Attorneys

UNITED STATES PATENT OFFICE.

JAMES W. PACKARD, OF WARREN, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

VALVE-OPERATING MECHANISM FOR MOTOR-VEHICLES.

1,050,288. Specification of Letters Patent. **Patented Jan. 14, 1913.**

Original application filed June 29, 1903, Serial No. 163,589. Divided and this application filed October 13, 1905. Serial No. 282,646.

To all whom it may concern:

Be it known that I, JAMES W. PACKARD, a citizen of the United States, and resident of Warren, Trumbull county, State of Ohio, have invented certain new and useful Improvements in Valve-Operating Mechanism for Motor-Vehicles, of which the following is a specification.

The present invention relates to improvements in hydrocarbon engines and particularly to the valve actuating devices and means for controlling the same.

In the drawing, Figure 1 is a side view partly in section of a hydrocarbon engine embodying the invention; Figs. 2 and 3 illustrate details of the engine; Fig. 4 is a plan view partly in section.

The engine illustrated in the drawing is a double cylinder engine having a single crank and each cylinder thereof is provided with an inlet valve 1 and an exhaust valve 2. Said valves are located above the explosion chamber 3 and in the wall of said chamber beneath each valve is a removable plug 4 closing an opening through which the valve may be removed. The plugs 4 are adjustable and checknuts 5 are provided for locking them in any desired position. The object of making the plugs adjustable is to permit of varying the size of the explosion chamber and thereby decreasing or increasing the intensity of the explosion. These adjustable blocks are not claimed in the present case, being made the subject of a separate application, Serial No. 390,971, filed August 31, 1907.

The valves 1, 2, are normally held closed by springs 6 abutting against heads 7 on the valve stems 8 and said valves are positively opened by means of cams 9 9′ on a cam shaft 10, which cams operate through rollers 11, 11′ arms 12, 12′ pins 13 13′ and levers 14, 14′ said levers bearing at one end upon the pins 13 13′ and at the opposite end upon the valve stems 8. In order to vary the degree of opening the inlet valves 1, the levers 14 which operate said valves are mounted on eccentrics 15 carried by a rock shaft 16. The levers 14′ which operate the exhaust valves 2 have bearings concentric with shaft 16. As shown in Figs. 1 and 3, the rock shaft 16 is operated by an arm 17 and a link 18 connecting said arm to any suitable operating lever or governor.

The cam shaft 10 is driven by suitable gearing 19, 20, from the crank shaft 21; and the arms 12 12′ are supported by a rod 22 supported to slide in the engine frame. This sliding movement is intended to permit the cam rolls 11′, which operate the exhaust valves, to ride upon either the aforesaid cams 9′ provided to actuate them, or upon both said cams and cams 23 which are arranged at the side of and are opposite in effect, or substantially so, to said cams 9′. That is, the rollers 11′ controlling the action of the exhaust valves may either be arranged, as shown in Fig. 2, so as to be in the path of the cams 9′ alone, or may be moved laterally so as to be actuated by both the cams 9′ and 23. When it is desired to reduce the charge in the explosion chamber, the rod 22 is moved by a suitable lever 24 so that the rollers 11′ controlling the exhaust valves will travel on both cams 9′ and 23. This adjustment will cause the exhaust valves 2 to open normally during the exhaust stroke of the pistons and then to open again during the compression stroke sufficiently to let a portion of the charge escape through the exhaust passages before ignition takes place. By this means the power and speed of the engine can be regulated either by hand or by the governor, and the starting of the engine facilitated by shifting rolls 11′ so as to be actuated by both cams 9′ and 23.

The governing device for the exhaust valves just described may be used in connection with the aforesaid governing device for the inlet valves, or either may be used singly.

It will be understood that the governing devices above described may be employed in connection with other forms of engines and valves from those shown in the embodiment of the invention illustrated in the accompanying drawing.

The form of engine illustrated is that shown in an earlier application, Serial No. 163,589, of which the present case is a division.

Having thus described the invention what

is claimed as new and desired to be secured by Letters Patent is,

1. In a hydrocarbon engine, the combination with the exhaust valve, of a cam for operating said valve to exhaust the burnt gases, and a relatively fixed oppositely disposed cam adapted to open said valve during a portion of the compression stroke, for the purpose set forth.

2. In a hydrocarbon engine, the combination with the cylinder, and the exhaust valve, of a cam shaft provided with two relatively fixed cams, one for operating said valve during the exhaust stroke, and the other for operating said valve during the compression stroke, and means for causing one or both of said cams to operate upon said valve.

3. In a hydrocarbon engine, the combination with a cylinder and the exhaust valve, of a cam shaft provided with two relatively fixed cams, one for operating said valve during the exhaust stroke and the other for operating said valve during a portion of compression stroke, and means shiftable longitudinally of the cam shaft for causing one or both of said cams to operate upon said valve.

4. In a hydrocarbon engine, the combination with a cylinder provided with an exhaust valve, of a cam shaft provided with an exhaust cam and a compression relief cam, mechanism connecting the valve and cams, and means to shift the cams and the valve mechanism relatively to each other to cause one or both of said cams to operate the valve.

5. In a hydrocarbon engine, the combination with a cylinder provided with an exhaust valve, of a cam shaft provided with an exhaust cam and a compression relief cam, a cam roll connected with the valve and adapted to engage the cams, and means to shift the roll and cams relatively to each other longitudinally of the shaft to cause one or both of said cams to operate the valve.

6. In a hydrocarbon engine, the combination with a cylinder provided with an exhaust valve, of a cam shaft provided with a set of relatively fixed cams comprising an exhaust cam and a compression relief cam, mechanism connecting the valve and cams, and means to shift said set of cams and the valve mechanism relatively to each other to cause one or both of said cams to operate the valve.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES W. PACKARD.

Witnesses:
E. A. NELSON,
F. E. PAINE, Jr.

Water Pump
V

R. HUFF.

SPEED GOVERNING DEVICE FOR MOTOR VEHICLES.

APPLICATION FILED OCT. 14, 1905.

906,884. Patented Dec. 15, 1908.

2 SHEETS—SHEET 1.

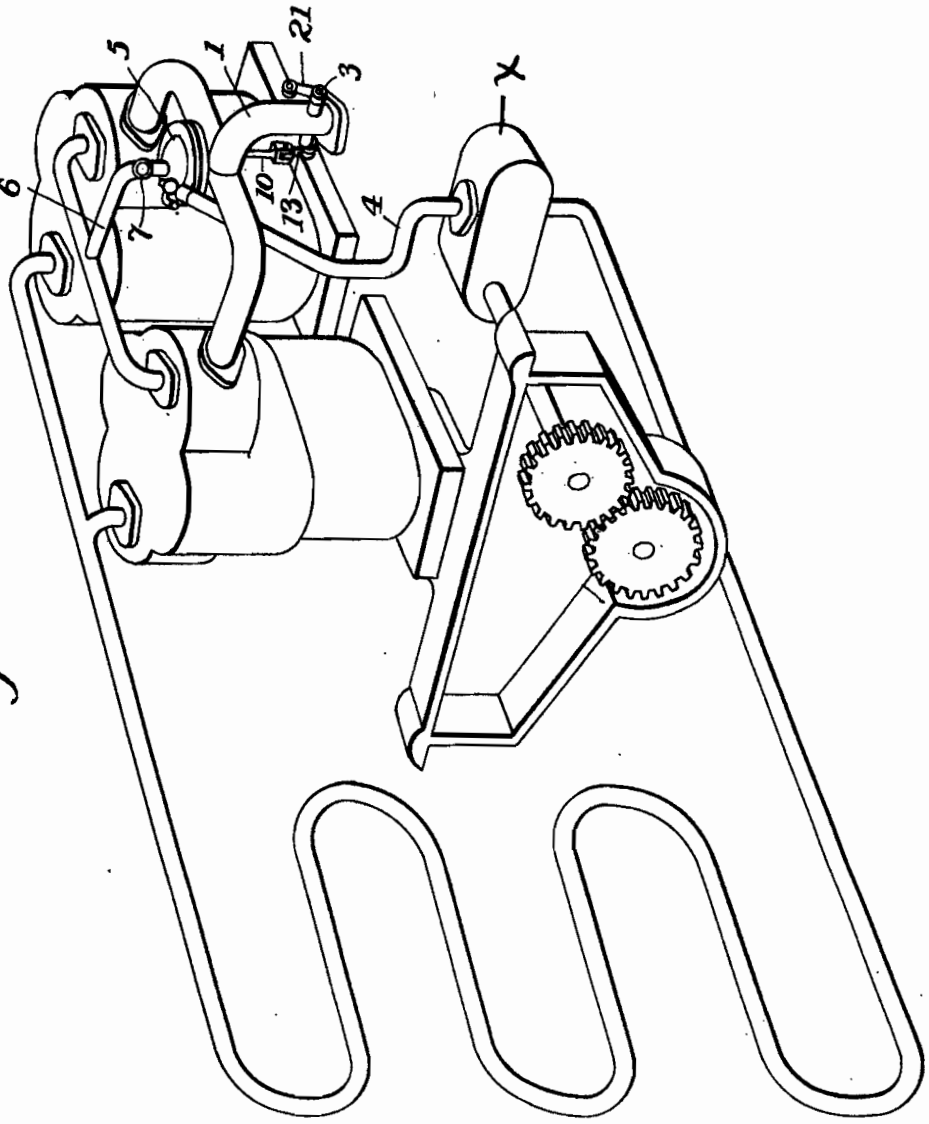


Fig. 1.

Witnesses
J. G. Stinkel
B. C. Rust

Inventor
Russell Huff
by Foster Freeman & Watson
Attorneys

R. HUFF.

SPEED GOVERNING DEVICE FOR MOTOR VEHICLES.

APPLICATION FILED OCT. 14, 1905.

906,884. Patented Dec. 15, 1908.

2 SHEETS—SHEET 2.

Fig. 3.

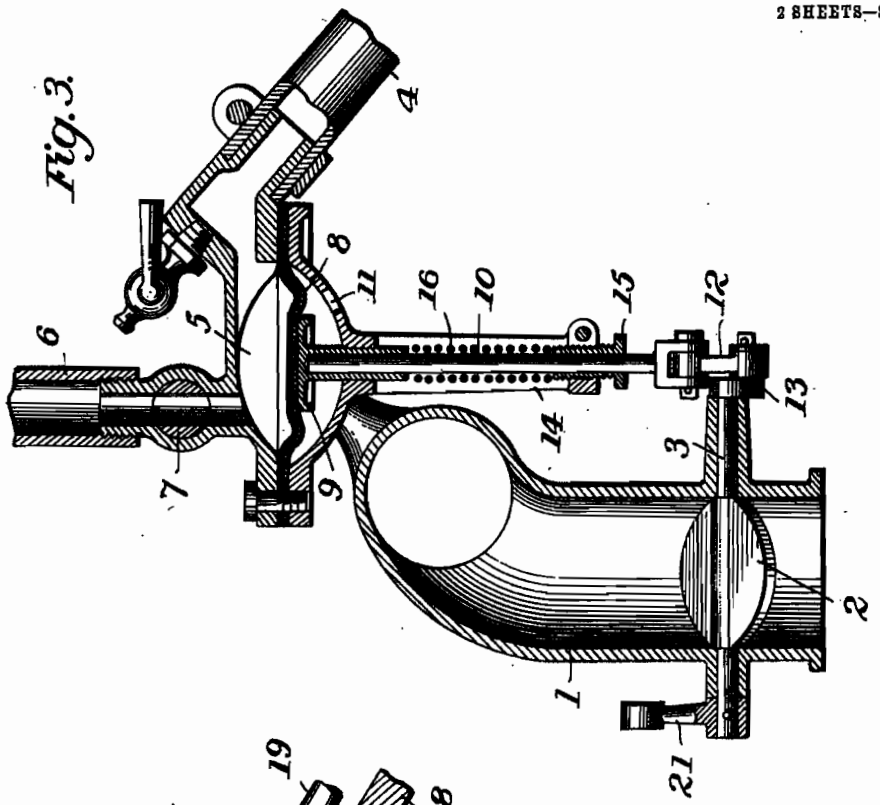
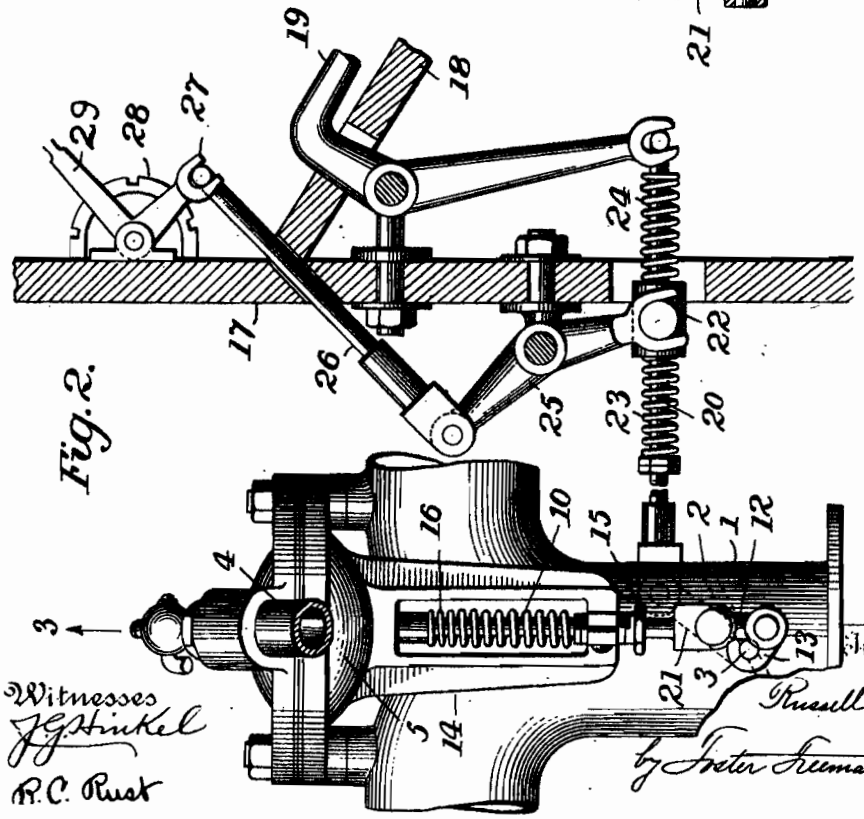


Fig. 2.



Witnesses
J. G. Hinkel
R. C. Rust

Inventor
Russell Huff
by Foster Freeman & Watson
Attorneys

UNITED STATES PATENT OFFICE.

RUSSELL HUFF, OF DETROIT, MICHIGAN, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

SPEED-GOVERNING DEVICE FOR MOTOR-VEHICLES.

No. 906,884. Specification of Letters Patent. Patented Dec. 15, 1908.

Application filed October 14, 1905. Serial No. 282,844.

To all whom it may concern:

Be it known that I, RUSSELL HUFF, a citizen of the United States, and resident of Detroit, Wayne county, Michigan, have invented certain new and useful Improvements in Speed-Governing Devices for Motor-Vehicles, of which the following is a specification.

In most of the motor vehicles which are driven by hydrocarbon engines, water is circulated about the engine cylinders and through cooling or radiating coils for the purpose of preventing overheating of the engines.

The present invention comprises means governed by the water circulation for regulating the speed of the engines. The pump for circulating the water is driven directly from the engine and hence the flow of water is in proportion to the speed of the engine. Advantage is taken of this fact to govern the speed of the engine from the pressure of water delivered by the pump.

The invention will be particularly described in the following specification, reference being had to the accompanying drawing, in which,

Figure 1 is a diagram of part of a motor vehicle, illustrating the present invention; Fig. 2 is an enlarged view of the essential parts of the invention; and Fig. 3 is a section on the line 3—3 of Fig. 2.

Referring to the drawing, 1 indicates the pipe leading from the carbureter to the engine through which the mixture of air and hydrocarbon passes, and 2 indicates the throttle valve for controlling the supply of mixture to the engine. As shown, the pipe 1 has two branches, leading to the cylinders of a double cylinder engine. The throttle valve 2 is fixed to a shaft 3 which is journaled transversely in the pipe 1. By rocking the shaft the valve is opened or closed. The manner of controlling the valve will now be described.

The water from the pump X passes through a pipe 4 through a chamber 5 and into a pipe 6. The chamber 5 may be in any part of the water circulating system, but it is preferably located near the pump on the delivery side thereof, in which position the pressure of water conforms more nearly to the speed of the pump. The pipe 6 is provided with a suitable valve 7 for a purpose to be hereinafter explained.

In the chamber 5 is a diaphragm 8 of flexible material such as sheet metal or rubber. In the drawing there is illustrated a diaphragm comprising an upper layer of rubber and a lower layer of leather. This combination forms a very satisfactory diaphragm, the leather affording the necessary strength and the rubber being impervious to water. Beneath the diaphragm 8 is a head 9 on a stem 10 which slides in an opening in the bottom of the chamber 5. The chamber below the diaphragm is also preferably provided with an air vent 11. The stem 10 of the head 9 is connected by a link 12 with a crank 13 on the throttle valve shaft 3. The stem 10 is guided in a bracket 14 depending from the chamber 5 and a step or nut 15 which is adjustably mounted in said bracket supports a spring 16, which spring in turn bears upon the head 9 and presses it against the diaphragm. The pressure of the head upon the diaphragm may be regulated by adjusting the nut 15.

The operation of the governor above described is as follows: When the motor slows down, due to an up-grade, or for any other reason, the pump will slow down correspondingly, and the pressure will be reduced in chamber 5. The spring 16 will then raise the head 9 and stem 10 and this movement will be communicated through the shaft 3 and open the throttle valve. On the other hand, if the motor exceeds its normal speed, the pressure will rise in the chamber 5 and the head 9 and the stem 10 will be depressed, closing the throttle valve. The valve 7 in the outlet from the chamber 5 serves to regulate the pressure in said chamber and hence controls the normal operation of the diaphragm. This valve 7 is also useful for bringing the governor back to normal operation in case that the flow of water varies, due to the wearing of the pump, or from other causes.

In Fig. 2, I have shown the relation of the governing device to the dash board 17 and foot board 18 of the vehicle. I provide for hand and foot control of the throttle valve, as shown, so that the throttle may be opened beyond the normal to automatically speed the vehicle. For this purpose a pedal 19 suitably located and pivoted is connected by a rod 20 with a crank 21 on the valve shaft 3. On depressing the pedal the valve will obviously be opened and on releasing the foot

pressure the water pressure in the chamber 5 will bring the valve back to normal.

On the rod 20 is a sliding block 22 which is normally held in mid-position by springs 23, 24, coiled about the rod. The block 22 is engaged by a lever 25 having a connection 26 with a hand operated lever 27 which may be locked in any desired position by means of a toothed segment 28 and a handle 29. By means of the connections between the handle 29 and the throttle valve, the latter may be opened to any desired extent to regulate the speed of the vehicle, that is, to set it for a given normal speed. The springs 23 and 24 thus hold the throttle valve yieldingly in any desired normal position and act as an additional balancing means for the governor, the said governor being required in its operation to overcome the tension of one or the other of said springs 23 and 24. By varying the normal position of the throttle valve by the handle 29, as above described, the tension of the governor spring 16 is also varied proportionately.

Having described my invention what I claim as new and desire to secure by Letters Patent is,

1. In a motor vehicle, the combination with the motor, water circulating system, pump and throttle valve, of a chamber in said system through which the water passes, a movable part in said chamber controlled by the pressure of water therein, connections between the said movable part and the throttle valve, means for locking said throttle valve yieldingly in any desired position, and manually operated means for temporarily opening the throttle valve without disturbing said locking means.

2. In a motor vehicle, the combination with the motor, water circulating system, pump and throttle valve, of a chamber in said system through which the water passes, a movable part in said chamber controlled by the pressure of water therein, connections between the said movable part and the throttle valve, and means for locking said throttle valve yieldingly in any desired position comprising two springs connected with the throttle valve, a part intermediate said springs and devices for adjusting said part.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

RUSSELL HUFF.

Witnesses:

E. A. NELSON,

F. E. PAINE, Jr.

No. 829,402. PATENTED AUG. 28, 1906.

R. HUFF.

STEERING GEAR AND MOTOR CONTROLLING MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED APR. 6, 1906.

2 SHEETS—SHEET 1.

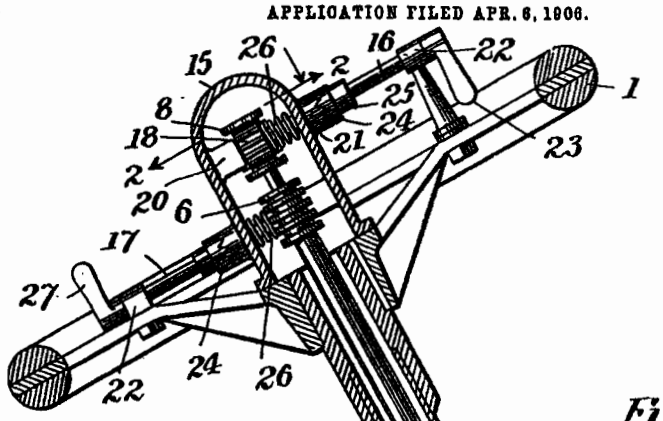


Fig. 1.

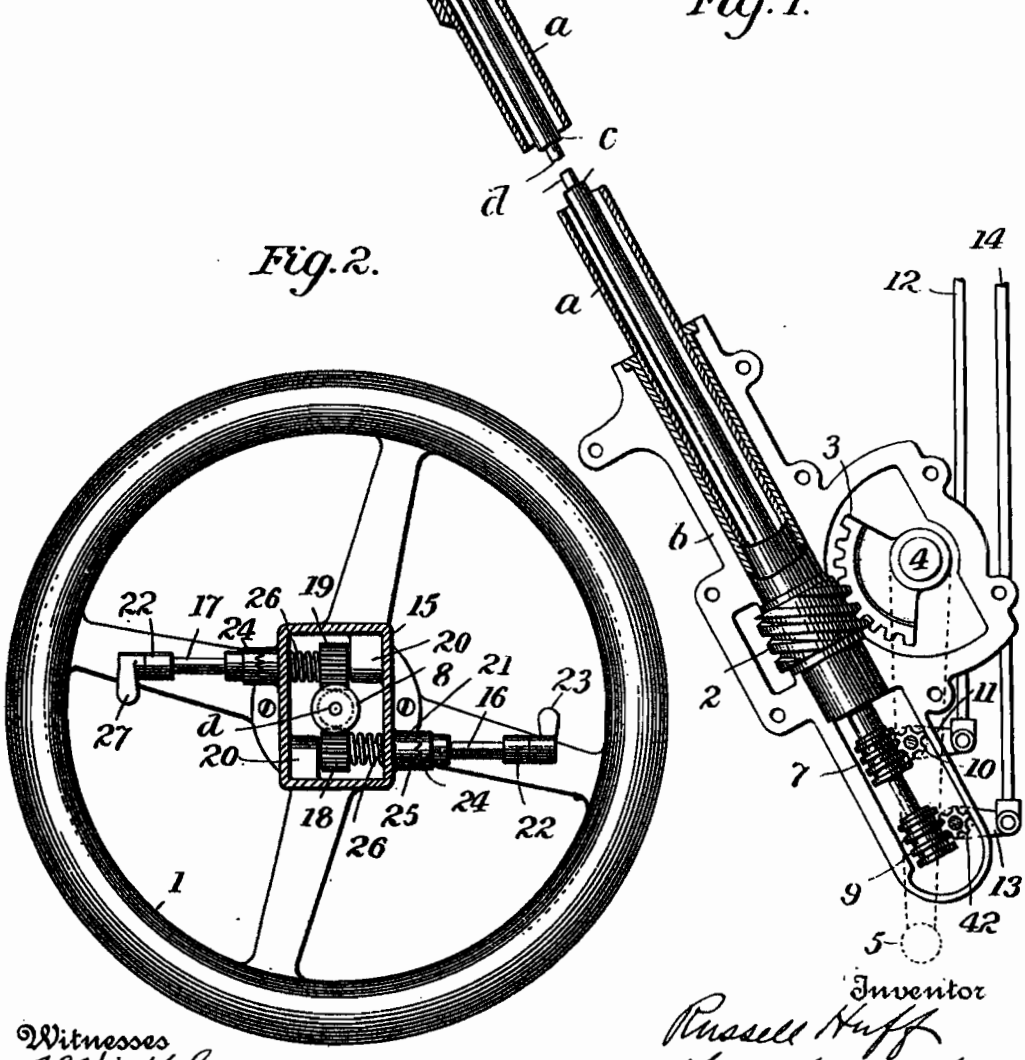


Fig. 2.

Witnesses
J. G. Stinkel
J. J. McCarthy.

Inventor
Russell Huff
by Foster Freeman & Watson
Attorneys

No. 829,402. PATENTED AUG. 28, 1906.

R. HUFF.

STEERING GEAR AND MOTOR CONTROLLING MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED APR. 6, 1906.

2 SHEETS—SHEET 2.

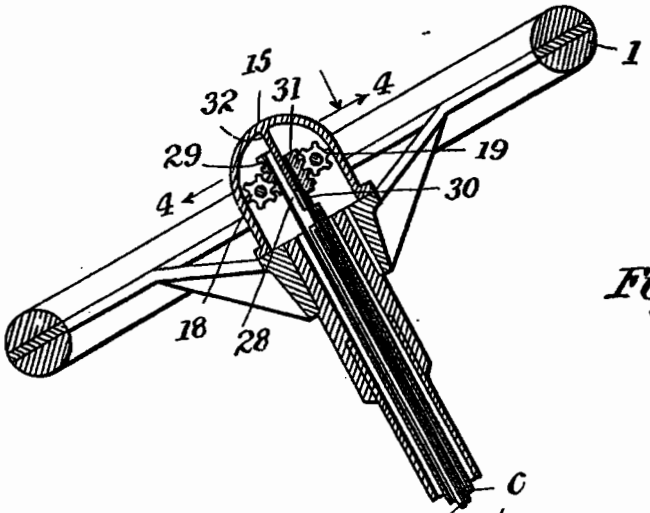


Fig. 3.

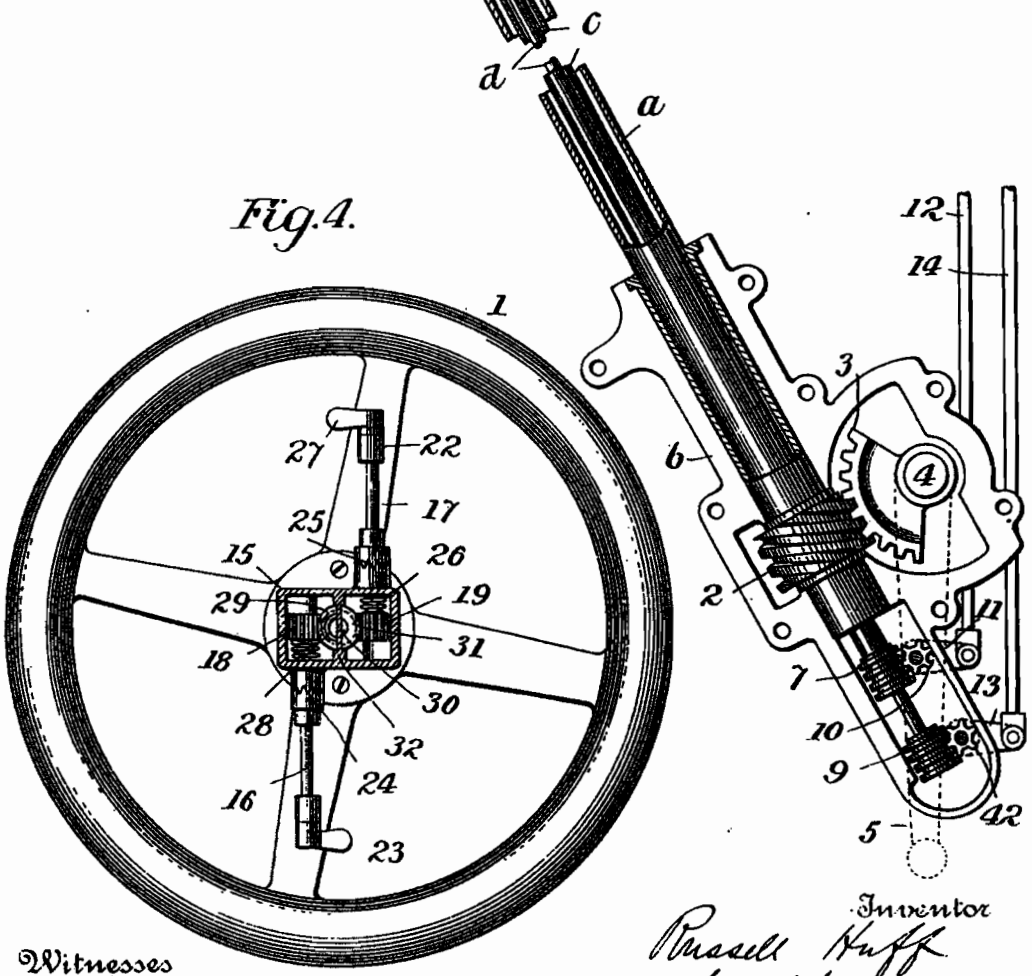


Fig. 4.

Witnesses
J. G. Stinkel
J. J. McCarthy.

Inventor
Russell Huff
By Foster Freeman Watson
Attorneys

775991 Nov 29, 1904

UNITED STATES PATENT OFFICE.

RUSSELL HUFF, OF DETROIT, MICHIGAN, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

STEERING-GEAR AND MOTOR-CONTROLLING MECHANISM FOR MOTOR-VEHICLES.

No. 829,402. Specification of Letters Patent. Patented Aug. 28, 1906.

Application filed April 6, 1906. Serial No. 310,303.

To all whom it may concern:

Be it known that I, RUSSELL HUFF, a citizen of the United States, and a resident of Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Steering-Gear and Motor-Controlling Mechanism for Motor-Vehicles, of which the following is a specification.

This invention comprises improvements in motor-control mechanism for motor-vehicles, and it relates more especially to improvements in that class of motor-control devices illustrated in the patent to Charles Schmidt, No. 775,991, dated November 29, 1904.

In the present invention the motor-controlling rods are preferably arranged within the tubular steering shaft or stem of the vehicle, and they both extend below the stem and are provided with circular racks. In the preferred form the upper ends are also provided with circular racks. Means for operating these rods are preferably mounted upon the wheel or handle of the steering shaft or stem.

In the accompanying drawings, Figure 1 is a vertical section through the steering-stem of a motor-vehicle, illustrating one form of the invention. Fig. 2 is a section on the line 2 2 of Fig. 1. Fig. 3 is a vertical section through a steering-stem, showing a modified arrangement of the upper racks, and Fig. 4 is a section on the line 4 4 of Fig. 3.

Referring to Figs. 1 and 2 of the drawings, *a* indicates the tubular steering-stem of a motor-vehicle, which is suitably supported at its lower end in a bearing *b*. A hand-wheel 1 is secured to the upper end of the stem, and a worm 2, secured to the stem at its lower end, engages a sector 3 on a shaft 4, the latter having a rocker-arm 5 thereon for communicating motion to the connecting-rods which guide the wheels.

Within the steering-stem is arranged a tubular motor-controlling rod *c*, having at its upper and lower ends cylindrical racks 6 and 7, respectively, and within the tubular rod *c* is arranged a longer motor-controlling rod *d*, having similar cylindrical racks 8 and 9 at its upper and lower ends, respectively. The cylindrical rack 7 at the lower end of the motor-controlling rod *c* engages a spur-pinion 10, which when the rod is moved longitudinally actuates an arm 11 and suitable connections 12 for adjusting either the throttle or the spark mechanism of the motor. The circular rack 9 upon the motor-controlling rod *d* similarly engages a spur-pinion 42, which when the rod is moved longitudinally operates a lever 13 and suitable connections 14 for adjusting the spark mechanism or the throttle mechanism of the motor. It will be understood that if the arm 13 is connected to the throttle mechanism the arm 11 will be connected to the spark mechanism, and vice versa.

As the rods *c* and *d* and the racks 7 and 9 are concentric with the axis of the steering-stem, it will be evident that any rotary movement of the stem or of the rods will not affect the adjustment of the motor-controlling mechanism nor cause the parts to bind.

A housing 15, secured to the hub of the steering-wheel, extends over the ends of the rods *c* and *d*, as shown, and rock-shafts 16 and 17, arranged parallel with the plane of the wheel-rim, extend in to the housing at opposite sides of the rods *c* and *d*, and these shafts are provided with spur-pinions 18 and 19, which engage the cylindrical racks 8 and 6, respectively. As shown, the rock-shaft 16 is journaled in bearings 20 and 21 at opposite sides of the housing 15 and also in a bearing 22, secured to the hand-wheel. A finger-piece 23 projects at right angles to the shaft at its outer end, so that the shaft may be readily turned by applying pressure to said finger-piece; but the shaft is prevented from accidental rotation and is held in any desired position of adjustment by means of a collar 24, secured to the shaft 16 and having a notched face 25, which is held in engagement with a similarly-notched face on the bearing 21 by a spring 26, interposed between the pinion 18 and one wall of the housing 15. The shaft 17, as shown, is arranged in substantially the same way as the shaft 16, although closer to the hand-wheel, and its finger-piece 27 projects upwardly, while the finger-piece 23 on the shaft 16 projects downwardly.

It will be readily seen that any movement of the finger-piece 23 or 27 will cause a corresponding upward or downward movement of the controlling-rods *d* or *c* and an adjustment of the corresponding motor-controlling device. In the form of device shown in Figs. 1 and 2, as the rods have cylindrical racks at both ends, the rods may turn with the steer-

ing-stem, or the steering-stem may turn without causing rotation of the rods; but in any event the rotation of the stem will not effect the longitudinal adjustment of the rods, and therefore will not affect the adjustment of the spark or throttle controlling devices.

Instead of providing cylindrical racks at the upper ends of the controlling-rods, so that the rods may turn relatively to the pinions upon the adjusting-shafts 16 and 17, the rods may be made to turn with the hand-wheel and steering-stem, and the racks at the upper ends of the rods may be rectangular or any other suitable form in cross-section.

In Figs. 3 and 4 the upper portion of the tubular controlling-rod *c* is cut away, leaving a semicylindrical part 28, to which is secured a semicylindrical rack 29. Similarly the central rod *d* has a part cut away at its upper end, leaving a stem 30, upon which is arranged a rack 31. In order to prevent the rods from turning, the housing 15ª is provided with a central partition 32, which extends down between the parts 28 and 30 of the rods and forms a bearing which guides the rods. The racks are held between the pinions 18 and 19 and the partition, and it will be evident that when the hand-wheel and steering-stem are turned the controlling-rods will also turn; but by reason of the circular racks at the lower ends of the rods the motor-controlling mechanism will not be affected by the turning of the rods or the stem. The racks 29 and 31 may obviously be rectangular in cross-section instead of semicircular, as shown, since these racks do not in this form of invention turn relatively to their engaging pinions.

What I claim is—

1. In a motor-vehicle, motor-controlling devices comprising a pair of parallel rods mounted in a suitable support and adapted to be reciprocated, laterally-extending shafts having geared connections with the upper ends of said rods, circular racks connected to the lower ends of said rods, pinions meshing with said circular racks, and connections from said pinions extending to the motor mechanism.

2. In a motor-vehicle, the combination with a suitable support, of two concentric rods, laterally-extending shafts geared to said rods and adapted to reciprocate the same, circular racks upon the lower ends of said rods, and pinions meshing with said racks, for the purpose set forth.

3. In a motor-vehicle, the combination with a suitable support, of motor-control devices comprising two concentric rods, circular racks upon the upper ends of said rods, laterally-extending shafts having pinions meshing with said racks, circular racks at the lower ends of said rods, and pinions meshing with said latter racks, for the purpose set forth.

4. In a motor-vehicle, in combination, a steering shaft or stem, two longitudinally-movable motor-controlling rods, each having a rack at its upper end, and an adjusting-shaft for each rod, each shaft having a toothed member engaging one of said racks.

5. In a motor-vehicle, in combination, a steering shaft or stem, two longitudinally-movable motor-controlling rods, each having a concentric rack at its upper end and an adjusting-shaft for each rod, each shaft having a toothed member engaging one of said racks.

6. In a motor-vehicle, in combination, a steering shaft or stem, two motor-controlling rods, each rod having a concentric rack at its lower end, and means for adjusting each rod longitudinally with respect to the stem.

7. In a motor-vehicle, in combination, a steering shaft or stem, two motor-controlling rods arranged within the stem, each rod having a concentric rack at its lower end and a rack at its upper end, and an adjusting-shaft for each rod, each shaft having a toothed member engaging the upper rack on the rod.

8. In a motor-vehicle, in combination, a steering shaft or stem, two motor-controlling rods arranged within the stem, each rod having a concentric rack at its lower end and a concentric rack at its upper end, and an adjusting-shaft for each rod, each shaft having a toothed member engaging the upper rack on the rod.

9. In a motor-vehicle, in combination, a steering shaft or stem, two adjusting-shafts journaled transversely at the upper end of the stem, two motor-controlling rods movable longitudinally with respect to the stem and connections between said shafts and rods whereby the rocking of the shafts will cause longitudinal movement of the rods.

10. In a motor-vehicle, in combination, a steering shaft or stem, a housing at the upper end of the stem, two adjusting-shafts journaled transversely in said housing, each shaft having a toothed member thereon, and two motor-controlling rods longitudinally movable with respect to the stem, each rod having a rack engaging the toothed member on one of said shafts.

11. In a motor-vehicle, in combination, a steering shaft or stem, a housing at the upper end of the stem, two adjusting-shafts journaled transversely in said housing, each shaft having a toothed member thereon, and two motor-controlling rods longitudinally movable with respect to the stem and each rod having a concentric rack engaging the toothed member on one of said shafts.

In testimony whereof I affix my signature in presence of two witnesses.

RUSSELL HUFF.

Witnesses:
F. E. PAINE, Jr.,
VINCENT LINK.

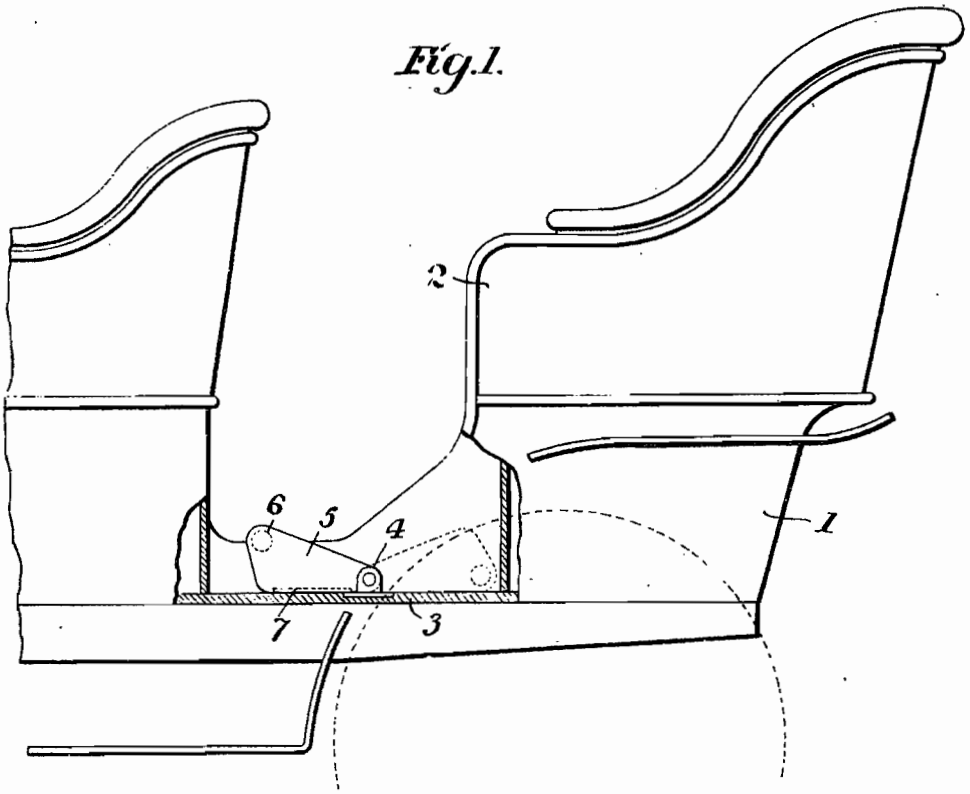
R. HUFF.

FOOT REST FOR MOTOR VEHICLES.

APPLICATION FILED APR. 16, 1908.

961,860. Patented June 21, 1910

Fig. 1.



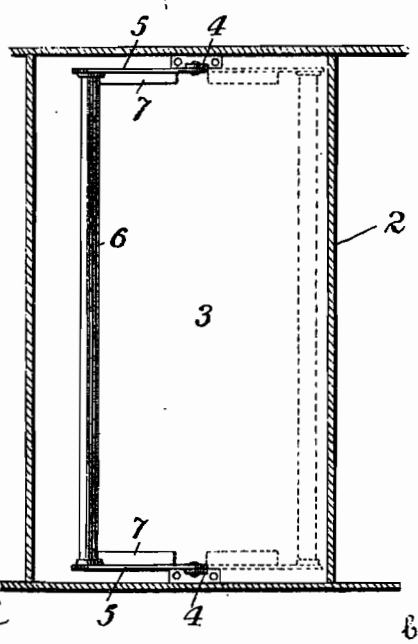


Fig. 2.

Witnesses
J. G. Stinkel
B. C. Rust

Inventor
Russell Huff
by Foster Freeman Watson
Attorneys

UNITED STATES PATENT OFFICE.

RUSSELL HUFF, OF DETROIT, MICHIGAN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

FOOT-REST FOR MOTOR-VEHICLES.

961,860. Specification of Letters Patent. Patented June 21, 1910.

Application filed April 16, 1906. Serial No. 312,028.

To all whom it may concern:

Be it known that I, RUSSELL HUFF, a citizen of the United States, and resident of Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Foot-Rests for Motor-Vehicles, of which the following is a specification.

This invention relates to a foot rest for motor vehicles which is adjustable so that it may be put into operative position when needed and folded out of the way when not needed, although at all times securely connected to the vehicle so that it cannot be lost or mislaid.

The invention is illustrated in the accompanying drawing, in which,

Figure 1 is a side view of a motor vehicle showing my improved foot rest in operative position in full lines and in its inoperative position in dotted lines; and Fig. 2 is a plan view of the foot rest.

It is found that the occupants of a motor vehicle do not need a foot rest, other than the floor of the vehicle, when the vehicle is running at an ordinary rate upon smooth roads. When running at a high speed or upon rough roads, however, it is very desirable to have a foot rest against which the feet can be firmly braced.

The present invention comprises a foot rest which is permanently connected with the vehicle and which can be moved from operative position into a position in which it does not interfere with the feet of the rider. The foot rest is pivotally connected with the car and adapted to be moved back close to the seat.

Referring to the drawing, 1 indicates the frame of the vehicle and 2 one of the seats. Upon the floor 3 at opposite sides of the vehicle are brackets 4 to which are pivotally connected a pair of arms 5. The outer or free ends of these arms are connected by a rod or bar 6 which forms the foot rest proper. Arms 5 are preferably triangular plates adapted when resting on the floor to hold the foot rest at some distance above the floor and they may be provided with flanges 7 which serve to stiffen them and also form "feet" upon which the arms rest. When the foot rest is in its operative position, as shown in full lines in Fig. 1, the bar 6 is supported at some distance above the floor of the vehicle. When the occupant of the vehicle desires to rest his feet upon the floor, which is the more comfortable position in ordinary smooth riding, the foot rest is folded back into the position shown in dotted lines in Fig. 1, in which the bar 6 is close to the floor and close to the front of the seat, being thus entirely out of the way of the person sitting on the seat. This is accomplished by making the arms substantially equal in length to the horizontal distance between the seat and the brackets, or in other words, locating the brackets at a distance from the seat substantially equal to the length of the arms.

Having described my invention what I claim and desire to secure by Letters Patent is,

In a motor vehicle, the combination with the seat, of brackets connected with the frame of the vehicle forward of the seat, arms pivotally connected with the brackets, and a foot rest connected with and extending between the arms, said arms and foot rest being movable relatively to the seat into operative and inoperative position, the horizontal distance from the seat to the brackets being substantially equal to the length of the arms, whereby the rest may be brought close to the seat when in inoperative position, for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

RUSSELL HUFF.

Witnesses:
MARK C. TAYLOR,
F. E. PAINE, Jr.

J. W. PACKARD.

MOTOR CONTROLLING MECHANISM FOR MOTOR VEHICLES.

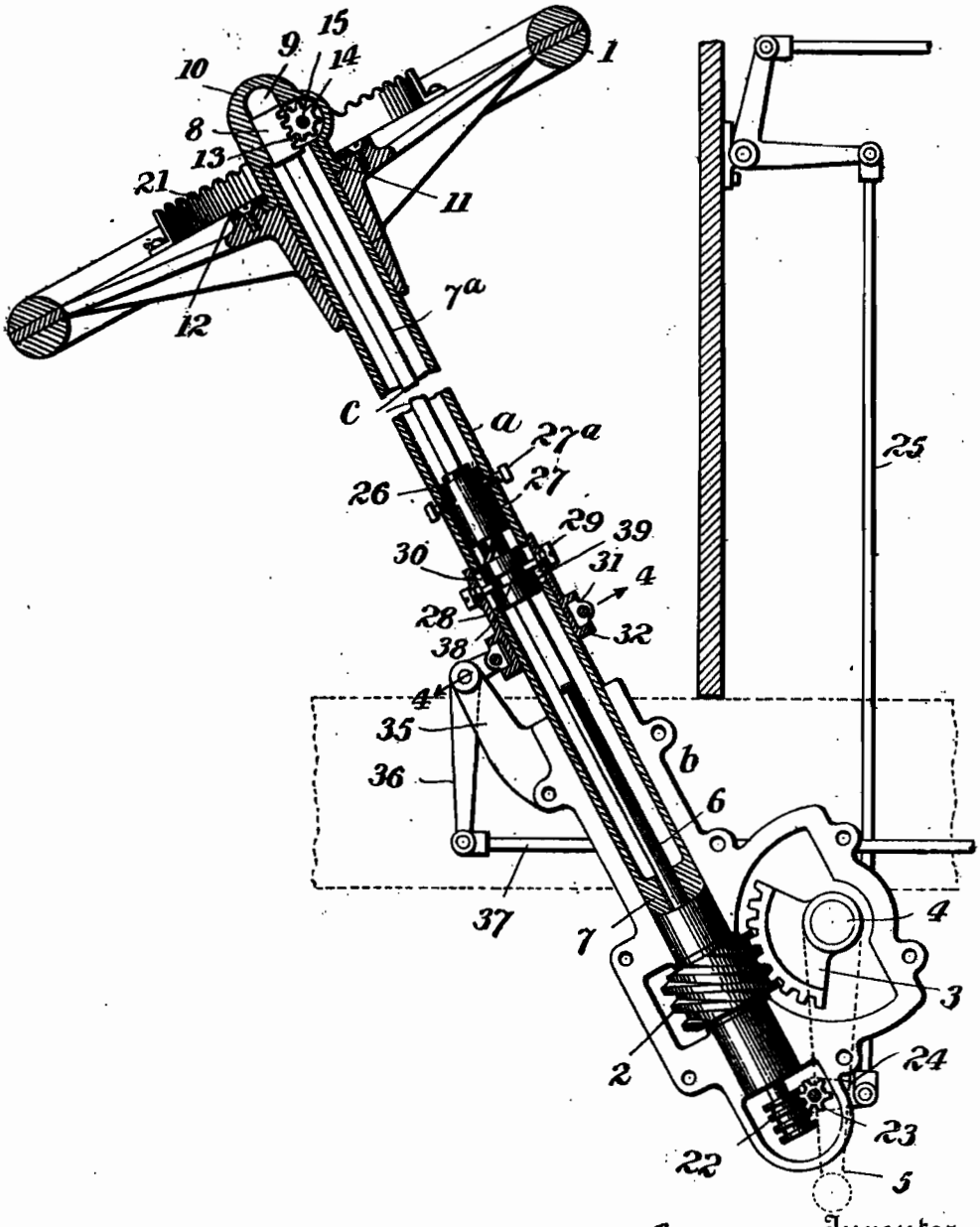
APPLICATION FILED APR. 20, 1906.

1,022,751.

Patented Apr. 9, 1912.

2 SHEETS—SHEET 1.

Fig. 1



Witnesses

J. G. Strubel

F. J. McCarthy.

Inventor

by J. W. Packard

Foster Freeman Watson

Attorneys

J. W. PACKARD.

MOTOR CONTROLLING MECHANISM FOR MOTOR VEHICLES.

APPLICATION FILED APR. 20, 1906.

1,022,751.

Patented Apr. 9, 1912.

2 SHEETS—SHEET 2.

Fig. 2.

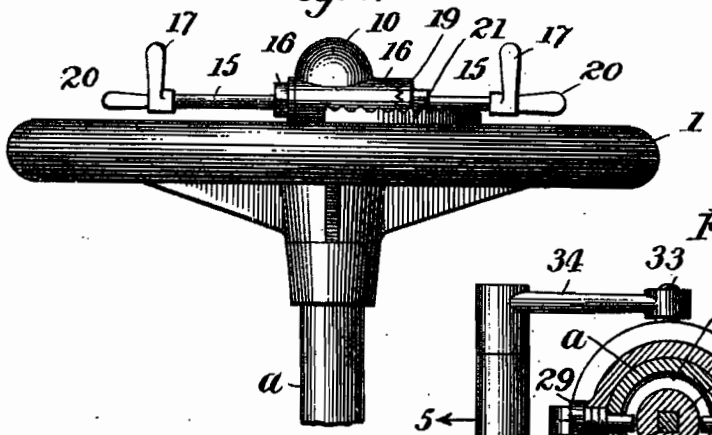


Fig. 4.

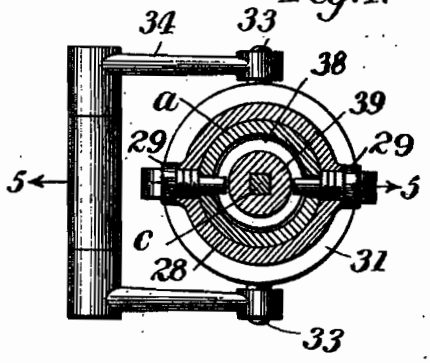


Fig. 3.

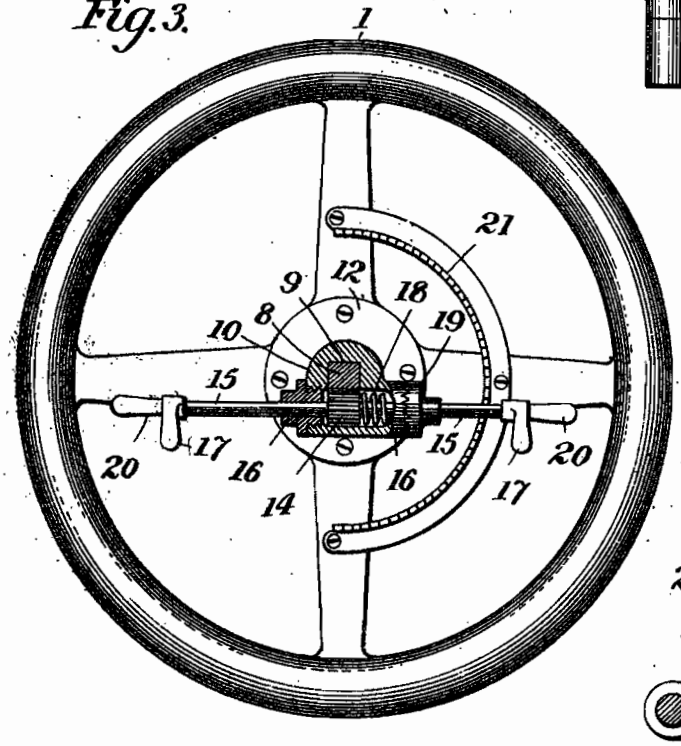
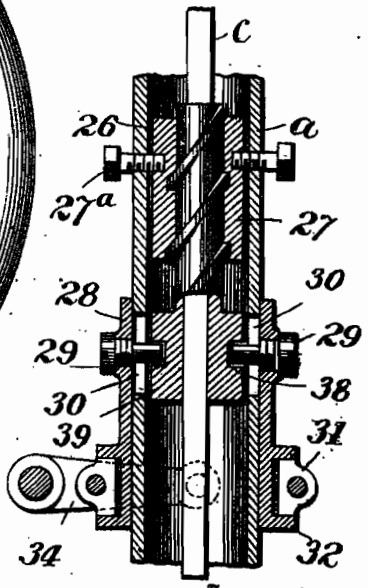


Fig. 5.



Witnesses

J. Gotthelf

J. J. McCarthy.

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Attorneys

UNITED STATES PATENT OFFICE.

JAMES W. PACKARD, OF LAKEWOOD, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

MOTOR-CONTROLLING MECHANISM FOR MOTOR-VEHICLES.

1,022,751. Specification of Letters Patent. Patented Apr. 9, 1912.

Application filed April 20, 1906. Serial No. 312,823.

To all whom it may concern:

Be it known that I, JAMES W. PACKARD, a citizen of the United States, and residing at Lakewood, in the county of Chautauqua and State of New York, have invented certain new and useful Improvements in Motor-Controlling Mechanism for Motor-Vehicles, of which the following is a specification.

This invention comprises improvements in motor controlling mechanism for motor vehicles of the kind illustrated in the patent to Charles Schmidt #775,991. In the invention shown in said patent two rods are arranged within the tubular steering stem of a motor vehicle, and these rods are independently adjustable, longitudinally, with respect to the stem, in order to independently adjust the spark and throttle mechanism of the motor. In the present invention the two adjustments of the motor controlling mechanism are effected by the oscillatory and reciprocatory movements of a single rod, and these movements are effected by a single hand lever arranged to rotate about its own axis and to swing about the axis of the rod and steering stem.

In the accompanying drawing, which illustrates my invention—Figure 1 is a vertical section through the steering stem, the lower end of the stem being shown in side view; Fig. 2 is a side view of the hand wheel or steering wheel, looking from the right in Fig. 1; Fig. 3 is a top plan view of the hand wheel, the head which guides the motor controlling rod and supports the adjusting shaft or lever being shown in transverse section on the line of said lever; Fig. 4 is a section through the steering stem on the line 4—4 of Fig. 1, and Fig. 5 is a section through the steering stem on the line 5—5 of Fig. 4.

Referring to the drawing, *a* indicates a tubular steering stem of a motor vehicle suitably supported at its lower end in a bearing *b*. A hand wheel 1 is secured to the upper end of the stem and a worm 2, secured to the stem at its lower end, engages a sector 3, on a shaft 4, the latter having a lever 5 thereon for connection to the steering wheels. Within the hollow steering stem *a* is arranged a motor controlling rod *c*. The lower portion 6 of this rod is round in cross section and is rotatable within a bearing 7 in the lower end of the steering stem. The upper portion 7^a of the rod is preferably angular in cross section, as shown, and a guide block 8 at the upper end of the rod fits within a guide groove or socket 9 in the head or cap 10 which fits over the upper end of the steering stem and is rotatable with respect to the stem. The guide block or portion 8 at the upper end of the motor controlling rod and the socket 9 in which it is arranged, are both, as shown, angular in cross section, or of some form other than round in cross section, so that the rotation of the head will cause the rotation of the rod, but the rod may move longitudinally within the socket in the rotatable head. As shown in the drawing, the rotatable head 10 has at its lower end an annular flange 11, and a collar or clamping ring 12 fits over the flange and is secured to the hand wheel 1. This collar holds the head in position concentric with the steering stem but permits the head to rotate with respect to the wheel and stem.

Upon the guiding portion 8 of the motor controlling rod is arranged a rack 13 which meshes with a spur pinion 14 upon an adjusting shaft or lever 15 which is arranged at right angles to the steering stem and controlling rod in bearings 16 in the rotatable head 10. As shown in the drawing, this adjusting shaft or oscillatory lever extends to a suitable distance beyond each of the bearings 16 and finger pieces or hand grips 17 project laterally from the lever at convenient points where they may be moved by the operator without necessitating the removal of the hand from the steering wheel. It will be seen that by pressing either of the finger pieces or hand grips 17 in one direction, the motor controlling rod *c* will be raised and the movement of the finger pieces or hand grips 17 in the opposite direction will cause a reverse movement of the rod. A spring 18, surrounding the shaft or lever 15 between the pinion 14 and one of its bearings 16, holds a notched collar 19 yieldingly against a similarly notched surface on the bearing, so that while the shaft or lever 15 may be rotated about its axis by applying pressure to the finger-pieces or hand grips 17, yet the lever will be held against accidental rotation on its axis and the motor controlling rod will be held in any position of longitudinal adjustment within the steering stem by the engagement of the collar

19 with the notched end of the adjacent bearing 16.

Finger pieces or handles 20 are arranged at the ends of the lever by means of which the operator may conveniently swing the lever and the rotatable head about the axis of the steering stem *a*. This movement of the adjusting lever parallel with the plane of the rim of the hand wheel causes the rotation of the motor controlling rod *c* with respect to the steering stem and hand wheel, by reason of the engagement of the angular or guiding portion 8 of the rod with the socket 9 in the rotatable head. A segmental rack 21, secured to the hand wheel, engages the lever 15 and holds the latter in any position of angular adjustment with respect to the wheel.

From the foregoing it will be clear that to effect a longitudinal adjustment of the motor controlling rod with respect to the steering stem, the adjusting lever 15 is rotated about its own axis by means of the finger pieces or hand grips 17, and in order to rotate the motor controlling rod with respect to the steering stem the adjusting lever 15 is swung about the axis of the steering stem and the rod. A single adjusting lever accomplishes both movements of the controlling rod and the operator may use either or both hands to accomplish these adjustments, as may be convenient or desirable.

At the lower end of the motor controlling rod *c* is secured a circular rack 22 which engages a pinion 23 which, when the controlling rod *c* is moved longitudinally, actuates an arm 24 and suitable connections 25 for adjusting either the throttle or the spark mechanism of the motor. The circular rack 22 permits the rod *c* and steering stem to turn without, in any way, binding upon the rod or affecting its adjustment. Preferably the longitudinal movement of the rod is utilized for adjusting the throttle mechanism, while the rotary movement of the rod with respect to the steering stem, is utilized to adjust the spark mechanism. As shown in the drawing, a worm 26 having steeply pitched threads, is arranged upon the angular portion of the controlling rod *c*, or loosely splined thereon, so that it will turn therewith, and yet permit the rod to move longitudinally through the worm. This worm engages a nut 27 arranged within the steering stem and surrounding the worm 26. The nut 27 is secured against movement within the stem by suitable means, such as the set screws 27^a. A sleeve 28 surrounds the steering stem and is connected to the worm 26 by pins 29 which are secured to the sleeve 28 and extend through longitudinal guide slots 30 in the stem into an annular recess 38 in a boss or collar 39 on the lower end of the worm. It will be readily seen that any rotary movement given to the controlling rod *c* by the movement of the adjusting lever 15 about the axis of the steering stem will cause the worm 26 to turn in the fixed nut 27, and thereby cause the collar 39 and sleeve 28 to move upward or downward. A collar 31 is fitted into a suitable annular recess or bearing 32 on the sleeve, and trunnions 33, projecting from the collar, are engaged by the arms 34 of a yoke which is pivoted upon a bracket 35 secured to the bearing *b*. An arm 36 upon this yoke is connected by suitable connecting means 37 to either the spark controlling mechanism or the throttle mechanism (not shown) of the motor. It will be understood, of course, that if the connection 37 extends to the spark mechanism the connection 25 will extend to the throttle mechanism, and vice versa.

From the foregoing description, the operation of the invention will be clear without further extended explanation.

What I claim is—

1. The combination of a hollow steering stem provided with a hand wheel, of a motor controlling rod arranged within the stem, means actuated by turning said rod, means actuated by reciprocating said rod, a hand lever for turning the rod extending at right angles to the stem adjacent to the wheel, and connections between said hand lever and said rod comprising a rack and pinion for reciprocating the rod.

2. The combination of a steering stem, a motor controlling rod within the stem, said rod having a rack at its upper end, a head rotatably mounted at the upper end of the stem and having a guide-way permitting longitudinal movement of the rod but preventing its rotation within the head, and an adjusting lever journaled transversely in the head and having a pinion engaging said rack.

3. The combination of a steering stem, a motor controlling rod within the stem, a cylindrical rack at the lower end of the stem, devices movable by the rack for operating one motor-controlling mechanism, a nut fixed within the stem, a worm loosely splined on the rod and engaging the nut, devices movable by the worm for operating another motor-controlling mechanism, and means for adjusting said rod longitudinally and angularly with respect to the stem.

4. The combination of a steering stem, a hand wheel secured thereto, a head rotatable with respect to the stem and hand wheel, a motor-controlling rod movable longitudinally with respect to the head and rotatable therewith, means actuated by turning said rod, means actuated by reciprocating said rod, a lever journaled transversely in the head for turning the latter and having means connected therewith for raising and lowering the rod, said lever projecting at

each side of the head and having finger-pieces for rotating it about its axis.

5. The combination of a steering stem, a hand wheel secured thereto, a head rotatable with respect to the stem and hand wheel, a motor-controlling rod movable longitudinally with respect to the head and rotatable therewith, said rod having a rack at its upper end, means actuated by turning said rod, means actuated by reciprocating said rod, a lever journaled transversely in the head for turning the latter, a pinion upon said lever engaging said rack, means for holding said head against rotation, and means for holding said lever against rotation about its axis.

6. The combination of a hollow steering stem, a wheel mounted thereon, a rod movable longitudinally relative to the stem to operate one of the motor controlling means and rotatable about its axis to operate another motor controlling means, a hand lever rotatable about its own axis to reciprocate the rod and rotatable about the axis of the stem to rotate the rod, means on the wheel for locking the hand lever against movement about the stem, and means on the hand lever for locking it against rotation about its own axis.

7. The combination of a hollow steering stem, a hollow head, a flange connecting said head rotatably with said stem, a rod movable relatively to said stem and head to operate one motor controlling means, and rotatable about its axis with said head to operate another motor controlling means, a hand lever journaled in said head and adapted to rotate said head and rod, and a toothed connection between said hand lever and rod and mounted in said head, whereby a rotary movement of said hand lever about its own axis will reciprocate said rod.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES W. PACKARD.

Witnesses:

RUSSELL HUFF,

F. E. PAINE, Jr.

No. 891,803. PATENTED JUNE 23, 1908.

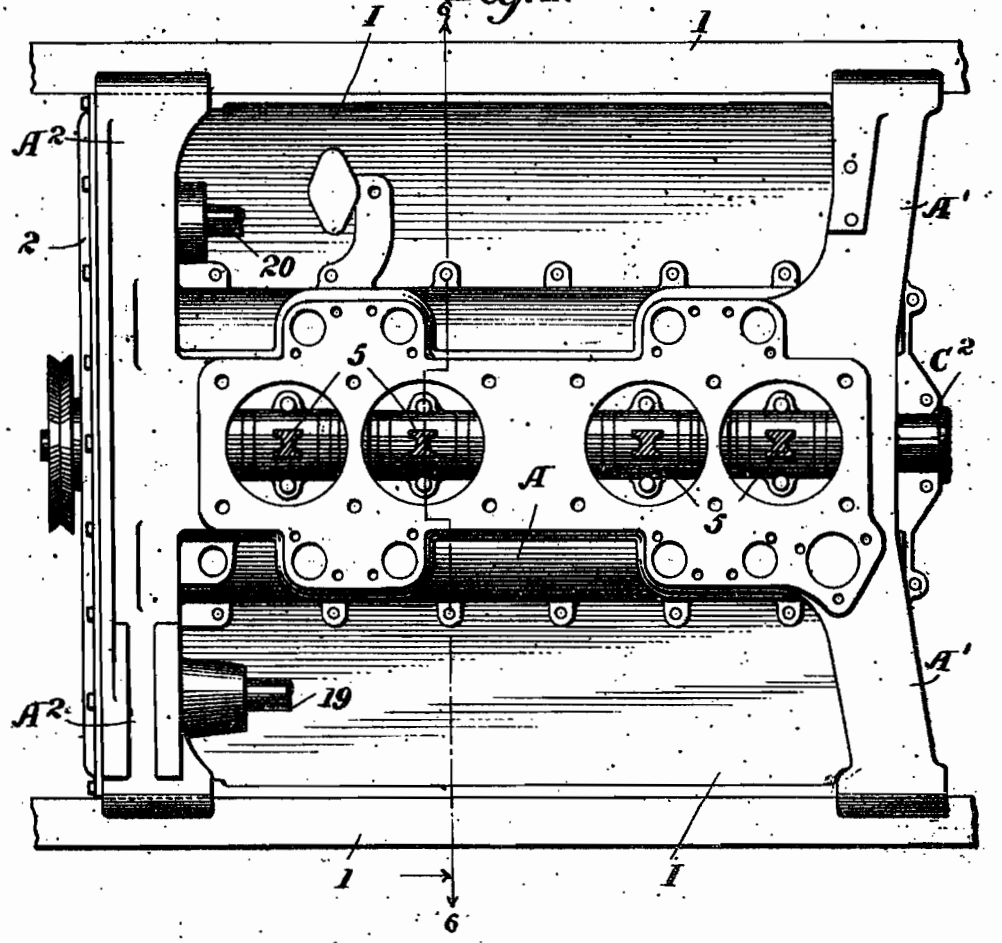
H. B. JOY.

BASE AND CRANK CASE FOR HYDROCARBON ENGINES.

APPLICATION FILED MAY 21, 1906.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses
H. G. Sinkel
F. J. McCarthy.

Inventor
by Henry B. Joy.
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Attorneys

No. 891,803. PATENTED JUNE 23, 1908.

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BASE AND CRANK CASE FOR HYDROCARBON ENGINES.

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3 SHEETS—SHEET 2.

Fig. 2.

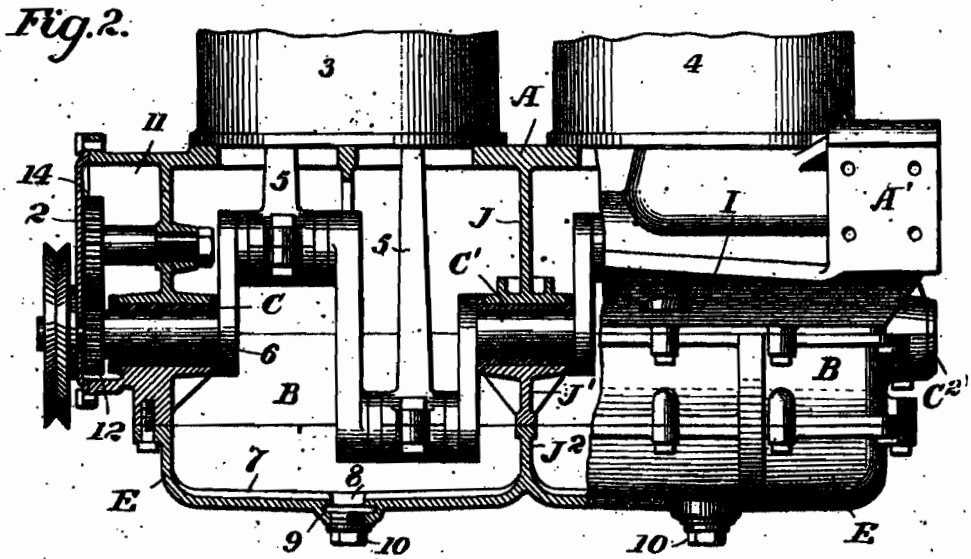


Fig. 3

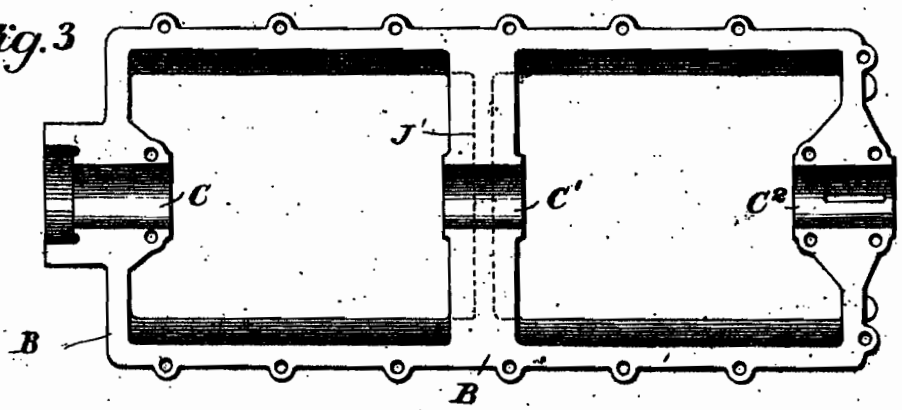
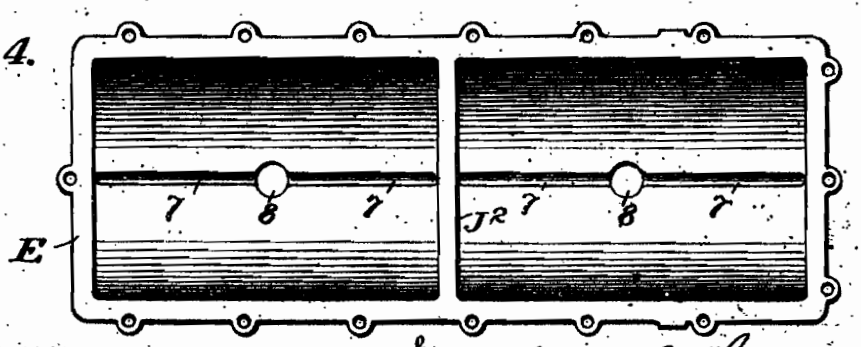


Fig. 4.



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No. 891,803. PATENTED JUNE 23, 1908.

H. B. JOY.

BASE AND CRANK CASE FOR HYDROCARBON ENGINES.

APPLICATION FILED MAY 21, 1906.

3 SHEETS—SHEET 3.

Fig. 5.

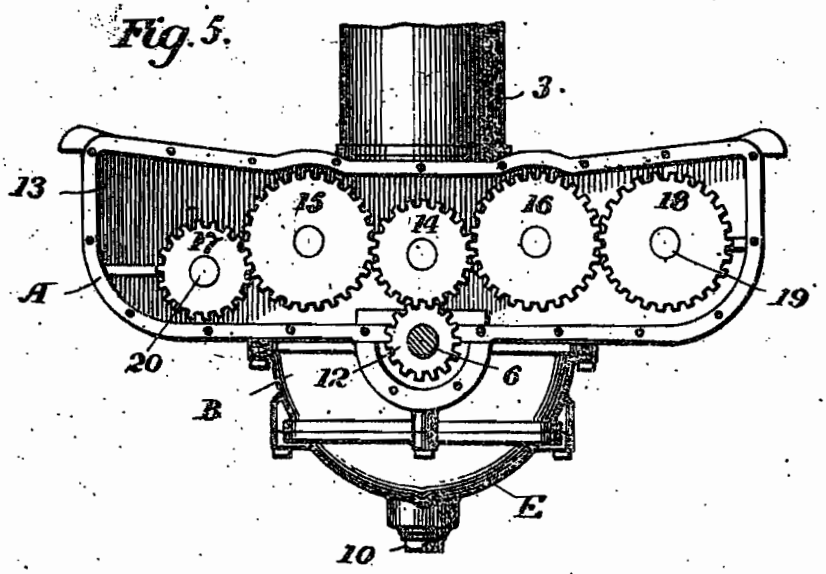
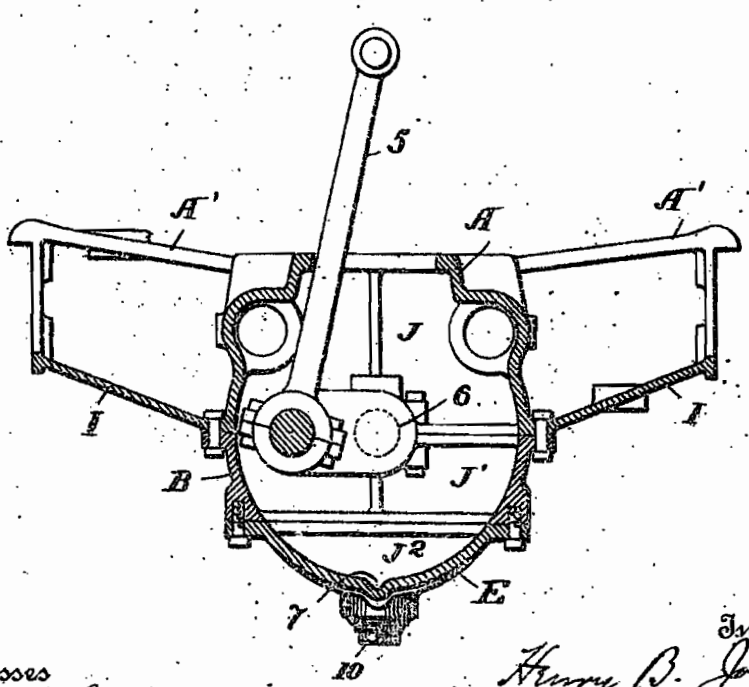


Fig. 6.



Witnesses
J. Stinkel
J. J. McCarthy

Inventor
Henry B. Joy
By Foster Freeman & Watson
Attorneys

UNITED STATES PATENT OFFICE.

HENRY B. JOY, OF DETROIT, MICHIGAN, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

BASE AND CRANK-CASE FOR HYDROCARBON-ENGINES.

No. 891,803. Specification of Letters Patent. Patented June 23, 1908.

Application filed May 21, 1906. Serial No. 318,055.

To all whom it may concern:

Be it known that I, HENRY B. JOY, a citizen of the United States, and resident of Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Bases and Crank-Cases for Hydrocarbon-Engines, of which the following is a specification.

This invention relates to various improvements in means for supporting and lubricating hydrocarbon engines and more particularly to the crank case and its various adjuncts.

The invention will be described in connection with the accompanying drawings, in which,

Figure 1 is a plan view of the engine base and crank case, the engine cylinders being removed; Fig. 2 is a side view of the same partly in section through the crank shaft bearings; Fig. 3 is a top plan view of the middle section of the crank case; Fig. 4 is a top plan view of the bottom section of the crank case; Fig. 5 is an end view, the cover or end plate of the gear case being removed; and Fig. 6 is a section on the line 6—6 of Fig. 1, the crank being shown in different position.

Referring to the drawings the upper section A of the crank case is provided at one end with opposite outwardly extending arms A′, the extremities of which rest upon the frame members 1, which, for instance, may be the side members of the frame of an automobile.

While my invention is primarily intended for use in automobiles, it is applicable to hydrocarbon engines for motor boats and other purposes and the frame members 1 may, for instance, be suitably connected to the frame of a motor boat. At the opposite end of the casing section A are hollow arms A^2, the outer ends of which are also adapted to rest on the frame members 1. There is a continuous compartment or chamber extending throughout the arms A^2 in which a series of gears, hereinafter referred to, are mounted, and this compartment or chamber is closed by means of a plate 2 fastened in position by suitable screws or bolts, as shown in Figs. 1 and 2.

Extending between the arms A′, A^2, on each side of the section A, and from the section A to the frame member 1, is a web or plate I forming a shield for preventing dust from blowing from beneath up into the engine compartment and for catching oil and dirt dropping from the machinery above. These shields are especially important in automobiles as dust shields.

According to my present invention the crank case section A, the arms A′, A^2, and the shields I, I, are preferably cast in one piece. The shields stiffen and strengthen the supporting arms and the gear case in addition to their function as shields. It will be noted that the side frame members, the section A, the supporting arms, and the shields I form the sides and bottom of the lower part of the housing within which the engine is located.

Beneath the casing section A is a second section B, the two having flanged meeting edges and being separably connected by suitable means, such as screws or bolts. Below the section B of the casing is a dish-shaped section E which covers the lower opening in the section B, the meeting edges of the sections B and E being also detachably connected by suitable means, such as screws or bolts.

The engine illustrated is of the four-cylinder type, two cylinders being contained in the casing 3 and two in the casing 4, as shown in Fig. 2. From the piston of each cylinder a pitman 5 extends down to the crank shaft 6. The crank shaft has three bearings, two of which, C, C^2, are located in the ends of the crank casing while the intermediate bearing C′ is supported by a vertical transverse partition through the middle of the crank casing. The upper section J of this partition is located in, and preferably integral with, the upper section A of the crank case; the intermediate section J′ of the partition is connected to and preferably integral with the middle section B of the crank case, while the lowest section J^2 is within and preferably integral with the bottom section E of the crank case. The three partition sections, J, J′, J^2 form a continuous partition separating the crank case into two distinct compartments and serving the double purpose of supporting the middle crank shaft bearing and preventing all of the lubricating oil from running to one end of the casing when the engine is inclined one way or the other, as when an automobile is going up or down hill. As will be observed in the drawing, one-half of each of the three crank shaft

bearings is formed in the upper casing section A and the other half in the intermediate section B, these sections being separable provide for easy insertion and removal of the crank shaft. When the lower section E of the case is removed, the crank shaft is fully exposed and accessible for cleaning and repairs. The lower section is filled or nearly filled with oil when the engine is in a normal running condition and the crank shaft bearings, the pistons and the pitmans are lubricated by the splashing of this oil as the shaft revolves rapidly.

In the bottom of each compartment E are grooves 7 leading downwardly to a sediment pocket 8 which is preferably undercut, as shown at 9, to prevent sediment from being washed out by splashing of the cranks. The grooves or gutters 7 are preferably parallel with the crank shaft and the cranks impart to the oil a movement across the grooves, the tendency of any sediment in the oil being to drop into the grooves and gradually work down into the sediment pockets 8. As often as may be necessary a plug 10 is unscrewed from the bottom of the pocket and the sediment is removed.

Within the compartment 11 inclosed by the hollow arms A^3 is a train of gears which are driven by a spur gear 12 on the crank shaft 6. The shafts of gears are supported in bearings in the end wall 13 of the crank case section A. The gear 14 is an idle gear. The gears 15 and 16 operate the cam shafts which control the engine valves while the gears 17 and 18 are respectively fixed on shafts 20, 19, (Figs. 1 and 5), which shafts supply power to operate auxiliary devices of the engine. The shaft 19 may, for instance, be used to drive a magneto to supply current for the igniting devices and the shaft 20 may be used to operate a pump to circulate the cooling water for the engine.

Having described my invention what I claim and desire to secure by Letters Patent is,

1. In an automobile, the combination with two side frame members, of a crank-case consisting of three longitudinally-separable sections, to wit, the section A having laterally-extended arms which are secured to said side frame members, a bottom dish-shaped section E, and an intermediate section B, the section A being formed with the upper half of the crank-shaft bearings, and section B with the lower half of said bearings.

2. A crank-case consisting of three longitudinally-separable sections, to wit, the upper section A which carries the upper half of the crank-shaft bearings and has an internal partition-piece J which carries the upper half of the middle crank-shaft bearing, and an intermediate section B which carries the lower half of the crank-shaft bearings and has an internal partition-piece J′ which carries the lower half of the middle bearing for the crank-shaft, which partition-pieces J and J′ divide the casing into independent chambers, and a lower dish-shaped section E removably secured to the lower edges of the section B and having a partition J^2.

3. In an automobile, the combination with two side frame members, of a crank-case consisting of three longitudinally-separable sections, to wit, the section A having laterally-extended arms which are secured to said side frame members, a bottom dish-shaped section E, and an intermediate section B, the section A being formed with the upper half of the crank-shaft bearings, and section B with the lower half of said bearings, and two dust-guard plates secured respectively to the side frame members and to the sides of the casing member B.

4. In an automobile, the combination with two side frame members, of a crank-case consisting of three longitudinally-separable sections, to wit, the section A having laterally-extended arms which are secured to said side frame members, a bottom dish-shaped section E, and an intermediate section B, the section A being formed with the upper half of the crank-shaft bearings, and section B with the lower half of said bearings, and a gear-case formed on one end of said crank-case, which gear-case is provided with a removable end cap.

5. A crank-case consisting of three longitudinally-separable sections, to wit, the section A having laterally-extended arms, a bottom dish-shaped section E, and an intermediate section B, the section A being formed with the upper half of the crank-shaft bearings, and section B with the lower half of said bearings.

6. A combined base and crank case for a hydrocarbon engine comprising an upper section, an intermediate section, and a lower section all detachably connected, each of said sections having an integral partition midway of its length, the said partitions forming a wall which divides the case into two compartments, the said case having bearings for the crank shaft in its end walls and in said partition wall.

7. The combination with a hydrocarbon engine, of a combined base and crank case comprising an upper section provided with laterally extending supporting arms, an inclosed gear case and a middle partition; an intermediate section provided with inclosed ends and a middle partition and a bottom dish-shaped section having a middle partition, the adjacent portions of the ends and partitions of the upper and middle sections being provided with bearings for the crank shaft of the engine.

8. The combination with a suitable frame and a hydrocarbon engine, of a crank case having arms directly supported by said frame, said arms being hollow and forming a

gear case, and a train of gears mounted in said gear case.

9. The combination with a suitable frame and a hydrocarbon engine, of a crank case provided with arms directly supported by said frame, said arms being hollow and open at one side and forming a gear case, a plate for closing the open side of said gear case, and a train of gears mounted within said gear case.

10. The combination with the side frame members 1 and with a hydrocarbon engine, of a combined engine base and crank case arranged between said side frame members and provided with supporting arms extending laterally from the engine base and resting on said frame members, one pair of said arms being hollow and forming a continuous gear case for a train of gears.

11. The combination with the supporting side frame members 1, of the intermediate sectional crank case, and the dust shields I extending from the crank case to said side supporting members.

12. The combination with the supporting frame members 1, of the crank case having lateral arms supported at their extremities upon said frame members, and the dust shields I extending between said arms and between the crank case and said frame members.

13. The combination with a hydrocarbon engine, of a sectional engine base and crank case, the upper section comprising as an integral structure a pair of laterally extending supporting arms on each side, and a dust shield on each side extending between the arms.

14. The combination with a hydrocarbon engine, of a sectional engine base and crank case, the upper section comprising as an integral structure a pair of laterally extending supporting arms on each side, and a dust shield on each side extending between the arms, two of said supporting arms being opposite and hollow and constituting a gear case.

15. In an automobile, the combination with the side frame members and with an engine, of a combined engine base and crank case arranged between said side frame members and having arms extending laterally and resting on the said frame members, one of said arms being hollow and forming a gear case for a train of gears.

16. In an automobile, the combination with a hydrocarbon engine, of a sectional engine base and crank case, the upper section comprising in an integral structure a pair of laterally extending supporting arms on each side, one of said supporting arms being hollow and constituting a gear case.

In testimony whereof I affix my signature in presence of two witnesses.

HENRY B. JOY.

Witnesses:
MARK C. TAYLOR,
LLEWELLYN W. CONKLING.

R. HUFF.

HYDROCARBON ENGINE IGNITION SYSTEM.

APPLICATION FILED JUNE 15, 1906.

973,507. Patented Oct. 25, 1910.

Fig. 1.

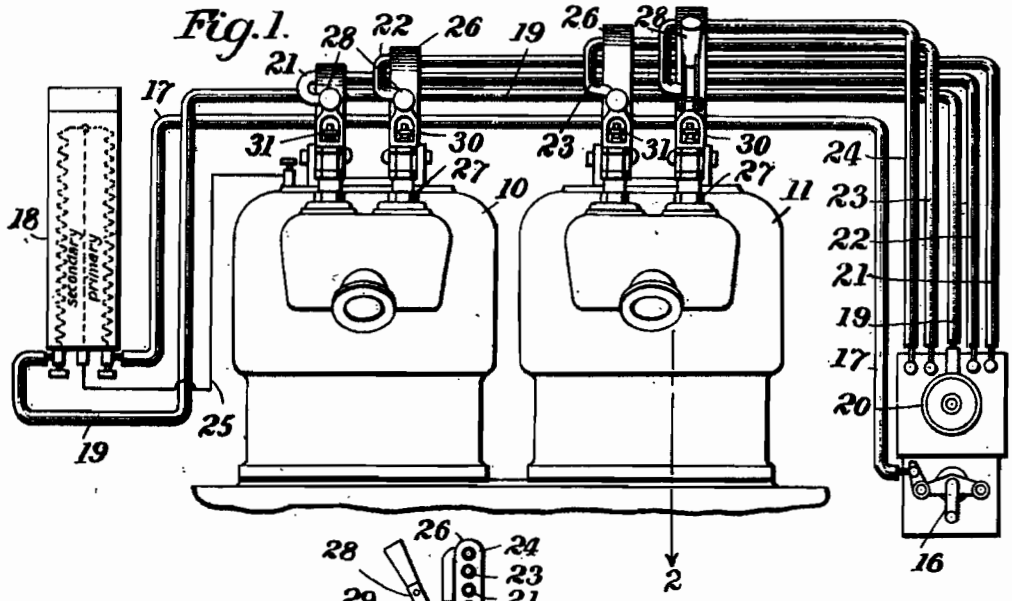


Fig. 2.

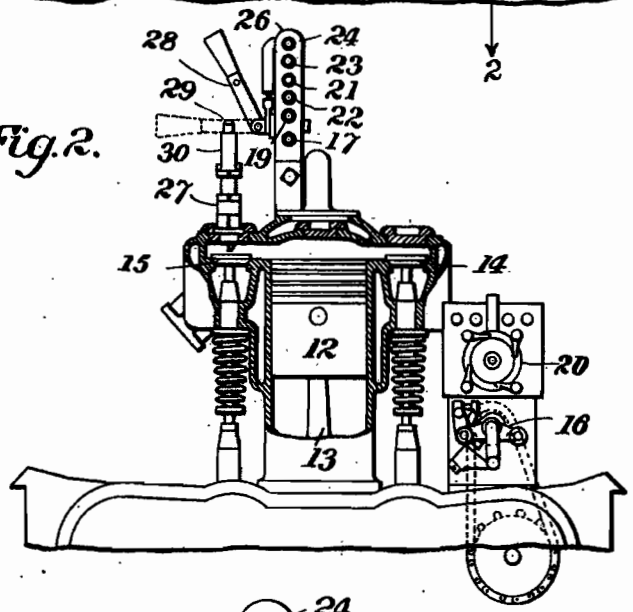
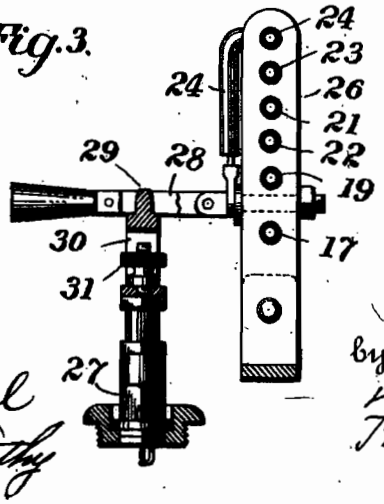


Fig. 3.



Witnesses

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J. J. McCarthy

Inventor

by Russell Huff

Foster Freeman & Watson

Attorneys

UNITED STATES PATENT OFFICE.

RUSSELL HUFF, OF DETROIT, MICHIGAN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

HYDROCARBON-ENGINE IGNITION SYSTEM.

973,507. Specification of Letters Patent. Patented Oct. 25, 1910.

Application filed June 15, 1906. Serial No. 321,936.

To all whom it may concern:

Be it known that I, RUSSELL HUFF, a citizen of the United States, and resident of Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Hydrocarbon-Engine Ignition Systems, of which the following is a specification.

This invention relates to improvements in the ignition apparatus of multiple cylinder hydrocarbon engines for motor vehicles.

The invention will be described in connection with the accompanying drawing, in which,

Figure 1 is a side elevation of the cylinders of a four-cylinder hydrocarbon engine showing the ignition system; Fig. 2 is a section on the line 2 of Fig. 1; and Fig. 3 is a detail.

Referring to the drawing 10, 11, indicate two cylinder casings each comprising a pair of cylinders of a four-cylinder hydrocarbon engine, 12 indicates one of the pistons, 13 a connecting rod, 14 an exhaust valve and 15 a mixture valve. A magneto 16 is suitably geared to the engine shaft and supplies the current for the ignition devices. The low tension current from the magneto passes through a conductor 17 to a coil or transformer in box 18. The high tension current from the transformer passes through a conductor 19 to a distributer 20 also driven by the engine, by means of which it is distributed to the several cylinders and the sparks properly timed. The current from the distributer passes to the cylinders through conductors 21 and 24 inclusive. The high and low tension circuits are completed through a ground wire 25 which connects the coil with the engine or other part of the machinery.

The conductors 17, 19 and 21 to 24 inclusive are supported by posts 26 of insulating material which are rigidly connected to the engine casings. These posts are set opposite the spark plugs 27 and upon each post is mounted a switch lever 28 which can be thrown into and out of contact with a contact 29 of the spark plug. This contact is in the form of a yoke 30 which is detachably connected to the spark plug by a thumb screw 31. The switch preferably has two blades and the part 29 is preferably cylindrical and enters between the blades, as illustrated in the drawings.

In a high tension ignition system it is important to have the conductors thoroughly insulated to prevent leakage. This is accomplished by mounting the conductors in the manner described and maintaining them separated. Another advantage obtained by this construction is that the inductive action of the high tension circuit for one cylinder upon the high tension circuit for another cylinder is reduced to a minimum or practically obviated so that a premature ignition by induction is prevented. I have found the arrangement above described to be very effective in this respect. In the operation of motor cars having multiple cylinder engines it is important to be able to locate trouble with the ignition system quickly, and by the apparatus above described I am enabled almost instantly to detect which conductor or spark plug is out of order when trouble occurs with any of them. Thus when there is a "miss" in any of the cylinders each cylinder is tested in turn by opening the switches of the other cylinders. Thus in a few moments each cylinder can be tested and the difficulty can be accurately located. By using the detachable yoke contacts upon the spark plugs I am able to replace a plug without discarding the contact and I am also able to use these yoke contacts with plugs of different design and manufacture.

Having described my invention what I claim is,

1. In a high tension ignition system for hydrocarbon engines for motor vehicles, the combination with a plurality of engine cylinders, of a spark plug on each cylinder, a post or support of insulating material adjacent to each spark plug, a switch carried by each support and arranged to coöperate with the spark plug, and a conductor leading to each switch, the said conductors being separately mounted upon said posts.

2. In a high tension ignition system for hydrocarbon engines for motor vehicles, the combination with a plurality of engine cylinders, of a spark plug on each cylinder, a detachable yoke 30 on each spark plug pro-

vided with a contact, a post or support of insulating material adjacent to each spark plug, a switch carried by each support and arranged to coöperate with said contact, and a conductor leading to each switch, the said conductors being separately mounted upon said posts.

3. In a high tension ignition system for hydrocarbon engines, the combination with a source of low tension current and a transformer for creating a high tension current, of a plurality of engine cylinders, a corresponding plurality of high tension conductors leading to the cylinders, a distributer for directing the current to said conductors successively, spark plugs on the cylinders, a post or support of insulating material upon each cylinder, and a switch carried by each post or support and coöperating with the spark plug of the corresponding cylinder, the said conductors being mounted upon said posts or supports.

4. In a high tension ignition system for hydrocarbon engines for motor vehicles, the combination with a plurality of engine cylinders, of a spark plug on each cylinder, supporting means consisting of insulating material adjacent each spark plug, switches carried by said supporting means and arranged to coöperate with the respective spark plugs, and high tension conductors mounted on said insulating supporting means, one of said conductors leading to each of said switches.

In testimony whereof I affix my signature in presence of two witnesses.

RUSSELL HUFF.

Witnesses:

HERBERT M. ALLISON,

MARK C. TAYLOR.

R. HUFF.

UNIVERSAL JOINT.

APPLICATION FILED JUNE 27, 1906.

1,015,267. Patented Jan. 16, 1912.

Fig. 1.

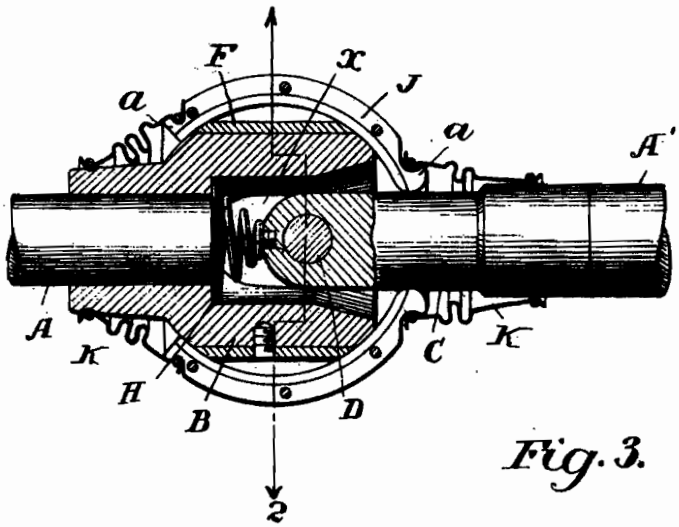


Fig. 2.

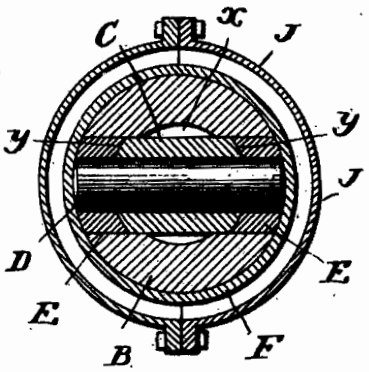


Fig. 3.

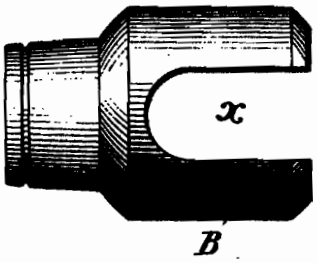
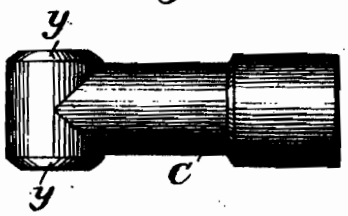


Fig. 4.



Witnesses
J. Epstinkel
J. J. McCarthy.

Inventor
Russell Huff
by Foster, Freeman & Watson
Attorneys

UNITED STATES PATENT OFFICE.

RUSSELL HUFF, OF DETROIT, MICHIGAN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

UNIVERSAL JOINT.

1,015,267. Specification of Letters Patent. Patented Jan. 16, 1912.

Application filed June 27, 1906. Serial No. 323,604.

To all whom it may concern:

Be it known that I, RUSSELL HUFF, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Universal Joints, of which the following is a specification.

My invention relates to universal joints, and consists of a joint so constructed as to permit a certain amount of end play of the shaft sections connected by the joints, in means for excluding dust and grit and maintaining the lubricant in contact with the joint, as fully set forth hereinafter and as illustrated in the accompanying drawing, in which,—

Figure 1 is a longitudinal section showing my improved joint as applied to two sections of a shaft; Fig. 2 is a transverse section on the line 2, Fig. 1; Fig. 3 is an outside view of one member of the joint; and Fig. 4 an outside view of the other member of the joint.

The two members B, C are adapted for attachment to the sections A, A′ of the shaft, the outer member B being keyed or otherwise secured to the section A, and the inner member C being socketed at one end to receive the end of the section A′, to which it is firmly attached. The member B has a central recess *x* adapted to receive the end of the member C, being preferably widened or expanded at the outer end to permit the member C to be brought at an angle to the member B within said recess, and at opposite sides of the recess *x* the member B is slotted, the said slots, as shown best in Fig. 3, extending to the outer end of the member B, although this is not essential, and into said slots extend the ends of a pin D which is seated transversely in the end of the member C. The ends of this pin may fit the slots in the member B, but preferably, and as shown, an antifriction roller E is fitted to rotate about each end of the pin D within the adjacent slot and has a concave inner face adapted to receive the concave outer face of a boss *y* upon the member C. A spring H within the recess *x*, and bearing against the end of the recess or on the end of the power shaft A, also bears against the end of the member C and tends to hold the two members in proper relation to each other. This spring is not under tension when the parts are in the relative position shown in Fig. 1. To confine the rollers E, E in place a sleeve F incloses and is secured to the member B, and the rollers E, E, have convex outer faces conforming to the curved inner face of the sleeve, and which also permit the play of the member C as it takes positions at an angle to the axis of the member B.

By the arrangement of parts above set forth the one member may be set at any desired angle to the other, and the two members may rotate together in their angular positions, as in ordinary forms of universal joints, but the construction set forth has advantages in various applications, as for instance, in connection with motor vehicles where the distance between the centers of the joints of the sectional shafts varies, as for instance, when the bearings of one shaft are upon the body and other upon the running gear frame of the vehicle, the cross pins sliding in such case in the slide slots and permitting the requisite change of position of the two shaft sections. The arrangement is further advantageous in avoiding the necessity of nice fitting of the bearings of the two sections even when one does not play in respect to the other.

In the use of universal joints where it is essential to maintain the joints well lubricated and where flexible covers are employed about the joints, the said covers are apt to be broken by the projection of the oil and grease violently against the inside of said covers, due to centrifugal action. To avoid this result I make use of a rigid cover J, preferably of metal, adapted to inclose the outer member B and preferably in the form of a hollow spherical casing seated upon a spherical portion of the member B so as to play freely about the latter, and recessed for the passage of one end of the member B and the member C, as shown. When made of metal, the casing may consist of a plurality of flanged parts the flanges connected by bolts or rivets, and preferably there is a neck *a* around each opening or recess in the casing to which may be attached one end of a flexible extensible sleeve K of rubber fabric, or other suitable material which is attached at the other end to the outside of the adjacent member and which will permit the requisite play of the parts in respect to each other while practically inclosing the two members of the joint so that the lubricant applied thereto cannot possibly escape.

In use the angular motion of one shaft section in respect to the other will simply cause a play of the casing about the outside member, while any end motion of the parts will be permitted without strain upon the casing or the sleeves. The casing cannot be burst by the projection of lubricant against the same, and the tendency of the lubricant will be to collect in the casing and not to be projected against the flexible sleeves, which also serve to exclude dust and grit. The casing rotates with the joint and hence it offers no resistance to the rotation of the shaft members.

Without limiting myself to the details of construction shown, I claim:

1. In a universal joint, the combination with the rotating members thereof, of a rigid spherical casing movably fitted to one of said members and having engagement therewith in zones on opposite sides of a central plane and also having an opening through which the other of said members extends, and said casing extending in both directions beyond the connections between said members and inclosing the same, for the purpose set forth.

2. In a universal joint, the combination with the two rotating members thereof, of a rigid spherical casing movably fitted to one of said members and having engagement therewith in zones on opposite sides of a central plane and also having an opening through which the other of said members extends, said second member fitting said opening and adapted to slide therein, and said casing extending in both directions beyond the connections between said members and inclosing the same, for the purpose set forth.

3. In a universal joint, the combination with the two rotating members thereof, of a rigid spherical casing movably fitted to one of said members and rotating therewith and having an opening through which the other member extends, said casing extending in both directions beyond the joint and inclosing the same, and flexible dust guards connected to said casing and to each of said members, for the purpose set forth.

4. In a universal joint, the combination with the two rotating members thereof, of a rigid spherical casing movably fitted to one of said members and having engagement therewith in zones on opposite sides of a central plane and also having an opening through which the other of said members extends, and said casing comprising a plurality of sections secured together and extending in both directions beyond the connections between said members and inclosing the same for the purpose set forth.

5. The combination with two shaft sections, of a universal coupling for said shaft sections, and a spherical casing surrounding said coupling and rotating therewith and having a universal movement on one member thereof and a sliding movement with respect to the other member, said casing extending in both directions beyond the joint and inclosing the same, for the purpose set forth.

6. The combination with two shaft sections, of a universal coupling for said shaft sections, a spherical casing surrounding said coupling and rotating therewith and having a universal movement on one member thereof and a sliding movement with respect to the other member, said casing extending in both directions beyond the joint and inclosing the same, for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

RUSSELL HUFF.

Witnesses:
MARK C. TAYLOR,
H. M. ALLISON.

No. 850,507. PATENTED APR. 16, 1907.

S. D. WALDON.

PEDAL FOOT REST FOR AUTOMOBILES.

APPLICATION FILED SEPT. 20, 1906.

Fig. 1.

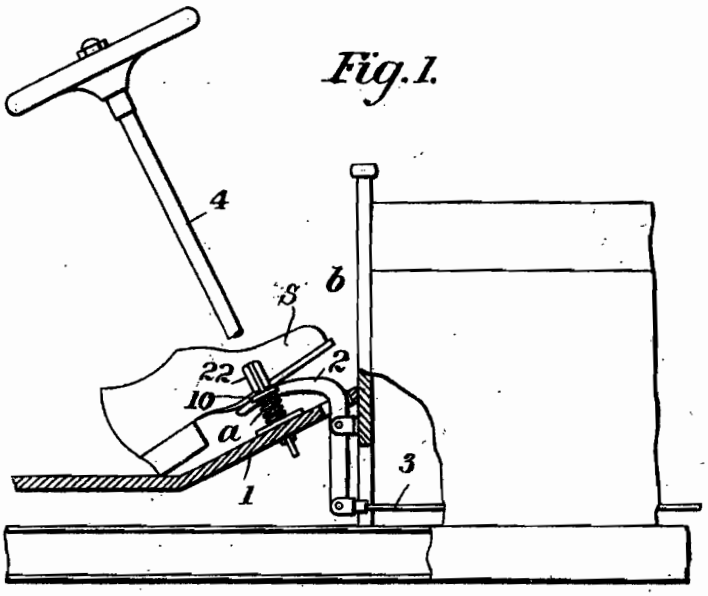


Fig. 2.

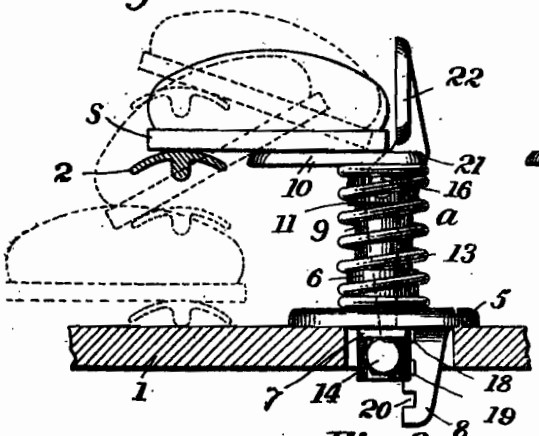


Fig. 4.

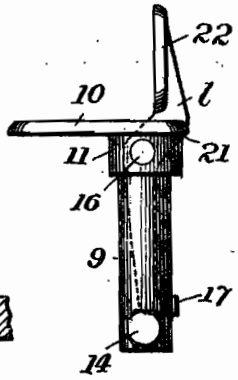


Fig. 6.

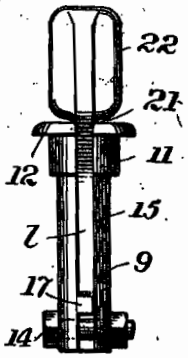


Fig. 3.

Fig. 5.

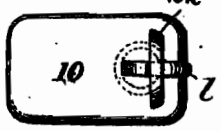
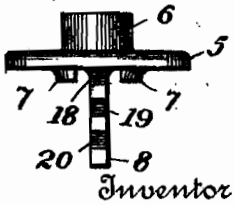


Fig. 7.



Witnesses
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J. J. McCarthy.

Inventor
by S. D. Waldon
Foster Freeman & Watson
Attorneys

UNITED STATES PATENT OFFICE.

SIDNEY D. WALDON, OF DETROIT, MICHIGAN, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

PEDAL FOOT-REST FOR AUTOMOBILES.

No. 850,507. Specification of Letters Patent. Patented April 16, 1907.

Application filed September 20, 1906. Serial No. 335,494.

To all whom it may concern:

Be it known that I SIDNEY D. WALDON, a citizen of the United States, residing at Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Pedal Foot-Rests for Automobiles, of which the following is a specification.

The purpose of this invention is to provide means for relieving the operator of a motor-vehicle from the fatigue which results from holding a motor-controlling pedal partially depressed for long periods of time.

The invention comprises a foot or toe rest arranged adjacent to the pedal, so that the forward part of the operator's foot may be supported while engaging and partially depressing the pedal.

The rest shown in the accompanying drawings is made adjustable, so that the operator's foot may be partially supported thereon and yet engage and hold the pedal in its various positions.

In the accompanying drawings, which illustrate the invention, Figure 1 is a side elevation of the toe-rest and portions of a motor-vehicle, illustrating the location of the rest upon the vehicle. Fig. 2 is a front elevation of the rest, showing also a portion of the pedal and the toe-board of the vehicle. Fig. 3 is a top plan view of the base of the toe-rest. Fig. 4 is a side elevation of the adjustable supporting post and plate and the latch for locking the same. Fig. 5 is a top plan view of the same. Fig. 6 is a side elevation of the same looking from the right of Fig. 4, and Fig. 7 is a side elevation of the base-plate with attached rack.

In Figs. 1 and 2 of the drawings, *a* indicates the foot-rest, which is arranged upon the footboard 1 of a motor-vehicle adjacent to the accelerator-pedal 2, which latter is connected to a rod 3, extending to the speed or motor controlling means of a motor-vehicle.

In Fig. 1, *b* indicates sufficient of the frame of the vehicle to illustrate the location of the foot or toe rest thereon. Preferably the foot or toe rest is arranged adjacent to the steering-stem 4.

In Figs. 2 to 7, inclusive, of the drawings, 5 indicates a base-plate by means of which the device is secured to the toe-board of the vehicle. This base-plate, as shown, has on its upper side a central sleeve 6, the opening in which extends also through the plate, and on its lower side a pair of stops 7 and a depending rack 8. The sleeve 6 forms a guideway for an adjustable post or standard 9, having at its upper end, either integral therewith or suitably affixed thereto, a foot piece or support 10, which projects at right angles to the post toward the accelerator-pedal. As shown, the post has a boss 11 at its upper end of the same diameter as the external diameter of the sleeve 6, and the plate 10 slightly overhangs the post, so as to afford a shoulder 12 at the upper end of the post. Between this shoulder and the base-plate 5 is arranged a helical spring 13, which normally presses the post and attached plate 10 upward into the position shown in Fig. 2. A bolt 14, passing diametrically through the lower end of the post, forms a stop which abuts against the stops 7 and limits the upward movement of the post. The side of the post opposite the laterally-extending foot piece or support 10 has a deep slot or groove 15 extending from end to end of the post and through the foot-piece. Within this groove is arranged a latch or dog 1, which is pivoted upon a pin 16, extending through the post, near the upper end of the latter. The part of the latch below the pivot-pin has at its lower end a right-angled hook or tooth 17, adapted to engage and interlock with the notches 18 19 20 in the rack. The part of the latch immediately above the pivot-pin extends at an obtuse angle to the lower part of the latch, as shown, a cam-surface 21 being thus provided on the latch, which surface extends to the outer edge of the slot in the boss 11 when the tooth 17 is in engagement with one of the notches in the rack. A tongue 22 extends upwardly above the cam portion of the latch to a convenient distance, so that it may be engaged by the side of the operator's foot when the latter is resting upon both the foot-piece 10 and the pedal 2. Normally the spring presses the post 9 upward, and the hook or tooth on the latch is pressed into locking engagement with one of the notches in the rack 8 by the engagement of the upper coil of the spring with the cam-surface 19 on the latch.

The foot-piece 10, as indicated in Fig. 2, is only about one-half as long as the width of the sole of the operator's shoe, (indicated at *s*),

and the device is arranged close enough to the accelerator-pedal so that when the foot of the operator is placed upon the foot-piece adjacent to the latch it will also extend over the pedal. The uppermost position of the foot-piece in practice is arranged at some point between the extreme positions of the pedal, preferably on a level with the position in which the throttle would be held by the operator to give a desired normal speed to the vehicle, so that when the pedal is pressed into this position the operator's foot will rest on the foot-piece and no muscular effort will be required to hold the pedal in this position. As indicated in dotted lines in Fig. 2, a considerable range of movement of the pedal is then possible for temporary decrease or increase in speed by simply rocking the foot one way or the other upon the foot-piece. If it is desired to throw the throttle or mixture valve wide open without adjusting the foot-piece, the operator's foot may be slid off of the end of the foot-piece and the pedal depressed to its lowermost position, as indicated by the lowermost dotted lines in Fig. 2.

From an inspection of Fig. 2 it will be apparent that a foot-rest adjacent to the pedal would relieve the strain on the operator's muscles even if the foot-rest were not adjustable. The rest is, however, made adjustable in height, so that when the foot rests naturally on the foot-piece the pedal will be held at the same height as the foot-piece, and thus the motor-controlling valve operated by the pedal may be held in any desired position permanently without effort on the part of the operator, or the pedal may be temporarily adjusted by rocking the foot, as illustrated in Fig. 2 or the speed may be permanently increased or decreased by adjusting the height of the foot-piece. In order to effect this vertical adjustment of the foot-piece, the operator merely moves his foot laterally against the tongue 22 of the latch without removing it from the foot-piece or the pedal, and thereby releases the tooth of the latch from the rack. By then pressing the foot piece or support downward or by relieving the pressure on the foot-piece the latter may be lowered or raised, as will be evident, and when the lateral pressure of the foot against the tongue 22 is relieved the latch is moved by the pressure of the spring on the cam-surface of the latch until the tooth on the latch engages the rack, and thus locks the foot piece or support in the desired position.

What is claimed is--

1. The combination, in a motor-vehicle, with a pedal, and with the footboard of a foot-support independent of and adjacent to the pedal, said support and pedal being above the footboard and arranged to be simultaneously engaged by the foot of the operator.

2. The combination, in a motor-vehicle, with a pedal, of an adjustable foot-support, independent of and adjacent to the pedal, said support and pedal being arranged to be simultaneously engaged by the foot of the operator.

3. The combination, in a motor-vehicle, with a pedal, of an adjustable foot-support independent of and adjacent to the pedal, said support and pedal being arranged to be simultaneously engaged by the foot of the operator, and means for locking said foot-support in any position of adjustment.

4. The combination with a motor-controlling pedal, of a vertically-adjustable foot-support independent of and adjacent to the pedal, said support and pedal being arranged to be simultaneously engaged by the foot of the operator, and means for locking said foot-support in any position of adjustment.

5. The combination with a motor-controlling pedal, of a foot-rest comprising an adjustable support independent of and adjacent to the pedal, and locking means for said support, said pedal, support and locking means being so arranged that they may be simultaneously engaged by the foot of the operator.

6. A foot-rest comprising a support, adapted to be engaged and depressed by the foot, a spring for moving said support to an upper position, and means for locking said support when depressed, in combination with a pedal independent of and adjacent to said foot-rest.

7. The combination in a motor-vehicle, with the pedal, and with the footboard of a foot-support above the footboard and at one side of the pedal, and independent thereof, said pedal and foot-support being so related that the pedal may be operated by a movement of the foot without removing it from the support.

8. A foot-rest comprising a support, adapted to be moved in a downward direction by foot-pressure, a spring adapted to move said support in an upward direction, and locking means for said support, said means being movable by lateral pressure of the foot to release the support.

9. A foot-rest comprising a support, adapted to be moved in a downward direction by foot-pressure, a spring adapted to move said support in an upward direction, and a latch movable with the support and adapted to lock the support against movement, said latch having a tongue adjacent to the support adapted to be engaged by the operator's foot.

10. An adjustable foot-rest comprising a base having a sleeve or guideway, a rack, a longitudinally-grooved post movable within said guideway, a latch arranged within said groove, said latch having a tongue projecting above the post and having a tooth normally engaging said rack, and a spring interposed between the base and a shoulder on the post.

11. An adjustable foot-rest comprising a

base having a suitable guideway, a rack secured to said base, a slotted post movable within the guideway and having a shoulder near one end, a coiled spring surrounding the post and interposed between said shoulder and base, a latch pivotally arranged within the slot in the post and having a cam-surface adapted to be engaged by the spring, said latch having means at one end for engaging the rack and a tongue or part at the other end adapted to be engaged by the foot of the operator.

In testimony whereof I affix my signature in presence of two witnesses.

SIDNEY D. WALDON.

Witnesses:

RUSSELL HUFF,

ALLEN LOOMIS.

No. 838,251. PATENTED DEC. 11, 1906.

R. HUFF.

SPARK COIL BOX FOR MOTOR VEHICLES.

APPLICATION FILED SEPT. 27, 1906.

3 SHEETS—SHEET 1.

Fig. 1.

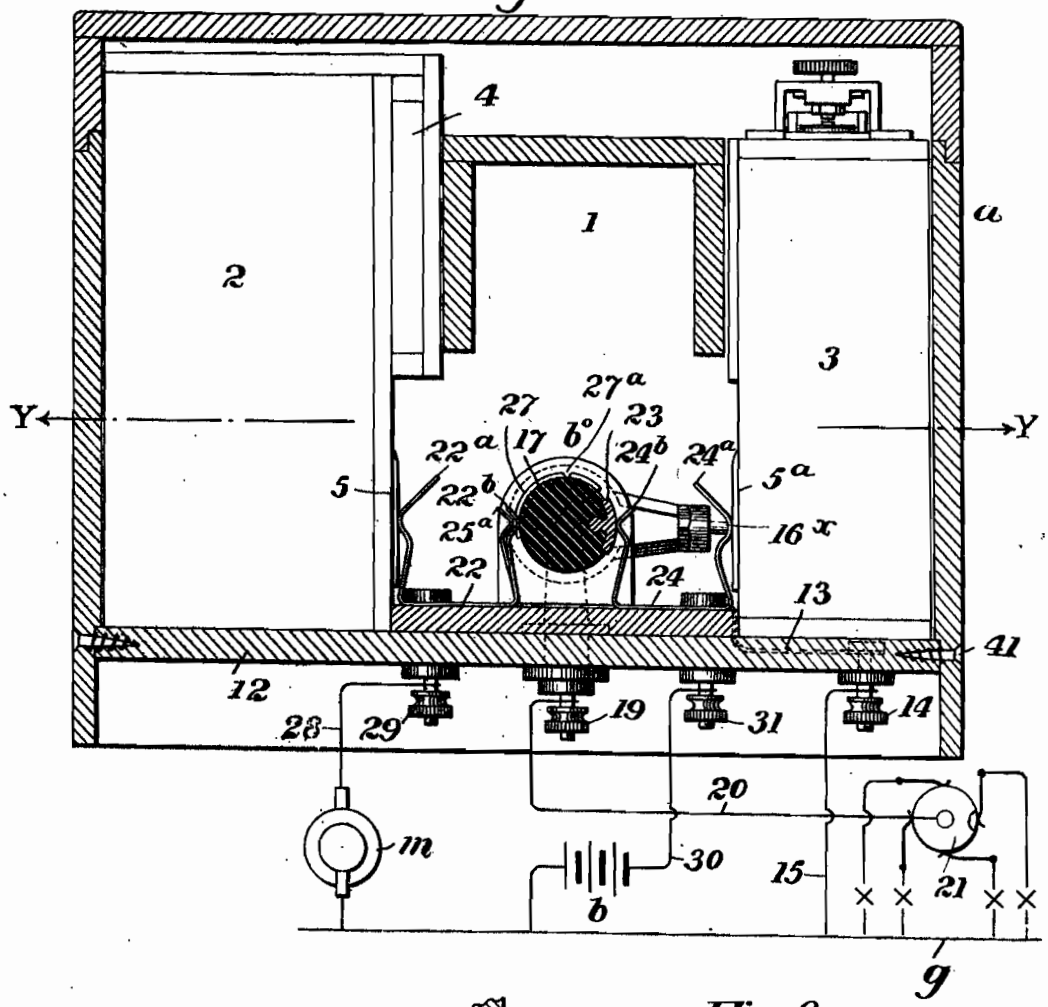


Fig. 7.

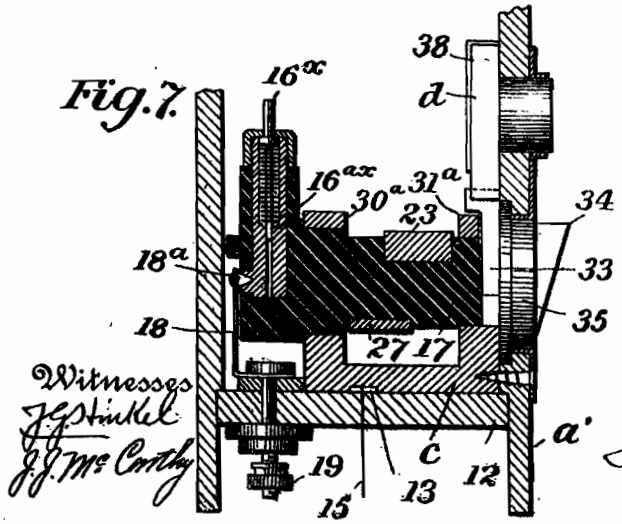
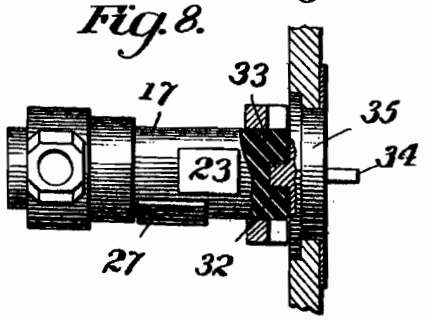


Fig. 8.



Witnesses
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J. J. McCarthy

Inventor
Russell Huff
by Foulet Freeman & Wilson
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No. 838,251. PATENTED DEC. 11, 1906.

R. HUFF.

SPARK COIL BOX FOR MOTOR VEHICLES.

APPLICATION FILED SEPT. 27, 1906.

3 SHEETS—SHEET 2.

Fig. 2.

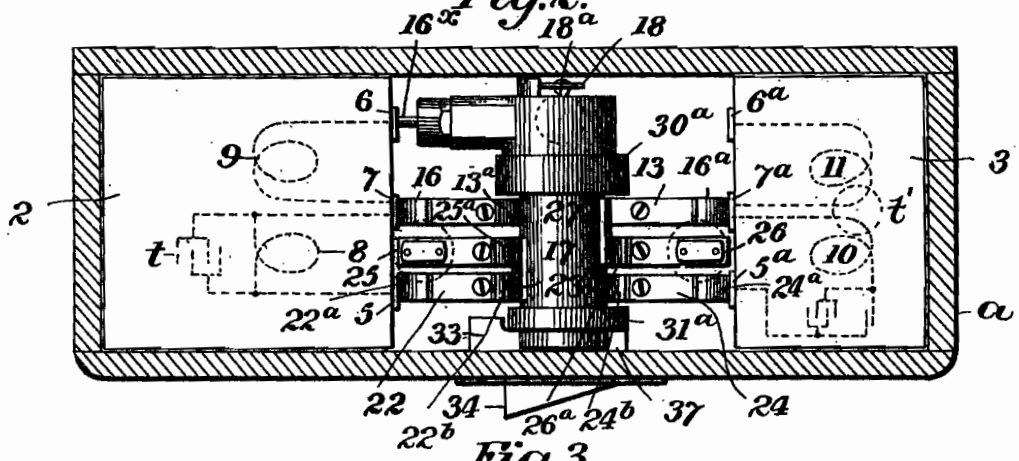


Fig. 3.

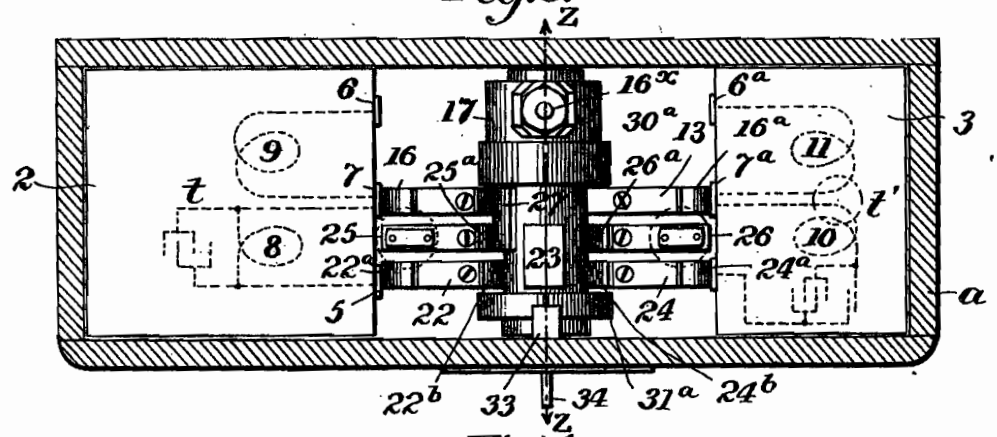
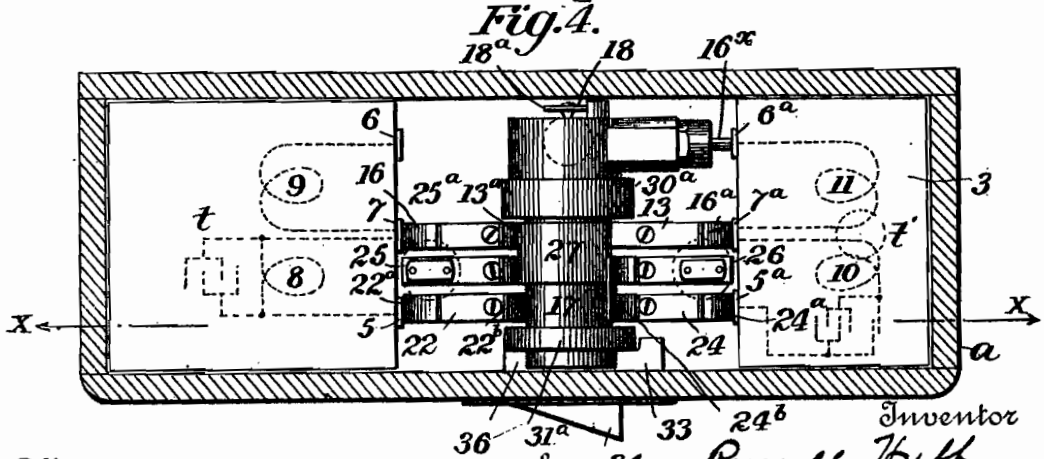


Fig. 4.



Witnesses

J. P. Sinkel

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No. 838,251. PATENTED DEC. 11, 1906.

R. HUFF.

SPARK COIL BOX FOR MOTOR VEHICLES.

APPLICATION FILED SEPT. 27, 1906.

3 SHEETS—SHEET 3.

Fig. 5.

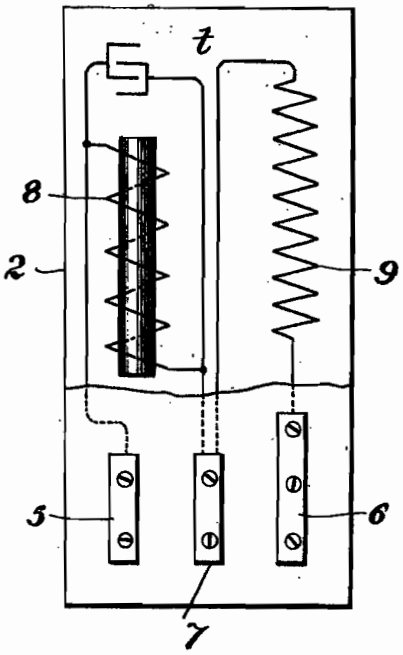


Fig. 6.

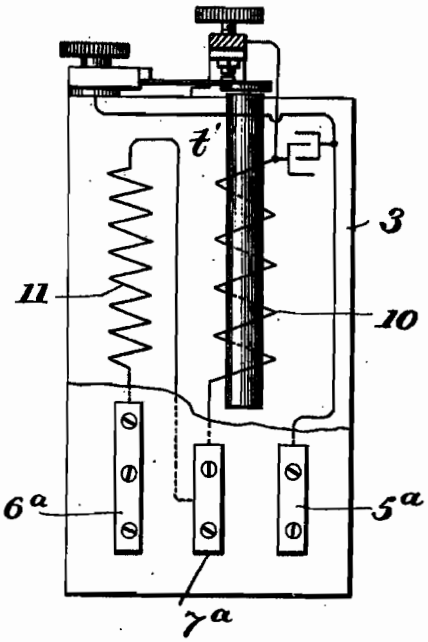
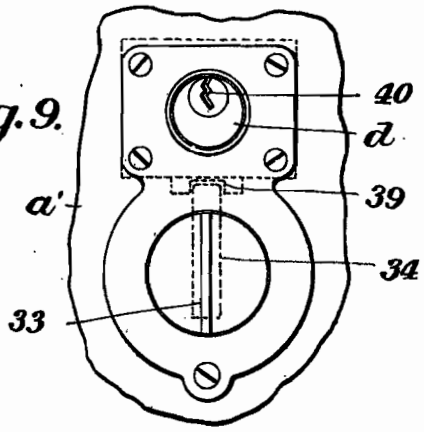


Fig. 9.



Witnesses

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UNITED STATES PATENT OFFICE.

RUSSELL HUFF, OF DETROIT, MICHIGAN, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

SPARK-COIL BOX FOR MOTOR-VEHICLES.

No. 838,251. Specification of Letters Patent. Patented Dec. 11, 1906.

Application filed September 27, 1906. Serial No. 336,456.

To all whom it may concern:

Be it known that I, RUSSELL HUFF, a citizen of the United States, and a resident of Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Spark-Coil Boxes for Motor-Vehicles, of which the following is a specification.

This invention comprises improvements in spark-coil boxes and switching means for use in connection with the ignition mechanism of an explosive-engine, whereby either the battery-current or the magneto-current may be connected to the primary windings of their respective spark-coils and the secondary coils of the latter connected to the spark-plugs by the operation of a single switch which opens the battery-circuit when the magneto is connected and short-circuits the magneto when the battery is connected.

The invention also comprises a convenient arrangement of the parts for effecting the above purposes and for facilitating the removal and insertion of the spark-coils and switch mechanism.

In the accompanying drawings, Figure 1 is a vertical section through the combined spark-coil and switch-box, taken on the line X X of Fig. 4. Figs. 2, 3, and 4 are horizontal sections through the same on the line Y Y of Fig. 1, the coils being shown diagrammatically. Figs. 5 and 6 are side elevations of the magneto-coil casing and the battery-coil casing, respectively, the sides of the casings being broken away and the coils being shown therein diagrammatically. Fig. 7 is a vertical section on the line Z Z of Fig. 3. Fig. 8 is a detail view showing the connection between the handle and the switch-barrel, and Fig. 9 is a front view of the lock.

Referring to the drawings, *a* indicates the spark-coil box as a whole, having a central compartment 1, containing the switching mechanism b° and side compartments, one adapted to receive a casing 2, containing the transformer spark-coil, for use in connection with a magneto, and the other adapted to receive a casing 3, containing the "trembler" spark-coil, for use in connection with a battery. Attached to the front of the casing 2 is a small box or compartment 4 suitable for containing a condenser.

Upon the outer side of the casing 2 facing the switching mechanism are arranged three flat contact-plates 5, 6, and 7. The plate 5 forms one terminal of the low-tension winding 8 of a transformer *t*, and the plate 6 forms one terminal of a high-tension winding 9, while the plate 7 is connected to the opposite terminals of both windings. Similarly upon the side of the casing 3 facing the switching mechanism are arranged flat contact-plates 5^a, 6^a, and 7^a, the plate 5^a being connected to one terminal of the low-tension winding 10 of a coil *t'* for use in connection with the battery, the plate 6^a being connected to one terminal of the high-tension winding 11 and the plate 7^a being connected to the opposite ends of both windings.

Secured upon the bottom 12 of the casing is arranged a metal conducting-strip 13, having one end secured to a binding-post 14, which latter is grounded upon the engine-casing (indicated at *g*) by means of a suitable conductor 15. Within the switch-compartment of the box spring fingers or brushes 16 and 16^a project upwardly from the conducting-strip 13 and engage the contacts 7 and 7^a upon the casings 2 and 3, respectively, when these casings are in position within the box. One terminal of each of the windings in both casings is therefore always grounded through the conductors 13 and 14. A spring-plunger 16^x, mounted in a tubular metal casing $16^{a\times}$, which projects radially outward from a rotatable cylinder 17, made of insulating material, is adapted to engage either of the contacts 6 or 6^a, and thereby electrically connect either of the high-tension coils 9 or 11 to a stationary spring contact member 18, having a part 18^a, which bears against the tubular metal casing $16^{a\times}$ in line with the axis of the cylinder 17. The contact member 18 is connected to a binding-post 19 on the under side of the box, and the latter is connected by a conductor 20 to a distributer 21, operated in the usual way by the engine, to electrically connect the conductor 20 to the spark-plugs *x* of the engine in succession. The return-circuit from the spark-plugs is through the engine-casing *g*, conductor 15, binding-post 14, and conductor 13 to the contact member 7 and winding 9 or contact member 7^a and winding 11, according as the plunger is in the

position shown in Fig. 2 or that shown in Fig. 4.

In the central position (shown in Fig. 3) it will be seen that the high-tension windings of both coils are interrupted, neither of the contacts 6 or 6^a being engaged by the plunger $16^\times$. The switch is so arranged that when the cylinder 17 is turned into the position shown in Fig. 2 a magneto *m*, Fig. 1, will be connected to the primary winding 8 of the transformer-coil *t*, the circuit of the battery *b* being then interrupted, and when the cylinder is turned through an arc of one hundred and eighty degrees, as shown in Fig. 4, the battery will be connected to the primary winding 10 of the trembler-coil *t'*. In the latter position, however, and also in the mid-position (shown in Fig. 3) the magneto is short-circuited in order to prevent destructive sparking at the magneto.

Upon the bottom of the box *a*, within the central chamber 1, is arranged a conducting-strip 22, having an upwardly-extending spring finger or brush 22^a, adapted to bear against the contact 5, connected to the low-tension winding of the coil *t* and having at its opposite end an upwardly-extending spring finger or brush 22^b, adapted to bear against the contact-plate 23 of the cylinder when the cylinder is in the position shown in Fig. 2. On the opposite side of the cylinder a conducting-strip 24 has similar fingers or brushes 24^a and 24^b, the former engaging the terminal 5^a of the low-tension coil 10 and the latter adapted to engage the contact-plate 23 when the cylinder is turned into the position shown in Fig. 4. Between the conducting-strip 13 and the strips 22 and 24 are other contact-strips 25 and 26, respectively, the former having a finger 25^a and the latter having a finger 26^a, adapted to bear against the cylinder. The return or ground conductor *f* also has a spring-finger 13^a, adapted to bear against the cylinder adjacent to the finger 25^a, and these two fingers are adapted to engage a contact-plate 27 upon the cylinder. This contact-plate is of such length and so arranged that it will be engaged by the fingers 25^a and 13^a when the plate 23 is engaged by the fingers 24^b and 26^a, as shown in Fig. 4, and it will also remain in engagement with said fingers 25^b and 13^a in the mid-position of the switch, (shown in Fig. 3;) but when the switch is rocked to the position shown in Fig. 2, so that the plate 23 engages the contact members 22^b and 25^a, the plate 27 is disengaged from the fingers 25^a and 13^a.

The magneto *m* is connected at one side to the engine-frame, as indicated in Fig. 1, and at its opposite side it is connected by a conductor 28 to a binding-post 29, which in turn is connected to the spring-finger 25^a through conductor 25. The battery *b* is connected to the engine-frame at one side, and the opposite pole of the battery is connected by conductor 30 to a binding-post 31, and thence to the spring-finger 26^a through conducting-strip 26.

When the switch is turned into the position shown in Fig. 2, it will be seen that the magneto-circuit will be completed as follows: from the magneto *m* through conductor 28 and binding-post 29 to the conductor 25, finger 25^a, contact-plate 23, finger 22^b, conductor 22, finger 22^a, contact 5 on the coil-casing 2, thence through low-tension winding 8 to the contact 7, thence through fingers 16 and conductor 13 to the binding-post 14, thence to engine-frame *g* by conductor 15 and through the frame to the opposite terminal of the magneto. At this time the high-tension winding of the coil *t* is connected to the ground on one side, as previously explained, through contact 7 and conductors 13 and 15 and to the distributer 21 through the contact 6, plunger $16^\times$, plunger-casing $16^{a\times}$, contact 18, binding-post 19, and wire 20, and from the distributer 21 to the insulated terminals of the spark-plugs *x* in succession.

When the switch-cylinder is in the position shown in Fig. 4, the contact-plate 27 engages the fingers 13^a and 25^a, short-circuiting the magneto, and the plate 23 engages the fingers 24^b and 26^a, thus completing the battery-circuit through the primary winding 10 of the coil *t'*. The battery-circuit then extends from one side of the battery through conductor 30 to binding-post 31, thence by conductor 26 and spring-finger 26^a to the plate 23, thence by spring-finger 24^b, conductor 24, and finger 24^a to the coil-terminal 5^a, thence through the primary winding 10 and the circuit-interrupter 10^a, connected with said coil, to the neutral or ground contact 7^a on the casing 3, thence through finger 16^a, conductor 13, binding-post 14, conductor 15, and the engine-frame to the opposite side of the battery. At the same time the circuit through the high-tension winding 11 is completed, on the one side, from the contact 7^a through finger 16^a, conductor 13, binding-post 14, and conductor 15 to the engine-frame *g*, and, on the other side, through plunger $16^\times$, plunger-casing $16^{a\times}$, contact 18, binding-post 19, conductor 20, and distributer 21 to the insulated contacts of the plugs *x* in succession.

After the motor has started by the use of the battery and its coil the switch is moved to the position shown in Fig. 2, thus interrupting the battery-circuit between the contact-fingers 24^b and 26^a, and when the plate 23 engages the fingers 22^b and 25^a the magneto is brought into operation, the plate 27 at that time having passed out of contact with the fingers 25^a and 13^a. In the mid-position (shown in Fig. 3) the contact-plate 23 does not engage any of the contact-fingers, and therefore in this position there is no connection between the windings of

either of the coils and the sources of electrical energy. It will be seen, therefore, that the switch provides for completing the primary and secondary circuits of the trembler-coil and at the same time maintaining the magneto on short circuit, so as to prevent sparking at the magneto, and it also provides for completing the circuits of the transformer-coil *t* and for maintaining the battery-circuit open while the transformer-coils are connected.

The switch-cylinder 17 is suitably mounted in bearings 30^a 31^a of a standard *c*, which is secured to the bottom of the box. This cylinder has a groove or slot 32 extending diametrically across it at one end. This groove is engaged by a feather or spline 33 within the box, which spline is rotatable by means of a handle 34 upon the outer side of the box, the spline and handle being connected by a cylindrical part 35, having a bearing in the front wall *a'* of the box. The spring-conductor 18 normally presses the cylinder toward the spline. Stops 36 and 37 are provided upon the front of the standard *c* and adapted to be engaged by the one end of the key or spline 35 in the extreme positions of the latter to limit the movement of the switch. In the mid-position of the switch-cylinder the spring-finger 25 rests within a notch 27^a in the contact-plate 27 and holds the cylinder against accidental rotation. In the extreme positions (shown in Figs. 2 and 4) the frictional engagement of the spring-plunger $16^\times$ with the contact 6 or 6^a prevents the cylinder from turning accidentally.

In order to prevent the unauthorized use of the motor-vehicle, means are also provided for locking the switch-cylinder in the mid-position. For this purpose a lock *d* is arranged on the front side *a'* of the casing, and this lock has a vertically-movable bolt 38, provided with a notch 39, adapted to fit over the end of the feather or spline 33 when the latter is in the mid-position, and thus prevent the turning of the switch. The bolt may be moved into and out of engagement with the spline 33 by means of a key to be inserted into the lock through the keyhole 40. The purpose of connecting the handle 34 with the switch-barrel by means of the spline fitting into a groove in the end of the cylinder is to permit the switch to be inserted and removed without disconnecting the handle or lock from the box. By simply turning the cylinder to the mid-position and removing the screws 41, which secure the bottom of the box to its sides, the bottom of the box and the cylinder may be removed without disturbing the lock or handle. The coil-casings may also be removed by taking out the bottom of the box, or they may be independently removed after taking off the top of the box, and it will be noted that the removal of a coil-case does not require the unfastening of any of the electrical connections. As soon as the coil-casing is placed in its appropriate compartment in the box its connections to the switching mechanism are complete.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A spark-coil box, a spark-coil, a casing for said coil, separate contact plates or pieces on said casing connected to the primary and secondary windings of said coil, and a contact-plate on said casing connected to the opposite ends of both of said windings, a switch within said box, and contact members connected with said switch adapted to engage the contact plates or pieces on the coil-casing when the latter is placed within the box.

2. A spark-coil box, two spark-coils, casings for said coils adapted to fit within said box, separate contact plates or pieces on each of said casings connected to the terminals of the primary and secondary windings of the coils, and a contact-piece on each casing connected to the opposite end of both windings of the coil within the casing, a switch within said box, and contact members connected with said switch adapted to engage the contact plates or pieces on the coil-casings when the latter are placed within the box.

3. In an ignition apparatus for explosive-engines, the combination with a magneto-generator, and a source of direct current, of a spark-coil box, transformer and trembler coils within said box and adapted for operation by currents from said sources respectively, and a switch within the box for completing the circuits of either coil independently.

4. In an ignition apparatus for explosive-engines, a magneto-generator and a source of direct current, a transformer-coil and a trembler-coil adapted for operation by said current sources respectively, a switch and suitable electrical connections adapted in one position of the switch to complete the circuits of the trembler-coil and short-circuit the magneto-generator, and in another position of the switch to interrupt the circuits of the trembler-coil and complete the circuits of the transformer-coil.

5. In an ignition apparatus for explosive-engines, a magneto-generator and a source of direct current, a transformer-coil and a trembler-coil adapted for operation by said current sources respectively, a switch and suitable electrical connections adapted in one position of the switch to complete the circuits of the trembler-coil and short-circuit the magneto-generator, and in another position of the switch to interrupt the circuits of the trembler-coil and complete the circuits

of the transformer-coil and in an intermediate position to interrupt the circuits of both coils.

6. In an ignition apparatus for explosive-engines, a magneto-generator and a source of direct current, a transformer-coil and a trembler-coil adapted for operation by said current sources respectively, a switch and suitable electrical connections adapted in one position of the switch to complete the circuits of the trembler-coil and short-circuit the magneto-generator, and in another position of the switch to interrupt the circuits of the trembler-coil and complete the circuits of the transformer-coil and in an intermediate position to interrupt the circuits of both coils and short-circuit the magneto-generator.

7. In a spark mechanism for explosive-engines, a transformer-coil and a trembler-coil, each having one side of its primary and secondary windings connected to a common ground-conductor, and a switch adapted in one position to complete the circuit of the primary and secondary windings of the transformer-coil and to interrupt the circuit of the trembler-coil, and in another position to complete the circuits of the trembler-coil and short-circuit the current source for the transformer-coil.

8. In a spark mechanism for explosive-engines, a transformer-coil and a trembler-coil, each having one side of its primary and secondary windings connected to a common ground-conductor, and a switch adapted in one position to complete the circuit of the primary and secondary windings of the transformer-coil and to interrupt the circuit of the trembler-coil, and in another position to complete the circuits of the trembler-coil and short-circuit the current source for the transformer-coil and in an intermediate position to interrupt the circuits of both coils.

9 In a spark mechanism for explosive-engines, a transformer-coil and a trembler-coil, each having one side of its primary and secondary windings connected to a common ground-conductor, and a switch adapted in one position to complete the circuit of the primary and secondary windings of the transformer-coil and to interrupt the circuit of the trembler-coil, and in another position to complete the circuits of the trembler-coil and short-circuit the current source for the transformer-coil and in an intermediate position to interrupt the circuits of both coils and short-circuit the current source from the transformer-coil.

10. In a spark mechanism for explosive-engines, a spark-coil box having a central and two side compartments, spark-coils arranged within said side compartments, and a switch in said central compartment adapted to complete the circuits of either coil independently, according to the position of the switch.

11. In a spark mechanism for explosive-engines, a spark-coil box having a central and two side compartments, spark-coil casings arranged within said side compartments, said casings having spark-coils therein and contacts on the casings connected to the terminals of said coils, stationary fingers or brushes in said central compartment adapted to engage the contacts connected to the terminals of the low-tension windings, and a switch in said central compartment for completing the low-tension winding of either coil through its current source and at the same time completing the circuit of the high-tension winding of the coil.

12. In a spark mechanism for explosive-engines, two spark-coils, each having one side of its primary and secondary windings connected to a common ground-conductor, brushes electrically connected to the opposite terminals of said primary windings, a movable switch member having a contact-plate adapted to engage either of said brushes independently, according to the position of said member, brushes connected to independent current sources adapted to be independently engaged by said plate in different positions of said switch member, to connect either primary winding to a current source, and means connected with said switch member for completing the secondary circuit of either one of said coils when its primary circuit is complete.

13. In a spark mechanism for explosive-engines, two spark-coils, each having one side of its primary and secondary windings connected to a common ground-conductor, a magneto-generator and a source of direct current for operating said coils respectively, a movable switch member having a contact-plate thereon, brushes for engaging said plate and connecting the coils independently to their current sources, a brush connected to said common ground-conductor, and a plate upon said switch member adapted to engage said latter brush and the brush connected to the magneto-generator, when the direct-current source is connected to its coil, and to be disengaged from said brushes when the magneto-generator is connected to its coil.

14. In a spark mechanism for explosive-engines, a switch for completing the circuits of two spark-coils, independently, comprising brushes for connecting the primary coils to the current sources, and a switch-cylinder having contact-plates coöperating with said brushes, said switch member having also a radially-arranged spring plunger or brush adapted to engage stationary contacts for completing the secondary circuits of said coils.

15. In a spark mechanism for explosive-engines, a spark-coil box, a rotatable switch-cylinder therein, said cylinder having a groove

extending across one end, a spline fitting in said groove and a handle on the outer side of the box for turning said spline.

16. In a spark mechanism for explosive-engines, a spark-coil box, a rotatable switch-cylinder therein, said cylinder having a groove extending across one end, a spline fitting in said groove, a handle for turning said spline, and a means for locking said spline.

17. In a spark mechanism for explosive-engines, a spark-coil box, a rotatable switch-cylinder therein, said cylinder having a groove extending across one end, a spline fitting in said groove, a handle for turning said spline, and a lock having a bolt provided with a notch adapted to engage said spline.

In testimony whereof I affix my signature in presence of two witnesses.

RUSSELL HUFF.

Witnesses:

ALLEN LOOMIS,

F. E. PAINE, Jr.

No. 840,626. PATENTED JAN. 8, 1907.

R. HUFF.

FRICTION CLUTCH.

APPLICATION FILED OCT. 19, 1906.

2 SHEETS—SHEET 1.

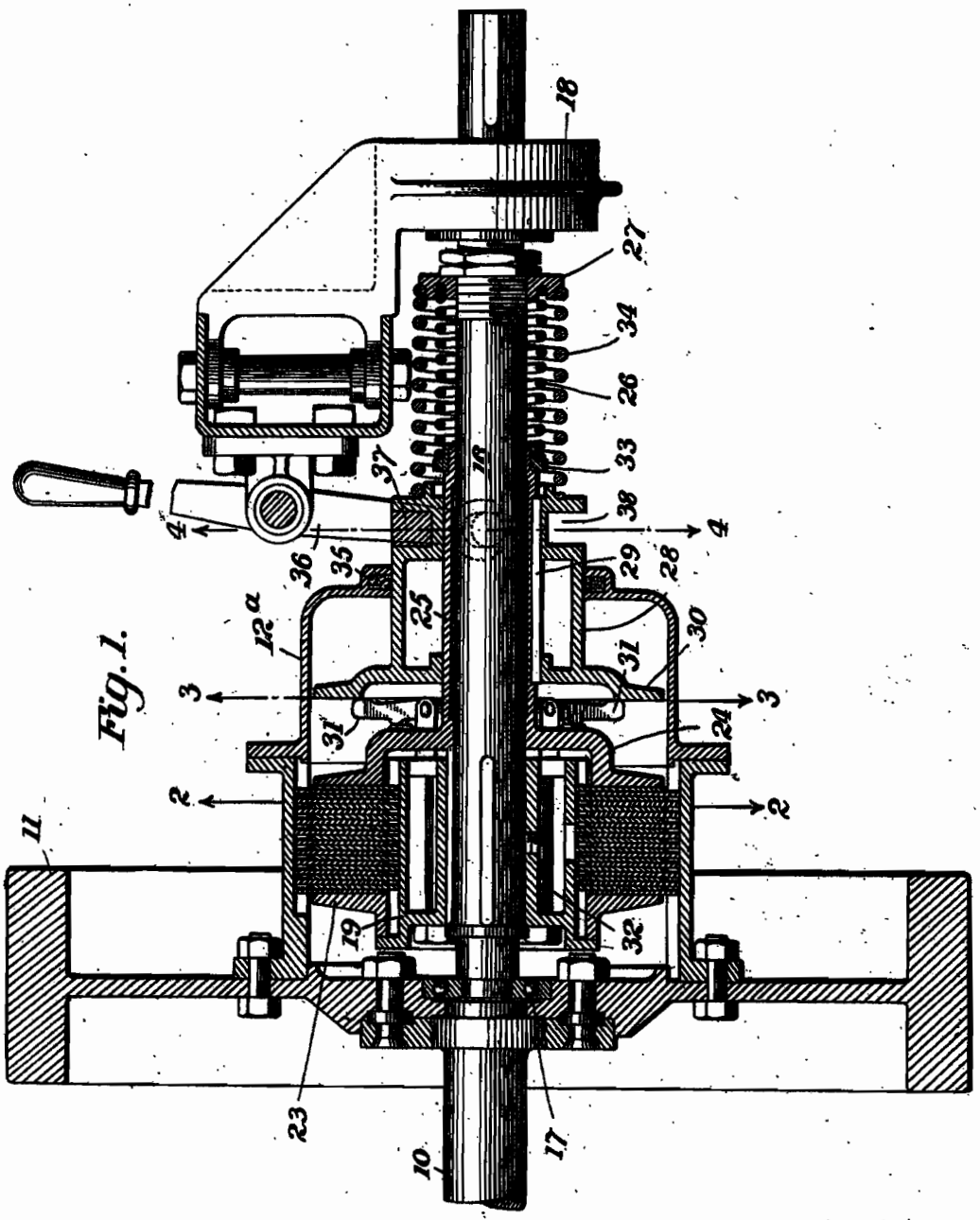

Fig. 1.

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No. 840,626. PATENTED JAN. 8, 1907.

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FRICTION CLUTCH.

APPLICATION FILED OCT. 19, 1906.

2 SHEETS—SHEET 2.

Fig. 2.

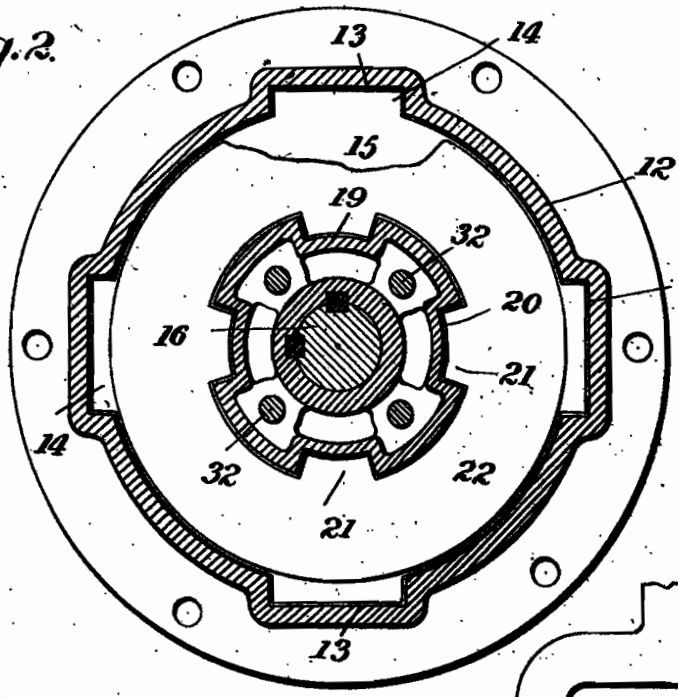


Fig. 4.

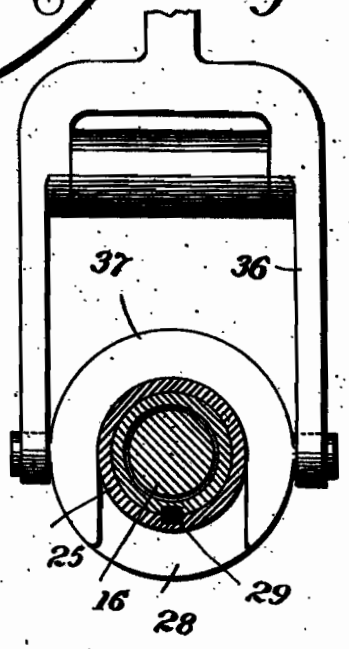
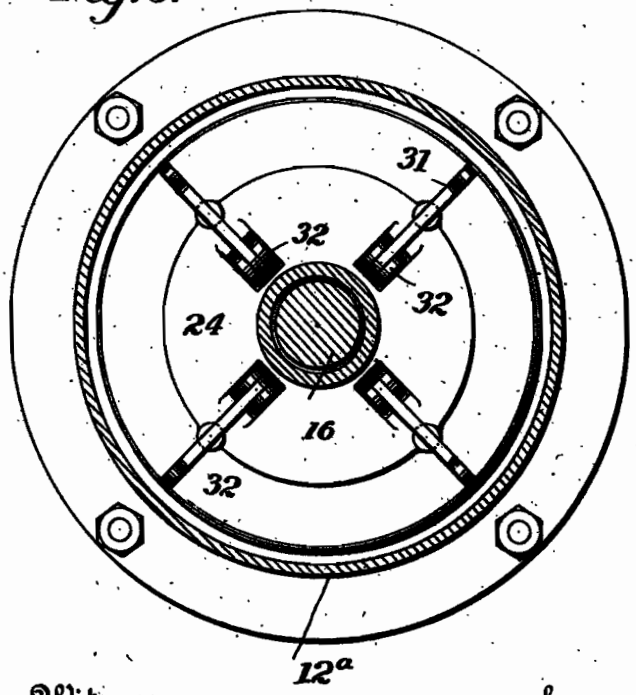


Fig. 3.



Witnesses.
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UNITED STATES PATENT OFFICE.

RUSSELL HUFF, OF DETROIT, MICHIGAN, ASSIGNOR TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF WEST VIRGINIA.

FRICTION-CLUTCH.

No. 840,626. Specification of Letters Patent. Patented Jan. 8, 1907.

Application filed October 19, 1906. Serial No. 339,663.

To all whom it may concern:

Be it known that I, RUSSELL HUFF, a citizen of the United States, and a resident of Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Friction-Clutches, of which the following is a specification.

In friction-clutches of the multiple-disk type, especially when used in motor-vehicles, it is desirable to apply pressure to the contacting clutch members gradually, permitting a relative slipping movement as the driven member is starting, and to eventually clamp the members together so tightly that they become positively engaged and rotate as a unit. In this manner the vehicle may be started slowly and gradually permitted to acquire speed until the limit of speed is reached.

The present invention relates to means for gradually applying pressure to the clutch members of a friction-clutch. In such clutches, and especially in clutches of the multiple-disk type, it has been customary heretofore to apply pressure to the clutch members by means of a spring, and in order that there may be no slip when the clutch is fully applied a very strong spring has been required. With such a spring there is danger of applying the power too suddenly and starting the mechanism with a jerk, thereby straining the parts.

According to the present invention two springs are used, the one being adapted to apply a preliminary pressure to the clutch to start the vehicle or other mechanism gradually and the other being adapted to come into play later and connect the clutch members forcibly and prevent relative slipping of said members.

The invention will be described in connection with the accompanying drawings, in which—

Figure 1 is a central sectional view of a clutch embodying the invention. Fig. 2 is a section on the line 2 of Fig. 1. Fig. 3 is a section on the line 3 of Fig. 1, and Fig. 4 is a section on the line 4 of Fig. 1.

Referring to the drawings, 10 indicates the driving-shaft—which, for instance, may be the crank-shaft of a hydrocarbon-engine adapted for driving a motor-vehicle. 11 indicates a fly-wheel rigidly connected to said shaft.

12 indicates a clutch-casing of substantially cylindrical form rigidly connected with the fly-wheel, and 12^a an extension of said casing. As shown in Figs. 1 and 2, the outer casing 12 is provided with internal longitudinal recesses 13, into which fit lugs 14 of a series of disks 15, arranged within the casing.

In line with the driving-shaft 10 is a driven shaft 16, having one end mounted in a bearing 17 in the fly-wheel 11. The driven shaft is also provided with a suitable bearing 18, adjacent to the clutch mechanism. Rigidly connected with the driven shaft near its inner end is a clutch-hub 19, having on its outer surface a series of longitudinal recesses or grooves 20, adapted to receive the lugs 21 of a series of clutch-disks 22. The clutch-disks 22 are arranged alternately with the clutch-disks 15, the former rotating with the clutch-hub 19, while the latter rotate with the clutch-casing 12 and the driving-shaft 10. The two series of disks are arranged between a collar 23, fixed on the hub 19, and a circular flange-like head 24 on a sleeve 25, which is adapted to slide on and turn with the driven shaft 16. The sleeve 25 is normally pressed toward the clutch members 15 22 by a coiled spring 26, which is interposed between the sleeve 25 and a collar 27, fixed on the shaft 16.

An outer sleeve 28 is arranged to slide on and turn with the inner sleeve 25 and being connected to said sleeve by a spline or key 29. The outer sleeve 28 is provided with a circular flange-like head 30, and between the heads 30 and 24 are a series of radially-arranged levers 31, having their inner ends pivoted to bolts 32, which are fixed in the hub 19 and pass through openings in the head 24, causing said head to rotate with the hub and with the shaft 16. The head 30 is arranged to bear on the outer ends of the levers 31, while the middle portions of said levers bear on the head 24, thus transmitting movement from the head 30 to the head 24. The inner sleeve 25 is provided at its end with a flange 33, against one side of which the spring 26 bears. The outer sleeve 28 contacts with the other side of the flange 33 in opening the clutch, as will be hereinafter explained. Between the sleeve 28 and the fixed collar 27 is a second coil-spring 34, surrounding the spring 26. The sleeve 28 is cylindrical on its outer surface and closely fits the opening in the extension 12^a of the

clutch-casing, a packing of felt 35 being used between the parts to make the joint oil-tight. The casing is usually partially filled with oil to lubricate the parts of the clutch. The clutch may be operated by means of a lever 36, which engages trunnions of a yoke 37, running in an external groove 38 in the outer sleeve 28. The lever 36 may be operated by hand or foot power, as desired.

The operation of the clutch is as follows: As previously stated, the outer clutch-disks 15, which may be termed the "primary" clutch-disks, rotate with the driving-shaft 10. When the clutch is open, the inner clutch member comprising the secondary clutch-disks 22 is stationary. As the lever 36 is moved to permit the springs to act the head 24 of the inner sleeve is first pressed against the clutch-disks by the spring 26, which is preferably weaker than the spring 34. The head 30 of the outer sleeve does not begin to bear upon the levers 31 until after the full pressure of the spring 26 is transmitted through the head 24 to the clutch disks or members. The spring 34 then begins to act through the outer sleeve and the head 30 upon the levers 31, and when the operating-lever 36 is fully released the full pressure of both springs acts upon the clutch, the spring 26 acting directly upon the head 24, while the spring 34 acts through the head 30 and the levers 31 upon the head 24. In opening the clutch the pressure of the outer spring 34 is first removed and later the pressure of the inner spring 26. The inner spring is preferably lighter than the outer spring, and pressure on the clutch is thus applied at first gently and later with great force. This clutch is especially valuable in transmitting the movement of a hydrocarbon-engine to the driving-wheels in a motor-vehicle, as it facilitates starting the vehicle gently and gradually increasing the pressure of the clutch until the clutch members are practically locked together and moved as a unit. While the pressure of the lighter spring 26 is applied to the clutch the clutch members slip relatively, the driven member gradually acquiring the speed of the driving member, and the vehicle is thus started gently and gradually.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a clutch mechanism, the combination with a driving-shaft and a friction-clutch member driven thereby, of a driven shaft, a friction-clutch member connected with said driven shaft, two springs arranged to press said clutch members together, and means for applying said springs successively to close the clutch, for the purpose set forth.

2. In a clutch mechanism, the combination with a driving-shaft and a friction-clutch member driven thereby, of a driven shaft, a friction-clutch member connected with said driven shaft, two springs arranged to press said clutch members together, and means for successively removing the pressure of said springs from the clutch members.

3. In a clutch mechanism, the combination of a driving-shaft and a primary friction-clutch member connected to rotate with said shaft, of a driven shaft, a secondary friction-clutch member connected to rotate with the driven shaft, a head or clamp for pressing said clutch members together, two springs adapted to bear upon said head of clamp, and means for successively throwing said springs into operation whereby the combined pressure of the springs is gradually applied to the clutch.

4. In a clutch mechanism, the combination of a driving-shaft and a primary friction-clutch member comprising a series of disks connected to rotate with said shaft, a driven shaft, a secondary friction-clutch member comprising a series of disks connected to rotate with the driven shaft, a head or clamp for pressing said clutch members together, two springs adapted to bear upon said head or clamp, and means for successively throwing said springs into operation whereby the combined pressure of the springs is gradually applied to the clutch.

5. In a clutch mechanism, the combination with driving and driven shafts, of the two series of friction-disks connected respectively to said shafts, the sleeve on the driven shaft having a head bearing on said disks, the spring adapted to bear on said sleeve, the outer sleeve, a second spring adapted to bear on the outer sleeve, and means for transmitting the pressure of the outer sleeve to the head of the inner sleeve, for the purpose set forth.

6. In a clutch mechanism, the combination with driving and driven shafts, of the two series of friction-disks connected respectively to said shafts, the sleeve on the driven shaft having a head bearing on said disks, the spring adapted to bear on said sleeve, the outer sleeve, a second spring adapted to bear on the outer sleeve, a head on said outer sleeve, and a series of levers arranged between the head of the outer sleeve and the head of the inner sleeve, for the purpose set forth.

7. The combination with the motor or driving shaft, of the driven shaft coaxial with the driving-shaft and having a bearing at the end of the driving-shaft, a clutch-casing connected with the driving-shaft and carrying a series of clutch-disks, a clutch-hub upon the driven shaft and carrying an alternate series of clutch-disks, an inner sleeve adapted to slide on the driven shaft and having a head adapted to clamp the clutch-disks together,

an outer sleeve adapted to slide upon the inner sleeve and turn therewith, a head upon the outer sleeve, a series of levers interposed between the heads of said sleeves, two springs bearing respectively on said sleeves and adapted to move them toward the clutch-disks, and means for applying said springs successively to clamp said clutch-disks and for relieving said clutch-disks successively of the pressure of said springs, for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

RUSSELL HUFF.

Witnesses:
ALLEN LOOMIS,
R. H. ALLEN.

J. W. PACKARD.

WATER COOLING SYSTEM FOR HYDROCARBON ENGINES.

APPLICATION FILED OCT. 23, 1906.

1,034,728.

Patented Aug. 6, 1912.

2 SHEETS—SHEET 1.

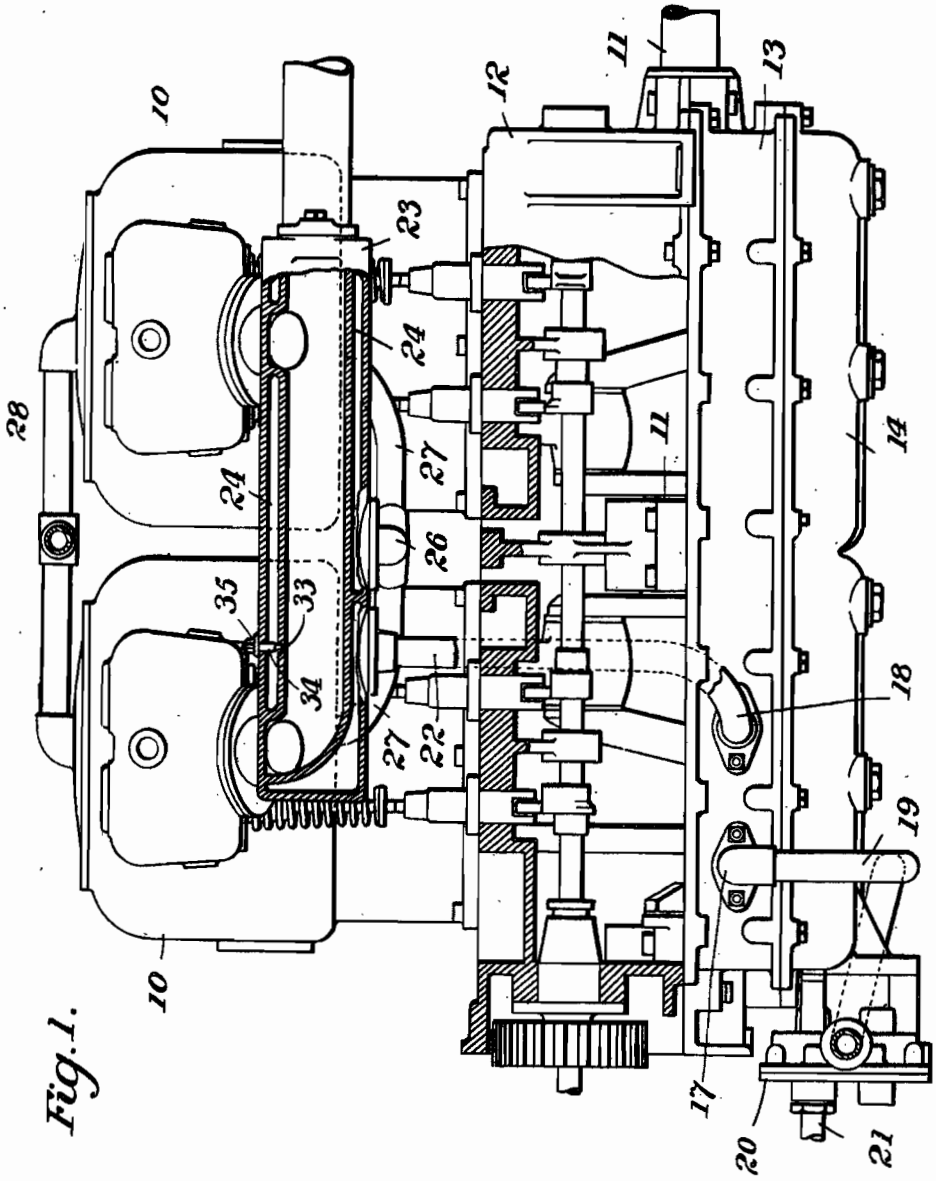

Fig. 1.

Witnesses

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J. J. McCarthy

Inventor

by James W. Packard

Foster Freeman & Watson

Attorneys

J. W. PACKARD.

WATER COOLING SYSTEM FOR HYDROCARBON ENGINES.

APPLICATION FILED OCT. 23, 1906.

1,034,728.

Patented Aug. 6, 1912.

2 SHEETS—SHEET 2.

Fig. 3

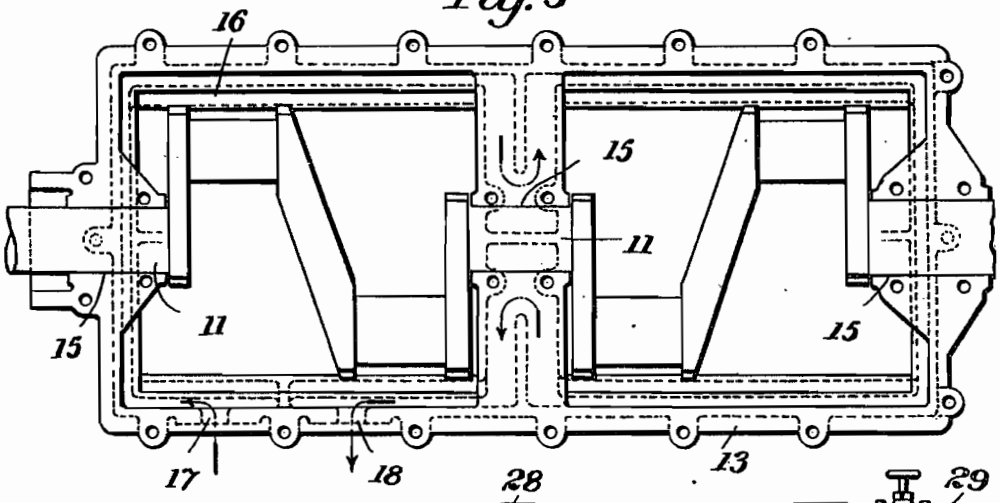
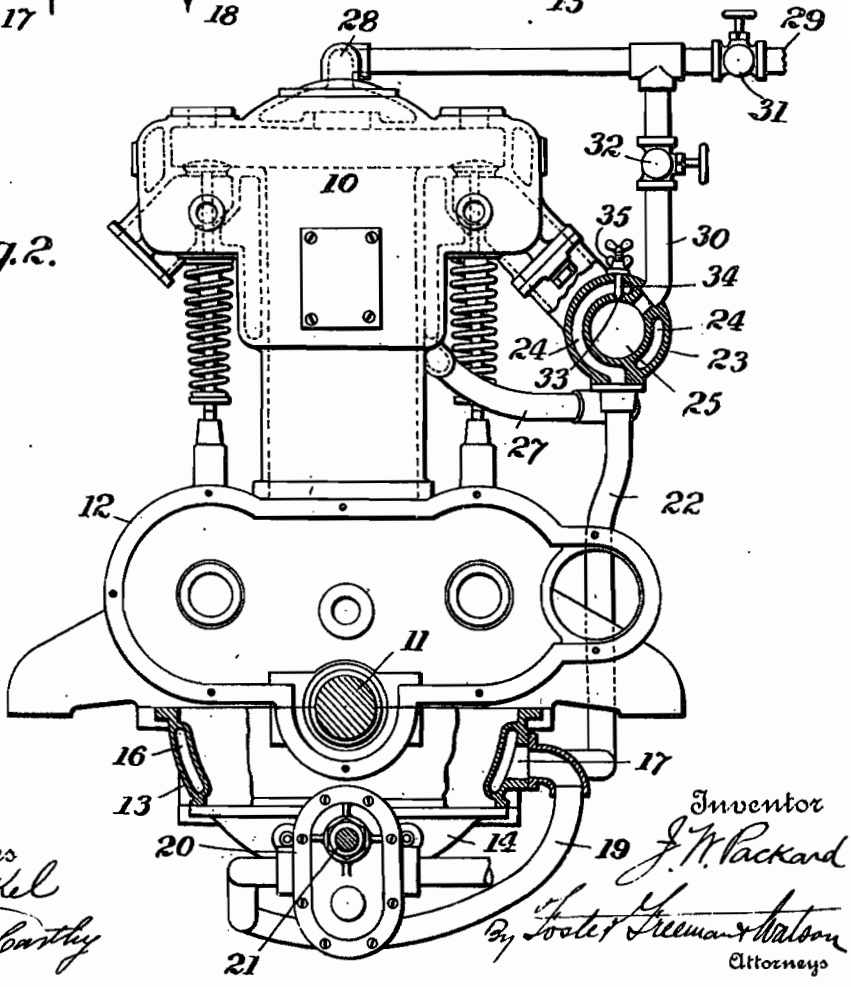


Fig. 2.



Witnesses

J. G. Stinkel

J. J. McCarthy

Inventor

J. W. Packard

By Foster Freeman & Watson

Attorneys

UNITED STATES PATENT OFFICE.

JAMES WARD PACKARD, OF LAKEWOOD, NEW YORK, ASSIGNOR, BY MESNE ASSIGNMENTS, TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

WATER-COOLING SYSTEM FOR HYDROCARBON-ENGINES.

1,034,728. Specification of Letters Patent. Patented Aug. 6, 1912.

Application filed October 23, 1906. Serial No. 340,238.

To all whom it may concern:

Be it known that I, JAMES W. PACKARD, a citizen of the United States, residing at Lakewood, in the county of Chautauqua and State of New York, have invented certain new and useful Improvements in Water-Cooling Systems for Hydrocarbon-Engines, of which the following is a specification.

The present invention relates to means for cooling the various working parts of a hydrocarbon engine and also for cooling the exhaust to assist in condensing and muffling the same.

The invention will be described in connection with the accompanying drawings in which,

Figure 1 is a side elevation partly in section of a four-cylinder hydrocarbon engine embodying the invention; Fig. 2 is an end view of the same, partly in section; and Fig. 3 is a plan view of the lower half of the casing showing the water circulating conduits in dotted lines.

The accompanying drawing illustrates a hydrocarbon engine having four cylinders arranged in line and in pairs, each pair being inclosed within a casing 10. The engine may be of any approved construction and its details will not be described herein as they form no part of the present invention. The crank shaft 11, as shown, is mounted in bearings 15 in a sectional crank casing comprising an upper section 12, a middle section 13 and a bottom section 14. The crank shaft bearings are formed in the upper face of the middle section and the lower face of the upper section so that by separating these sections the crank shaft may be removed. The lower half of the crank case may, so far as the present invention is concerned, be formed in a single piece instead of the two parts 13, 14. The particular construction of the crank case is not an essential feature of the present invention except in so far as the water cooling system is concerned. The crank case is partially filled with oil into which the several cranks dip as the crank shaft rotates and the splashing of the oil lubricates the cylinders, crank pins, crank shaft bearings and other parts exposed to the interior of the crank case.

I have found it advisable to partially heat the cooling water for the engine cylinders before introducing it into the cylinder castings, especially in the case of marine motors taking constantly a fresh supply of cold water, to prevent local contraction of the cylinder walls near the inlets, and in the present invention I also utilize the water, before introducing it into the cylinder castings, to cool the oil in the crank case and the crank shaft bearings. I thus obtain the double result of keeping the oil and the crank bearings cool and warming the water before utilizing it to cool the cylinders. I also preferably pass the water through the casing of the exhaust passage as it flows from the crank case to the cylinder casings for the double purpose of condensing the exhaust and thereby muffling the same and raising the water to a still higher temperature. From the exhaust casing the water flows to and through the cylinder casings and from the cylinder casings it may be discharged, although in some instances I lead the water from the cylinder casings into the exhaust pipe to further cool and condense the exhaust.

The invention is particularly applicable to marine motors as such motors are not exposed to the cooling effect of the atmosphere as are motors used in motor vehicles, and stationary motors. The invention is however applicable to hydrocarbon motors regardless of the particular use to which they may be applied.

The section 13 of the crank case is cored out to form a continuous channel 16 from an inlet 17 to an outlet 18, as shown in dotted lines in Fig. 3. The channel 16 runs completely around the casing under the end bearings thereof and it is offset inward at each side opposite the middle bearing, as shown in the drawing. All of the bearings, and the oil in the casing, are thus kept cool. The water may be supplied to the inlet 17 in any suitable way. As shown, it is pumped through a pipe 19 by means of a rotary pump 20, the shaft 21 of which is driven in some suitable way by the engine. The pipe 19 conducts the water to the inlet 17 and from said inlet the water flows in the direction of the arrows, Fig. 3, to the outlet 18. From the outlet 18 the water flows through a pipe 22 to the exhaust casing 23. This casing is suitably cored to produce in-

ternal channels 24 extending lengthwise of the casing and nearly surrounding the exhaust passage 25. The channels 24 conduct the water to an outlet pipe 26 having two branches 27 which conduct the water to the lower parts of the cylinder casings 10. The water is suitably circulated through these casings and discharged through piping 28 at their upper ends. The water leaving the cylinder casings may be discharged finally as through a pipe 29 or it may be directed into the exhaust passage 25, as through the pipe 30. The pipes 29, 30, may be provided with valves 31, 32, to direct the water as desired.

In cases where it is not desirable to permit all of the cooling water to enter the exhaust, I provide an opening 33 between the channel 24 and the exhaust passage 25 to admit a relatively small quantity of the cooling water to the exhaust passage to cool and condense the hot gases, for the purpose of lessening and muffling the exhaust and also to cool the exhaust pipe to a temperature at which it will not burn an attendant or other person touching it. I also provide a valve 34 for the opening 33 and means for locking the valve in any desired position. In the drawing I have illustrated an ordinary needle valve provided with means for setting it and a lock nut 35 for holding it in any desired adjustment.

It will be understood that the particular shape and course of the channels in the various parts of the motor may be varied and the arrangement of pipes and conduits may be varied without departing from the spirit and scope of the invention. Furthermore the crank case may be made in two parts separated along a plane passing through the shaft bearings instead of three parts as shown. The invention is furthermore applicable to engines having more or less cylinders than the number shown in the drawing.

As previously stated the invention is particularly desirable in and applicable to hydrocarbon engines for marine purposes, such as motor boats.

Having described my invention what I claim and desire to secure by Letters Patent is,

1. In a hydrocarbon engine, the combination with a cylinder having a water jacket and with a crank case comprising bearings for the crank shaft, of a channel in said crank case having transverse portions extending to the crank shaft bearings, means for circulating water through said channel whereby the bearings are kept cool and the water partially warmed, and means for conducting the water from the crank case to and through the said cylinder water jacket.

2. In a hydrocarbon engine, a crank case having a water jacket or conduit, an exhaust passage having a water jacket, and an engine cylinder having a water jacket, and means for forcing the same water successively through said water jackets in the order mentioned.

3. In a hydrocarbon engine, the combination with a cylinder having a water jacket, an exhaust casing having a water jacket and a connection between said water jackets, of means for forcing the water first through the exhaust jacket and then through the cylinder jacket, and means for diverting a part of the water in the exhaust jacket directly into the exhaust passage.

4. In a hydrocarbon engine, the combination with a cylinder having a water jacket, an exhaust casing having a water jacket, and a connection between said water jackets, of means for forcing the water successively through the exhaust jacket, and the cylinder jacket, means for conducting a part of the water from the cylinder jacket to the exhaust passage, and means for conducting a portion of the water from the exhaust jacket directly into the exhaust passage.

5. In a hydrocarbon engine, the combination with a cylinder having a water jacket, an exhaust casing having a water jacket, and a connection between said water jackets, of means for forcing the water successively through the exhaust jacket and the cylinder jacket, valve controlled means for conducting a part of the water from the cylinder jacket to the exhaust passage and valve controlled means for conducting a portion of the water from the exhaust jacket directly into the exhaust passage.

In testimony whereof I affix my signature in presence of two witnesses.

JAMES WARD PACKARD.

Witnesses:
L. W. MAXSON,
R. H. MAXSON.

A. LOOMIS.

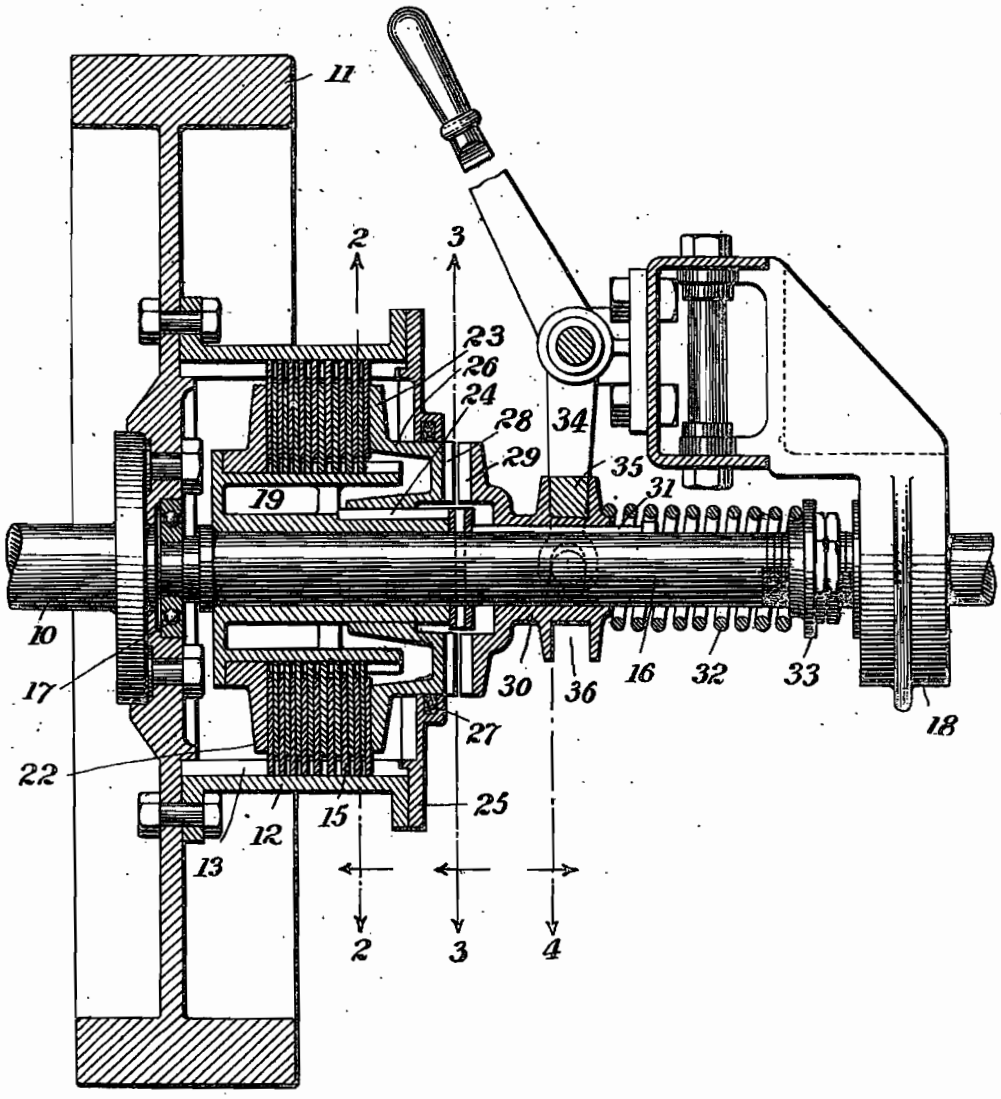
COMBINED FRICTION AND POSITIVE CLUTCH.

APPLICATION FILED NOV. 10, 1906.

952,535. Patented Mar. 22, 1910.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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J. J. McCarthy

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COMBINED FRICTION AND POSITIVE CLUTCH.

APPLICATION FILED NOV. 10, 1906.

952,535. Patented Mar. 22, 1910.

3 SHEETS—SHEET 2.

Fig. 2

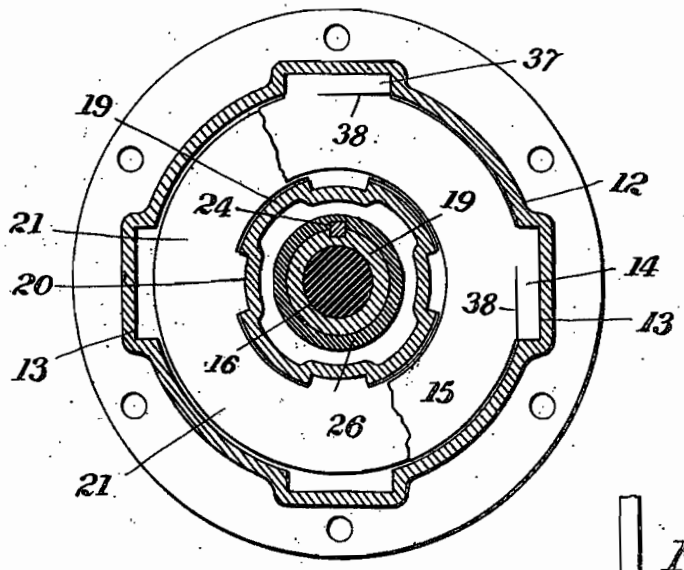


Fig. 3.

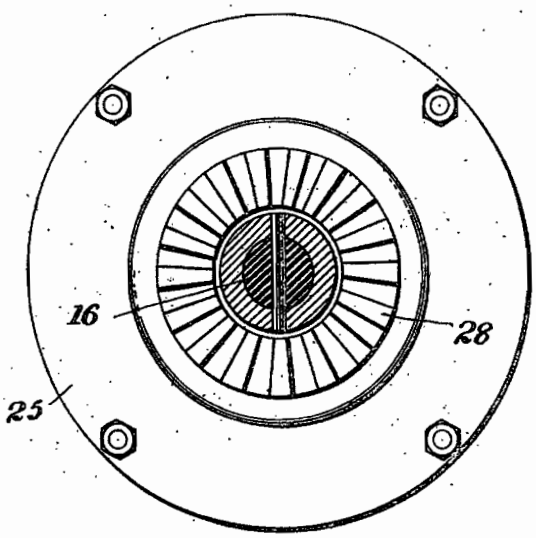


Fig. 4.

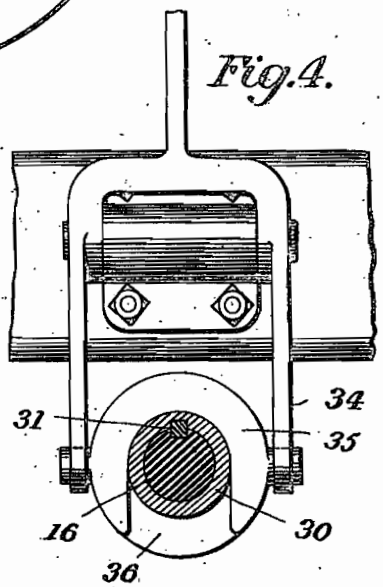
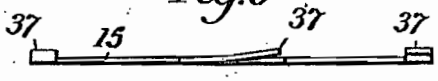


Fig. 5



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COMBINED FRICTION AND POSITIVE CLUTCH.

APPLICATION FILED NOV. 10, 1906.

952,535. Patented Mar. 22, 1910.

3 SHEETS—SHEET 3.

Fig. 6

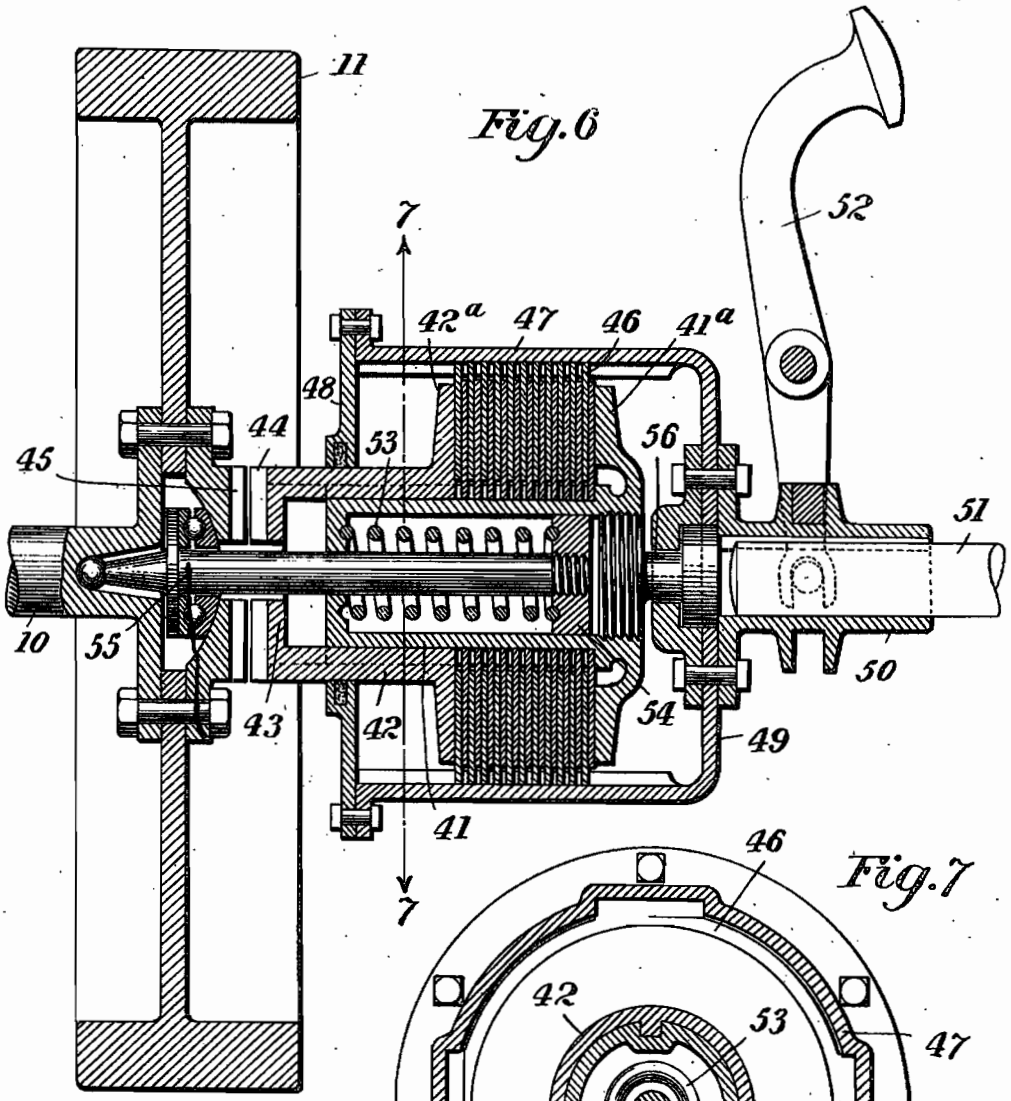
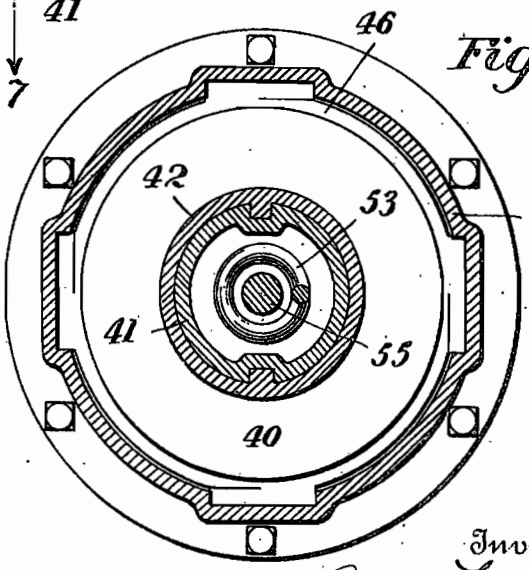


Fig. 7



Witnesses

J. G. Stinkel

Inventor

Allen Loomis

by Foster Freeman & Watson

Attorneys

UNITED STATES PATENT OFFICE.

ALLEN LOOMIS, OF DETROIT, MICHIGAN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

COMBINED FRICTION AND POSITIVE CLUTCH.

952,535. Specification of Letters Patent. Patented Mar. 22, 1910.

Application filed November 10, 1906. Serial No. 342,685.

To all whom it may concern:

Be it known that I, ALLEN LOOMIS, a citizen of the United States, and residing at Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Combined Friction and Positive Clutches, of which the following is a specification.

This invention relates to improvements in clutches and particularly to a clutch which is specially adapted for connecting and disconnecting the driving wheels of a motor vehicle with the motor.

One of the features of the invention especially applicable to motor vehicles comprises means for instantly disconnecting a clutch of the multiple disk friction type, thus avoiding the usual drag due to the comparatively slow disengagement of the friction members in clutches of this type now in use.

The invention will be described in connection with the accompanying drawings, in which:

Figure 1 is a central sectional view through a clutch embodying my invention; Fig. 2 is a section on the line 2 of Fig. 1; Fig. 3 is a section on the line 3 of Fig. 1; Fig. 4 is a section on the line 4 of Fig. 1; Fig. 5 is an edge view of one of the primary friction disks; Fig. 6 is a central sectional view through another form of clutch embodying my invention; and Fig. 7 is a section on the line 7 of Fig. 6.

Referring to the drawing, 10 indicates a driving shaft, which may be the crank shaft of a hydrocarbon engine, 11 indicates a fly-wheel rigidly connected to the shaft, and 12 a substantially cylindrical clutch casing rigidly connected with the fly-wheel. The clutch casing 12 has a series of internal recesses or grooves 13, which receive the ears 14 of a series of primary clutch disks 15, as shown in Figs. 1, 2 and 5. Coaxial with the driving shaft 10, is a driven shaft 16, one end of which has a bearing 17 in the fly-wheel. The said shaft is also supported near the clutch by a bearing 18, these bearings being of any suitable design.

Loose upon the driven shaft 16 and within the clutch casing, is a hub 19 having an outer substantially cylindrical surface provided with longitudinal grooves 20 adapted to receive lugs on a series of secondary clutch disks 21, the said disks being circular at their outer edges. The disks 15 and 21 are concentric and arranged alternately as shown in Fig. 1, and when pressed together the outer disks, which are driven by the clutch casing, turn the inner disks and the hub 19. The clutch disks are sustained at one side by a ring 22 on the hub 19 and at the other side they are sustained by a clutch ring 23, which is adapted to slide longitudinally upon an inner portion of the hub 19 and connected with the hub so as to turn therewith by means of one or more keys 24. Rigidly connected with the end of the clutch casing opposite to the fly-wheel, is a cover plate 25, which has a central circular opening fitting a cylindrical surface 26 on the clutch ring 23. The joint between this cover and the ring is preferably packed by a ring of felt or other fabric 27 arranged in a groove in the inner edge of the cover. The cover 25 serves to close the clutch casing and prevent the escape of oil with which the casing is preferably filled.

The outer face of the clutch ring 23 has a series of teeth or projections 28, which are adapted to engage a similar series of projections or teeth 29 upon a clutch sleeve 30, which is keyed to the shaft 16 by one or more keys 31 and adapted to slide on said shaft. A spring 32 surrounding the shaft 16 and interposed between a fixed collar 33 on said shaft and the clutch sleeve 30 tends to hold the clutch members 28 and 29 in engagement and to force the clutch ring 23 against the disks and clamp the primary and secondary disks together. The spring 32 has sufficient power to clamp the clutch disks together so tightly that they will form practically a positive clutch. The clutch sleeve 30 as shown, is operated by a lever 34 fulcrumed on a fixed part of the frame, one arm of said lever engaging a yoke 35 which runs in an annular groove 36 in the clutch sleeve 30. The lever 34 is preferably operated by a pedal when the clutch is used for transmitting power in a motor vehicle.

When the parts of the clutch are in the position shown in Fig. 1, the motor shaft 10 is entirely free from the driven shaft 16 and the motor may continue to run without turning the driven shaft. In this position of the parts, the spring 32 is compressed by the power applied to the lever 34. To start the machine, the lever 34 is released, permitting the spring 32 to first move the posi-

tive clutch member 29 into engagement with the clutch member 28 and then press the ring 23 against the clutch disks in the casing 12. These disks are thus clamped between the ring 23 and the ring 22, and the inner or secondary clutch disks gradually acquire the speed of the primary clutch disks, after which all of the parts run together and the shaft 16 is driven at the same speed as the motor shaft 10.

My invention is especially valuable for instantly disconnecting the driven shaft from the engine as is desirable in stopping an automobile, especially in making emergency stops. Thus while pressing the lever 34 forward, the positive clutch members 28 and 29 can be instantly disconnected, thereby disconnecting the driven shaft 16 from the motor shaft. Thereafter the clutch disks gradually separate, being assisted in separating by springs interposed between the lugs of the disks. These springs may be integral with the lugs and form part of the same, as shown in Figs. 2 and 5, in which 37 indicates spring tongues which are formed by slitting the lugs along the lines 38 and bending the tongues outward. In friction clutches of the class shown, the friction disks or plates are held together by suction after being released from positive pressure and it is impossible to stop the machine quickly if the friction clutch alone be relied on. By combining, however, the positive clutch with the friction clutch, I am enabled to start the machine without a jar and to stop it in the same manner and I am also enabled to disconnect the driven shaft instantly from the motor if it is desirable to make a quick stop. As it is frequently of vital importance to stop suddenly to prevent accident, the importance of this improvement will be appreciated.

It will be noted that the clutch ring 23 is connected to rotate with the inner or driven member of the friction clutch. When the positive clutch 28, 29 is disconnected as shown in Fig. 1, both members of the friction clutch may rotate freely while the driven shaft 16 is stationary. On throwing in the positive clutch, the inner friction clutch member will be momentarily stopped, but as the spring 32 is allowed to expand, the primary and secondary clutch disks will be gradually clamped together and the inner clutch member gradually started, carrying with it the driven shaft. As the full force of the spring 32 is applied the friction clutch members will be gripped so tightly that they will turn together and all of the parts connected with the driving and driven shafts will rotate as a unit.

The modified form of the invention illustrated in Fig. 6 is in the nature of a reversal of a number of the parts shown in Fig. 1. Referring to Figs. 6 and 7, the primary elements 40 of the friction clutch are mounted on a cylinder 41 which carries one of the annular clamping jaws 41^a. The other clamping jaw 42^a is carried by a second cylinder 42 which is adapted to slide on and turn with the cylinder 41. The cylinder 42 is provided on its end 43 with a series of jaws or teeth 44 which are adapted to interlock with a similar series of jaws or teeth 45, carried by the fly wheel 11, forming therewith a positive clutch. The secondary elements 46 of the friction clutch are arranged alternately with the primary elements and are connected with a cylindrical casing 47 which incloses both sets of friction disks. At one end the casing 47 has a flange 48 which fits the periphery of the cylinder 42, and at its other end the casing 47 has a flange 49 which is rigidly connected to the sleeve or collar 50 which is adapted to slide on and turn with the driven shaft 51. The sleeve or collar 50 and the parts connected thereto may be shifted longitudinally of the shaft by any suitable means, such as a foot-lever or pedal 52. As shown, the members of the positive clutch 44, 45, are normally engaged and the elements of the friction clutch are normally clamped together by a spring 53 which is interposed between the head of the cylinder 41 and an abutment 54 which is connected with the driving shaft 10. As shown, the rod 55 is suitably tied to the driving shaft, with freedom to turn relatively thereto, and the abutment 54 is connected to said rod. The spring presses the jaw 41^a against the friction elements and moves them bodily to the left, as shown in Fig. 6, carrying the opposing jaw 42^a to the left until the clutch teeth 44, 45, are engaged. The jaw 42^a then becomes fixed and the spring 53, still pressing against the jaw 41^a, clamps the friction disks securely together, causing the entire clutch to run as one piece. To open the clutches, the jaw 41^a and casing 47 are simultaneously pulled to the right. The casing is rigidly connected with the sleeve 50 and the jaw 41^a is also connected to said sleeve by means of a rod 56, one end of which is rigidly connected with the jaw 41 and the other end of which is swiveled to the casing 47 and sleeve 50, as clearly shown in the drawing. The operation of this modified clutch is as follows: As shown in the drawing the spring 53 is compressed by means of the lever 52 sufficiently to disconnect the positive clutch members 44, 45. When these members are disconnected, the jaw 42^a of the friction clutch is not under the influence of force to move it in either direction and hence the elements of the friction clutch are free to move relatively. When the lever 52 is released the casing 47, the jaws 41^a, 42^a, and their connected parts move bodily to the left until the positive clutch members 44, 45, are in-

terlocked. Further movement to the left is therefore prevented and the spring next takes effect upon the friction clutch, clamping the plates or elements securely together. On moving the lever 52 in reverse direction, the positive clutch is instantly disengaged and both members of the friction clutch are thus permitted to stop quickly.

Having described my invention what I claim and desire to secure by Letters Patent is,

1. In a clutch mechanism, the combination with a driving shaft, a clutch casing connected with said shaft, and primary clutch disks connected with said casing, of the driven shaft concentrically arranged within said casing, a clutch disk hub mounted with freedom to turn on said shaft within the casing, the secondary disks mounted on said hub, the clutch ring arranged to slide on and turn with said hub and adapted to bear on the clutch disks, a positive clutch member on said clutch ring, and a positive clutch member on said driven shaft and adapted to engage with the clutch member on the ring, for the purpose set forth.

2. In a clutch mechanism, the combination with a driving shaft and a driven shaft, of a friction clutch comprising two series of interleaved friction disks, a member on the driving shaft interlocked with one series of said disks, two members rotatably mounted on the driven shaft and forming clamping jaws for said friction disks, one of said members being interlocked with a series of said disks, and means for positively connecting said latter member to said driven shaft.

3. In a clutch mechanism the combination with a driving shaft and a driven shaft, of a cylindrical casing connected with the driving shaft, two series of interleaved disks within said casing, one of said series being interlocked with the casing, a hub loosely mounted on the driven shaft and interlocked with the other series of said disks, a member sliding on said hub and adapted to close the casing, and means for connecting and disconnecting said hub and the driven shaft.

4. In a clutch mechanism, the combination with a driving shaft and a driven shaft, of a cylindrical casing connected to one of said shafts, a hub loosely mounted upon the other shaft, two series of interleaved friction disks, one series being interlocked with the casing and the other with the hub, a member sliding on said hub and adapted both to close the casing and to clamp the friction disks, and a clutch mounted on the driven shaft and adapted to engage said member.

In testimony whereof I affix my signature in presence of two witnesses.

ALLEN LOOMIS.

Witnesses:
RUSSELL HUFF,
R. H. ALLEN.

R. HUFF.

IGNITION APPARATUS FOR HYDROCARBON ENGINES.

APPLICATION FILED DEC. 22, 1906.

1,079,413.

Patented Nov. 25, 1913.

4 SHEETS—SHEET 1.

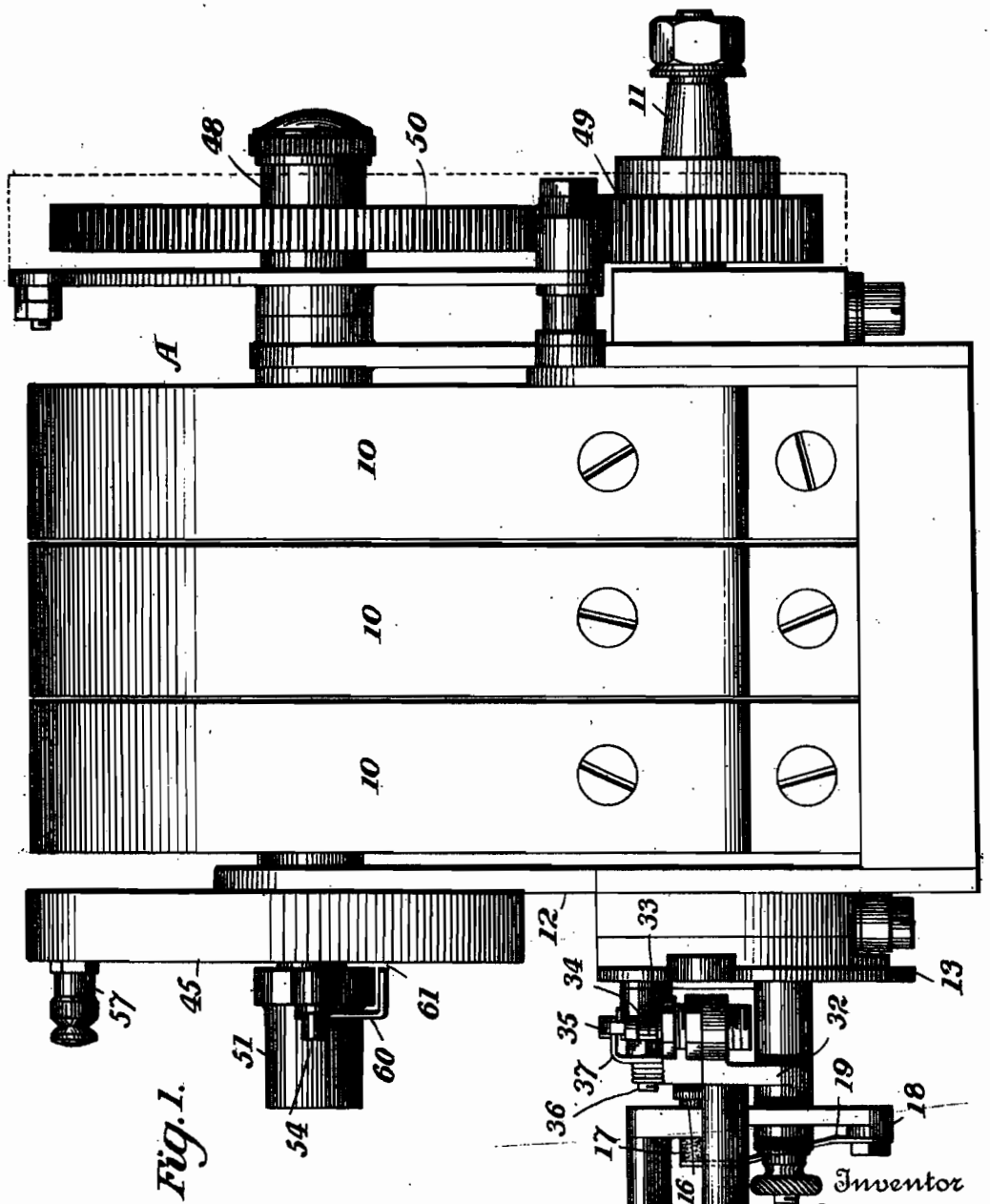


Fig. 1.

Witnesses
J. G. Stinkel
J. J. McCarthy

Inventor
Russell Huff
By Foster Freeman Watson Coit Attorneys.

R. HUFF.

IGNITION APPARATUS FOR HYDROCARBON ENGINES.

APPLICATION FILED DEC. 22, 1906.

1,079,413.

Patented Nov. 25, 1913.

4 SHEETS—SHEET 2.

Fig. 2.

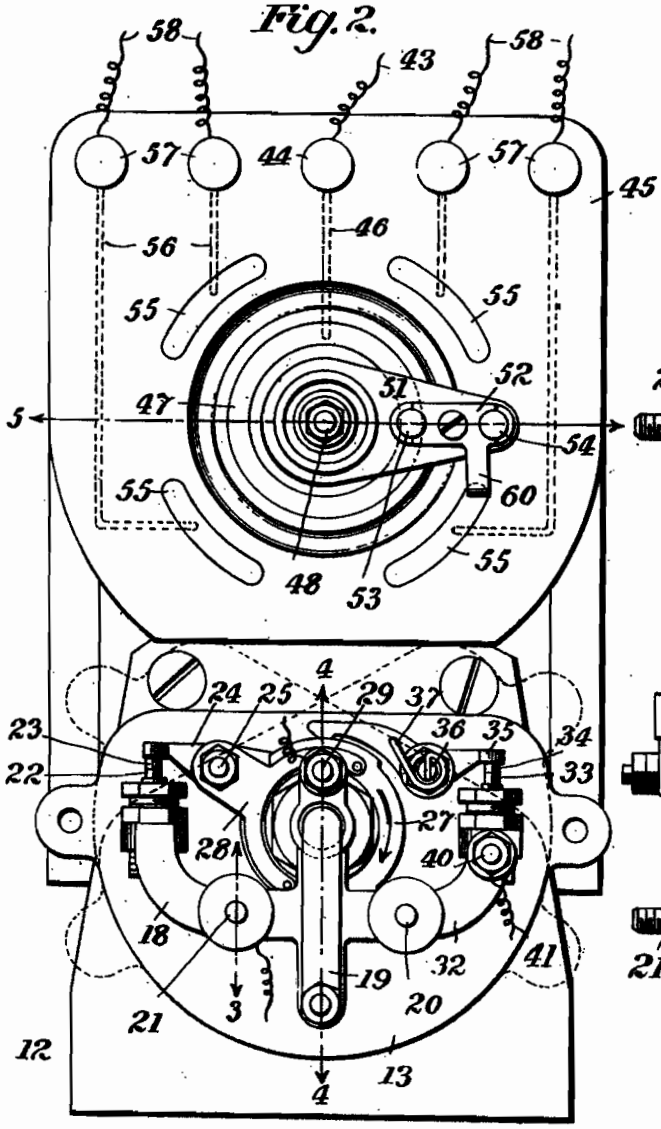


Fig. 3

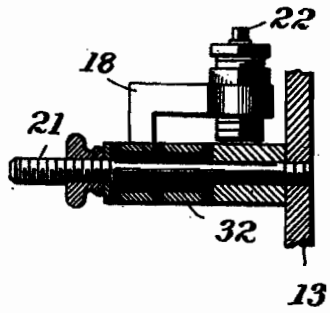


Fig. 4.

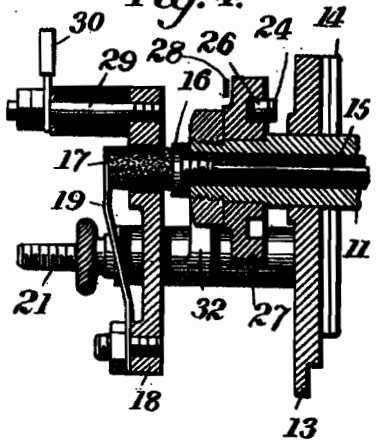
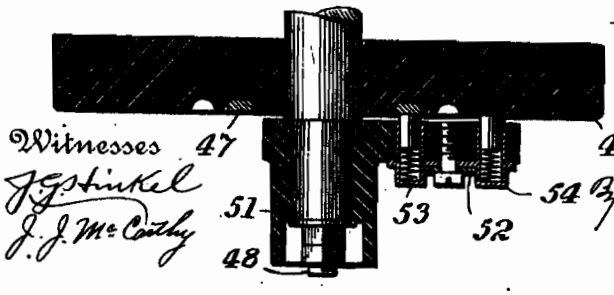


Fig. 5.



Witnesses
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J. J. McCarthy

Inventor
Russell Huff
By Foster Freeman Watson
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IGNITION APPARATUS FOR HYDROCARBON ENGINES.

APPLICATION FILED DEC. 22, 1906.

1,079,413.

Patented Nov. 25, 1913.

4 SHEETS—SHEET 3.

Fig. 6.

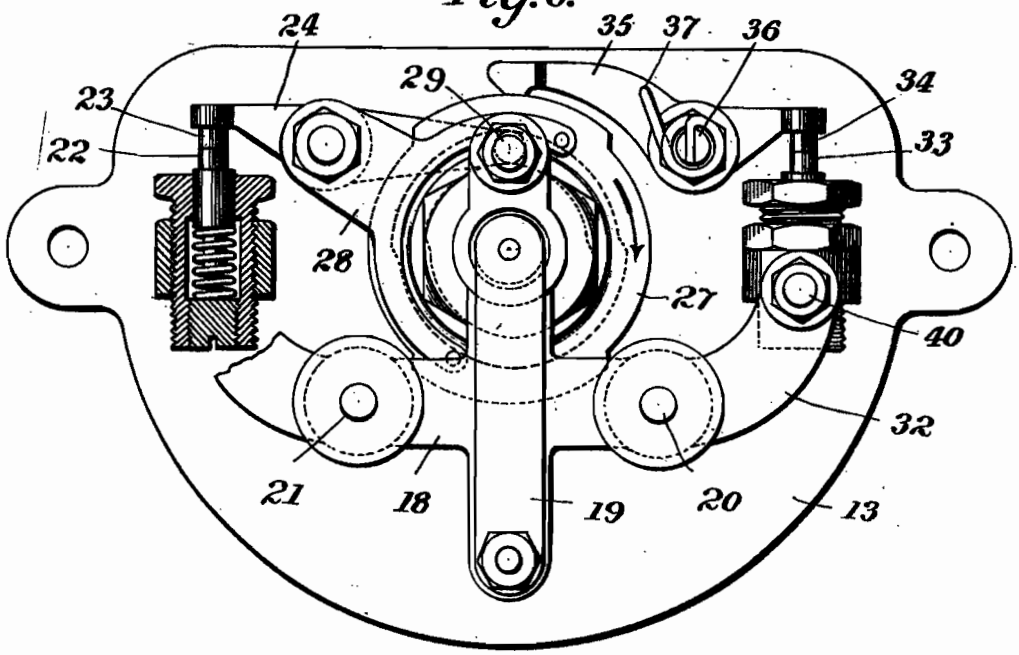

Fig. 7

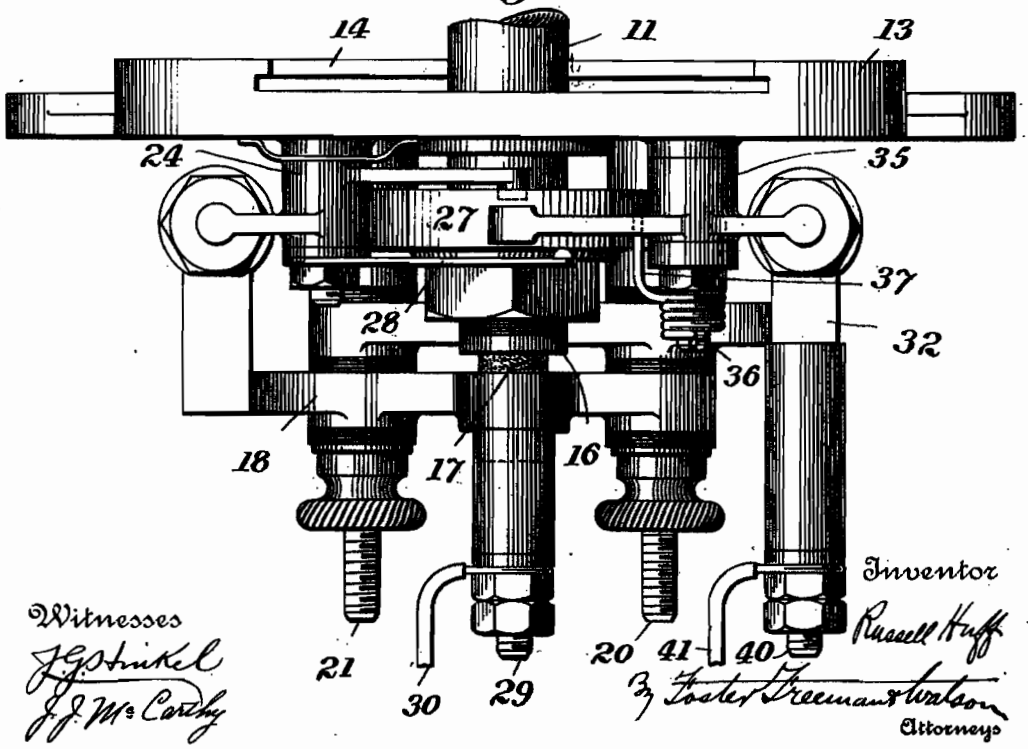

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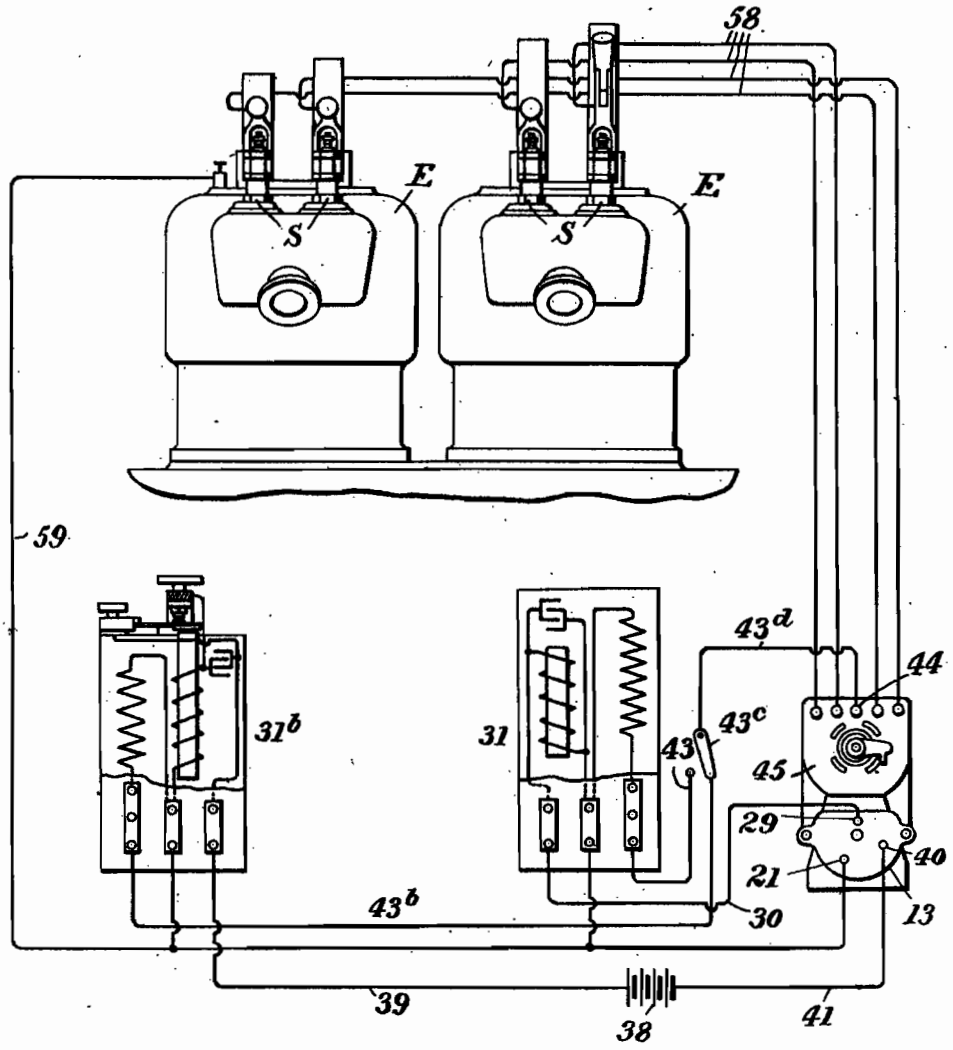
Fig. 8.



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UNITED STATES PATENT OFFICE.

RUSSELL HUFF, OF DETROIT, MICHIGAN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO PACKARD MOTOR CAR COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

IGNITION APPARATUS FOR HYDROCARBON-ENGINES.

1,079,413. Specification of Letters Patent. Patented Nov. 25, 1913.

Application filed December 22, 1906. Serial No. 349,190.

To all whom it may concern:

Be it known that I, RUSSELL HUFF, a citizen of the United States, and resident of Detroit, Wayne county, State of Michigan, have invented certain new and useful Improvements in Ignition Apparatus for Hydrocarbon-Engines, of which the following is a specification.

This invention relates to electric ignition apparatus for multiple cylinder hydrocarbon engines and more particularly for engines adapted for driving motor vehicles and motor boats.

The invention will be described in connection with the accompanying drawing in which,

Figure 1 is a side elevation of a magneto generator illustrating the present invention; Fig. 2 is a left end elevation of the generator showing the switching and contact devices; Fig. 3 is a section on the line 3 of Fig. 2; Fig. 4 is a section on the line 4 of Fig. 2; Fig. 5 is a section on the line 5 of Fig. 2; Fig. 6 is an enlarged view of the lower part of Fig. 2; Fig. 7 is a plan view of the devices shown in Fig. 6; Fig. 8 is a diagrammatic view illustrating the cylinders of the hydrocarbon engines and the various circuits.

Referring to the drawing 10 indicates the permanent magnets of the magneto generator A, and 11 the armature shaft. The armature may be of any desired type, such, for instance, as that illustrated in Letters Patent No. 780,221 to J. W. Packard. Upon the face of the generator is a fixed plate 12 upon which is mounted a face plate 13. The armature shaft passes through the plates 12 and 13 and the plate 13 is arranged to rock about an axis concentric with the shaft. As shown the plate 13 is provided with a circular in-turned lip 14 which engages a circular groove in a bracket or projection of the plate 12. The current generated by the magneto passes through a terminal 15 to a contact 16 on the end of the armature shaft, thence to a brush 17 bearing on said contact and to a bracket 18 which carries a spring 19 bearing on the brush 17. The bracket 18 is carried on but insulated from two posts 20, 21, fixed in the face plate 13. Bracket 18 carries a suitable spring-supported contact 22 adapted to coöperate with a contact 23 carried by a cam lever 24. Lever 24 is pivoted on a post 25 fixed in the face plate 13. One arm of the lever bears a pin or roller 26 running in a cam groove in the face of a cam wheel 27 fixed on the armature shaft 11 (Figs. 2, 4, 6 and 7). The post 25 carries a brush 28 bearing on the cam wheel 27 and the cam wheel and lever 24 are "grounded" on the armature shaft. When the points 22 and 23 are in contact the armature is short-circuited and when the contact is broken the current in the armature circuit is forced to pass out through binding post 29 on the bracket 18, through conductor 30, through the primary coil of a transformer 31 and back to armature shaft by way of post 21. The secondary circuit of the transformer will be referred to hereinafter.

Upon the posts 20, 21, and insulated therefrom, is supported a bracket 32 carrying a spring contact point 33 similar to the point 22. Coöperating with the point 33 is a contact point 34 carried by a cam lever 35 pivoted on a post 36 upon the face plate 13. A spring 37 tends to move the points 33, 34, apart and to press one arm of the lever upon a face cam on the periphery of the cam wheel 27. When the points 33, 34 are in contact, the current from a battery 38 passes through conductor 39, the primary coil of the transformer 31^b, binding post 21, face plate 13, cam lever 35, bracket 32, post 40 and conductor 41. It will be understood that the magneto current is only available when the motor is operating, the magneto being driven from the motor and at the same speed as the motor. For starting the motor the battery current is used. The primary circuits of the battery and magneto are provided with suitable switches as shown in my prior Patent 838,251, Dec. 11, 1906.

The secondary or high tension circuit from the transformers 31 and 31^b passes through conductors 43, 43^b respectively to a switch 43^c and thence through conductor 43^d to a post 44 on a distributer plate 45 of insulating material which is mounted on the magneto above the face plate 13. From the post 44 the high tension circuit passes through a conductor 46 to a conducting ring 47 on the distributer plate. Concentric with the ring 47 is a shaft 48 which is mounted on the magneto and driven from the armature shaft by gears 49, 50, the latter having twice as many teeth as the former and driving the shaft 48 at one-half the speed of the arma-

ture shaft. On the shaft 48 is an arm of insulating material 51 carrying a plate 52 of conducting material.

Mounted in the plate 52 is a brush 53 which is constantly in contact with the ring 47 and another brush 54 which is adapted to make contact with four segmental plates 55 upon the distributer plates, which plates 55 are respectively connected by conductors 56 with binding posts 57. From the posts 57 the conductors 58 lead respectively to the spark plugs S of the motor cylinders E. One element of each spark plug is grounded on the engine and the circuit returns from the engine to the transformers 31 or 31^b through conductor 59.

Circuit breakers 23 and 34 are operated twice during each rotation of the armature shaft and, therefore, four times during each rotation of the distributer shaft 48, and the cams are arranged to break the circuits at times when the brush 54 is in contact with one or other of the plates 55. In order that the spark may be advanced or retarded with respect to the position of the piston in the cylinder at the time of explosion, I arrange the face plate 13 so that it may be rocked in either direction as indicated by the dotted lines in Fig. 2. Thus, assuming that the magneto is turned in the direction of the arrow, Figs. 2 and 6, the spark will be advanced by rocking the right end of the face plate upward and will be retarded by rocking it downward, the extreme positions being shown in dotted lines in Fig. 2. Ignition may occur when the brush 54 is at any point upon one of the curved contact plates or segments 55. If the face plate 13 is set in a position to cause late or retarded ignition, the high tension current will flow through the brush 54 and contact segment 55 just before the brush leaves the segment and the cam 27 may prolong the primary current after the brush has left the segment. This with result in a great difference of potential between the brush and the segment, which would tend to cause a spark to leap from the brush to the next succeeding segment across which it is to rub and thus cause pre-ignition and a "back kick" in the cylinder having its spark plug connected with said succeeding segment. To avoid this a safety device in the form of a finger 60, connected electrically with the plate 52, is mounted on the arm 51, which finger trails after the brush 54. The finger 60, as shown in Fig. 1, has its point close to but not in contact with the face of the distributer plate, there being an air gap 61 between the finger and the contact plates 55. If the difference of potential between the brush 54 and one of the contact plates 55 becomes sufficient to cause a spark to leap from one to the other, the current, choosing the path of least resistance will leap the air gap from the finger 60 to the contact segment which has just been left by the brush 54, causing an additional spark in the cylinder which is making its working stroke and thus avoiding a premature explosion in the succeeding cylinder, such as would occur if the spark were permitted to leap ahead to the contact plate in advance of the brush 54.

It is to be understood that my invention may be embodied in various mechanical and electrical structures and that it is not limited to the precise construction and arrangement of parts illustrated and described herein.

The preferred system of conductors or wiring is shown and described in my Patent No. 838,251.

Having described my invention what I claim and desire to secure by Letters Patent is,

1. The combination with a hydrocarbon engine and an electric ignition apparatus comprising a battery, a generator having a shaft and driven by the engine, and transformer apparatus in circuit respectively with the battery and the generator, of a face plate adapted to rock upon an axis concentric with the generator shaft, a cam wheel on said shaft, and a pair of circuit breakers connected to said face plate and operated by said cam wheel, said circuit breakers being included respectively in the battery and generator circuits, and being movable to advance or retard the spark in the engine.

2. The combination with a hydrocarbon engine, an electric ignition apparatus comprising a battery, a generator having a shaft and driven by the engine, and a transformer apparatus, of a face plate adapted to rock about an axis concentric with the generator shaft, a cam wheel on said shaft adjacent to the face plate and having two cam surfaces, a pair of cam levers operated by said cam surfaces, and circuit breakers operated by said levers, said circuit breakers being respectively in the battery and generator circuits, and said face plate being movable to advance or retard the spark in the engine, for the purpose set forth.

3. The combination with a hydrocarbon engine and an electric ignition apparatus comprising a battery, a generator having a shaft and driven by the engine, a transformer in the battery circuit, and a second transformer in the generator circuit, of a face plate adapted to rock upon an axis concentric with the generator shaft, a cam wheel on said shaft, and a pair of circuit breakers connected to said face plate and operated by said cam wheel, said circuit breakers being included respectively in the battery and generator circuit, and said face plate being movable to advance or retard the spark in the engine.

4. In an ignition apparatus, in combina-

tion, an electric generator, a battery, suitable transformer apparatus for the generator and battery, a plurality of contact devices for sending current from either the battery or the generator through the transformer apparatus, and means for simultaneously adjusting the contact devices for advancing or retarding the spark.

5. In an ignition apparatus, in combination, an electric generator, a transformer therefor, a battery and a transformer therefor, a plurality of contact devices for sending current from either the generator or the battery through the primaries of their respective transformers, a spark plug, a single switch for connecting the spark plug in circuit with either of the secondaries of the transformers, and means for simultaneously adjusting the contact devices for advancing or retarding the spark.

6. In an ignition apparatus for a multicylinder hydrocarbon motor, the combination of an electric generator, a battery, transformers for the generator and the battery, a plurality of contact devices arranged respectively in the generator and battery primary circuits, a set of spark plugs for the motor, a single distributer having conductors leading to said plugs, means for connecting either of the high tension windings of said transformers to said distributer, and means for simultaneously adjusting the contact devices for advancing or retarding the spark.

7. The combination with a hydrocarbon motor, of an electric ignition apparatus comprising a battery, a suitable transformer for the battery current, a generator driven by the motor, a suitable transformer for the generator current, a member adapted to rock about the axis of the generator shaft, a circuit breaker mechanism and cam means operating same, one of which is mounted on the generator shaft and the other on said member, and said circuit breaker mechanism being adapted to control the primary circuits of both the battery and the generator, and said member being movable to advance or retard the spark in the motor.

8. The combination with a hydrocarbon motor, of an electric ignition apparatus comprising a battery, a transformer for the battery current, a generator driven by the engine, a transformer for the generator current, a member adapted to rock about the axis of the generator shaft, a circuit breaker and a cam for operating same, one of said parts being mounted on the generator shaft and the other on said member and the circuit breaker being arranged in the battery circuit, and a second circuit breaker and a cam for operating same, one of said parts being mounted on the generator shaft and the other on said member and the circuit breaker being arranged in the generator circuit, said member being movable to advance or retard the spark in the engine.

9. The combination with a hydrocarbon engine, of an electric ignition apparatus comprising a battery, a transformer for the battery current, a generator driven by the engine, a transformer for the generator current, a plate mounted on the generator adjacent the shaft thereof, a circuit breaker and a cam for operating same, one of said parts being mounted on the generator shaft and the other on the plate and the circuit breaker being arranged in the battery circuit, and a second circuit breaker and a cam for operating same, one of said parts being mounted on the generator shaft and the other on the plate and the circuit breaker being arranged in the generator circuit.

In testimony whereof I affix my signature in presence of two witnesses.

RUSSELL HUFF.

Witnesses:
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F. E. PAINE, JR.