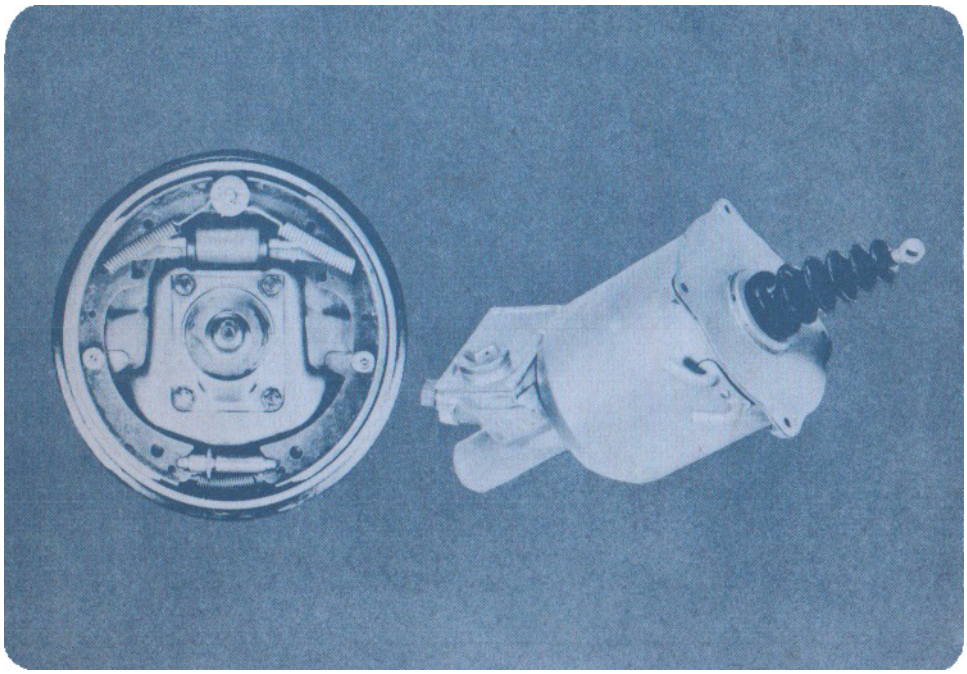
TRAINING PROGRAM

Serviceman's Training Book

BRAKES AND EASAMATIC



APRIL 1952

PACKARD MOTOR CAR COMPANY

DETROIT 32, MICHIGAN

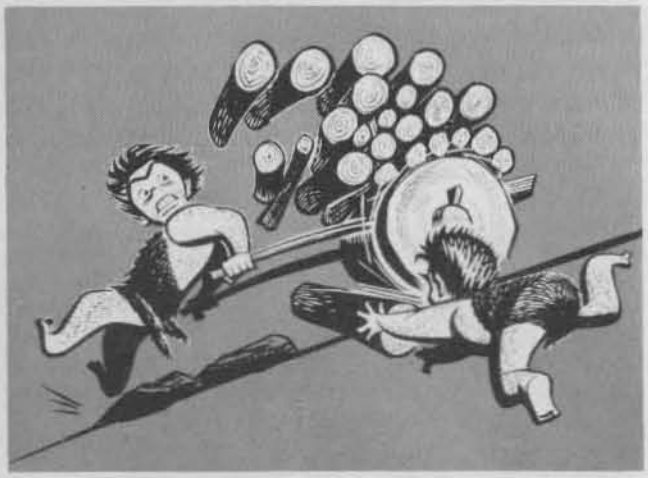
BRAKES AND EASAMATIC

Part I

INTRODUCTION

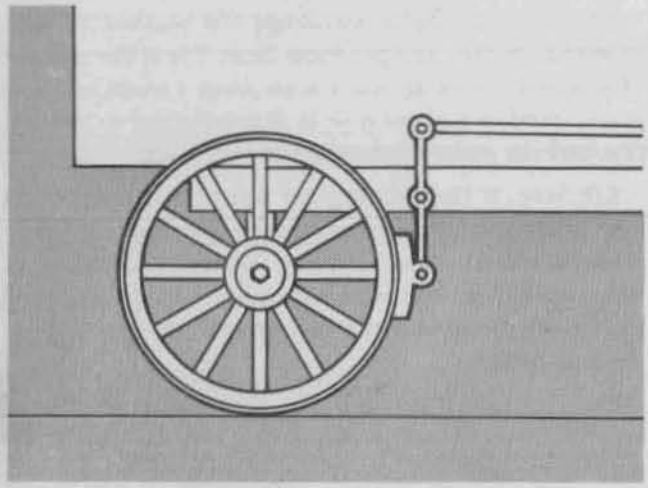
It is the purpose of this manual to provide the Packard Serviceman with a greater understanding of the fundamental principles, construction, operation, and servicing the braking systems including the new outstanding Easamatic power brake, used on the Packard car of today.

Therefore, it will be necessary to go back more than fifty years to show the progress and development which led to the modern day Easamatic brake.



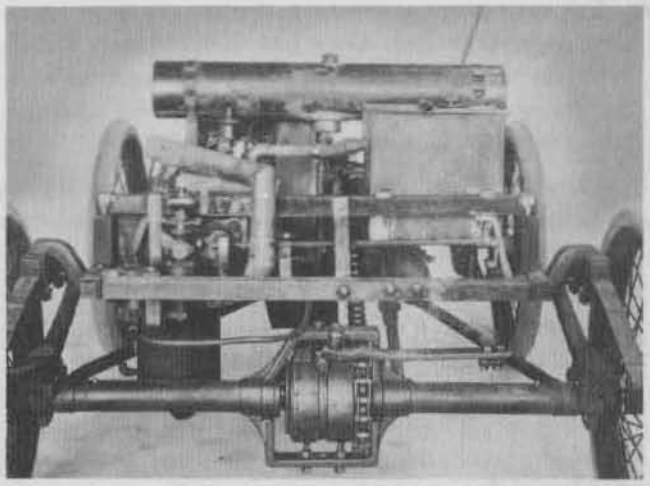
Fundamental Principles of Brakes

Brakes are nothing new, but the first methods used date back to the time of the ancient cart or wagon. The purpose of a brake is to stop or retard a moving object. This can be accomplished by increasing the resistance between the moving object and the surface of the earth.



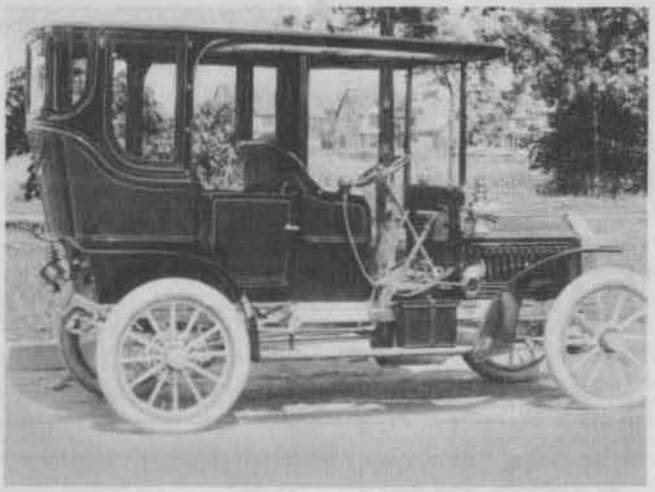
The first step of the development of the braking system for the car was the development of the wagon brake shoe.

It will be noted that the means of transportation up to the turn of the century was primarily the horse and wagon and the wagon type brake was adequate for stopping this vehicle. Therefore, for the early type car with its limited horsepower, and poor roads to limit its speed, the wagon type brake served the purpose. However, the surface of the wheel rim was an unsatisfactory surface to contact the brake shoe and braking material.



A brake drum was then developed and attached to the differential which gave a smooth contact surface and resulted in a better braking effect. The external contracting brake band was a new and effective method of increasing the contact area between the drum and the braking material.

As the popularity of the automobile increased, roads improved, engine horsepower increased giving greater car speeds, more braking power was needed to stop the car .The differential type brake was not satisfactory for these needs and little better than the wagon type brake, thus, the two wheel mechanical brakes were developed, using a new type brake drum that was developed for use with the external contracting band on each of the rear wheels.



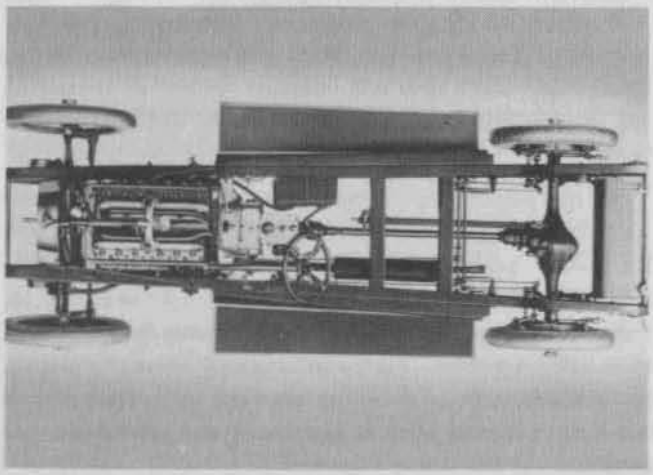
Mechanical brakes were first used on the rear wheels and later were added to the front wheels to increase the stopping ability of the car. When brakes on all four wheels were developed, it made possible quicker and safer stops from high speeds.

Another independent brake had to be developed to keep the car from moving when it was parked. The service brake could not be used for this purpose since it could not be locked in the "on" position. Thus, the emergency or hand brake was developed.

The external type service brakes on the front wheels were exposed to road dirt which reduced their braking efficiency and shortened the life of the linings. As a protection against the entrance of dirt, internal expanding brakes were developed for the front wheels for service use.

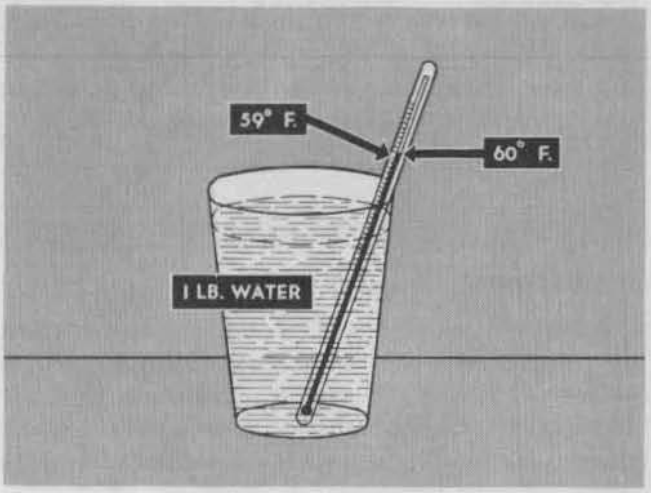
The earlier types of four wheel brakes were operated by rods, cables, levers and linkages, which were known as the mechanical brakes.

However, mechanical brakes did not give equal effort on all four wheels, thus, it would throw the car off its course when the brakes were applied. To correct this condition, hydraulically operated brakes were developed which gave smooth equal braking effort on all wheels. Hydraulic brakes kept the car on its course, regardless of the speed when the brakes were applied.



Before going into the construction and operation of brakes it would be well to consider the two basic principles of brakes, which are heat and friction.

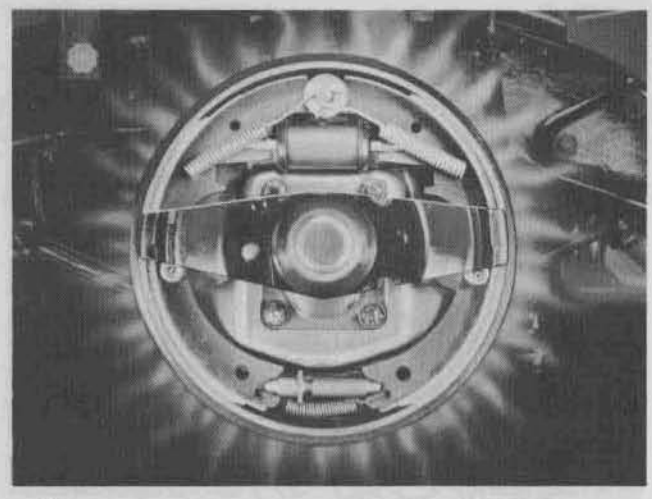
Heat is power. One B.T.U. (British Thermal Unit) of heat is the amount of heat required to heat one pound of water through one degree Fahrenheit of temperature. One B.T.U. per second = 1.44 H. P. (Horse Power).



Friction is that force which opposes motion. Friction consumes power and produces heat. Thus, the amount of power required to move a car from a stand still to a given speed in a given time is proportionate to the friction and the resistance holding the car back.

Likewise, if that moving car was to be brought to a stop in the same given time, an equal amount of power must be converted into heat by friction. If the car is to be stopped in a shorter period of time, the power must be converted into heat in a shorter time, thus the friction must be greater.

The principle of brakes is that the friction between the braking material and the drum converts the power of a moving car into heat.



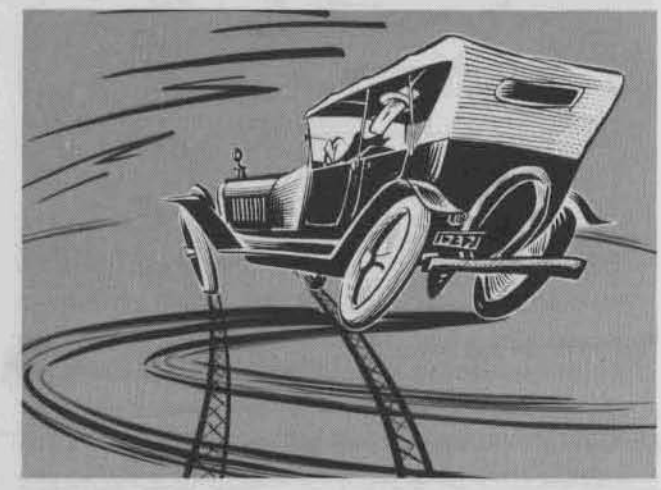
There are two important factors that affect friction:

(1) The composition of the material and the condition of the surfaces.

(2) The amount of pressure on the contacting surfaces.

This is due to the friction characteristics of material which is known as "coefficient of friction." The *area* of the contact surfaces has no effect on the coefficient of friction. It does, however, have a great effect on the *temperatures* caused by the heat of friction.

The "coefficient of friction" of a material can be determined by taking the force required to slide the object and dividing it by its weight. The "coefficient of friction" plays an important part in determining the braking materials required for the desired braking effect of the car.



If the coefficient of friction of the braking materials is too high, the brakes may grab or lock and cause skidding. If the coefficient of friction is too low, the braking effect will be so low that excessive pedal pressure will be required to stop the car. This condition is known as *hard pedal.*

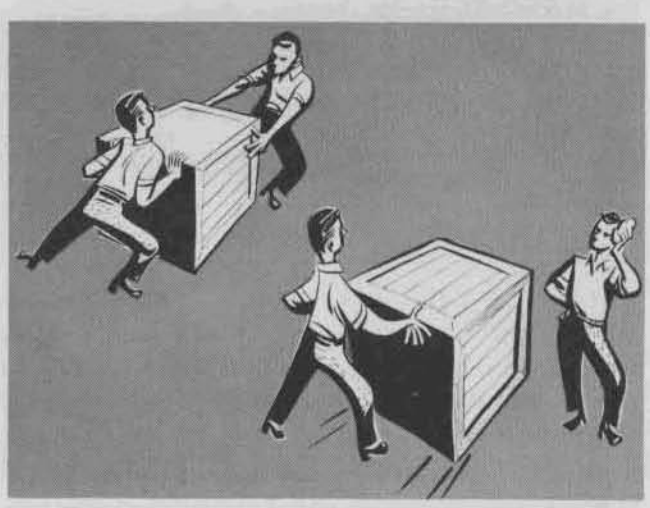
There are two kinds of friction:

Static Friction is friction at rest.

The friction between an object that is not moving and the surface upon which is rests.

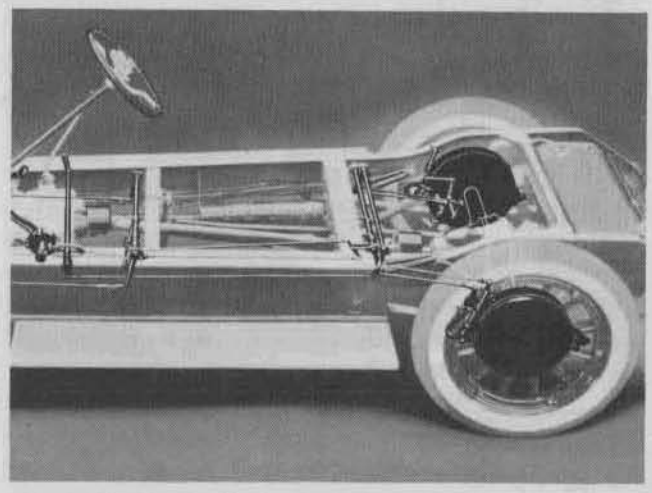
Kinetic friction is friction of motion.

Friction of motion consumes power, produces heat, and causes wear.



It requires much more effort to start an object in motion than it requires to keep it moving once it has started to move. This is due to the same materials having two different "coefficients of friction."

The coefficient of "static friction" and the coefficient of "Kinetic friction."

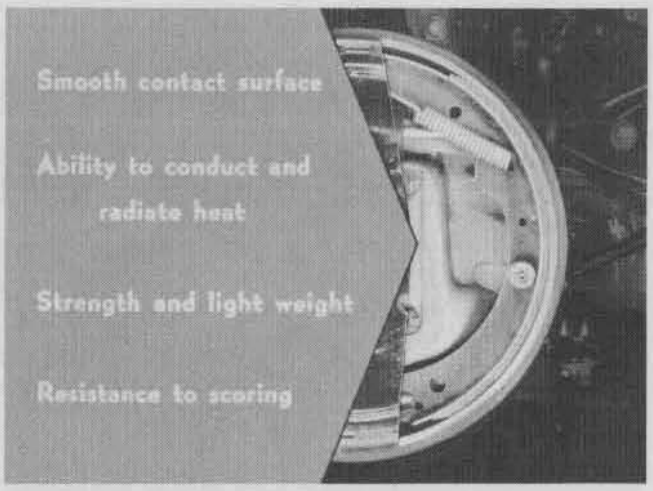


Static friction is friction between the braking material and the drum that prevents the car from moving when the hand brake is applied.

Kinetic friction is the friction between the braking material and the brake drum which is converted by the power of a moving car into heat.

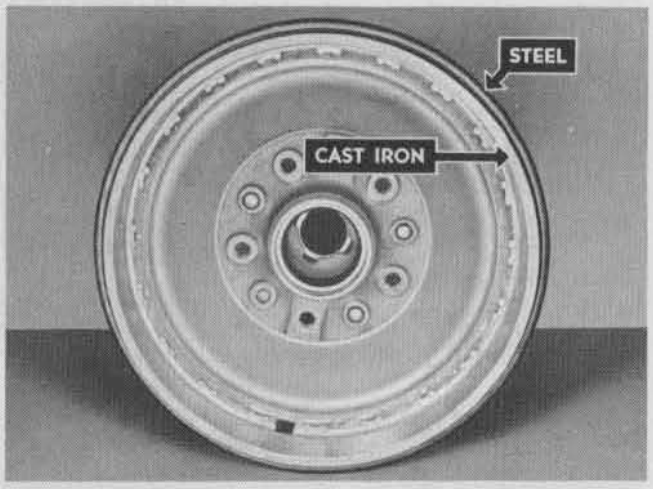
Brake linings are composed of asbestos and bonding materials. Asbestos is used because of its heat resisting qualities. However, asbestos has very little strength, so bonding materials such as asphalts, gums, and resins are used to hold the lining together.

The brake drum, in addition to giving a smooth lining contact surface, also conducts most of the heat away from the linings and radiates it into the air. Some of the heat also passes through the linings and brake shoes to the backing plates where the backing plates radiate it into the air.

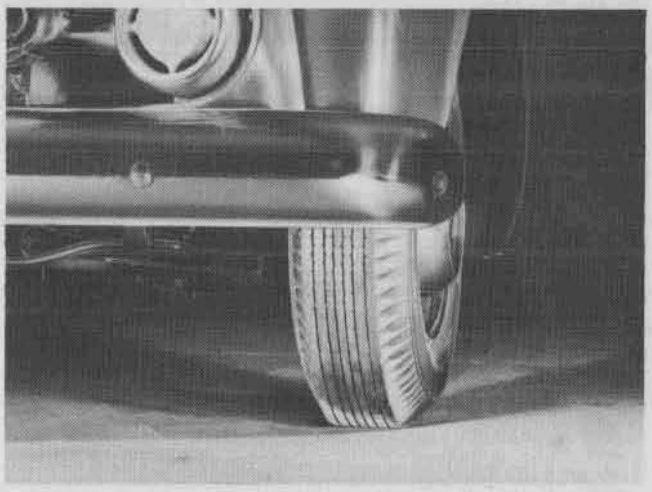


Brake drums to give satisfactory service must have these qualities:

Smooth contact surface.
Ability to conduct and radiate heat.
Strength and light weight.
Resistance to scoring.

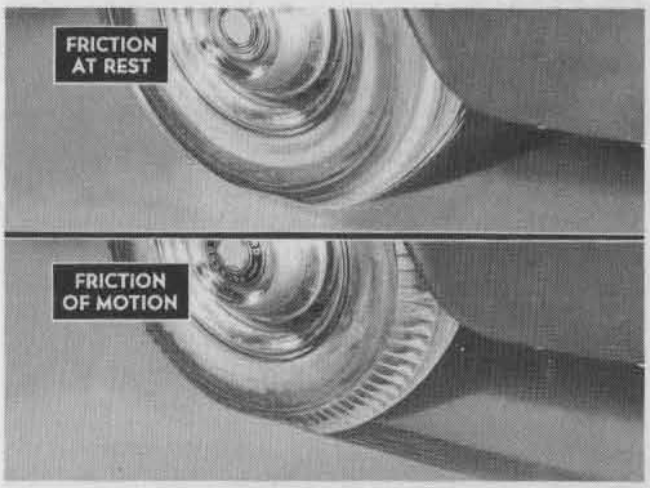


The brake drums used on Packard cars are steel backed cast-iron lined. This type drum combines the advantages of steel which has strength and light weight, and cast iron which gives a good contact surface and has little tendency to score. Both steel and cast iron give satisfactory heat conduction and radiation.



Another factor governing the effectiveness of brakes is the friction between the tires and the road surface. The friction between the tire and the road varies, depending on composition, condition, and tread design of the tire as well as the material and condition of the road.

The distance within which a car may be stopped depends on the friction between the tire and road surface. It is well to remember that the coefficient of friction between the tires and road surface is greater when the wheels are turning than when the wheels are sliding while the brakes are applied.



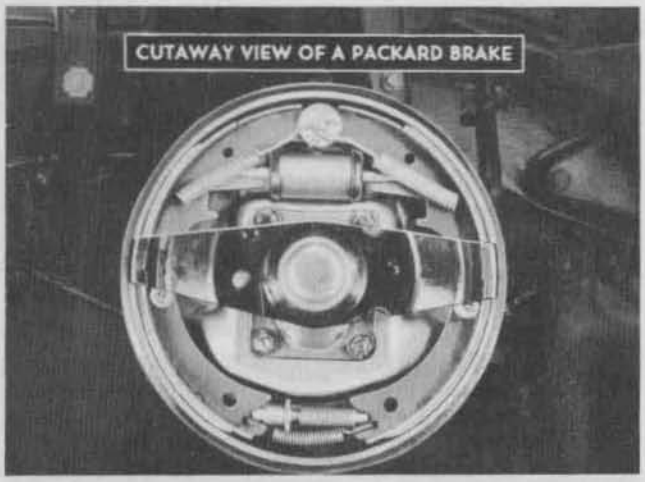
The friction is greater because with a turning wheel the friction between tire and road surface is static friction (friction at rest) while the friction between a sliding tire and the road surface is kinetic friction (friction of motion).

Part II

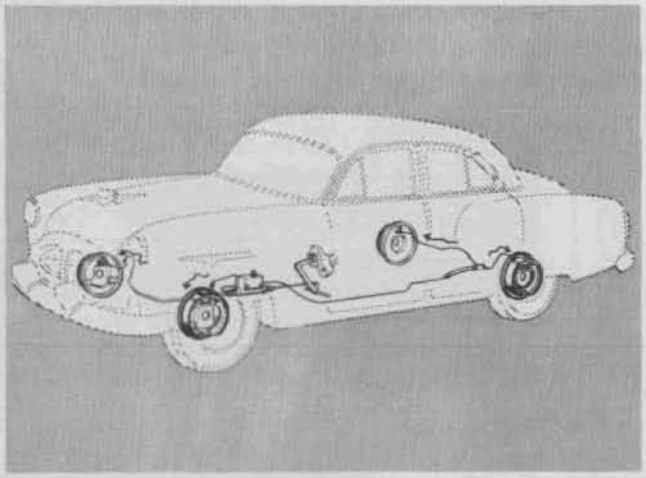
BRAKE CONSTRUCTION AND OPERATION

Service Brakes

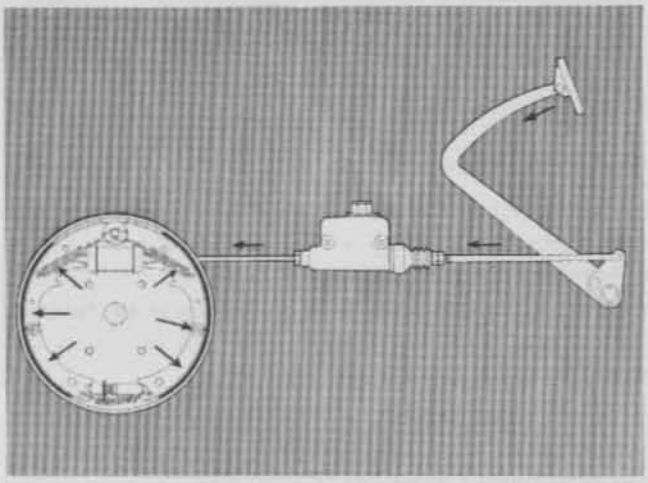
The Packard hydraulic service brakes are of the servo or self-energizing type and are hydraulically operated. The principle of hydraulic brake operation is based upon Pascals' law of physics which states:— "That pressure applied to a confined body of liquid is transmitted equally and undiminished in all directions through the liquid."



Therefore, the foot pressure applied to the brake pedal is transferred to each wheel equally and all four brakes are applied with equal force.



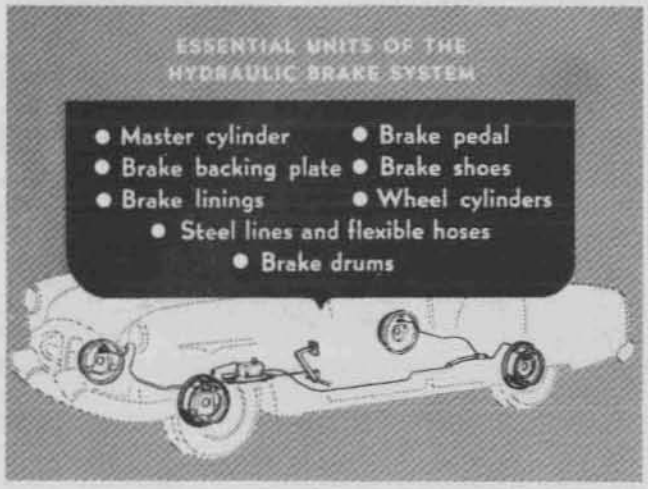
Packard brakes make full use of the servo or self-energizing principle. When foot pedal pressure is applied and the brake shoes are forced against the drums, the turning of the drum tends to rotate the shoes in the same direction.

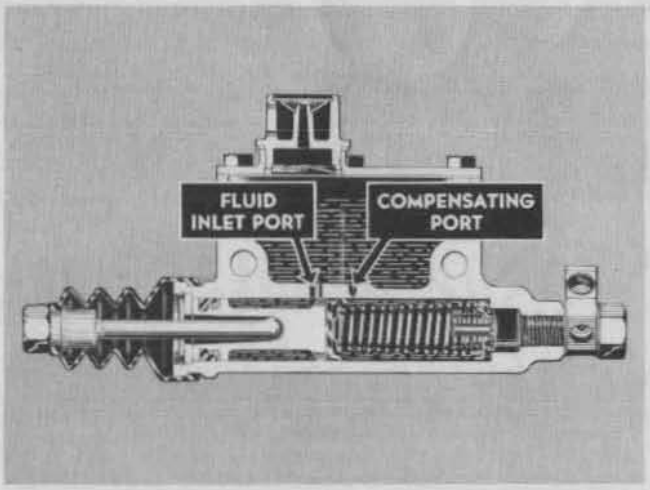


This wrapping action of the shoes uniformly increases the pressure at every point around the braking surface, which increases the stopping ability with less physical effort required of the driver.

The essential units of the hydraulic brake system are:

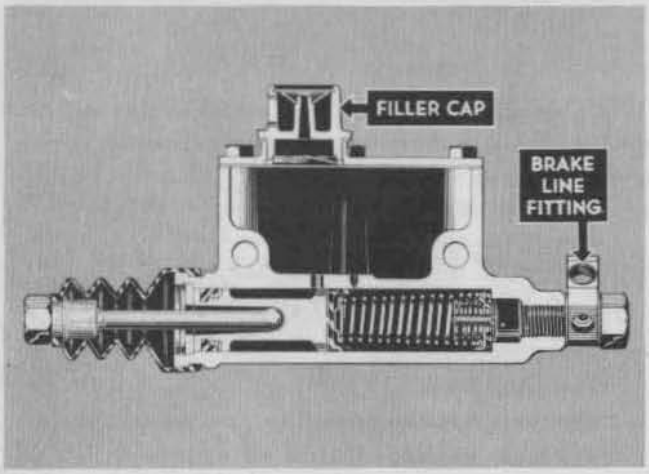
The master cylinder.
The brake pedal.
The brake backing plate.
The brake shoes.
The brake lining.
The wheel cylinders.
The steel lines and flexible hoses.
The brake drums.



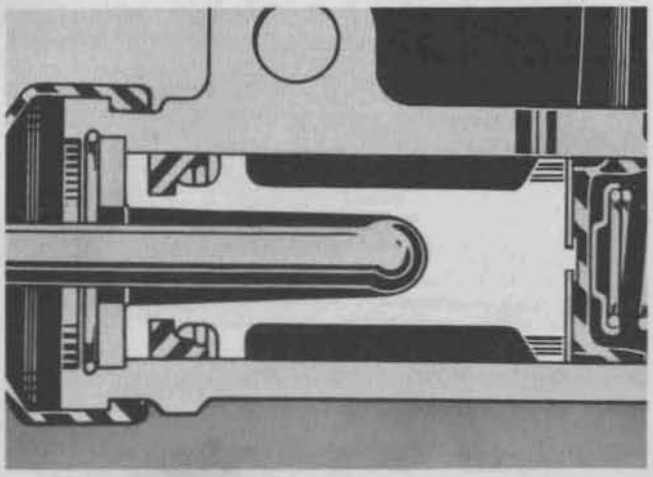


Master Cylinder

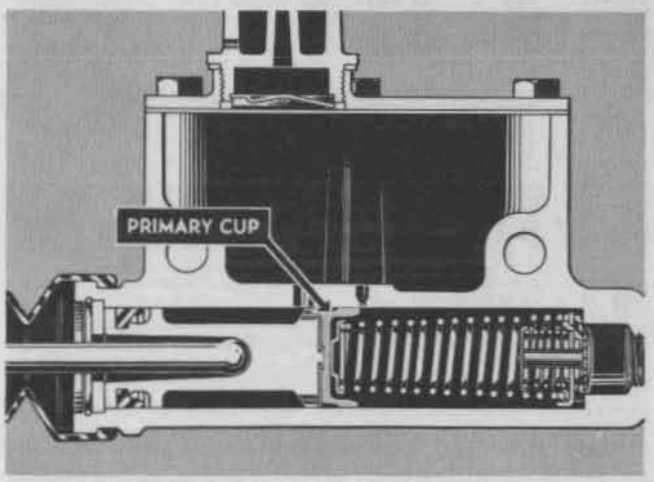
The master cylinder furnishes the hydraulic pressure. It is an accurately machined cylinder casting and has an integral fluid reservoir which contains the reserve fluid for the hydraulic system. It contains two ports between the reservoir and the cylinder—the fluid inlet port and the compensating port.



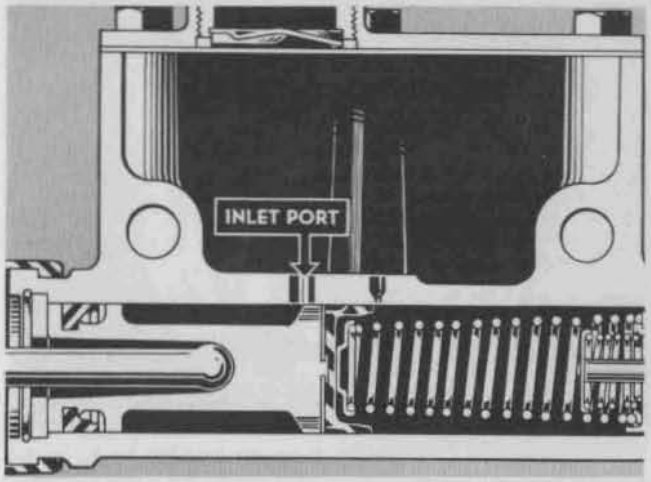
The cylinder has threaded openings at the forward end into which the brake line fittings are connected. The reservoir has a threaded vented filler cap.



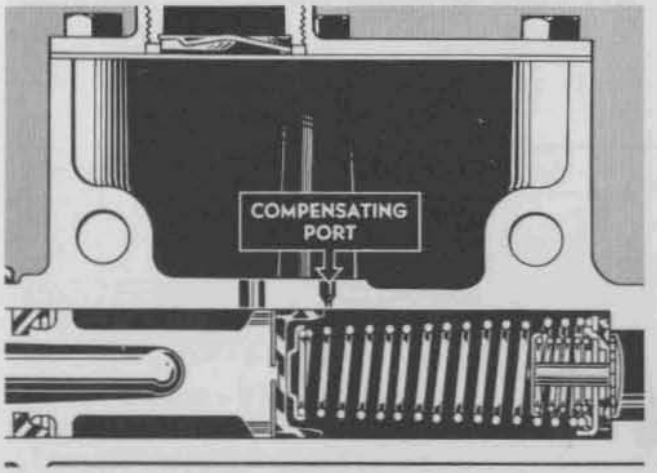
A spool-type piston is fitted into the cylinder and is actuated by the brake pedal link rod. Two rubber piston cups operate with the piston to seal it in the cylinder.



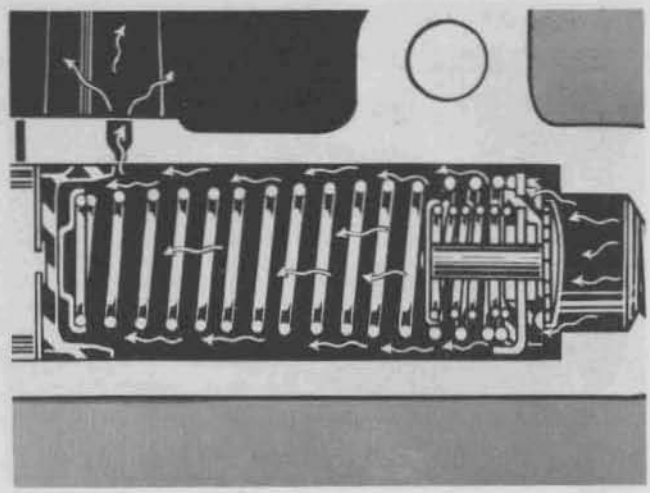
The primary cup at the forward end prevents the fluid from flowing back into the reservoir on the pressure stroke of the piston.



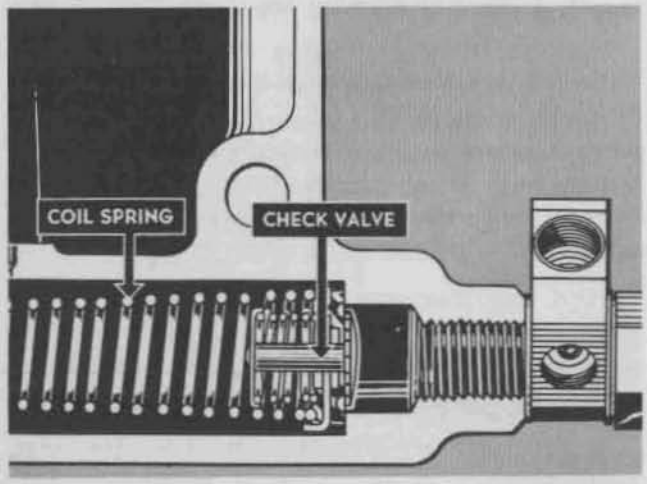
The inlet port of the cylinder is located just in back of the piston head, when the brakes are released and the piston is in the rearmost position. This arrangement permits filling the hydraulic system through the holes in the piston head on the return stroke of the piston.



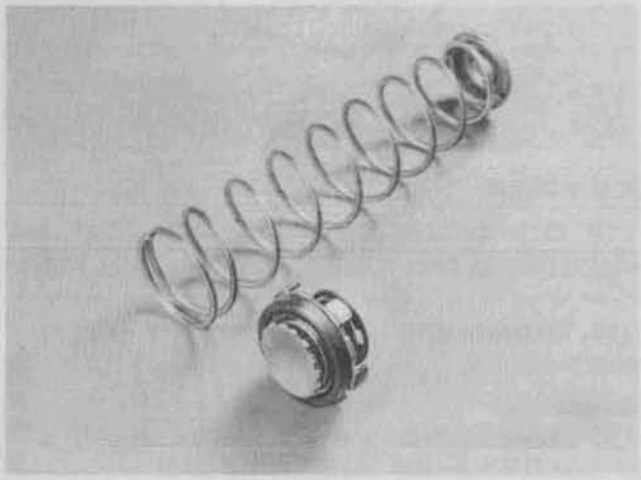
The compensating port, located just forward of the



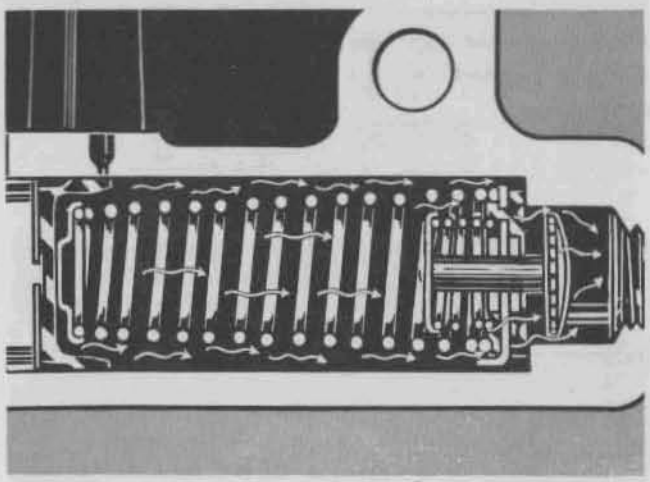
primary cup when the piston is in the rearmost position, permits the excess fluid in the hydraulic system to return to the reservoir when the brakes are released. The compensating port permits complete releasing of the brakes and prevents build up of pressure in the hydraulic system.



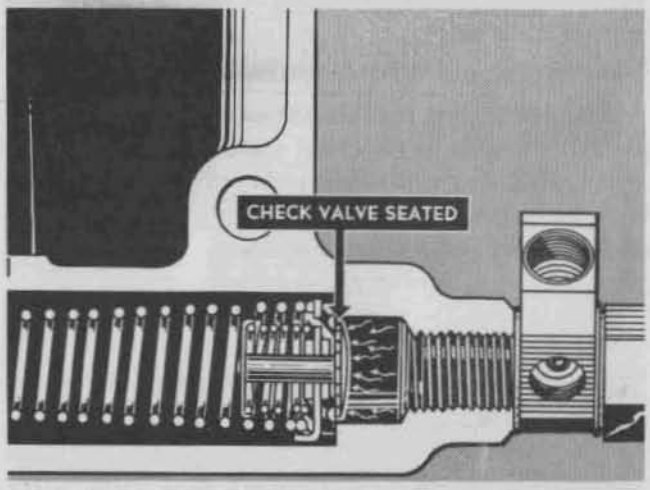
A coil spring is used to return the piston and cups to the released position. A two way check valve is located at the forward end of the cylinder and controls the flow of the brake fluid to and from the master cylinder.



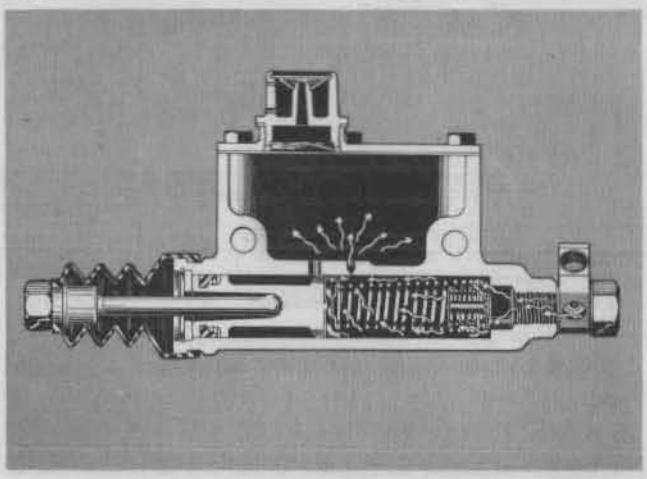
The check valve consists of a spring loaded poppet type valve located inside the front end of the piston return spring.



The construction of the valve is such that it permits the fluid to flow from the master cylinder through the valve by lifting the poppet valve off its seat when pressure is applied.

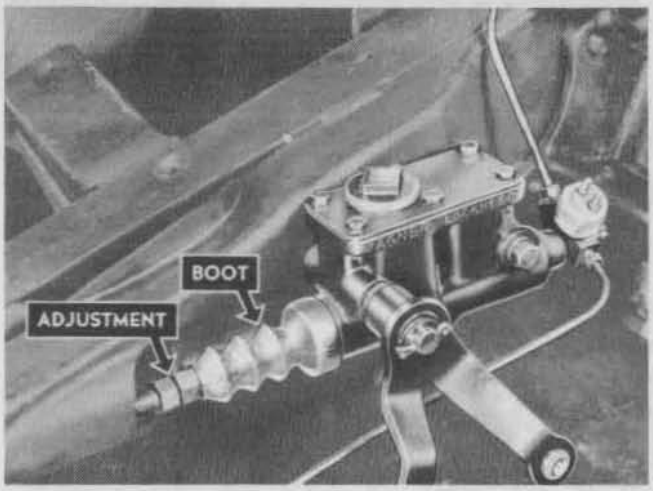


Fluid cannot return to the master cylinder through these holes since a flow-back into the cylinder would make the lip of the rubber cup seal the holes in the metal cup.

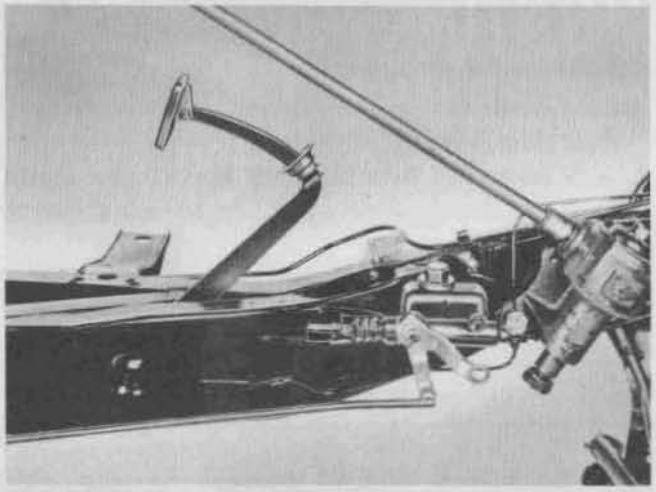


To permit fluid to return to the master cylinder, enough

pressure must be exerted on the metal cup to compress the valve spring and lift the valve assembly off its seat. It is for this reason that the valve impedes or restricts the flow of fluid back into the master cylinder and helps the master cylinder act as a pump during brake bleeding operation.

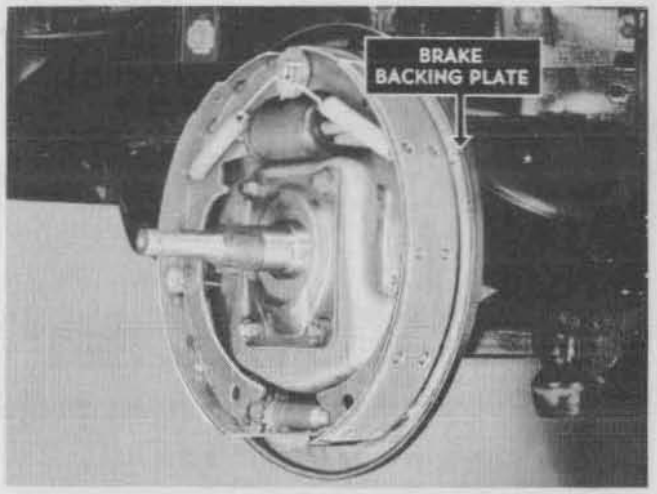


A rubber boot at the rear end of the master cylinder protects the cylinder from dirt and foreign matter. The brake pedal link rod is adjustable to give the proper brake pedal free play and make sure the master cylinder piston returns to the released position.



Brake Pedal

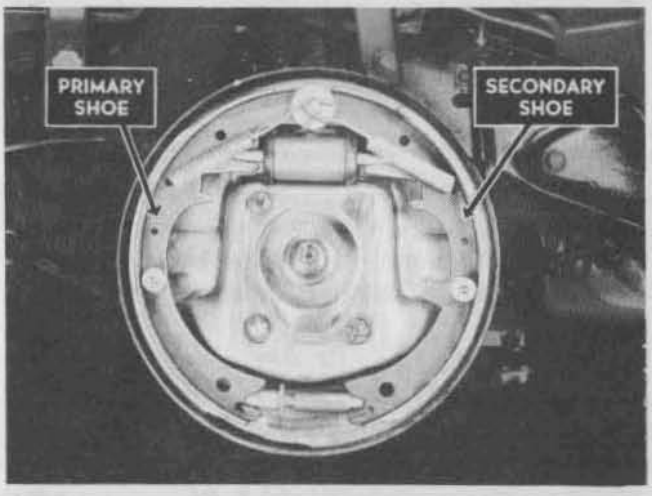
The brake pedal applies the force to the master cylinder and multiplies the driver's efforts. The stamped lever is pivoted at the lower end. The link rod is attached to the pedal with a clevis pin in such a location that in operation the leverage increases the pressure applied at the master cylinder to approximately 5.58 times that of the driver's effort.



Brake Backing Plate

The brake backing plate supports the brake parts at each wheel. The rear wheel brake backing plates are attached to the ends of the rear axle housing. The front wheel brake backing plates are attached to the steering knuckle centered by the front wheel spindle.

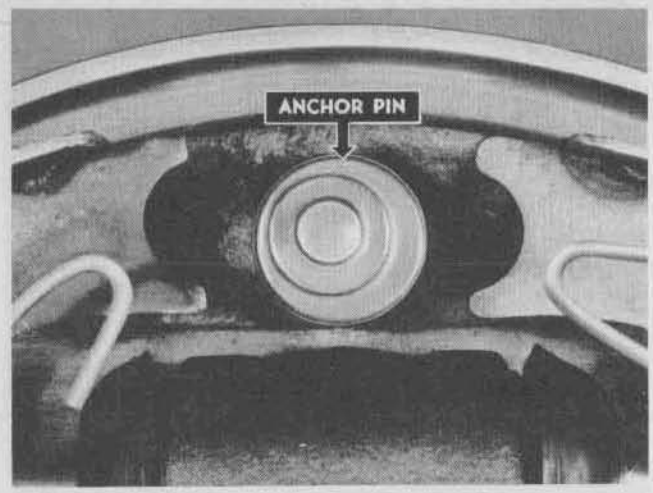
The braking force of the front wheels is transmitted to the frame by the backing plates through the front suspension control arms and vertical wheel support. The braking force of the rear wheels is transmitted to the frame by the backing plates through the rear axle housing and rear springs.



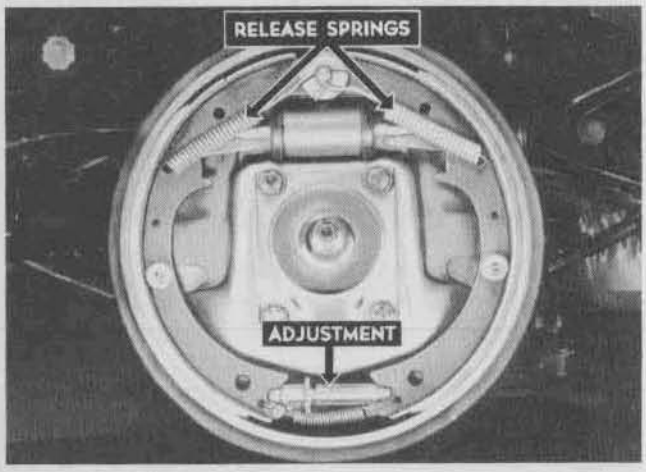
Brake Shoes

The brake shoes support the brake linings, and transmit the braking force to the brake drums. There are two brake shoes at each wheel. The forward shoe is known as the "primary shoe." The rear shoe is the "secondary shoe."

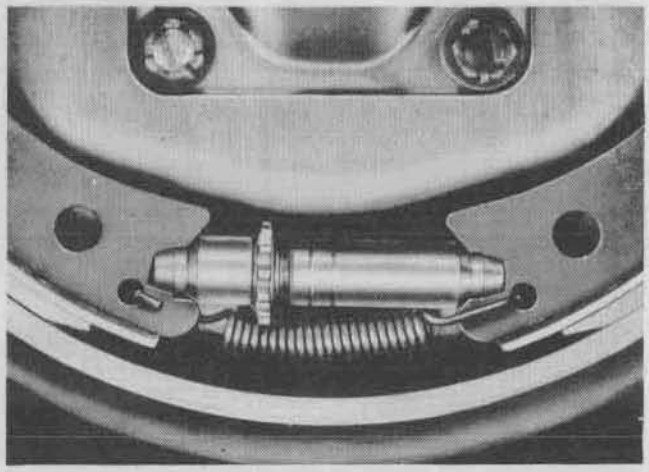
The brake shoes are held to the brake backing plate by hold-down springs and cups. However, they are not rigidly anchored.



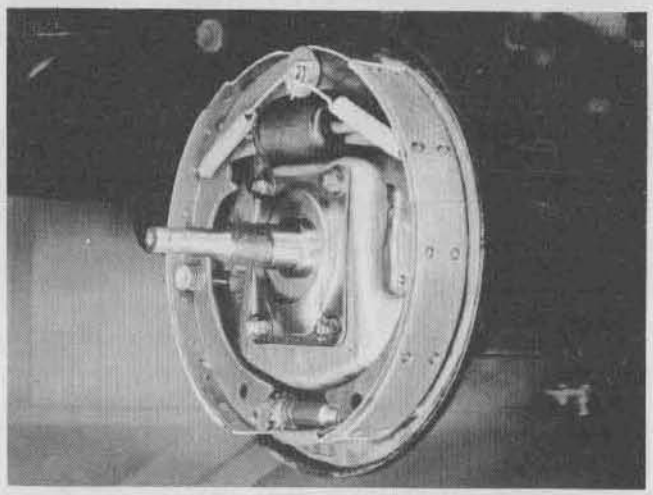
An anchor pin at the top of the backing plate *provides a stop* for the shoes to limit the amount of rotation of the shoes with the drum when the brakes are applied.



In the released position the upper ends of the shoes are held against the anchor pin by return springs. The anchor pin is eccentric to provide an adjustment for the clearance at the upper end of the shoes. The adjusting screw lock spring holds the lower ends of the shoes against the adjustment and locks the adjusting screw in the "set" position.



The adjustment acts as an articulating link between the shoes and permits better distribution of the self-energizing forces. This arrangement makes the Packard brakes equally effective in either forward or reverse drum rotation.

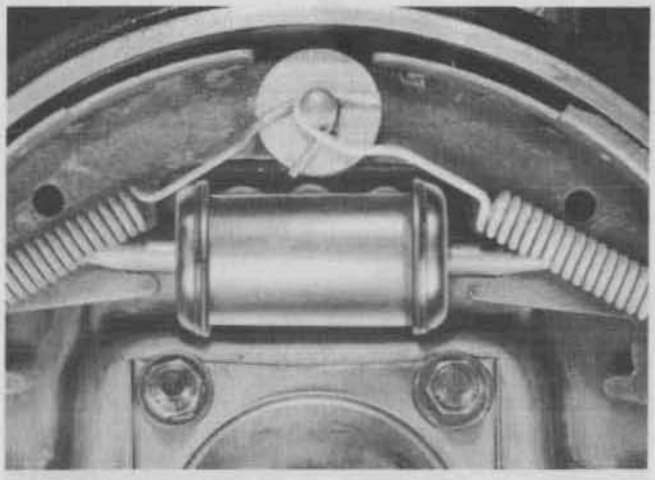


Brake Linings

The brake linings produce friction and convert the power of the moving car into heat. They are attached to the shoes by countersunk tubular brass rivets. They are of the correct thickness and have the same contour as the inside contact surface of the brake drum.

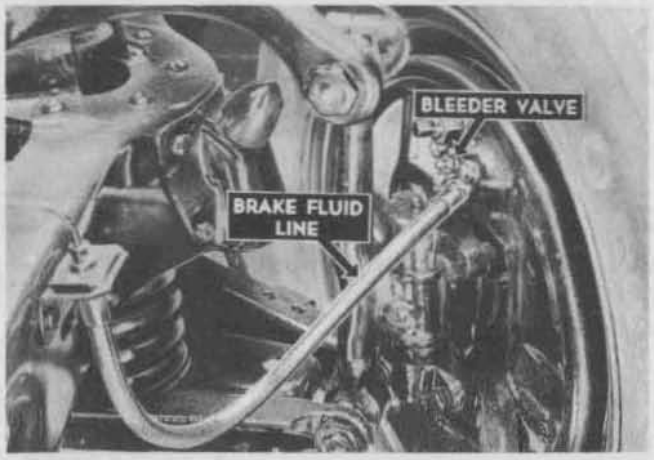
The brake linings of Packard brakes are molded asbestos composition materials. They are bonded with the correct bonding material to obtain the correct coefficient of friction, and having satisfactory wearing, non-scoring, and non-squealing qualities .

The composition of Packard brake lining was selected by Packard Engineers because it gave the best braking results. Always replace the linings with Packard Brake Lining Sets.

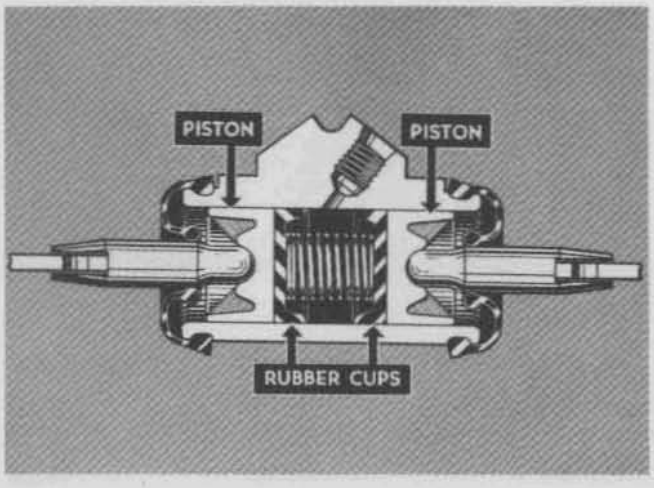


Wheel Cylinders

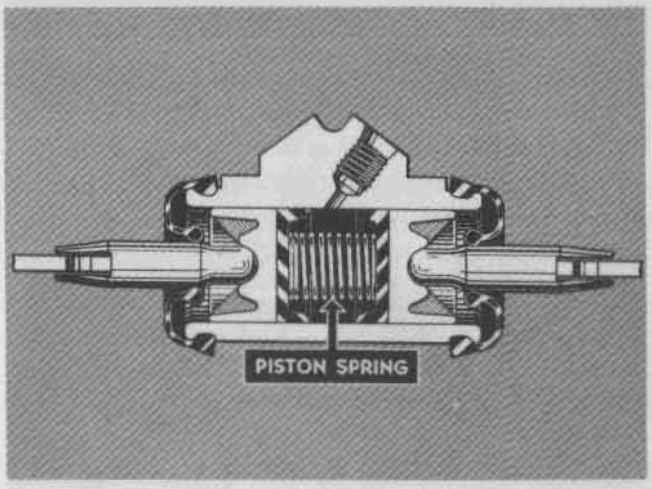
The wheel cylinder actuates and applies the pressure to the brake shoes. It is located horizontally at the top of each brake backing plate, just below the anchor pin. It is attached to the backing plate with two cap screws. The wheel cylinder is an internally machined cylindrical casting that is open at both ends. A fluid inlet port is located approximately in the middle of the cylinder on the backing plate side.



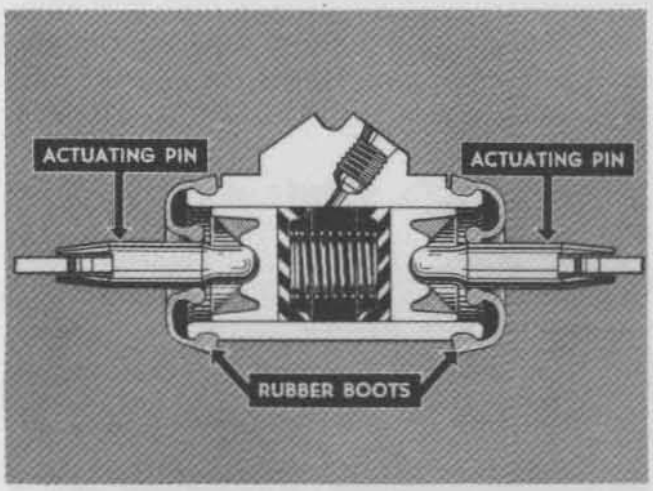
The brake fluid line from the master cylinder is connected to this port. A bleeder valve is located in the wheel cylinder just above the inlet port.



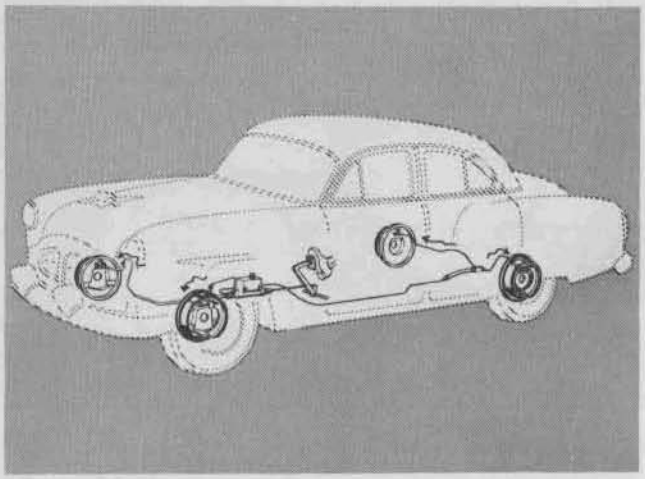
Each end of the wheel cylinder bore is fitted with an aluminum piston that has a smooth flat surface on the inner end. A rubber piston cup rests against the flat surface of the piston at each end and acts as a seal between the piston and cylinder.



A piston spring, located in the center of the cylinder, tends to push the pistons away from each other and keeps the pistons in contact with the brake shoe actuating pins.

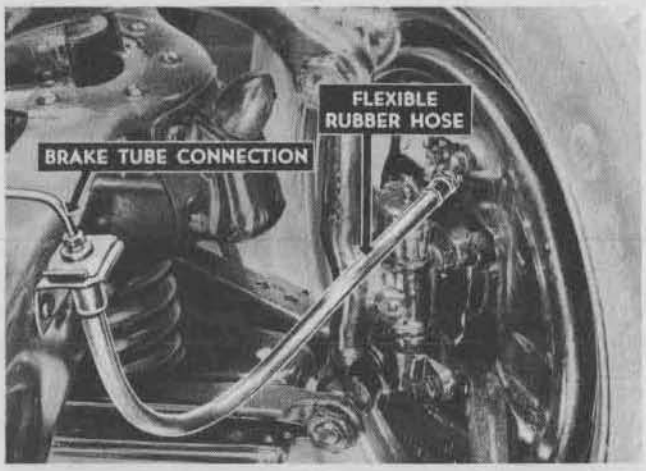


The actuating pins fit into a concave milled surface on the outer end of the pistons and transmit the force from the pistons to the shoes. A rubber boot is used at each end of the cylinder to keep out dirt and foreign matter. The actuating pin operates through the center hole of the boot.

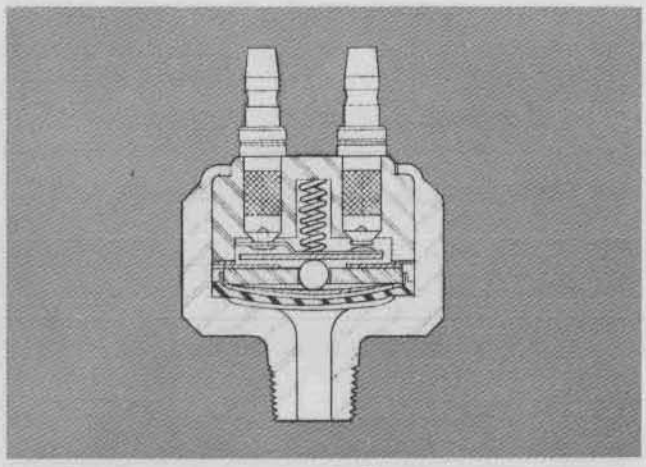


Brake Lines and Hoses

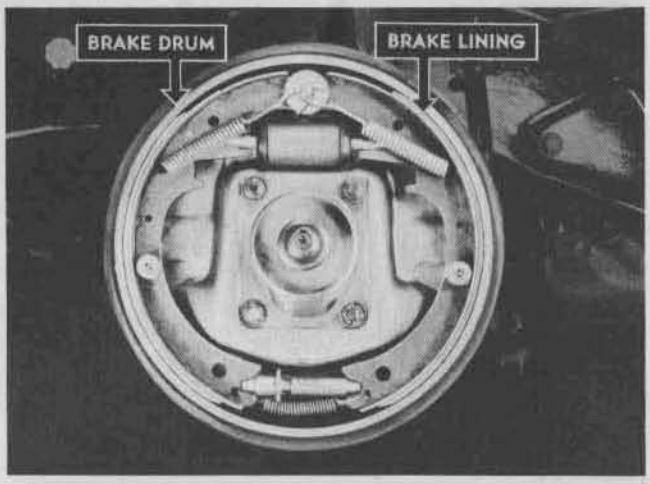
The steel brake line tubes and flexible hoses transmit the hydraulic force from the master cylinder to each wheel cylinder.



The flexible rubber hose at each front wheel and between the rear axle housing and the brake tube connection on the frame, permit free up and down movement of the front wheels and rear axle housing.

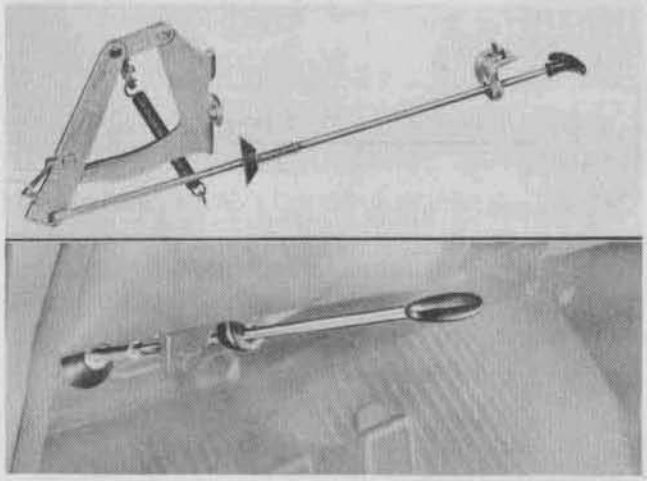


A diaphragm type hydraulically operated switch makes the contact for the stop light when the brakes are applied. It is located at the brake line connection just forward of the master cylinder.



Brake Drums

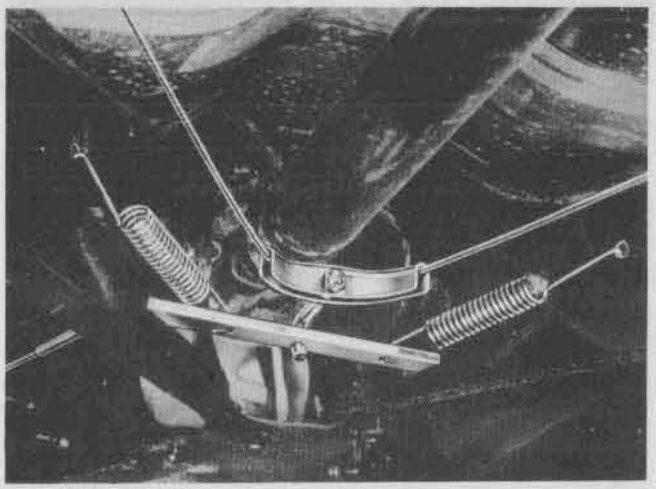
The brake drum is attached to the wheel and is the means of receiving the force of the brake shoe application for creating friction between the shoe linings and drum, retarding or stopping the motion of the wheel.



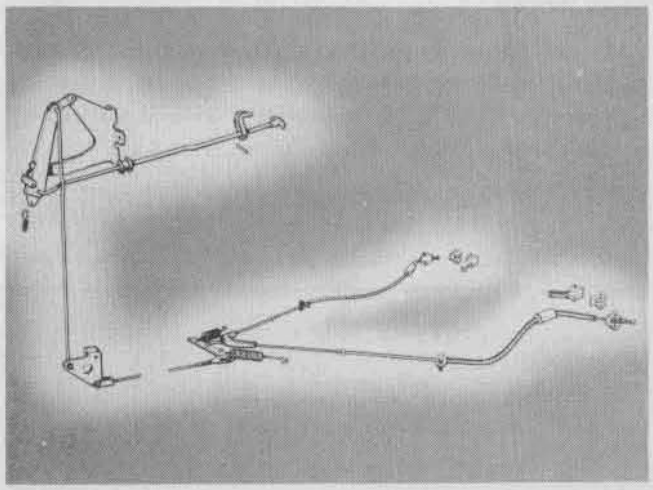
Hand Brake

The hand brake is the mechanical device that operates the shoes of the rear wheel brakes. The force is applied by a lever with a "T" type handle, which is pulled out to lock the rear wheels when the car is parked.

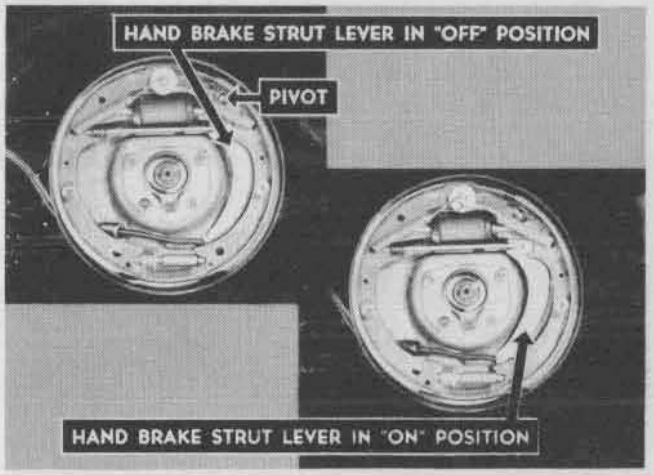
The lever is equipped with a pawl and ratchet sector to hold the brakes in the *on* position. Turning the handle to the left approximately 15° releases the pawl from the ratchet. Spring tension moves the lever to the *off* position. From the pawl and ratchet assembly a rod extends downward to a bell crank which is supported on the frame body bracket.



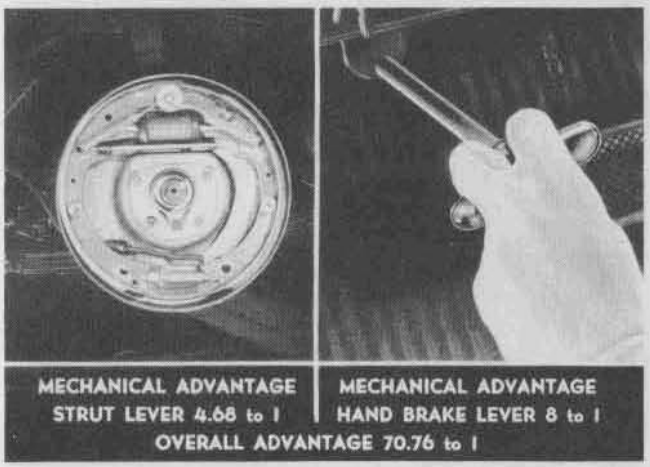
A steel rod connects the lever on the bell crank to one end of the equalizer lever, whose fulcrum end operates in a slot in the frame "X" member. A single steel rear cable passes through the equalizer which is connected to the equalizer lever by a link.



The ends of the rear cable are connected to a strut lever in each rear wheel brake. The use of an equalizer provides an equal pull to each rear brake strut lever. Steel conduit protects the rear cable against moisture and dirt where it enters the rear backing plate.



The rear wheel brake strut lever is pivoted on the reinforcement rib of the secondary shoe. A brake shoe strut connects the strut lever to the primary shoe. When the lower end of the lever is pulled forward, the strut and lever force the primary and secondary shoes apart.



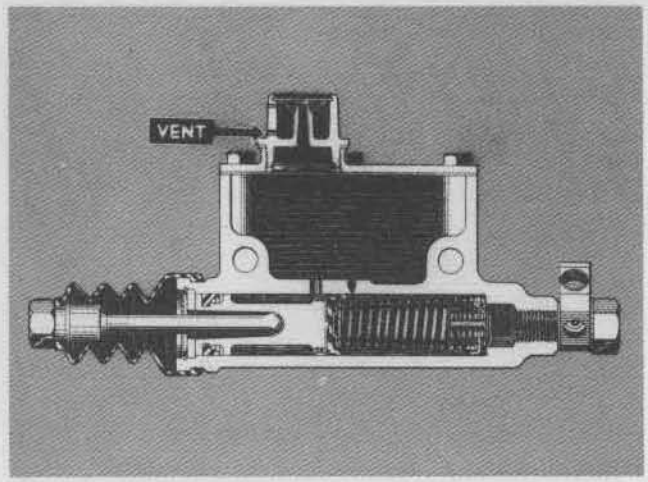
The mechanical advantage of the strut lever is approximately 4.68 to 1. While the mechanical advantage of the hand brake lever is about 8 to 1. This gives an overall mechanical advantage of about 70.76 to 1.

20 lbs. effort on lever
X mechanical advantage

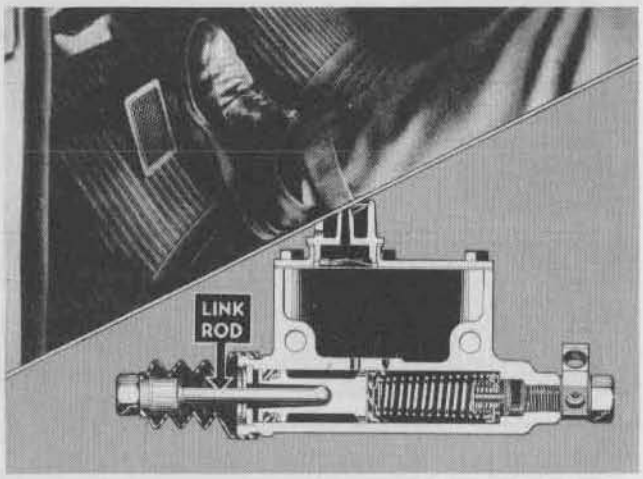
280 lbs. pressure on shoes
− friction loss

Actual force at shoes

Theoretically, 20 lbs. effort on the hand brake lever would give about 280 lbs. pressure on the rear brake shoes. However, the friction loss reduces actual mechanical force at the rear brake shoes.

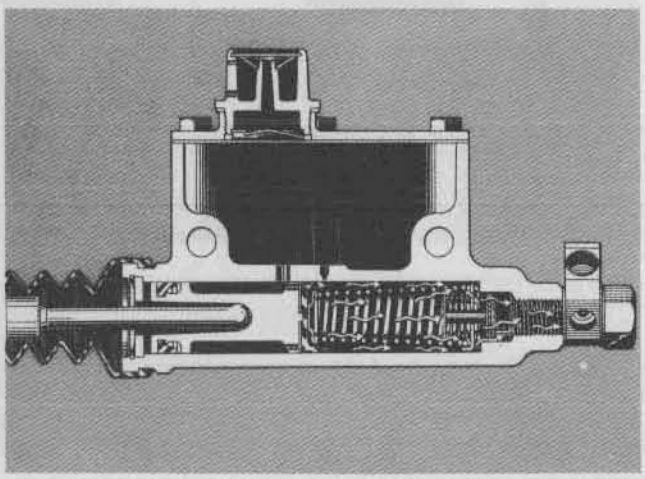


In the released position the pressure in the fluid reservoir and master cylinder is atmospheric, since the fluid reservoir is vented and the master cylinder compensating port is uncovered by the primary cup.

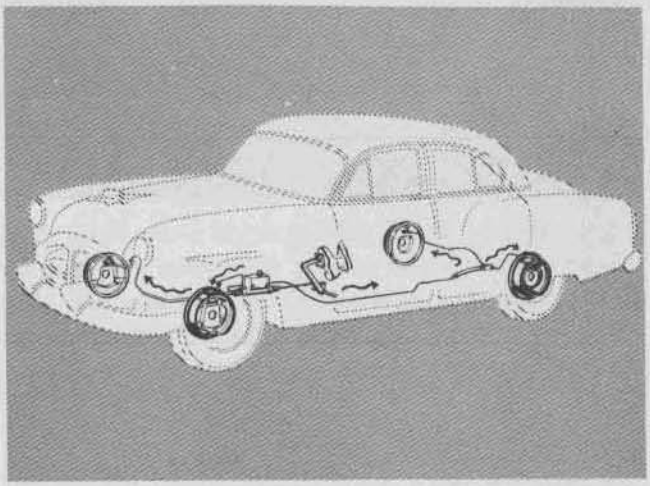


Applying the Brakes

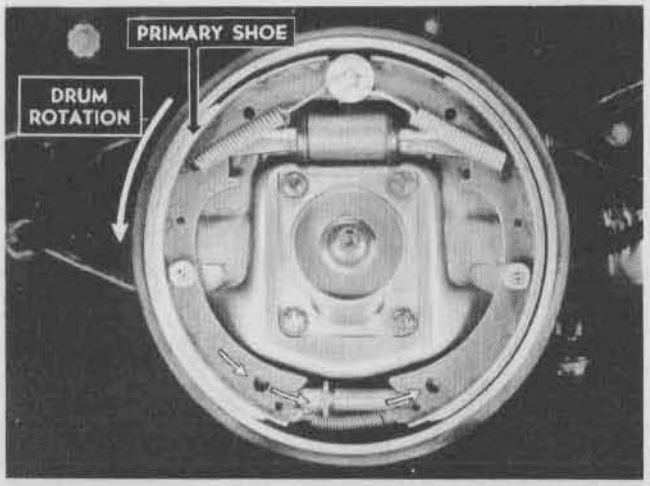
When the brake pedal is depressed, the master cylinder link rod forces the piston forward. The first movement of the piston moves the primary cup forward enough so that the lip of the primary cup covers the compensating port.



This will prevent the brake fluid from returning to the reservoir. Further travel of the pedal moves the piston forward, and since the compensating port is covered, it will force the fluid from the master cylinder through the check valve, through the lines and into the wheel cylinders.

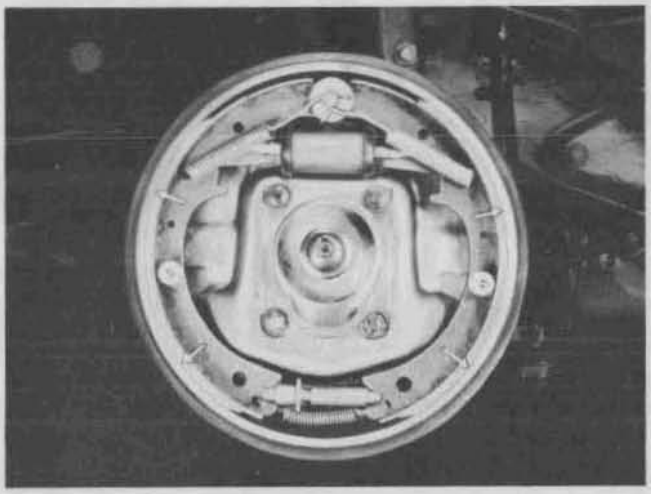


Since a liquid under pressure transmits pressure equally in all directions, it will force the wheel cylinder pistons outwardly and force the brake shoes into contact with the brake drum.



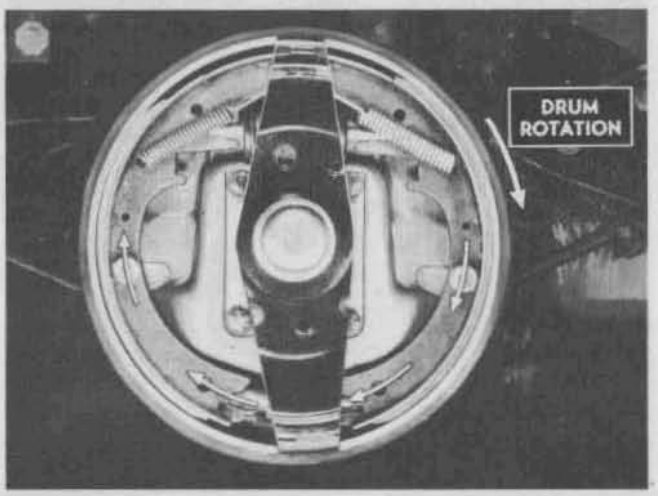
After all brake shoes are contacting the drums, any further downward movement on the brake pedal builds up more pressure in the hydraulic system which puts more pressure on the brake shoes.

When the primary shoe contacts the brake drum of a moving car, the rotation of the drum will tend to rotate the shoe with the drum. This will transmit the force to the bottom of the secondary shoe through the adjustment which acts as an articulating link. When the bottom of the secondary shoe contacts the drum, the rotation of the drum will tend to rotate the secondary shoe with it.



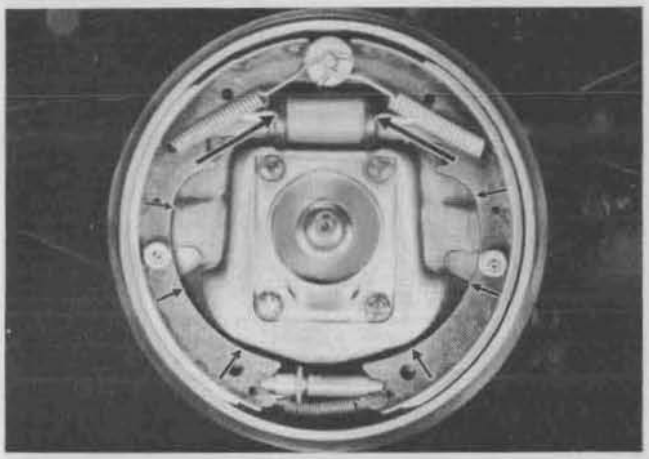
The servo or self-energizing action of the drum tending to turn the shoes around the anchor pin, will increase the force of the shoes against the drum. This gives smoother, more positive brake application, requiring less effort of the driver.

The use of the adjustment as an articulating link helps to increase and evenly distribute the self-energizing forces through the secondary shoe.

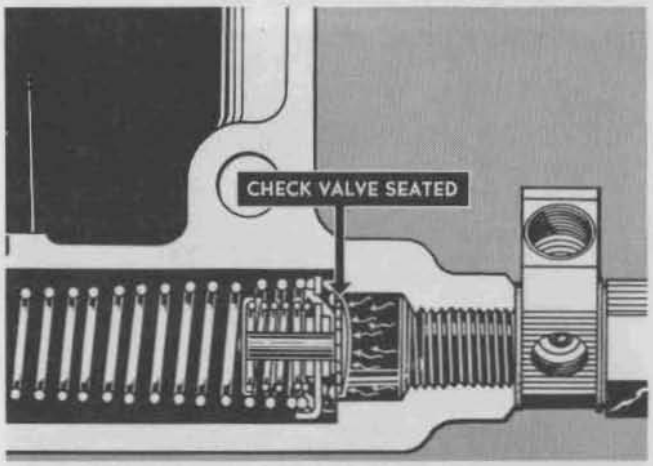


In reverse rotation, the same self-energizing action takes place, except that the rotation of the drum will energize the secondary shoe and force the lower end of the primary shoe against the drum. This causes the shoes to tend to rotate with the drum causing the primary shoe to tend to rotate around the anchor pin, increasing the force of the shoe against the drum. The self-energizing action of the brakes is equally effective in forward or reverse rotation.

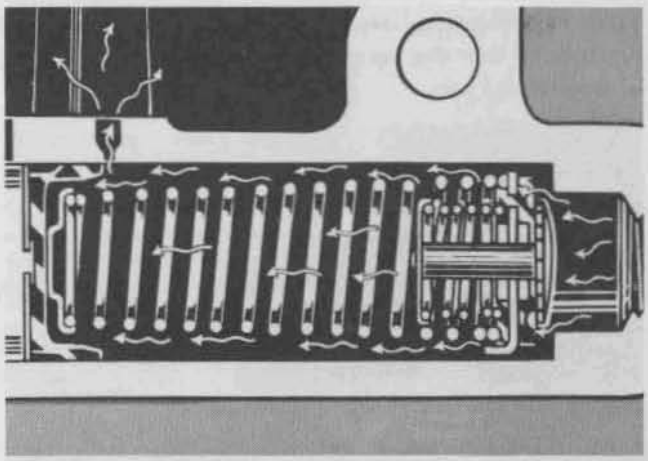
Releasing the Brakes



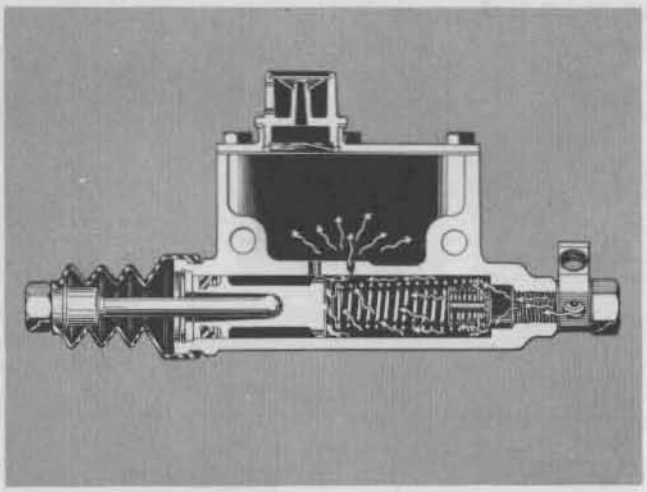
When the brake pedal pressure is released and the master cylinder piston moves back, the pressure in the master cylinder is relieved. The brake shoe return springs then pull the shoes toward the released position.



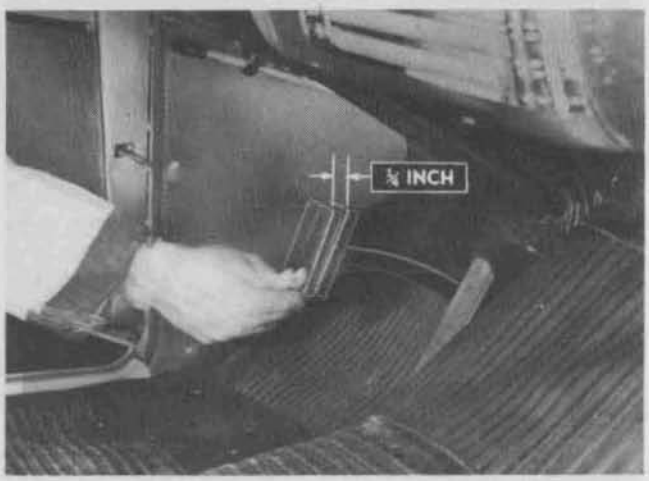
The shoes force the wheel cylinder pistons in forcing the fluid from the wheel cylinders back to the master cylinder. However, the check valve impedes the return of fluid into the master cylinder .



Further movement of the master cylinder piston back causes the fluid behind the primary cup to flow through the holes of the piston head and over the lip of the primary cup into the master cylinder.



When the master cylinder piston reaches the fully released position, the primary cup has uncovered the compensating port and the excess fluid which entered the master cylinder on the return stroke, flows back into the reservoir.



Therefore, it is very obvious why the compensating port must be uncovered when the master cylinder piston is in the released position. It is likewise important that the master cylinder link rod be properly adjusted to give the brake pedal ¼-inch free play. It is to make sure the piston *does* return to the released position.

Adjustments

The adjustments provided for the brake system are necessary to:

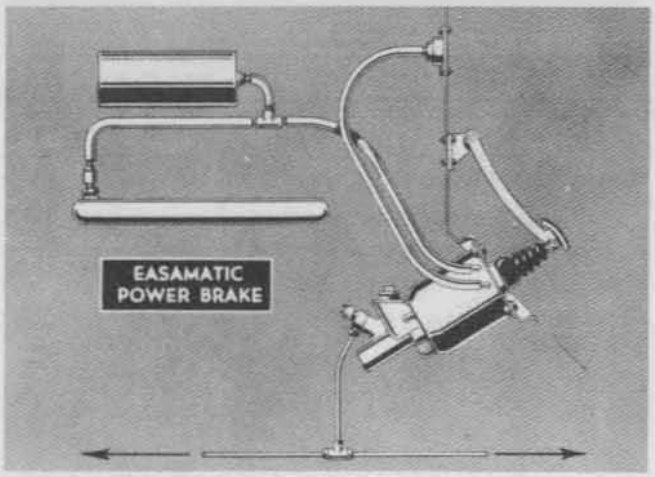
(1) Give full lining contact and equalization.
(2) Centralize the brake shoes and give proper clearance between the drum and linings.
(3) Compensate for brake lining wear.

Heavy traffic conditions in which there are many stop-and-go operations eventually led to the demand for a more effective brake to reduce the amount of physical effort required to apply the brakes to stop the car.

Another factor leading to this demand for improved braking, was the increase of women drivers who required better brakes with less physical effort being needed for the application.

These combined factors resulted in the development of the Packard Easamatic Power Brake which will be described in the following paragraphs.

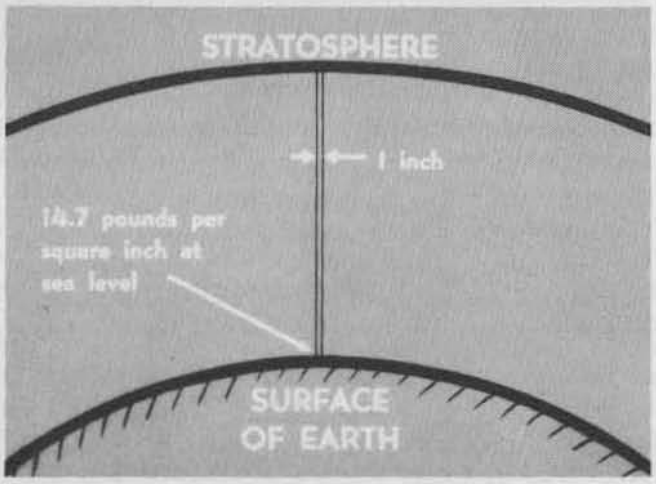
Part III
CONSTRUCTION AND OPERATION OF THE EASAMATIC POWER BRAKE



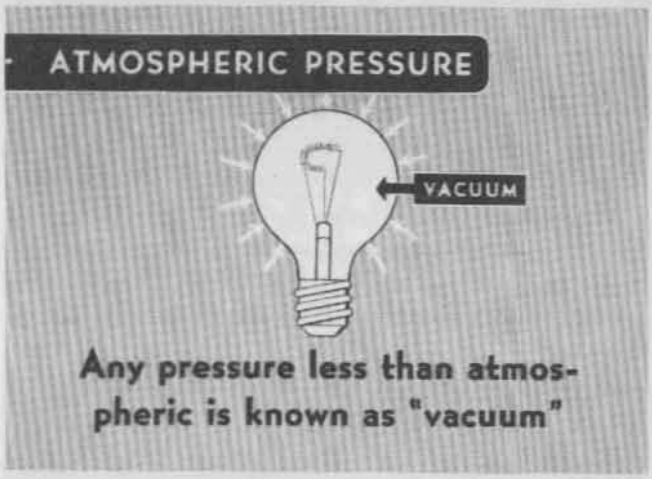
Elementary Principles

Before attempting to describe the construction and operation of the Easamatic Power Brake, it is first necessary to have an understanding of the elementary principles that make the Easamatic brake possible.

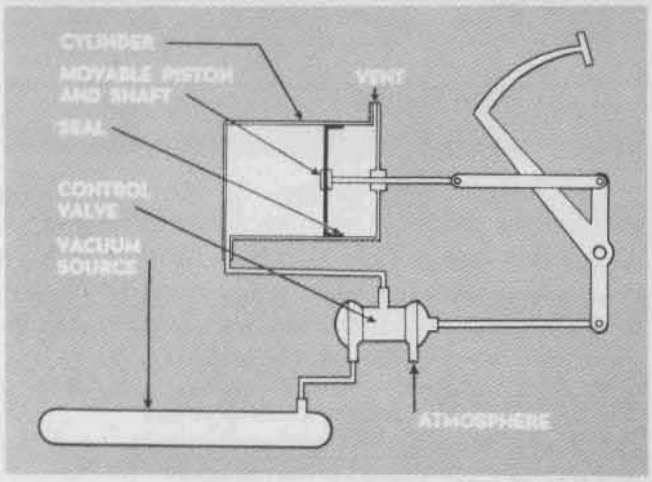
Two important principles are atmospheric pressure and vacuum pressure.



Atmospheric pressure is the great mass of air that surrounds the earth and extends out to the atmosphere, and presses down on the earth with a pressure of 14.7 pounds per square inch at sea level. This is the weight of a column of air one inch square and extending as far upward as there is air.



Vacuum is a space where the pressure is less than atmosphere, or in other words, a space devoid of air. The force of suction is not due to the pull of vacuum, but to the pressure of the air outside. Air always tries to enter an evacuated area (a vacuum created). The movement of air is always due to changes in pressure, not *suction.*



Let us apply atmospheric pressure and vacuum to an elementary unit.

The unit would consist of the following—

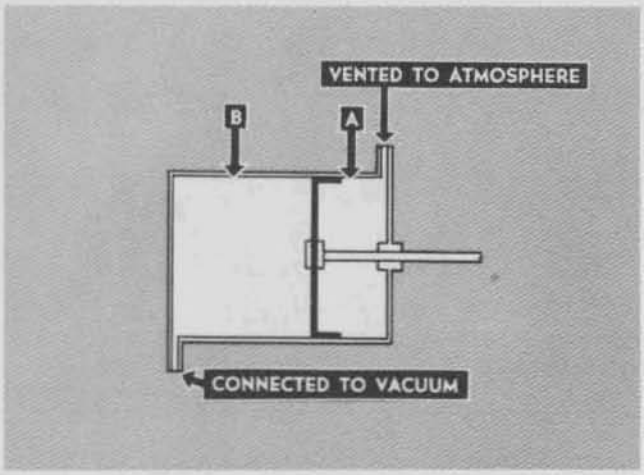
A cylinder.

A movable piston and shaft.

A suitable seal around the piston and shaft.

A vent on one side of the piston.

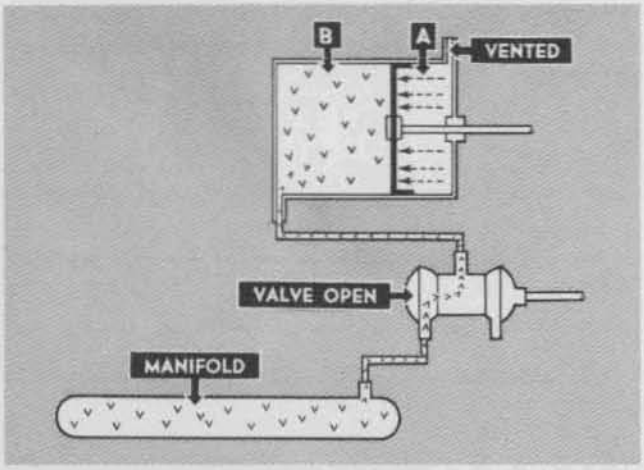
A connection on the other side, to a control valve. The valve to be connected to a vacuum source or to atmosphere as desired.



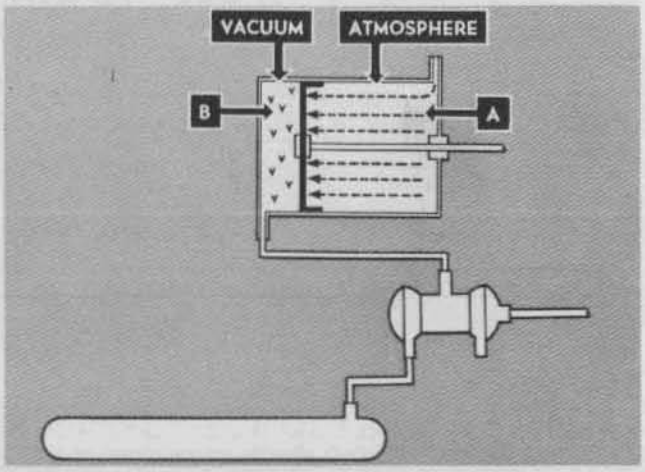
For easier explanation, let us name each side of the piston.

"A" Chamber—vented to atmosphere.

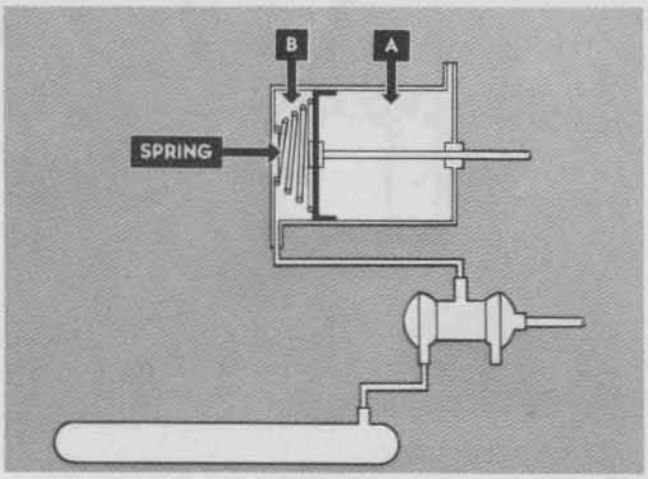
"B" Chamber—connected to vacuum.



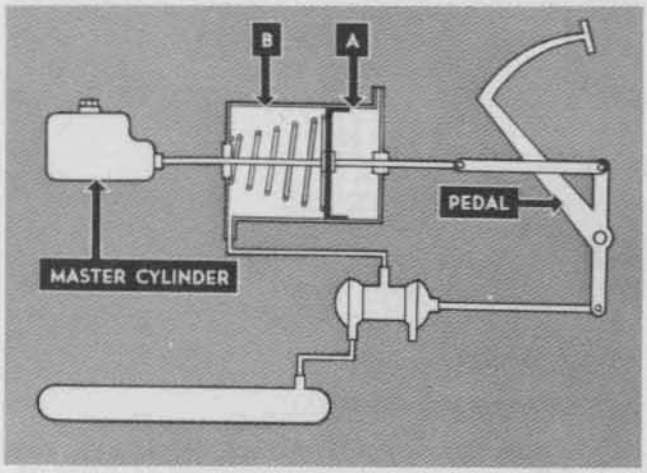
When the valve is opened, a lower-than-atmospheric pressure is created in the "B" chamber by the vacuum from the intake manifold. The "A" chamber being vented to atmospheric pressure would then have the greater pressure.



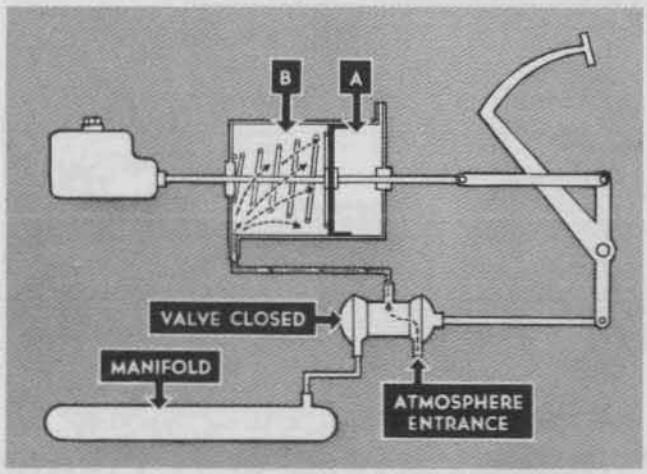
We now have a pressure differential. This greater pressure will push the piston into the lower pressure area, which gives us power.



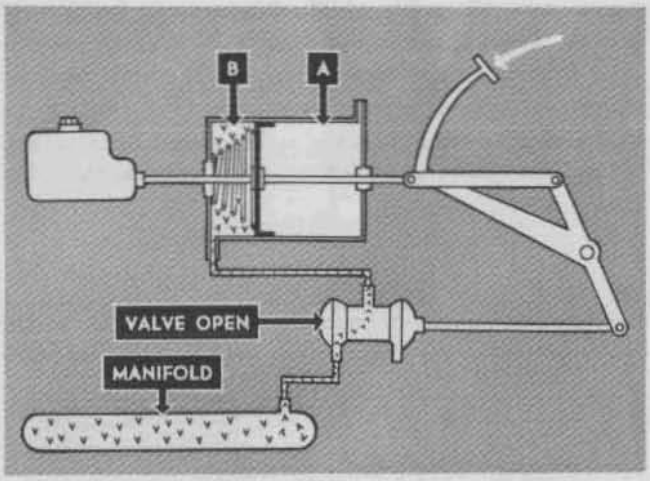
It is now necessary to install a spring on the "B" side of the piston to return the piston to the off position when the unit is inoperative.



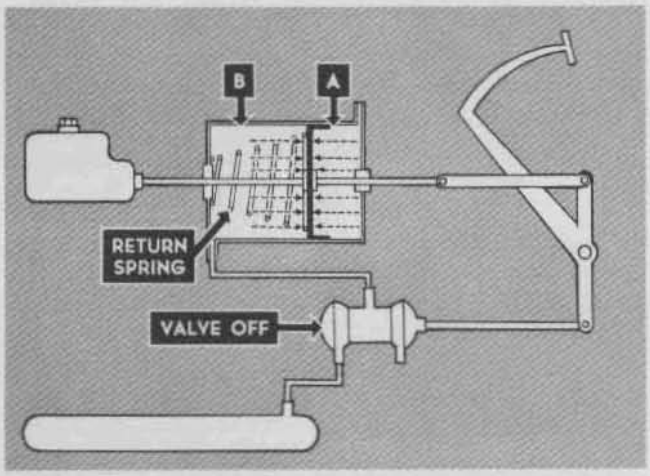
The shaft is then connected on the "A" side of the piston to a pedal. The opposite end of the shaft is then connected to the master cylinder piston in the hydraulic unit.



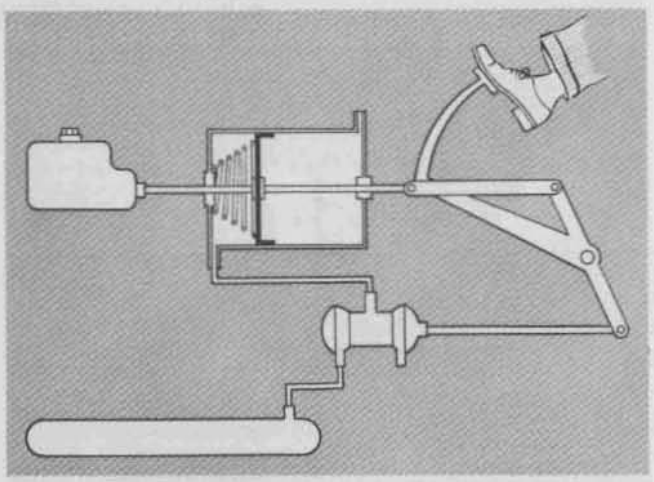
The design of the valve is such that when the valve is closed shutting off the vacuum, atmospheric pressure is then permitted to replace the vacuum in the "B" chamber.



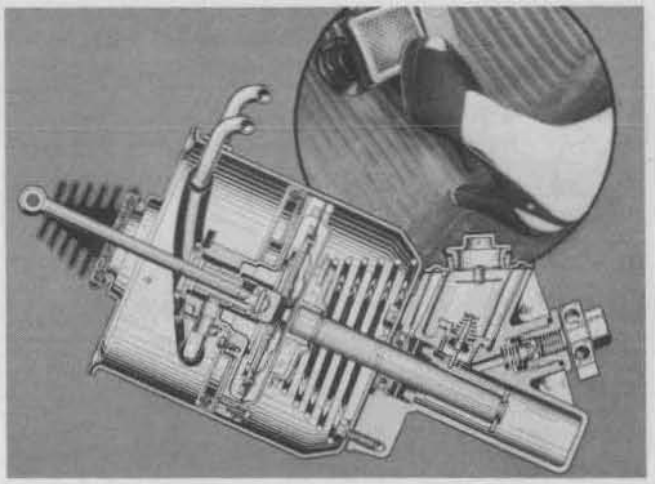
The valve is controlled by the foot pedal. When the foot pedal is depressed moving the valve to the *on* position, vacuum is permitted to enter the "B" chamber.



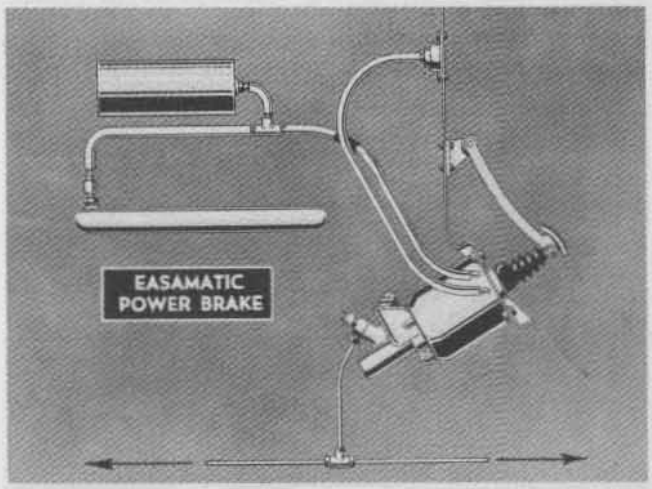
When the brake pedal is released returning the valve to the *off* position, the "B" chamber will be vented to the atmosphere and each side of the chamber will be balanced by atmospheric pressure. The return spring then moves the piston to the *off* position.



The control is positive and the unit develops power only as long as the driver continues to press on the foot pedal. It releases automatically when the driver removes his foot from the pedal.

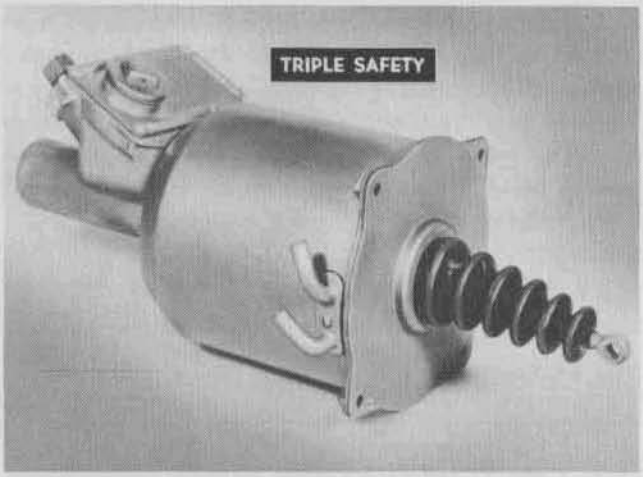


This power unit incorporated with the master cylinder makes an effective unit to apply the brakes in which vacuum power supplements foot pressure for brake application. The purpose of a power brake unit is to reduce driving fatigue through less physical effort for brake application. The Packard Easamatic Brake accomplishes this very effectively.

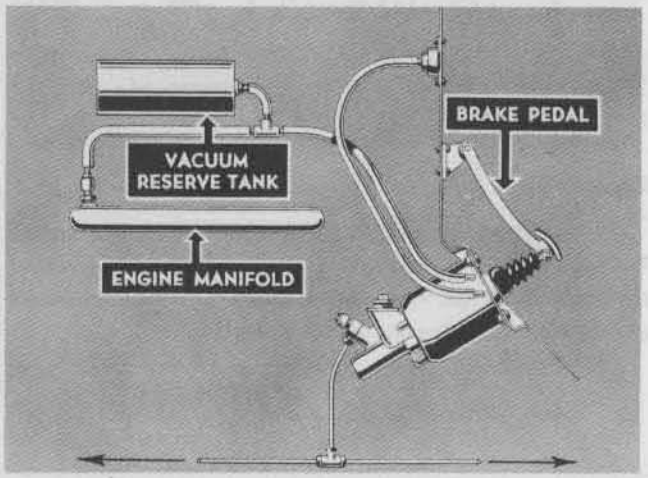


Description

The Easamatic power brake is a self-contained unit having no external rods or levers exposed to dirt and moisture. It is a combined vacuum and hydraulic unit for power braking, utilizing engine intake manifold vacuum, and atmospheric pressure for its operation.

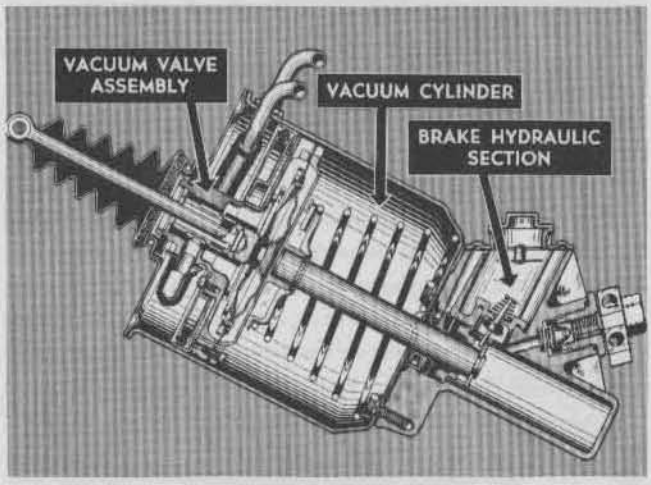


Packard Easamatic power brakes are outstanding as they have a triple safety feature providing brake action at all times.

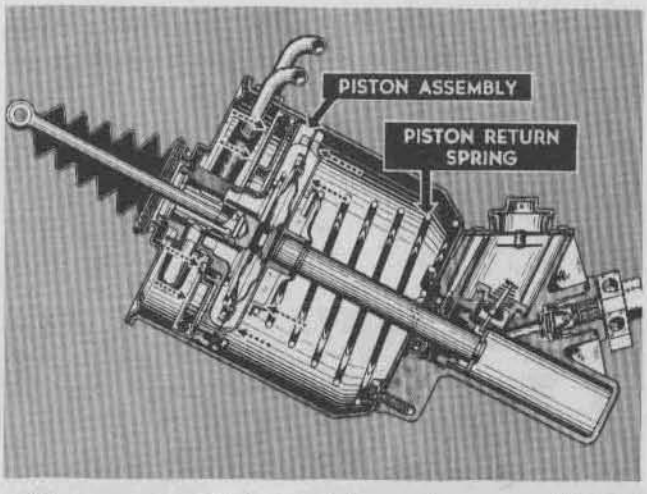


Vacuum from the engine manifold which makes possible light pedal pressure, an emergency vacuum reserve tank that makes possible a vacuum reserve should the engine stall, and the conventional brake pedal action that is available even when vacuum cannot be supplied .

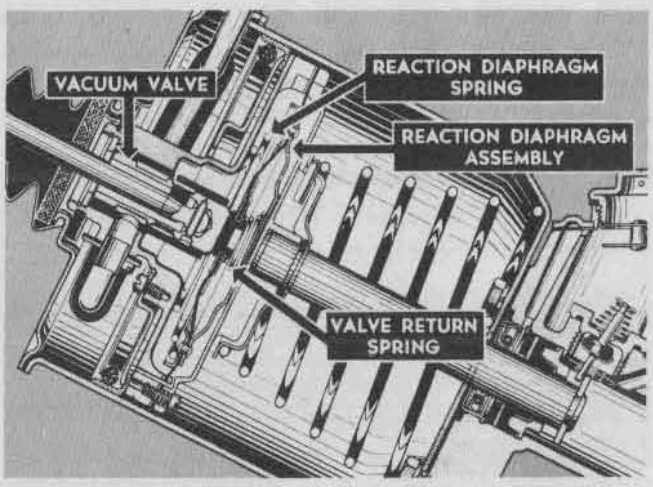
The foot brake pedal used with the Easamatic brake unit is conveniently located by being suspended from a bracket attached to the dash panel. This location allows more foot room for the driver, as the brake pedal is three inches nearer to the floor in the released position than a car equipped with conventional brakes. This reduced pedal travel brings the height of the pedal down to the approximate height of the accelerator pedal, permitting the driver to shift his toe from one pedal to the other without lifting his heel from the floor. Lighter pedal pressures are required to apply the brakes.



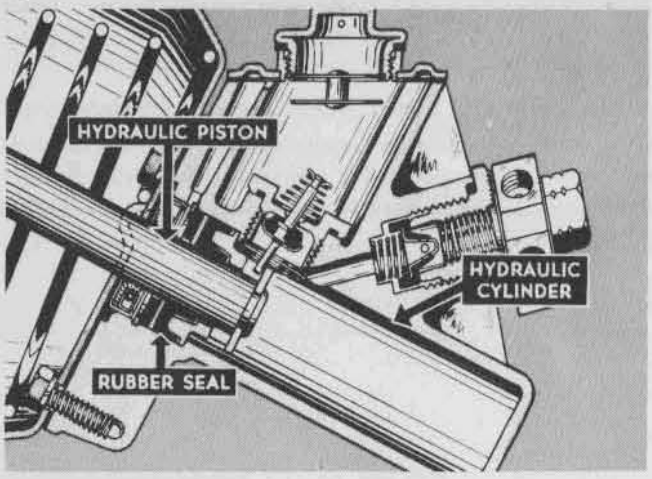
The Easamatic power brake consists of three operating units built into one assembly, namely—the vacuum cylinder, the vacuum valve assembly, and the brake hydraulic section. The later section includes a brake master cylinder.



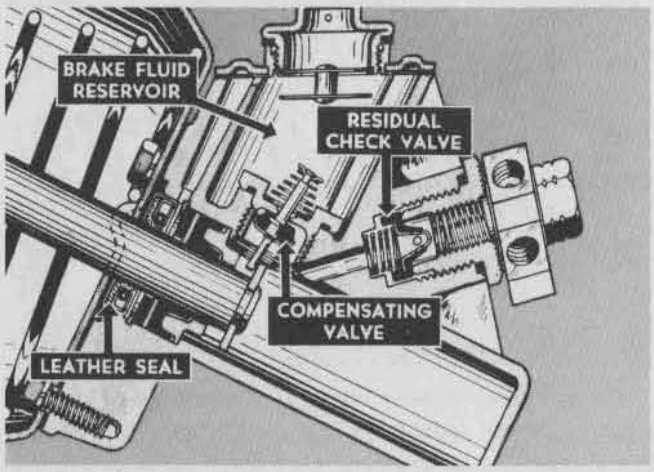
The vacuum cylinder contains a piston assembly and a piston return spring. When the brakes are in the released position, atmosphere is admitted on both sides of the piston in the cylinder and the return spring holds the piston in the off position.



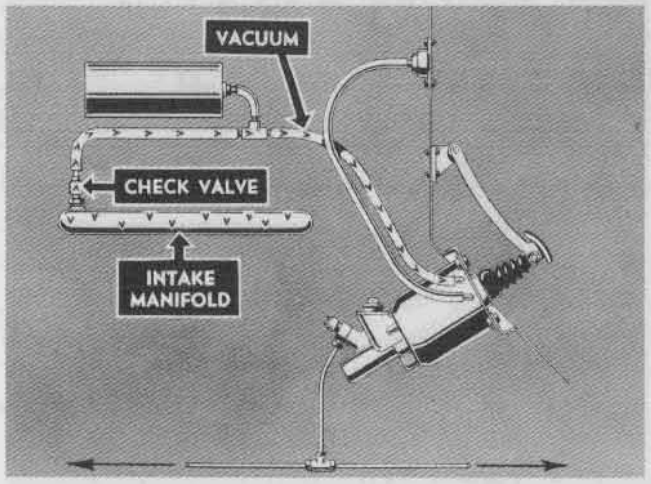
The control valve assembly contains a vacuum valve, a reaction diaphragm assembly, a vacuum valve return spring, and a diaphragm reaction spring. The vacuum valve assembly is actually integral with the vacuum cylinder piston and moves as the piston moves during the operation of the unit.



The brake hydraulic section contains a hydraulic cylinder, a hydraulic piston, and a rubber seal which prevents the brake fluid from leaking into the vacuum power cylinder.

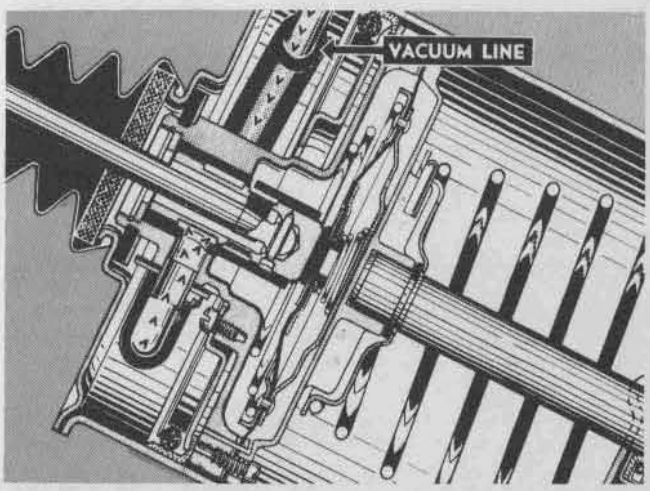


A spring-loaded leather seal is used on the master cylinder piston to act as an oil wiper and vacuum seal between the hydraulic master cylinder and the vacuum cylinder. A bleed-back hole is located between the leather seal and rubber seal. In the event of a slight seepage of the fluid past the rubber seal it is allowed to return to the master cylinder reservoir through this hole and passage. A brake fluid reservoir, a compensating port and valve, and a residual check valve complete the hydraulic section.

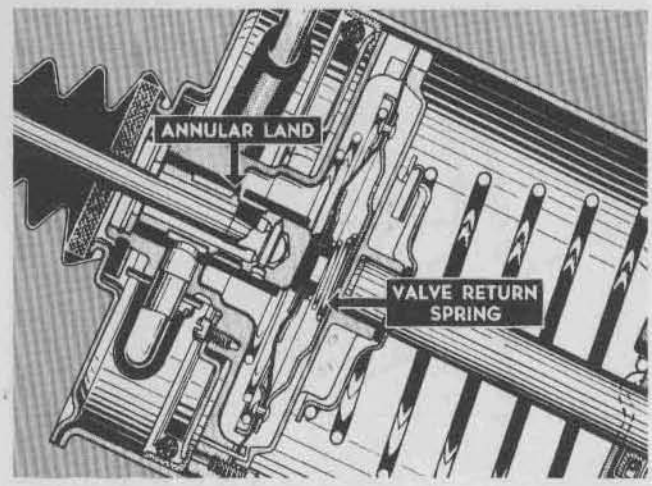


Operation

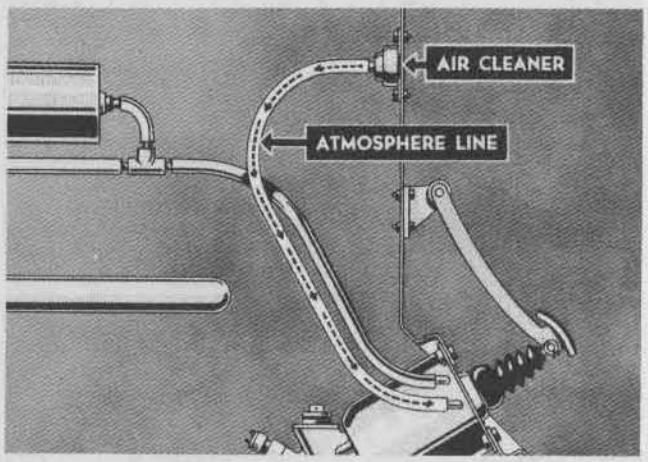
When the engine is running and the brakes are released, vacuum from the intake manifold is transmitted through the check valve and vacuum line to the vacuum connection on the vacuum cylinder.



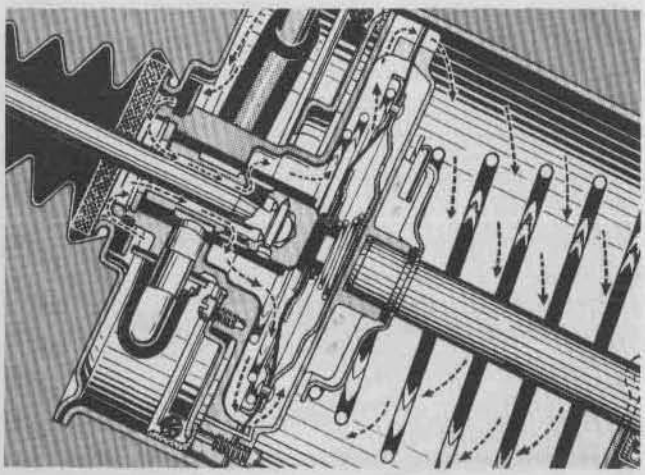
From the vacuum connection, it continues through the coiled internal vacuum line to the vacuum connection on the vacuum valve sleeve to the annular opening on the vacuum valve.



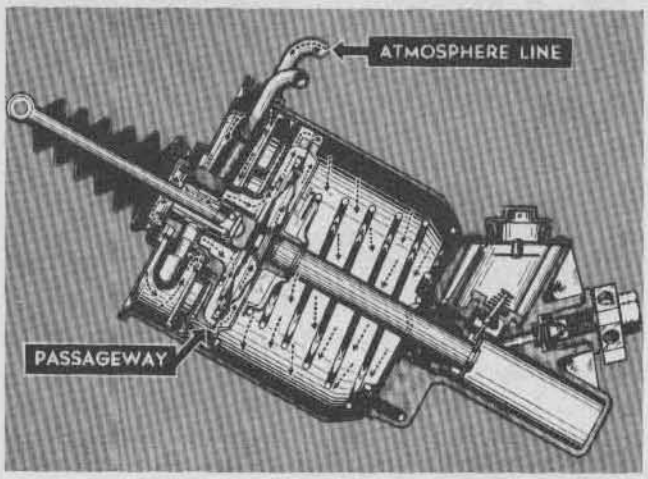
With the brake pedal released, the vacuum valve is held in its released position by the action of the valve return spring. In this position, the vacuum valve annular land cuts off the vacuum from further communication with other parts of the valve.



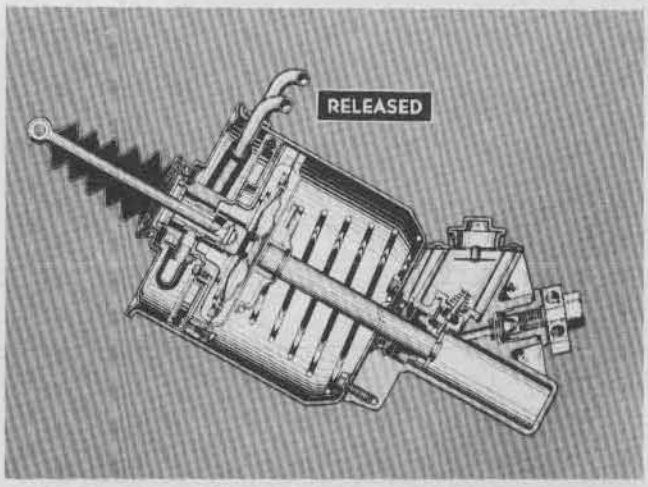
Atmosphere is transmitted through a small air cleaner and atmosphere line attached to the dash panel under the bonnet, to the atmosphere connection on the vacuum cylinder body.



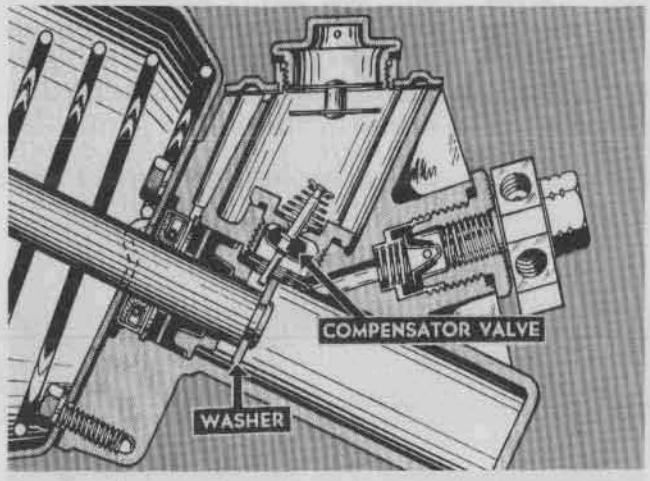
It then continues through the rear piston chamber past the notched stop washer to the inside of the valve operating boot. From the boot it continues on through the hollow inside diameter of the vacuum valve, and through a hole in the vacuum valve to the annular opening on the vacuum valve, and through passages to the chamber at the front of the piston.



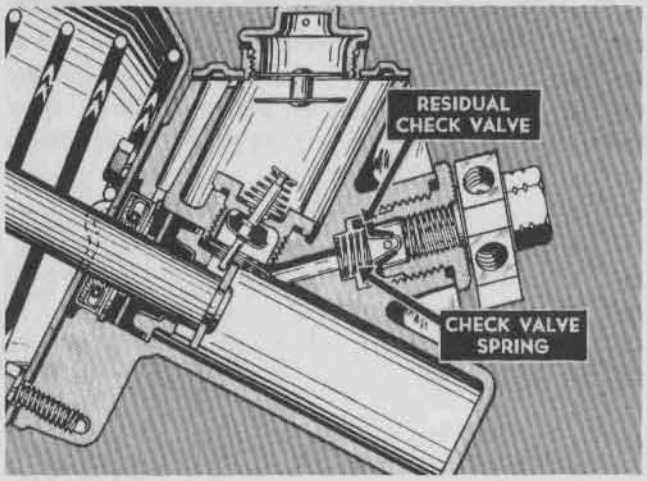
Atmosphere is also communicated past the inside diameter of the piston seal retainer through a passage to the front reaction diaphragm chamber. With atmosphere on both sides of the piston, the piston is held in its released position by the action of the piston return spring.



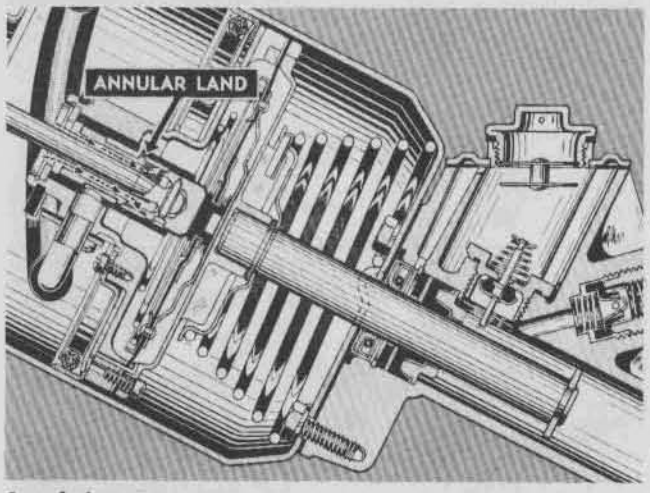
When both the vacuum cylinder piston and the vacuum valve are in their respective released positions, the various parts of the hydraulic section are also in released positions.



The compensator port valve is tilted by the washer on the end of the master cylinder piston to permit the brake fluid to flow between the brake fluid reservoir and the hydraulic cylinder as required by expansion or contraction of the fluid in the hydraulic system.

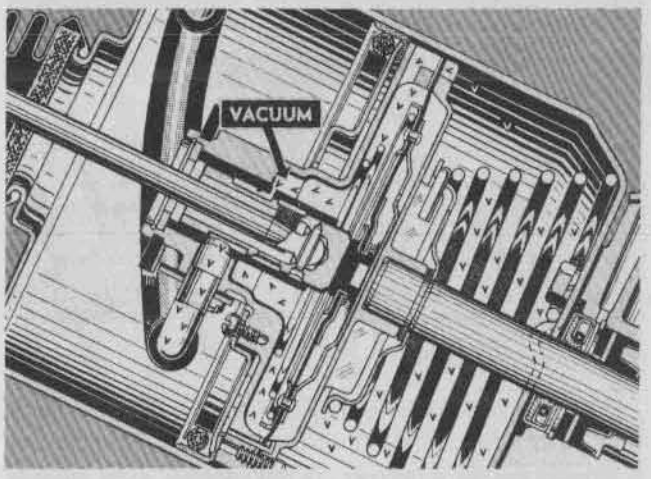


The residual check valve seal is seated by the action of the check valve spring to maintain a residual line pressure as in a conventional brake system.

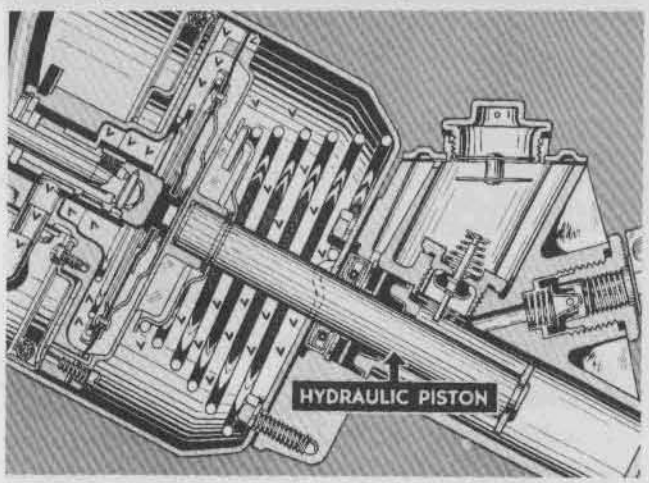


Applying

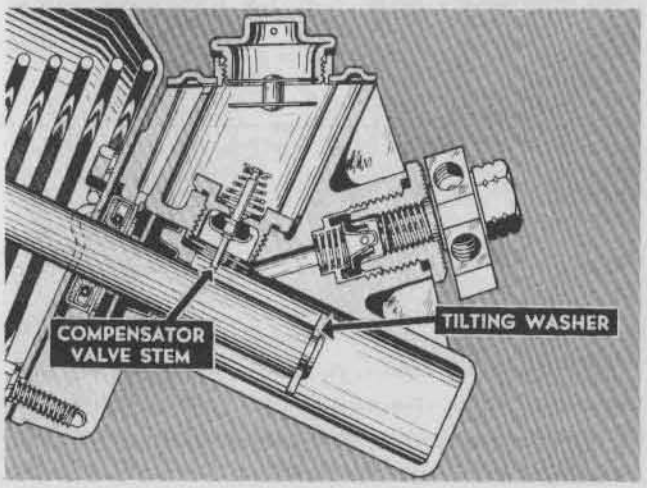
As the brake pedal is depressed by the driver, the vacuum valve moves forward until the annular land moves to the opposite side of the port, closing off the communication of atmosphere in the annular opening of the vacuum valve.



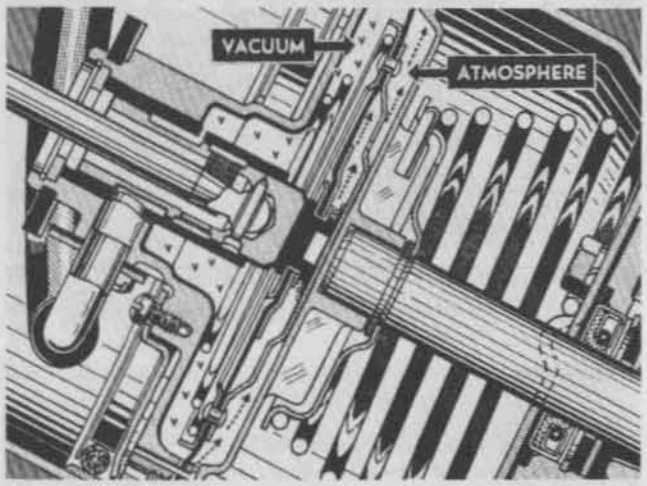
This forward movement of the vacuum valve permits the vacuum to communicate with the rear of the diaphragm and through two passageways of the vacuum cylinder piston to the front of the piston.



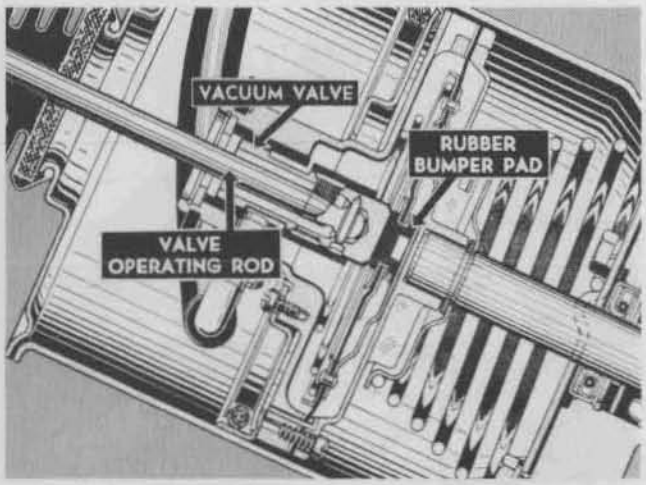
Since this area at the rear of the diaphragm is connected with the chamber at the front of the piston as previously described, a pressure differential is created causing the piston to move forward, pushing the hydraulic piston into the brake master cylinder.



As the master cylinder piston moves forward, the tilting washer on the end of the master cylinder piston moves away from the compensator valve stem, allowing the compensator valve to seal to the master cylinder reservoir to create the hydraulic pressure applied to the brake system.

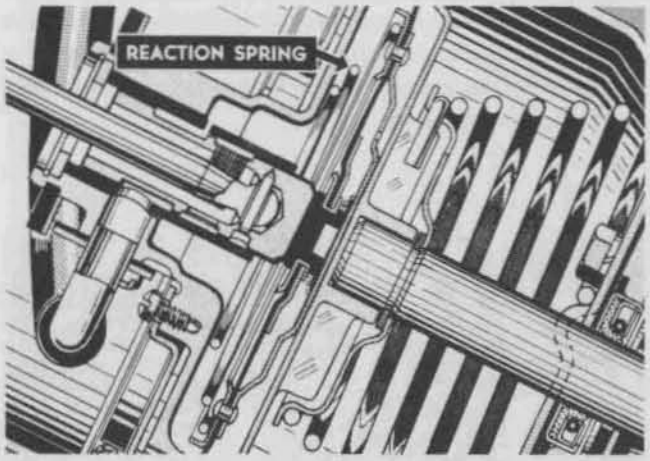


At the same time that the pressure differential is created causing the vacuum cylinder to move it forward, a similar pressure differential has been created in the reaction diaphragm by virtue of atmosphere in the front diaphragm chamber, and vacuum in the rear diaphragm chamber.

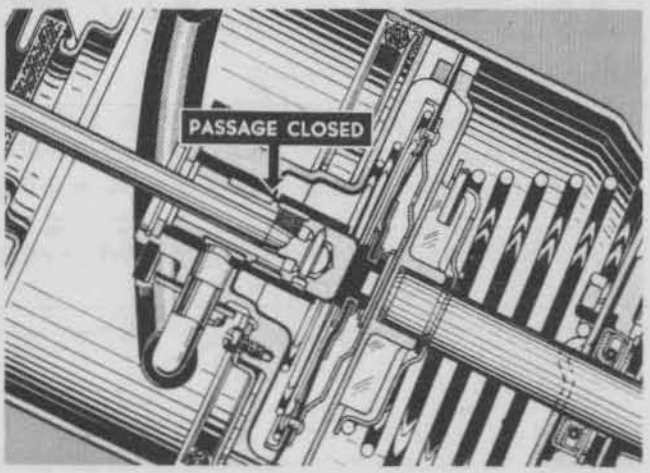


This causes the diaphragm to move and create a rearward force. This reactionary force is transmitted through a rubber bumper pad to the vacuum valve, to the valve operating rod to the brake pedal.

This force gives the driver the *feel* of the brakes, since the *reactionary* force increases in direct proportion to the amount of brake pressure applied.



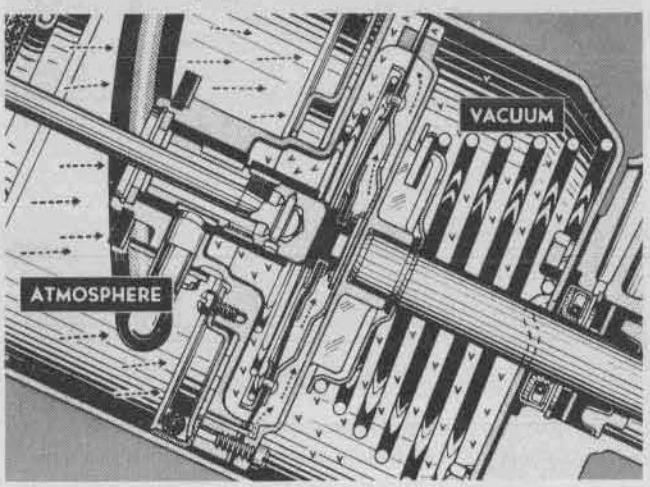
A counter-reaction spring is provided to permit operation of the vacuum valve sufficiently to allow cylinder piston movement and line pressure increase to a point of brake shoe and drum contact with only enough *reactionary* force to approximately balance the weight of the driver's foot.



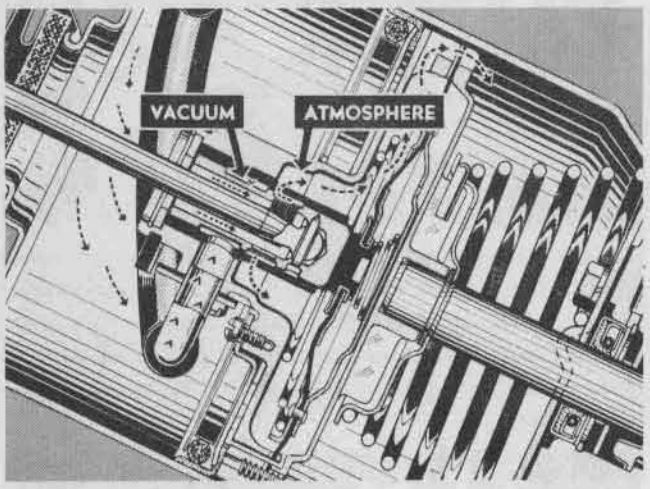
Holding

When sufficient braking force is obtained, and as soon as the pedal pressure on the vacuum valve stops increas-

ing, the reaction diaphragm moves back until the passage is just covered by the annular land.



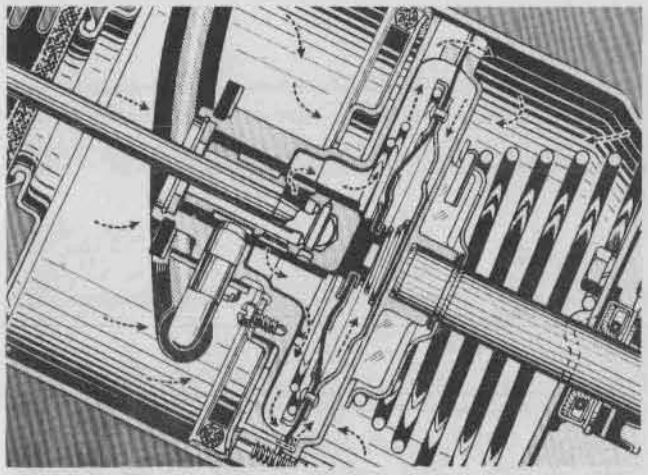
With the passage covered, vacuum which has entered the power cylinder is trapped, and no further action takes place until pedal pressure against the vacuum valve is increased or decreased; and the brakes are, therefore, held in the holding position.



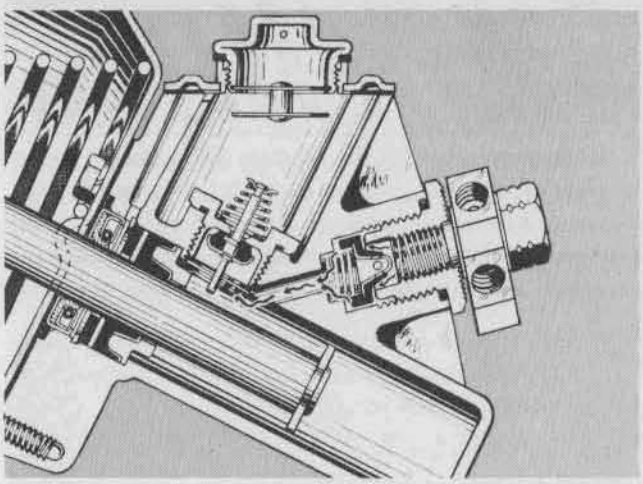
Releasing

When foot pedal pressure is released from the brake pedal, the valve return spring moves the vacuum valve rearward, closing off communication of vacuum at the annular opening of the vacuum valve and opening the communication of atmosphere from the other annular opening with the front of the piston.

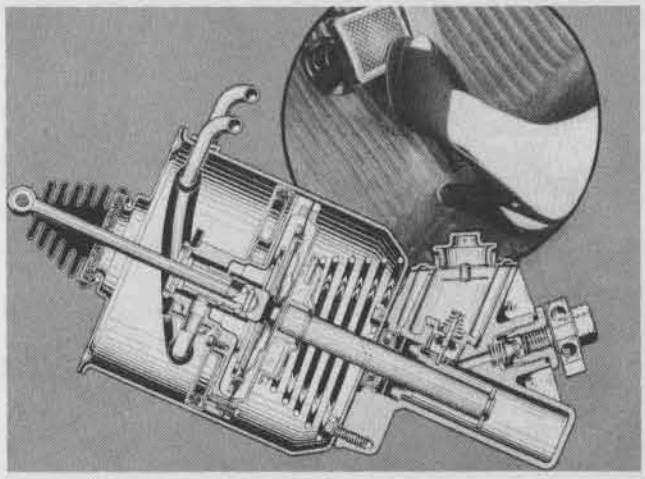
With atmosphere on both sides of the vacuum cylinder piston, the piston return spring and hydraulic pressure force the piston to the rear of the cylinder shell,



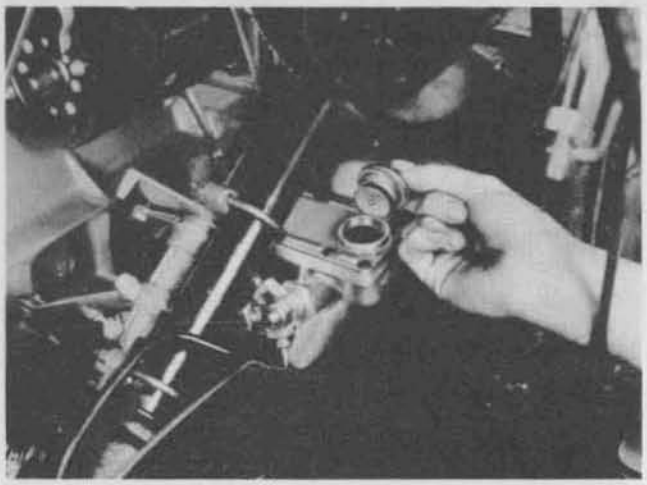
the hydraulic master cylinder piston is returned to the rear of the cylinder, and the compensating port valve is unseated.



Hydraulic fluid, which has been displaced into the wheel cylinders, returns to the master cylinder through the hydraulic lines, the residual check valve, and the hydraulic cylinder as the brake shoe return springs pull the shoes away from the brake drums.



It should be remembered that only gentle pressure of the toe is required to obtain brake action on Easamatic equipped cars. Therefore, care should be exercised to avoid stopping the car too fast.

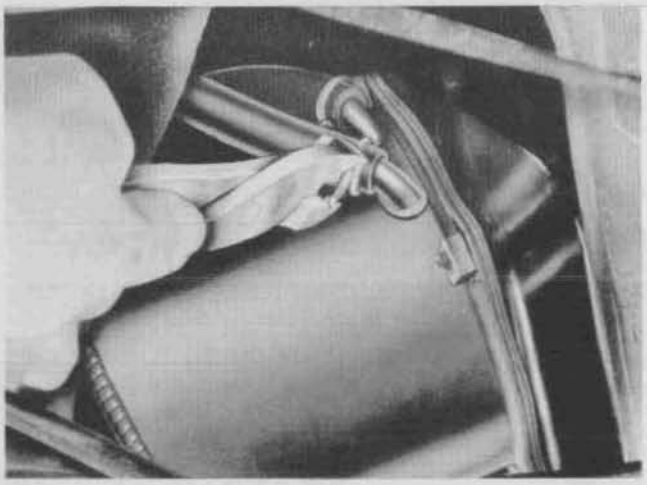


The Easamatic unit needs no lubrication or adjustments. However, the brake fluid level should be checked every thousand miles and the Easamatic air cleaner unit changed every 10,000 miles.

Some repair work may be performed on the Easamatic power unit in its installed position in the vehicle such as cleaning of the vacuum valve, replacement of the vacuum valve assembly or the valve rod boot.

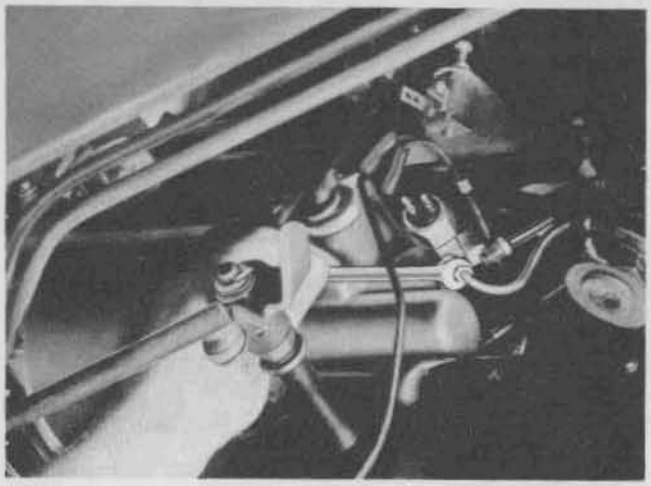
More extensive repair work may be performed with partial disassembly of the unit in its installed position by removing the toe board panel. This includes replacement of the vacuum hose, reaction diaphragm, counter-reaction spring, piston return spring, etc.

It is recommended, however, that the following complete disassembly procedure be studied before minor repair work is attempted on the unit in its installed position.



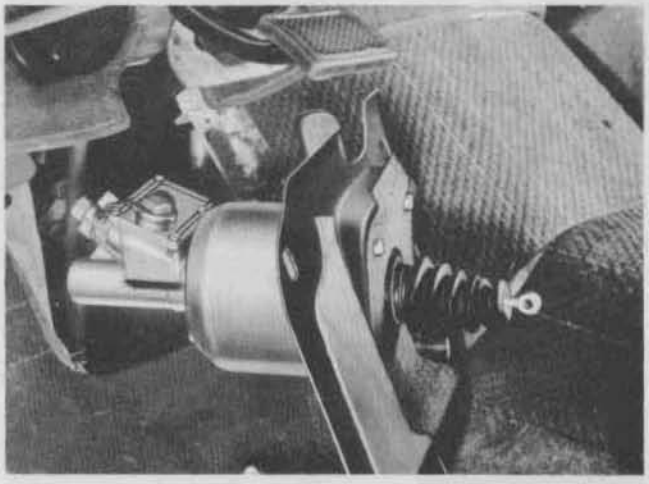
Removal from Vehicle

Disconnect the vacuum and atmospheric lines, hydraulic lines, and the stop light switch wires from the power unit.



Remove the cotter pin and clevis pin connecting the pedal to the valve rod. Disconnect the accelerator pedal.

Remove the two screws holding the steering column grommet and slide the grommet up out of the way. Remove the floor mat screws and fold back the floor mat.



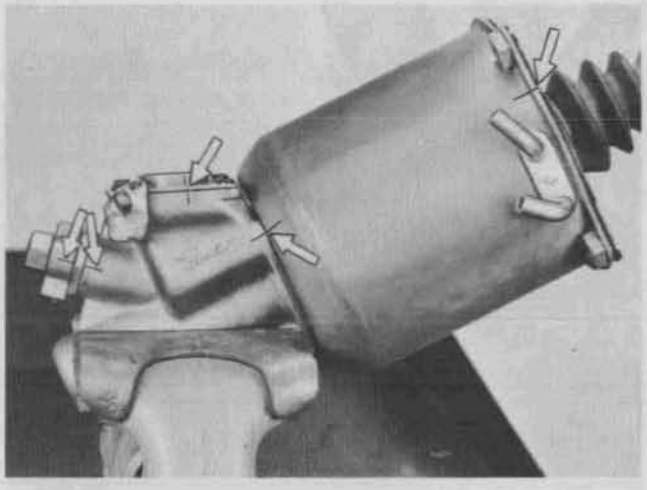
Remove the toe board plate to toe board mounting screws. Lift the power unit and toe board plate assembly from the vehicle.

Remove the toe board plate to power unit mounting screws and separate the unit from the toe board plate.

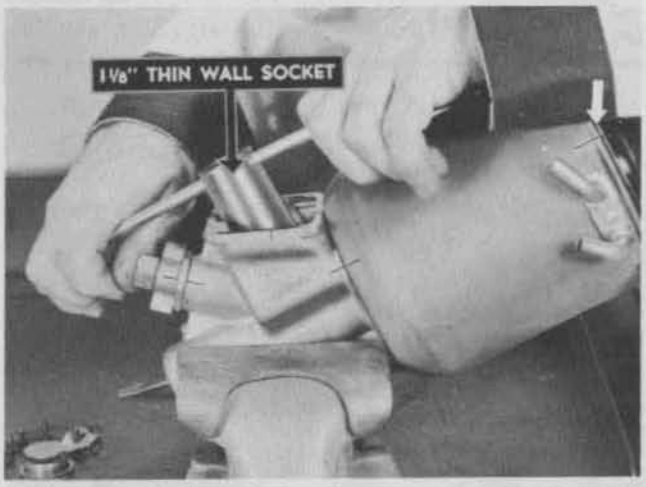
Disassembly

Clean all dirt from the outside of the unit, using care not to allow any of the dirty solvent to enter the unit.

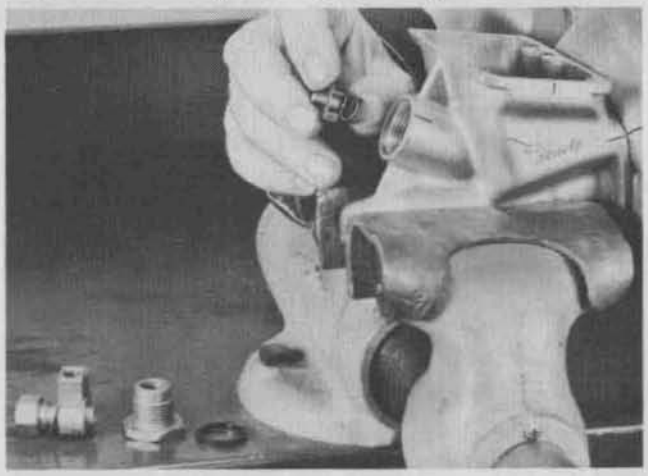
Remove the hydraulic fluid reservoir filler cap and filler cap gasket and empty the fluid from the reservoir. Scratch alignment marks on the cylinder shell and the shell end plate, on the cylinder shell and the hydraulic cylinder casting. Scratch alignment marks between the tube fitting and on the hydraulic cylinder casting.



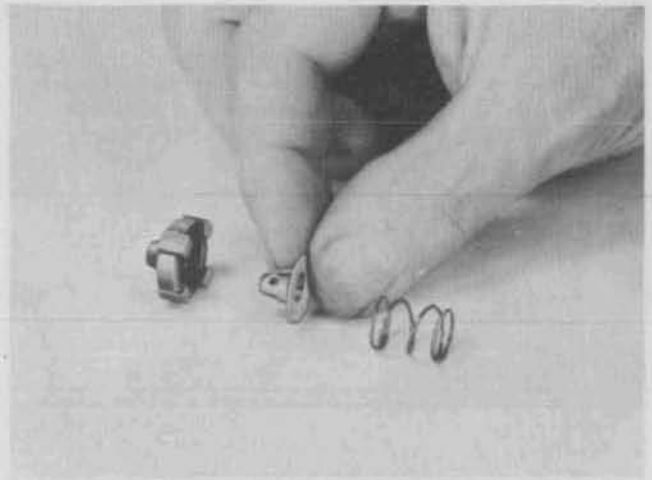
With the reservoir casting held between lead jaws in a vise, and having the unit at its normal mounting angle, remove the six reservoir cover screws, the cover and the cover gasket.



Unscrew the compensator port and valve assembly using a 1⅛" thin wall wrench. Remove the rubber seal ring from the compensator port fitting.



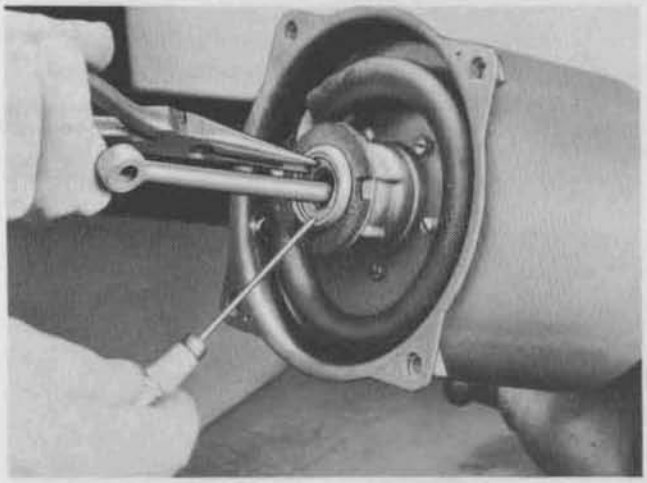
Unscrew the hydraulic output fitting bolt and output fitting. Remove the rubber seal ring from the output fitting. Remove the check valve assembly and the check valve spring.



Separate the check valve rubber cup and cup retainer of the check valve assembly.

Remove the unit from the vise and empty the remaining fluid from the reservoir and hydraulic cylinder. Replace the unit in the vise.

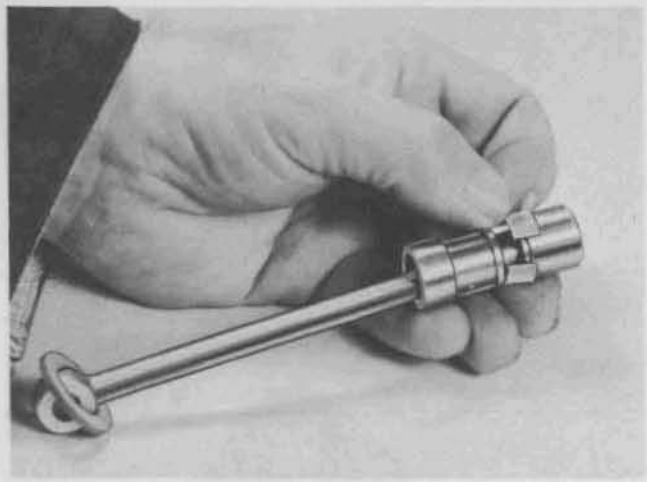
Release the lip of the valve rod boot from the shell end plate and slip the boot off over the end of the valve rod. Remove felt washer from the valve rod.



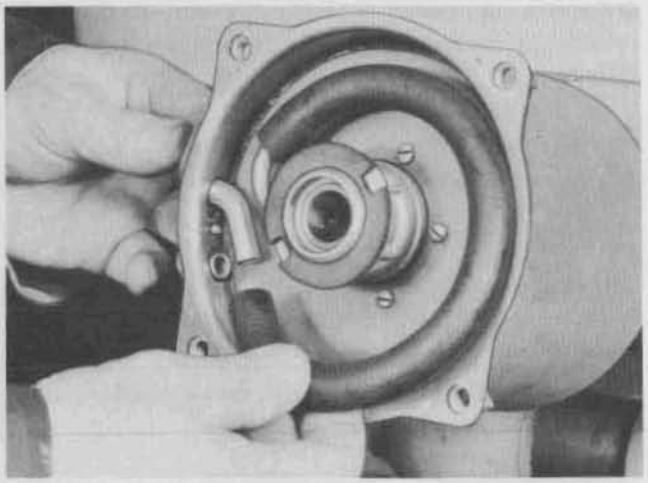
Remove the screws holding the cylinder end plate and gasket to the cylinder body. Using a pair of small nose pliers to compress the ends of the valve stop washer snap ring, pry the opposite side of the snap ring out with a small screwdriver.

Remove the snap ring, and the rod and valve assembly.

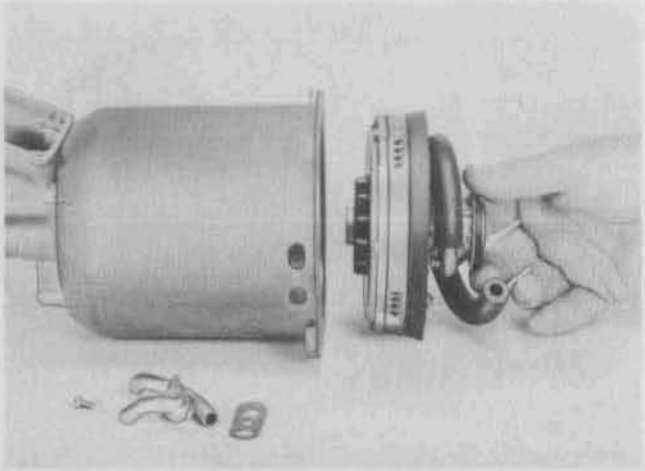
CAUTION: Take care to protect the polished surfaces of the vacuum valve.



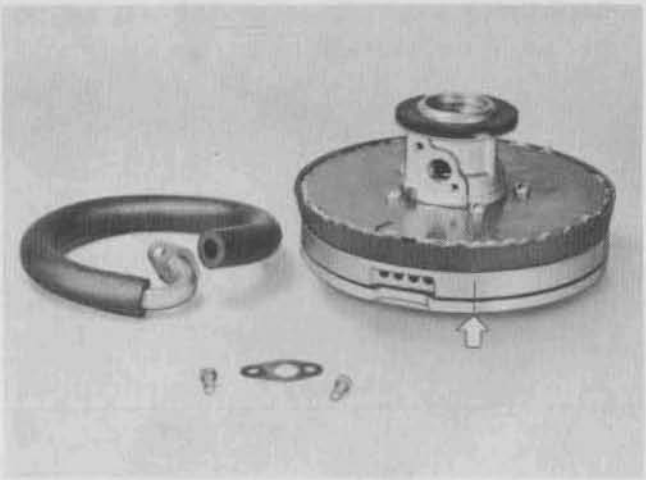
Remove the screen from the valve.



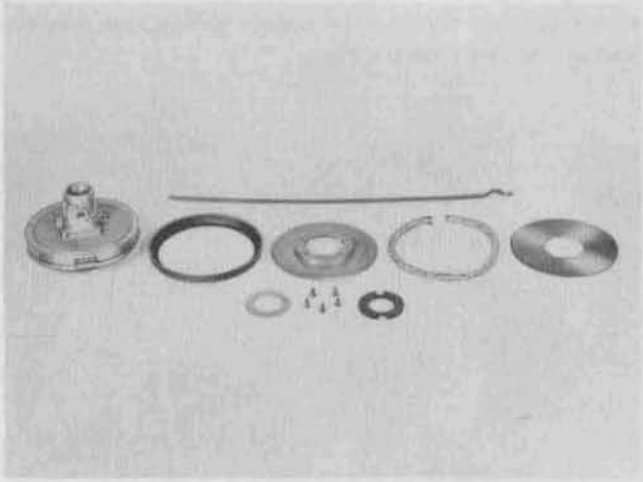
Remove the hose from the vacuum inlet tube at the shell.



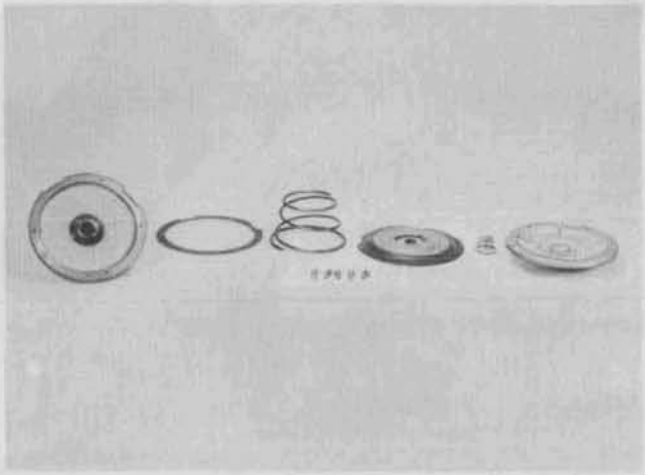
Holding the vacuum piston into the shell about ½", remove the inlet tube assembly screw and the inlet tube assembly and gasket. Lift out the vacuum piston assembly.



Remove the two vacuum tube mounting screws and remove the tube and hose assembly and gasket. Scratch alignment marks on the front and rear piston plates.

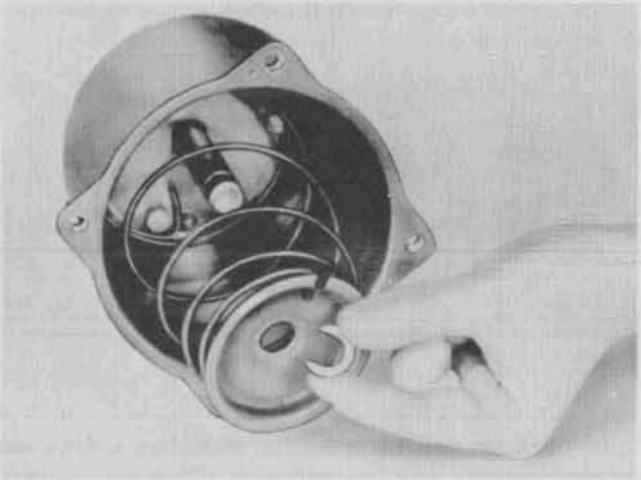


Remove the piston steel and rubber stop washers. Remove the five packing plate screws, retainer plate, expander spring, wicking, vacuum piston seal retainer and seal. Turn the unit over on the bench.



Remove the five piston plate screws, separate the front and rear piston plates, the diaphragm assembly, counter-reaction spring, gasket and vacuum valve return spring.

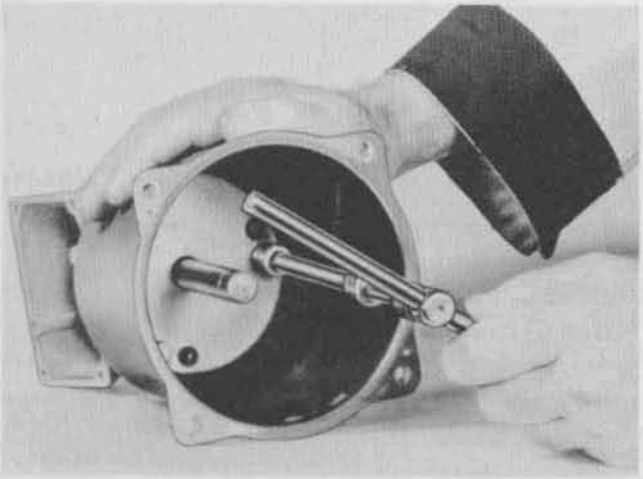
CAUTION: Take care to protect the inside bore of the valve sleeve in the rear piston plate.



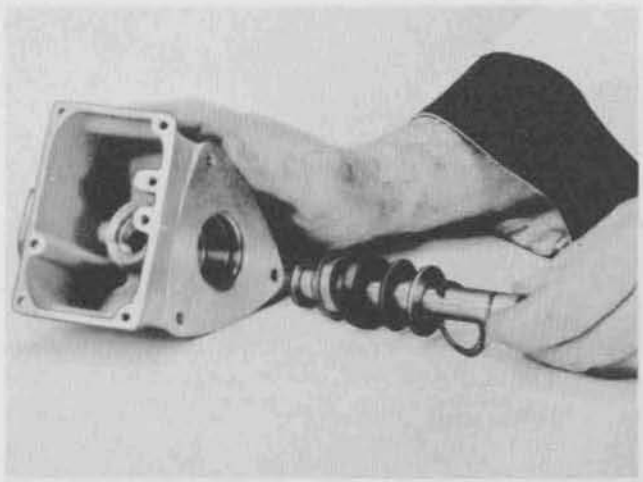
Using care not to push the master cylinder piston from its released position, compress the piston return spring about ½" and remove the return spring seat retainer, spring seat and return spring.

Using special pliers PU-376, remove the master cylinder piston cup washer retaining ring and lift the master cylinder piston and seal parts as a unit from the hydraulic cylinder.

CAUTION: Take care to protect the polished surface of the master cylinder piston.



Remove the three cylinder shell mounting bolts and lockwashers, cylinder shell, gasket, rubber seal ring and metal encased leather vacuum seal.

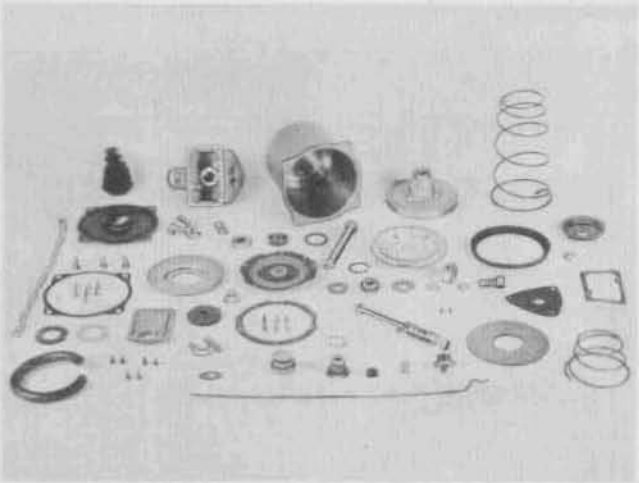


Remove the steel back-up washer, phenolic guide washer, master cylinder piston seal, and seal retainer from the master cylinder piston.

CLEANING AND INSPECTION

Wash all parts thoroughly in alcohol and wipe dry. Blow the dirt and cleaning fluid out of the internal passages. If the inside of the vacuum cylinder shell is corroded or rusted, clean the surface with fine emery cloth and finish with crocus cloth.

CAUTION: It is important that the cleaned parts be placed on clean paper or cloth prior to assembly, to prevent the possibility of dirt getting into the Easamatic power unit.



Inspection

In addition to replacement of parts contained in "Easamatic Repair Kit," inspection of parts should be made as follows and parts replaced as necessary.

Inspect the cylinder shell for scoring, pitting, dents, nicked edges or damaged threads. Replace if necessary.

Examine the hydraulic cylinder bore 1" from the open end. The surface must be free from scores, deep scratches, or corrosion, and be satisfactory for sealing with the rubber hydraulic seal. Gasket surfaces at the reservoir cover and the compensator port and hydraulic output fitting must be free of scoring, pitting, dents and nicked edges. Check for cracks and damaged threads. Replace if necessary.

The surface on the face at the small end of the hydraulic output fitting must be free from scores, deep scratches to provide a proper sealing surface with the rubber cup of the check valve assembly. Replace if necessary.

Make sure the braze on the vacuum inlet tube is *secure* and the tube and mounting plate are not distorted. Replace either part if necessary.

Examine the rear piston plate for cracks or damaged threads. The sleeve must be securely pressed into the piston plate. Replace the assembly if the bore of the sleeve has scores, deep scratches, or corrosion.

CAUTION: Do not refinish the sleeve bore as excessive clearance between the sleeve and the vacuum valve will cause serious vacuum leakage. Replace the vacuum piston rear plate assembly if the sleeve bore is found excessively worn or scored.

Inspect the hydraulic master cylinder piston for scoring, pitting or nicks.

CAUTION: Do not attempt to refinish the piston as an undersize piston may cause serious hydraulic leakage. Replace the hydraulic master cylinder piston if it is scored or damaged.

The operating rod must pivot freely in the vacuum valve, but without noticeable end play. Inspect the vacuum valve for scoring, pitting or nicks on the outside diameter.

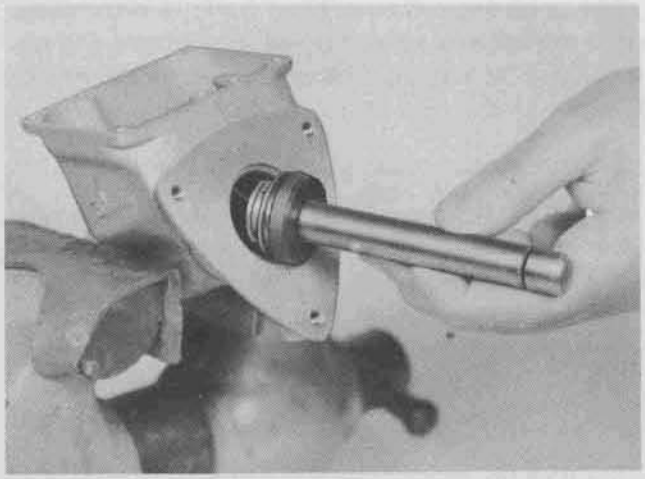
CAUTION: Do not refinish the outside diameter of the valve as excessive clearance between the valve and the sleeve bore will cause serious vacuum leakage. Replace the vacuum valve assembly if it is found scored or damaged.

Examine the vacuum cylinder and plate for cracks or distortion. Replace any other parts that do not come up to inspection standards.

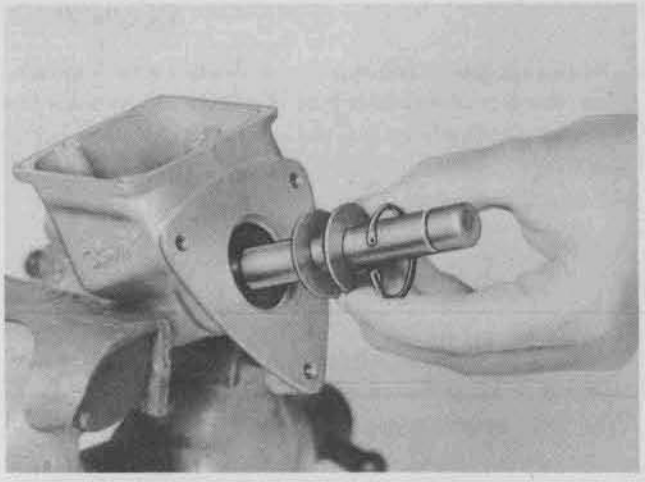
Assembly

NOTE: All parts, tools, work area, etc., must be free from grease, oil, or dirt before reassembly is started.

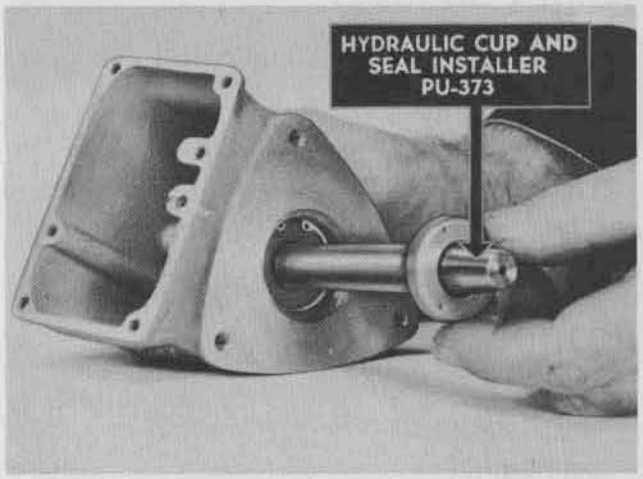
Dip the hydraulic master cylinder piston and cup in brake fluid. Install the cup retainer on the master cylinder piston with the end having the smaller diameter facing the washer on the end of the piston. Slip the Hydraulic Cup and Seal Installer PU-373 over the end of the master cylinder piston and install the lip side of the cup on the cup retainer.



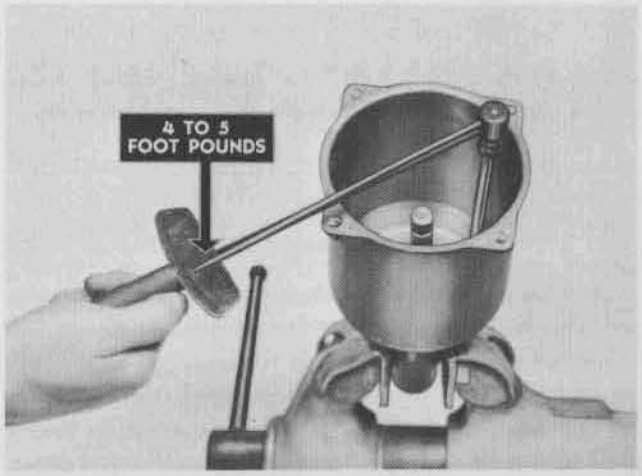
Place the piston-retainer-cup sub-assembly in the hydraulic cylinder.



Care must be used not to damage the cup lip as it enters the cylinder bore. Put the phenolic washer and piston cup steel stop washer in place and install the retaining ring.

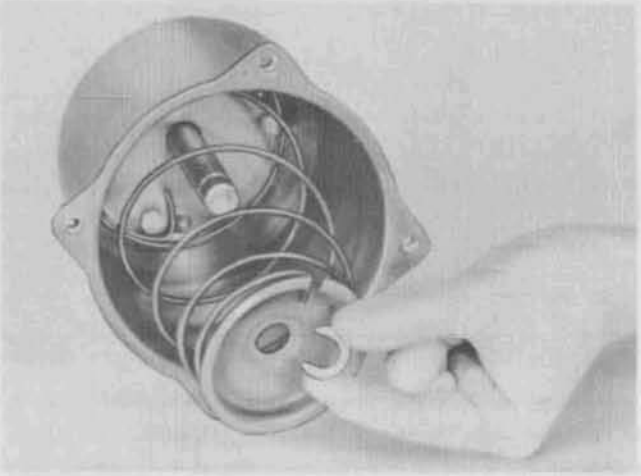


Holding the hydraulic master cylinder piston in its outward position and using the Hydraulic Cup and Seal Installer Tool No. PU-373, install the master cylinder leather seal with the seal lip toward the hydraulic cylinder.



Install the master cylinder rubber seal ring and the cylinder gasket. Match the vacuum cylinder shell and the

hydraulic cylinder casting alignment marks, and fasten with mounting bolts and lockwashers. Torque tighten to 4 to 5 foot pounds.



Install the piston return spring engaging the hooked end of the large end of the spring between a mounting bolt and a small hump in the shell, (any one of the three positions should be satisfactory). Place the spring retainer over the piston, engaging the hooked end of the small end of the spring in the slot of the retainer. Install the retainer washer.

Place the rear piston plate on the bench, the rear side facing up. Using the Vacuum Piston Packing Assembly Ring No. PU-375, install it over the piston plate. Install the vacuum piston leather seal, making certain that the seal seats in the recess of the piston plate. Install the vacuum piston packing seal retainer, wicking, wick retaining expander spring, wick retaining plate and five screws.

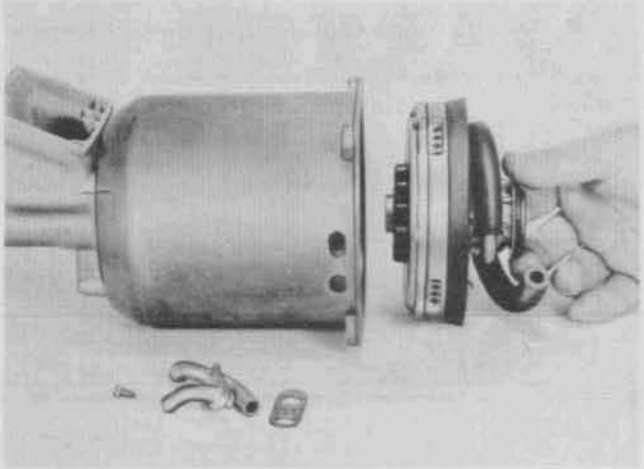
Care must be used when installing these screws to apply sufficient downward pressure on the screwdriver to partially compress the packing seal and thoroughly engage the screw threads to prevent stripping the threads.

Turn the vacuum piston rear plate assembly over on the bench with the valve sleeve assembly side facing the bench. Install the five Diaphragm Installation Guide Pins PU-374 into the screw holes.

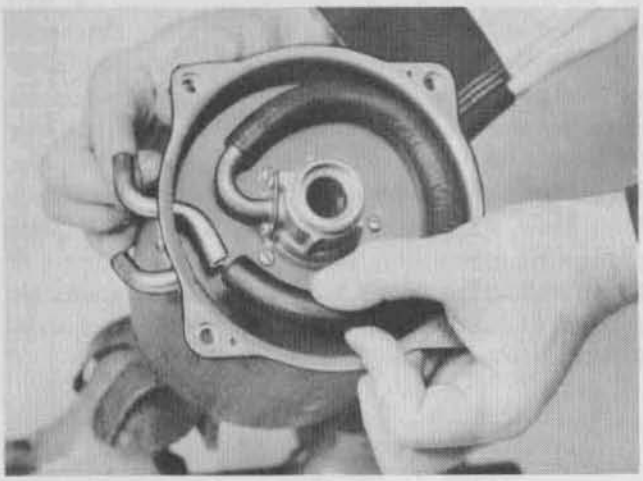
Place the counter-reaction spring, small end down, on the piston plate. Place the reaction diaphragm and then the gasket over the locating pins. The large diaphragm plate must be toward the rear piston plate. Align the two air passage cutouts. Install the valve return spring, the small end into the reaction diaphragm. (This will be over the back of the rubber pad.) Install the front piston plate, again align the air passage cutouts or alignment marks. Press down, compressing the spring. Remove one guide pin at a time, replacing each with a screw. Be sure to obtain uniform tightness. Following assembly, saturate the new wicking and wipe the leather seal with a maximum of two teaspoons full of shock absorber oil.

Fasten the vacuum tube, hose assembly and gasket to the rear piston plate with two screws.

Apply a thin film of shock absorber oil to the inside wall of the cylinder shell. Insert the piston assembly into the shell and align the open end of the hose with the center of the large elongated hole in the cylinder shell.

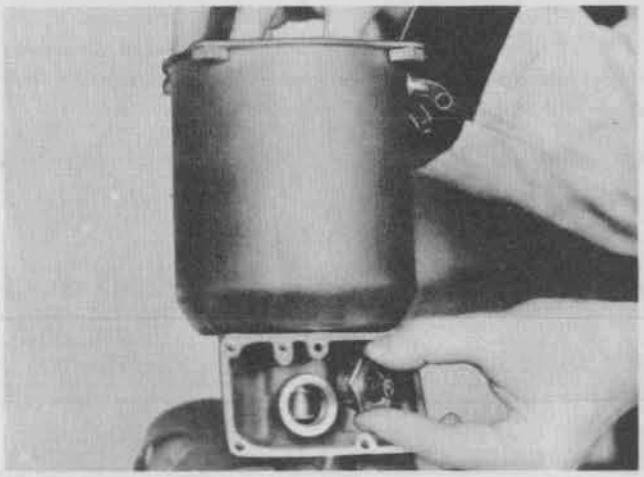


Push the piston assembly into the shell. Make sure that the bore of the vacuum cylinder piston front plate fits over the end of the master cylinder piston. Rotate the piston assembly clockwise 20° to 30° and then 20° to 30° counterclockwise; then move the piston assembly through its full stroke several times *to make certain* that after the piston finds its normal working position, the open end of the vacuum hose is aligned with the large elongated hole in the cylinder shell.



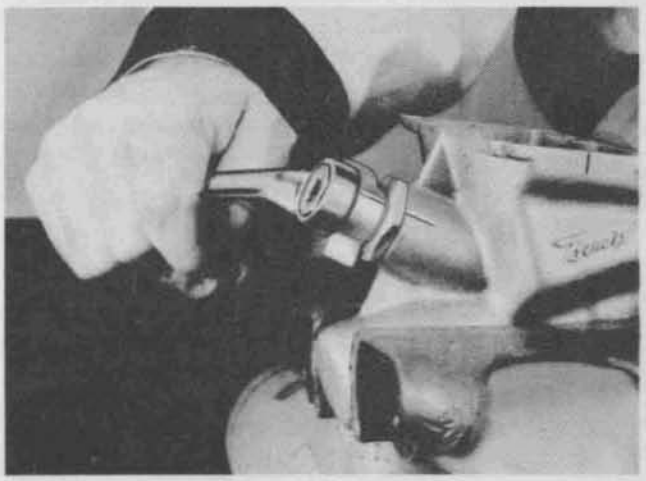
Install the tube assembly, gasket and screw on the cylinder shell. Tighten the screw firmly. Slip the hose on the tube connection. Again push the piston into the cylinder to its full stroke, permitting it to come back by itself. Do this several times. Watch if the piston return spring causes the piston to rotate. If it rotates enough to cause the coiled hose connection to rub against the inlet connection, correct as follows:

Remove the piston and move the piston return spring 120°. In other words, this will be moving the large looped end of the spring to the next bolt and hump position.

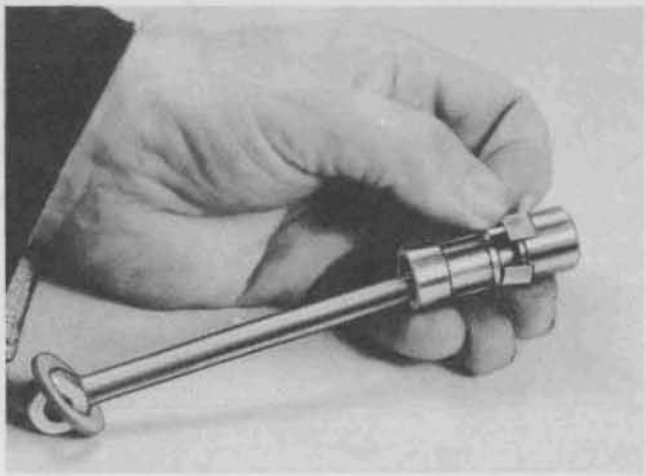


Dip the rubber seal ring in brake fluid and place it around the compensator port fitting. Holding the piston assembly forward in the cylinder about ½", install and tighten the compensator port and valve assembly.

Assemble the residual check valve rubber cup on the cup retainer after dipping the cup in brake fluid. Position the spring and cup-retainer assembly on the hydraulic output fitting lower face at the small end of the fitting. Invert the unit and screw the fitting into place, using care to see that the parts remain in correct alignment. Torque tighten to 30-42 foot pounds.

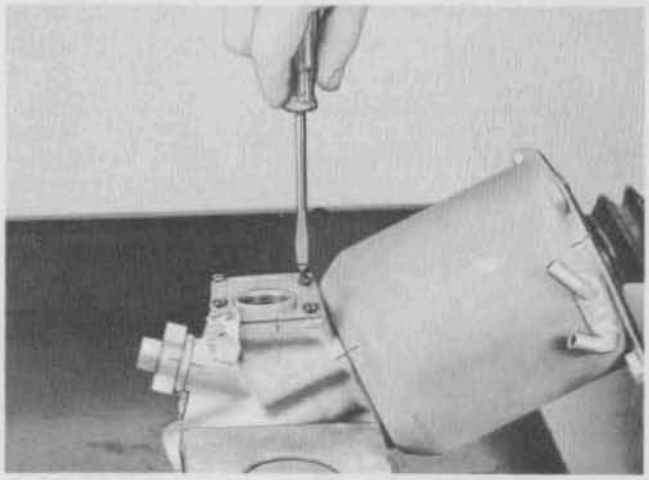


Assemble the copper gasket, hydraulic tube fitting, and copper gasket over the fitting bolt. Screw the parts into the output fitting, having the fitting outlets in correct position as indicated by alignment marks.



Place the piston steel stop washer and a new piston rubber stop washer in place. It will be noticed that the rubber stop washer has a glossy finish on one side. This is a cement which must be moistened before installing. This can be accomplished by using Metyl Ethyl Ketone which is available at drug stores or its equivalent. When the cement becomes tacky, install the steel washer without cement on the end of the vacuum piston. Install the new rubber stop washer (cemented side downward) on the upper end of the vacuum piston. Work the inner end of the rubber stop washer into the groove on the upper end of the vacuum piston. Install the gasket and the cylinder shell end plate, using the two screws, matching the alignment marks. Tighten the screws.

Install the screen over the grooved port in the vacuum valve. Carefully insert the valve assembly in the vacuum piston with the phenolic washer on the rod and install the snap ring. Install the felt washer. Install the valve rod rubber boot.



Movement of the vacuum piston 3/32" to 7/32" from its full release position should allow the compensator port to close. If this dimension does not check, recheck the unit for faulty assembly.

Match the fluid reservoir cover alignment marks and install the gasket and cover with six screws. Install the filler cap and gasket.

INSTALLATION

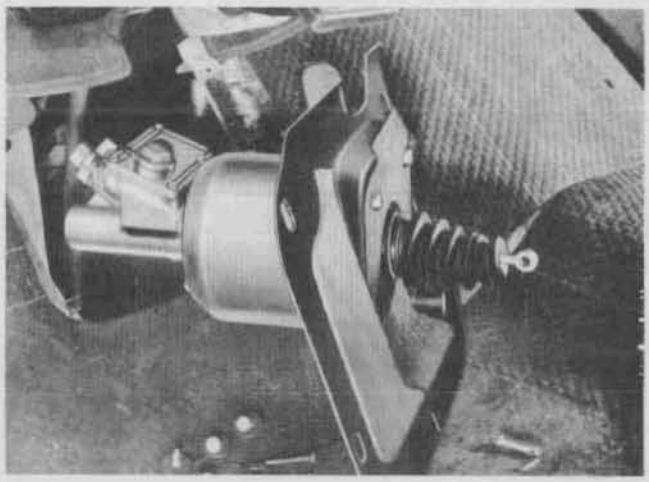
The Easamatic power unit is mounted on the underside of the toe board and is installed from inside the driver's compartment.

At the bench, mount the unit on the toe board plate with four screws and lockwashers with the unit positioned so that the fluid reservoir filler cap will be upward when installed in the vehicle.

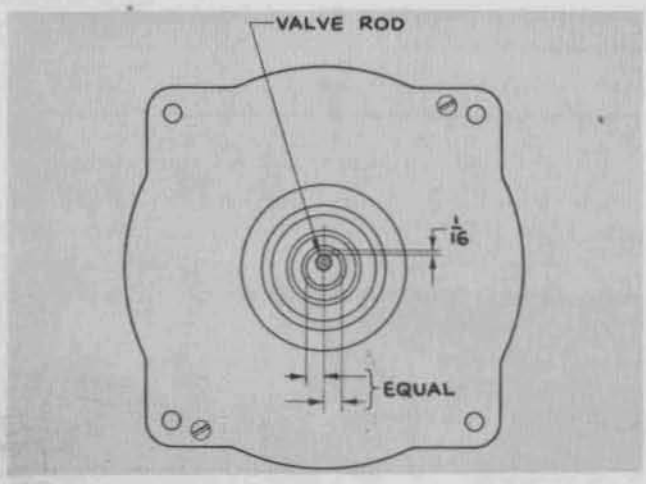
Holding the pedal up to give clearance, install the unit and toe board plate sub-assembly in place on the toe board.

Install two toe board plate screws, tightening them only enough to hold the unit in place during alignment.

Fasten the pedal to the valve rod with the clevis pin. Do not install the cotter pin at this time.



Raise the forward end of the valve rod boot to inspect the clearance of the valve rod with the inside diameter of the vacuum valve at the upper end of the valve.

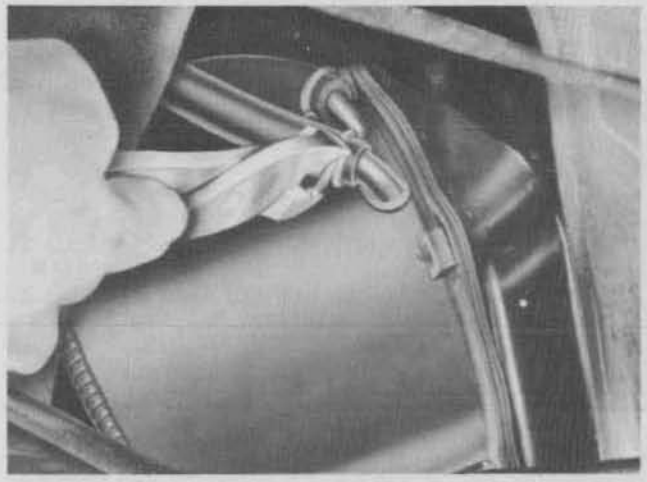


The toe board plate should be positioned so that the valve rod has equal clearance on the left and right, but with slightly less clearance above than below. A clearance of 1/16-inch should be allowed between the rod and upper edge of the inside diameter of the valve. If additional movement for alignment is necessary, the pedal support bracket on the dash can be loosened and repositioned slightly.

IMPORTANT PRECAUTION: Stroke the unit manually through its full stroke a number of times to check that no bind exists due to misalignment. Both the piston and vacuum valve must return freely to their full release positions.

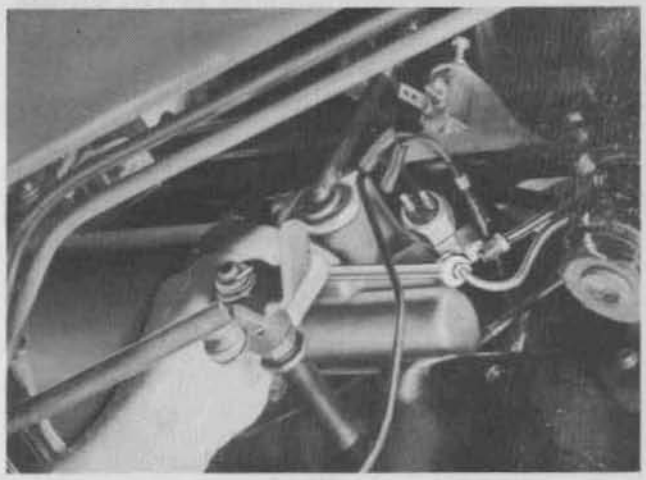
If alignment is satisfactory, install and tighten the remaining toe board plate to toe board hold-down screws. Replace the valve rod rubber boot.

Remove the clevis pin and install the floor mat. Reinstall the clevis pin and the cotter pin. Slide the grommet on the steering column down to its normal position and install the two screws. Connect the accelerator pedal.



Connect the vacuum line to the upper hose connection.

Connect the atmospheric line to the lower hose connection.



Connect the hydraulic lines, two leading to the front wheel cylinders and one to the rear wheel cylinders.

Connect the stop light switch wires.

Bleeding

The Easamatic brake system bleeding may be done manually or with a pressure bleeder in the conventional manner.

NOTE: Only new, clean, Packard hydraulic brake fluid should be used.

Clean any dirt from around the hydraulic reservoir filler cap. Fill the reservoir and maintain fluid in the reservoir during the bleeding operation.

Slip the bleeder hose over the bleeder valve on the wheel cylinder furthest from the reservoir. Place the other end of the hose in a container having sufficient fluid to submerge the end of the hose.

Open the bleeder valve by turning ¾ turn counterclockwise and watch the flow of fluid at the end of the bleeder hose while depressing the brake pedal. Then slowly release the pedal allowing it to return to the released position. This operation should be repeated several times. When the air bubbles cease to appear, depress the brake pedal and close the bleeder valve by turning it clockwise.

Repeat the above procedure at the remaining wheel cylinders, bleeding the shortest line last.

After bleeding the system, fill the hydraulic fluid reservoir to within ½" of the top of filler cap opening and replace the filler cap. Fluid bled from the system should not be used again.

Lubrication

The Easamatic piston packing seal is lubricated at the time of original assembly and needs no further lubrication.

CAUTION: Do not lubricate the vacuum valve under any circumstances.

System Tests

Road test the brakes by making a brake application at about 20 m.p.h. to determine if the vehicle stops evenly and quickly. If the pedal has a spongy feel when applying the brakes, air is present in the hydraulic system. Bleed the system as previously described.

With the engine stopped, hand brake applied, and the transmission in neutral, apply the brakes several times to exhaust all vacuum in the system. Depress the brake pedal, hold foot pressure on the pedal, and start the engine. If the vacuum system is operating, the pedal will tend to fall away under foot pressure, and less pressure will be required to hold the pedal in the applied position. If no action is felt, the vacuum system is not functioning.

Stop the engine and again exhaust all vacuum in the system. Depress the brake pedal and hold foot pressure on the pedal. If the pedal gradually falls away under foot pressure, the hydraulic system is leaking.

If the brake pedal travels to within 1 inch of the toe board, the brake shoes require readjustment or relining.

Easamatic Repair Kit

Whenever an Easamatic unit is disassembled, it is recommended that the parts listed in the Easamatic Repair Kit be obtained prior to the disassembly. The parts listed in the kit include perishable parts such as rubber seals and gaskets, as well as parts for those that probably cannot be used again due to mutilation, such as snap rings, etc.

Part IV

BRAKES

TROUBLE SHOOTING AND CORRECTIVE MEASURES

CONVENTIONAL BRAKE

CONDITION	POSSIBLE CAUSE	CORRECTION
1. Brake pedal goes to floor board. Brakes do not hold.	(a) Normal wear of lining. Clearance between lining and drums too great.	(a) Perform minor brake adjustment.
	(b) No fluid in the master cylinder.	(b) Fill the master cylinder reservoir and bleed the brake lines.
	(c) A leak in the hydraulic system will permit the brake pedal under pressure to go to the floor board gradually.	(c) Locate and correct the leak in the system. Bleed the brake lines. Fill the master cylinder reservoir.
	(d) Air in the hydraulic system will cause the brake pedal under pressure to feel "spongy."	(d) Bleed the brake lines. Fill the master cylinder reservoir.
	(e) Excessive brake pedal free play will reduce the effective stroke of the master cylinder.	(e) Adjust the master cylinder push rod so that the brake pedal has 1/4" free play before the pressure stroke starts.
	(f) Brake shoe anchor pins improperly set, allowing the shoes and drums to spring.	(f) Perform the major brake adjustment.
	(g) Master cylinder bore pitted or rusty. Piston cups excessively worn or deteriorated.	(g) Replace master cylinder or recondition master cylinder as required.
2. Brakes on all wheels drag.	(a) Brake pedal improperly set. Master cylinder rod adjusted too tight, not allowing the master cylinder compensating port to be uncovered.	(a) Adjust the master cylinder push rod so that the brake pedal has 1/4" free play, before the pressure stroke starts.
	(b) Master cylinder primary cup swollen, not allowing the compensating port to be uncovered.	(b) Recondition the master cylinder. Install new piston and cups. Adjust the push rod properly.
	(c) Faulty master cylinder check valve will cause master cylinder pressure to build up and will not let the fluid return to the master cylinder reservoir.	(c) Recondition the master cylinder. Install new piston, cups and check valve. Adjust push rod properly.
	(d) Mineral oil in the hydraulic system will cause all cups and fluid lines to build up.	(d) Recondition the master cylinder and all wheel cylinders. Install all new cups and rubber parts. Flush the hydraulic system with alcohol and fill with new Packard Hydraulic Brake Fluid.
3. Brake on one wheel drags.	(a)Broken or weak shoe return springs.	(a) Install new shoe return springs.
	(b) Brake adjusted too tight.	(b) Perform minor brake adjustment.
	(c) Brake shoe anchor improperly set.	(c) Perform major brake adjustment.
	(d) Frozen hand brake cable (on rear wheel).	(d) Free up and lubricate hand brake cable. Readjust the brakes.

BRAKES

TROUBLE SHOOTING AND CORRECTIVE MEASURES—Continued

CONVENTIONAL BRAKE

CONDITION	POSSIBLE CAUSE	CORRECTION
3. Brake on one wheel drags. (Continued)	(e) Hand brake cable improperly adjusted (on rear wheel).	(e) Perform hand brake adjustment.
	(f) Swollen wheel cylinder cups will retard the return action of the shoes and cause the brake to drag.	(f) Recondition the wheel cylinder, bleed lines and perform minor brake adjustment.
	(g) Loose wheel bearings (front wheels).	(g) Adjust the wheel bearings and perform minor brake adjustment.
4. Spongy brake pedal. Brakes do not hold satisfactorily.	(a) Brake shoes improperly adjusted.	(a) Perform major brake adjustment.
	(b) Air in the hydraulic system.	(b) Bleed the lines and fill the master cylinder reservoir.
5. Hard pedal. Brakes do not hold satisfactorily.	(a) Brake shoes improperly adjusted.	(a) Perform major brake adjustment.
	(b) Excessively worn lining.	(b) Reline the brakes and perform major brake adjustment.
	(c) Improper lining.	(c) Reline the brakes with Packard Brake Lining Set. Major adjustment.
	(d) Oil or grease on lining.	(d) Clean the lining and drums. Reline the brakes if the lining is soaked. Perform major brake adjustment.
6. Severe brakes. Brakes grab.	(a) Oil or grease soaked lining.	(a) Reline the brakes and perform major adjustment.
	(b) Brake shoes improperly adjusted.	(b) Perform the major brake adjustment.
	(c) Loose backing plates.	(c) Tighten the backing plates and perform the major brake adjustment.
	(d) Improper brake lining. (Coefficient of friction too great.)	(d) Reline the brakes with the Packard Brake Lining Set. Major adjustment.
7. Car swerves to one side when the brakes are applied.	(a) Oil or grease soaked lining on one wheel.	(a) Reline the one brake with the same type of lining as other wheels. Major brake adjustment.

EASAMATIC POWER BRAKE

TROUBLE SHOOTING AND CORRECTIVE MEASURES

Brake trouble may be easily diagnosed if the complaint is understood. The trouble will always show up in one or more of the ways listed. Related parts of the power brake system should be checked before dismantling the Easamatic when a malfunctioning brake system is experienced.

8. Hard Pedal (Vacuum failure).	(a) Faulty vacuum check valve.	(a) Clean if dirty or sticky. Replace if damaged.

EASAMATIC POWER BRAKE

TROUBLE SHOOTING AND CORRECTIVE MEASURES—Continued

CONDITION	POSSIBLE CAUSE	CORRECTION
8. Hard Pedal (Vacuum failure). (Continued)	(b) Collapsed vacuum hose.	(b) Replace the hose.
	(c) Plugged vacuum fittings.	(c) Clean the fittings. Locate where foreign matter is coming from and eliminate source.
	(d) Leaking vacuum reserve tank.	(d) Replace the tank.
9. Hard Pedal (Easamatic Unit trouble).	(a) Internal vacuum hose loose or restricted.	(a) Attach the hose if loose. If the hose is faulty, replace it. Be sure the inside of the cylinder is clean.
	(b) Jammed master cylinder piston.	(b) Locate cause of jamming and correct, replacing damaged parts.
	(c) Vacuum leaks in unit caused by loose piston plate screws.	(c) Tighten the screws.
	(d) Faulty rubber diaphragm rubber stop in reaction diaphragm.	(d) Replace the stop.
	(e) Loose piston wick.	(e) The spring retainer is not in place. Reinstall the spring, or replace the spring if necessary.
	(f) Faulty vacuum piston seal.	(f) Replace the piston seal.
10. Hard Pedal (Mechanical condition).	(a) Glazed linings.	(a) Clean off the glaze with sandpaper. Perform major brake adjustment.
	(b) Grease or brake fluid on the linings.	(b) Locate and stop source of the grease or fluid leak. Clean off the linings with alcohol. If soaked, replace the linings. Perform major brake adjustment.
	(c) Bound up pedal pivot.	(c) Free up the pivot.
11. Grabbing brakes.	(a) Grease or brake fluid on linings.	(a) Clean the linings. If soaked, reline the brakes. Perform major brake adjustment.
	(b) Scored drums.	(b) If it is very slight, dress up with fine emery cloth. If it is deep, reface in a lathe. See the Shop Manual for additional information.
	(c) Reaction diaphragm leakage.	(c) Replace the diaphragm.
	(d) Broken counter-reaction spring.	(d) Replace the spring.
	(e) Restricted diaphragm passage.	(e) Clean the passage.
	(f) Sticking vacuum valve action.	(f) Clean up valve lightly with crocus cloth. Do not oil as it needs no oiling.
12. Pedal goes to floor (or almost to floor).	(a) Brakes need adjustment.	(a) Perform major brake adjustment.

EASAMATIC POWER BRAKE

TROUBLE SHOOTING AND CORRECTIVE MEASURES—Continued

CONDITION	POSSIBLE CAUSE	CORRECTION
12. Pedal goes to floor (or almost to floor). (Continued)	(b) Air in hydraulic system.	(b) Bleed the lines and refill the master cylinder.
	(c) Hydraulic leak.	(c) Locate and correct leak, bleed lines. Refill master cylinder.
	(d) Fluid reservoir needs replenishing.	(d) Fill reservoir. Bleed the brake lines, and refill the master cylinder reservoir.
	(e) Cracked drum.	(e) Replace the drum. Perform minor brake adjustment.
	(f) Compensating valve leak.	(f) Replace compensating valve assembly. Bleed lines. Refill the reservoir.
	(g) Hydraulic piston seal leak.	(g) Recondition master cylinder. Bleed lines. Refill reservoir.
	(h) Compensating port on out-put fitting seal leak.	(h) Replace the seal. Bleed lines. Refill reservoir.
13. Brakes fail to release (or slow release).	(a) Bound up brake pedal pivot.	(a) Free up the pedal pivot.
	(b) Brakes improperly adjusted.	(b) Perform major brake adjustment.
	(c) Faulty residual check valve.	(c) Replace the check valve. Refill the reservoir. Bleed the lines.
	(d) Excessive hydraulic seal friction.	(d) Replace the seal. Refill reservoir. Bleed lines.
	(e) Compensator port plugged.	(e) Clean the port. Refill the reservoir. Bleed lines.
	(f) Restricted air passage.	(f) Eliminate restriction.
	(g) Piston stroke interference.	(g) Be sure that coiled vacuum line at vacuum connection to valve is not striking the intake end. Push piston in and out several times. If it has tendency to creep and foul up, relocate the piston return spring by moving 120°.
	(h) Sticky vacuum valve.	(h) Touch up lightly with crocus cloth. Do not oil.
	(i) Sticky compensating valve.	(i) Replace the valve. Refill reservoir. Bleed the lines.
	(j) Broken piston return spring.	(j) Replace the broken spring.
	(k) Misalignment of operating rod and valve.	(k) Align rod and upper edge of valve so there will be 1/16 inch clearance between rod and upper inside diameter of valve. If additional alignment is necessary, the pedal support bracket on the dash can be loosened and repositioned slightly.

EASAMATIC POWER BRAKE

TROUBLE SHOOTING AND CORRECTIVE MEASURES—Continued

CORRECTION	POSSIBLE CAUSE	CONDITION
14. Flutter felt at brake pedal at light application.	(a) Restriction in air cleaner or hose.	(a) Replace air cleaner if blocked by dirt. Replace hose if restricted.
	(b) Dirty or restricted screen on vacuum valve.	(b) Clean valve screen on vacuum valve.
		(c) If the above two items do not correct this condition, and there is no blue paint mark on top of the master cylinder, replace diaphragm and front piston plate with Part Number 436412 and 436413.

LITHO IN U.S.A.