



## Valves

**C**LEAN CARBON, grind valves and tune motor—M-24—comprises about 30% of all the work done in the average Service Department. Why should all of this work be required?

The action of the valve mechanism is so well known that it should need no further explanation here. The valve, actuated by the cam and valve spring thru the guide, and resting on its angle seat, depends upon the accurate alignment of all these parts for its successful operation.

At the factory, during manufacture the valve guide holes are drilled and reamed in a jig at right angles to the top face of the block. The guides are then pressed in and accurately reamed to  $2\frac{1}{2}$  thousandths clearance on the  $11/32$  Intake Valve Stem and  $4\frac{1}{2}$  thousandths on the Exhaust Valve Stem. A cutting tool mounted on a pilot that snugly fits the valve stem guide is now used to cut the valve seat, concentric with and at right angles to the valve stem guide. Special dial indicators are used to measure every valve seat to insure its accuracy. When the valve is installed it fits the seat perfectly all around making a gas tight joint. A simple test is to hold the valve up an inch or two above the seat and let it drop. If the seat is true the valve will rebound. If it is not, but is striking on only one edge, it will have a more hollow sound and will not rebound nearly so far. Another test is to put a light coating of Prussian Blue on the valve face and turn it very lightly on its seat. The high spots will, of course, show blue which will be absent on the low spots. The danger in the latter test is that even a slight pressure on a valve will cock it in the guide and cause it to show a false seat.

We grind valves in an attempt, in too many cases a futile one, to restore the alignment that

the valves had when first assembled. The attempt fails because the valve seat is no longer concentric or at right angles to the guide and the valve cannot find a perfect seat.

Both the cylinder block and valve stem guide are cast-iron which is subject to seasoning when heated. During the seasoning process, the texture of the metal changes and becomes more dense. This sometimes causes the valve stem guide to warp or shift position slightly so that it is no longer in proper alignment with the valve seat. (Fig. 1.)

The blame is not confined alone to the guide, although with its long area exposed to the great heat of the exhaust it is more subject to warpage than the valve seat which is cooled by the water in the water jacket.

After the first 1000 or 1500 miles this seasoning process is completed and if the seat is then re-cut so that it is again concentric and at right angles to the guide regardless of the top face of the block, it will remain so during the life of the car and will require very little attention.

If left, however, the raised edge of the valve (Fig. 1) is exposed to the direct heat of the explosion which will burn



Figure One

Showing, in an exaggerated condition the valve resting on the edges of the seat, due to warpage of the valve guide and block by the seasoning process.

**"Better Service Means More Car Sales"**

both the seat and the valve—the hot flames beating directly on the exposed valve stem will warp it causing worn guides and stuck valves. (Fig. 2.)

A badly burned valve seat cannot always be repaired without bringing the seat too low in the block for efficient operation. Blocks with the seats in this condition will be refused for credit by the factory when returned for credit on the reground basis.

Valve seats not concentric with the guides are also responsible for noisy tappets. In those cases where the tappets are noisy and adjusting them even closer than the prescribed .004" does not correct, the fault can almost invariably be traced to this cause. When operating at low speeds, the spring brings the valve to its seat where one side strikes first, (Fig. 1.) During the moment that the valve is on its seat, the tension of the spring causes the valve to make a second movement on the seat which closes the valve, slapping the face against the seat and the stem against the sides of the guide. (Fig. 2.)

It is this second movement that causes the noise which defies adjustment.

In addition to the tappet noise, so-called, it also has a tendency to pound out the seat, wear the valve stem on alternate sides at the top and bottom part of the travel and wear the valve guide egg-shaped.

At high speeds, the moment of pause is so slight that there is not time for the valve to take the second movement and it remains open on one side burning the valve and valve seat.

To correct these evils, the valves should be re-seated and refaced. By reseating with the proper method, the seats are made concentric and at right angles to the new position of the guide and the valve is trued up so that it will find a full seat at all motor speeds without having to take the second movement just described, with the resultant noise.

After 1000 to 1500 miles of operation, the seasoning process is completed and the valves may now be re-seated with the assurance that they will remain in line. After having once been re-seated the valves need not be disturbed again for

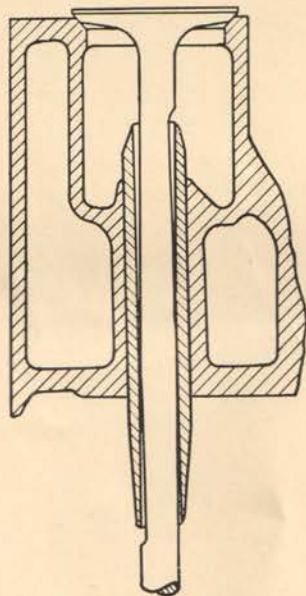


Figure Two

Showing an exaggerated condition of valve stem and guide wear, the result of the valve spring cocking the valve stem with a second motion after it has found its seat.

many miles more than was previously thought necessary. It may be necessary to clean the carbon more often, but the valves should not be disturbed as long as compression is maintained.

In cases where the valve seat has been pounded or burned past any chance of reseating, it was previously necessary to scrap the block. It is possible, however, to counterbore around the valve and fit in a cast iron ring in which a new seat may be cut and the block put back in service again.

To do both of these operations, the Service Department has developed Valve Reseating Equipment S. T. 669 which when used in conjunction with a Black and Decker Valve Refacer S.T. 412, makes possible doing these operations in the field just as accurately as at the factory.

The principle is to locate a pilot in the valve guide so that its center coincides with the new center of the guide. The cutter should be turned on this pilot thus recutting the seat concentric with and at right angles to the new center line of the guide.

The valve guide being of small bore, the pilot must necessarily be small. Trouble is sometimes experienced due to the pilot being sprung by the operator pushing or pulling on the cutter as he turns it. To eliminate any tendency of this kind a bearing should be fitted above the cutter to take all side thrust so that the action of the driving wrench on the cutter is only rotative with just enough downward pressure to feed the cut.

S. T. 669 illustrated in Fig. 3 was designed with these principles in mind.

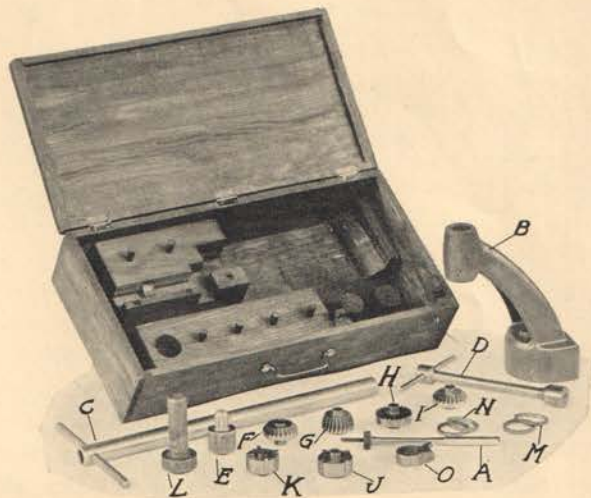


Figure Three

Packard Valve Reseating Equipment S. T. 669.

The pilot "A" fits in the valve stem on a taper and has a thread milled on the lower end for the attachment of the cone and nut shown. This arrangement fixes the pilot in the guide locating

it both top and bottom true with the center line of the guide. Fixing the pilot in the guide has the advantage that once fixed on center it does not get out of line through turning in an eccentric bore. Being fixed at the extreme ends of the bore rather than at the center it has no tendency to wobble as do oversize pilots which are fitted to the smallest diameter of the guide. A small portion not over  $1\frac{1}{2}$ " in length near the middle where it has the very minimum of piloting effect.

The pilot should be fitted snug, but not tighter than necessary to make it solid and to prevent turning in the guide.

The support arm "B" is then fastened to the top face of the cylinder being held in place by the wrench "D" which screws down on the cylinder head studs.

Before the support arm is fastened tightly, the driving wrench "C" which is reamed on the inside to fit the straight shank of the pilot should be put through the bearing and slipped down over the pilot.

This locates the support arm over the pilot, although no attempt has been made to align it perfectly. Any error in alignment is taken care of by the universal joint action between the driving adapter "E" and the driving wrench. After aligning the support arm in the manner just described, it is locked tight with the wrench "D" after which the driving wrench is removed.

The cutters are fitted with split tapered bushing which serve the double purpose of compensating for wear and act as a brake on the cutter, eliminating any tendency to chatter. The friction of the cutter on the pilot should be adjusted so that there is an appreciable drag when the cutter is turned with the fingers.

The cutter is slipped on the pilot and down against the valve seat. The drive adapter "E" is next applied to the cutter, the driving wrench is fitted to the drive adapter thru the bayonet slots. A counterbore in the end of the driving wrench rests on the spherical head of the drive adapter, all downward force being applied thru this ball joint which prevents any angularity between the driving wrench and the cutter effecting the accuracy of the cut. The pin in the bayonet slots serve to drive the cutter only, it being possible to turn the driving wrench thru a considerable angle without exerting other than a turning motion on the cutter.

Care should be exercised in using the cutter to prevent taking out an excess of stock and thus lowering the valve seat too much for efficient operation.

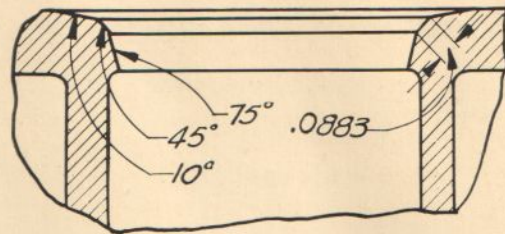


Figure Four

Typical valve seat showing two narrowing cuts and the proper width of valve seat .0883 in.

The best procedure is to first use the 45 degree notched tooth cutter "F" taking one very light cut to break the scale. Follow up with the 75 degree throat cutter "G" cutting just enough to show a thin mark around the entire line of the seat. The seat should next be narrowed to .0883" using the 10 degree top face cutter "H." Finish up with one very light cut with the 45 degree smooth cutter "I" to put a finished surface on the valve seat.

The valves should now be refaced and reinstalled without grinding. To grind the valve now would be to undo all the good that has been done. Grinding a valve even with a screw driver and using a light pressure will shift the valve in the seat and put it out of line.

Without grinding the motor may not show full compression cold, but running it a few minutes giving the valves and seats a chance to pound in will bring it back to standard.

When the seats are burned or pounded out past any possibility of repair by reseating, a replacement seat should be fitted. The procedure in this case is to set up as for reseating except that the replacement seat cutter "J" or "K," depending on whether it is an exhaust or intake valve, is used rather than a valve seat cutter. Take one very light cut, just enough to show a mark all the way around. Remove the driving wrench and fit the stop collar "O" on above the support arm bearing. Select a replacement seat "M" or "N" depending on whether it is an exhaust or intake valve and with the driving wrench in place hold the replacement seat against the top of the support arm bearing—bring the stop collar down tight against it and lock tight by turning up on the thumb nut. Remove the replacement seat and cut in with the cutter until the stop comes flush against the top face of the support arm. Remove the driving wrench, support arm and cutter and with the replacement seat drift "L" drive the replacement seat in place. Set up again as before and cut a new seat as was described.

# "Beware the Deadly Poison of the Service Controversy"

"I assure you we have the most skillful washers and polishers in the business and your car must have needed that much time to clean up or the charge would not have been made."

Impressive logic from the writer's point of view.

He was a clerk in the Service Department and it sold him the justice of the charge completely. Those washers knew their business. If they couldn't shine up a car under 5¼ hours it must have been a mess. This owner who had kicked was putting something over.

But the owner, it so happened, knew his car. He had brought it in himself in average road condition. He had left it for repair work and, knowing its exterior would be pretty well greased up in the process, had ordered it washed and polished before delivery.

It has come back again looking no better than when he had it washed and polished by the garage or when he did the job himself—and the charge had been \$7.88!

The garage charged \$2.50 for the self same operation and that was robbery.

And these pirates wanted \$5.38 more.

Somebody had been joy riding the car, that was obvious. It must have been in far worse shape than shop work alone could account for. Some tester with a criminal record had probably pulled a holdup in it or taken it into Canada on a bootleg jaunt. Probably he had driven it wide open, too, right after a rebore. The motor didn't sound just right when he got it back, and it seemed to be smoking like a young volcano that first cold morning when he had backed it out of the garage. Scored, probably.

Crooked work somewhere—and after abusing his car they had the undiluted affrontery to overcharge him some 215% for making it fit to deliver.

Well, it was all a part of their policy anyhow. Eighteen dollars to reline a set of brakes was brigandage and one hundred for a set of rebored cylinders sheer pillage and rapine. Seven and a half for complete lubrication was another steal.

The whole outrageous bill was attempted extortion and Hell was certainly due to freeze tight before they ever got the half of it from him.

They were all alike, these automobile bandits. Every last one of them licked your boots clean to sell you a car but—O, what a difference when they got you in their clutches!

Politeness ended with the sale. This thing they called service was the world's worst combination of incompetence and sneering rapacity. They'd steal the pennies off a dead man's eyes and laugh while they did it. This was where they got back the loss they always claimed they were due to take on your used car. That was probably apple sauce, too. Like as not they gyped some poor neophyte on that as well, at double its value. It would be like the buzzards.

Well, they weren't going to pick his bones. He'd light a backfire—a hot one. He'd have his lawyer threaten suit on this \$7.88 charge for cleaning the car, charging misuse of it by their employees. He'd scare them into cutting their whole bill in half or better before he was through.

And if any friend of his ever bought a Rustler so long as he had breath in his body or a pen to write with, it would only be because he couldn't spread the story fast enough.

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Overdrawn did you say?

Nobody ever charged 5¼ hours time to wash and polish a car? Well it just so happens that the writer of these lines saw the bill and the time cards and the letter of the nitwit who tried to defend the account.

Whether or not the customer went as far as the story shows we won't assert—but he should have if he didn't and plenty of his kind have gone further on less provocation.

And the sad part of the legend is the fact that the dealer really meant well by his customers and used his Service as a selling argument.

He was so proud of it in fact that it never could be wrong—in his opinion.

So it was very, very wrong in the opinion of many of his owners. So wrong that before he woke up it had cost him thousands of dollars in repeat orders that would have been his hands down except for Service squabbles.

Service makes friends or it makes enemies.

There is no middle ground.

Service that never can be wrong is the deadliest millstone any dealer can tie to the neck of a promising business."

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The foregoing article is printed thru the courtesy of the Commercial Credit Companies, National Headquarters, Baltimore, Md.

It cites an excellent example of how an owner became roiled—an owner upon whom was spent a lot of time and effort to bring into the fold—an owner who was lost in the time that it took him to read the half-baked letter from the service clerk—an owner who if handled properly, when the bill was protested, would have, no doubt, remained a profitable booster—an owner who turned out to be a champion order killer.

In these Packard Service Letters we do not wish to appear as taking the stand that the owner's word must always be law and that there are none who are unreasonable, we know better than that. There are cases when a firm *but polite* stand must be taken.

What we do want to accomplish is to establish thoroughly a fact which we do not believe is fully appreciated by the field in general. The fact is this—a satisfied owner is a powerful asset, to your business, and your business will grow in proportion to the number of these assets that you possess.

Let us quote here two paragraphs from a letter written by Mr. Macauley a little over a year ago. You can't go wrong by operating on the basis outlined:

"Our owners are quick to sense our fairness—or otherwise—and their attitude towards us and our product will, in the main, agree with our attitude as to fairness and liberality toward them. A narrow, selfish service attitude by any distributor will automatically create that same kind of an attitude on the part of his owners toward himself, toward Packard cars, and toward the Packard Company.

It is true that the occasional customer will demand something that cannot be conceded without a sacrifice of self-respect. In such case, a concession should not be made. But it should not be measured in the light of the fact that if the concession is made it will cost the company or the distributor a certain number of dollars. The indirect cost of failing to create a happy satisfied owner will usually be infinitely greater. Let's make our mistakes on the side of too great a liberality. Let's, with our eyes open, allow owners to sometimes put something over on us, in the interest of getting the troubles swept out of our way quickly and cleanly. Let's end disputes as soon as they begin. And in the long run we will have more friends, less worries, and be more prosperous and highly regarded."