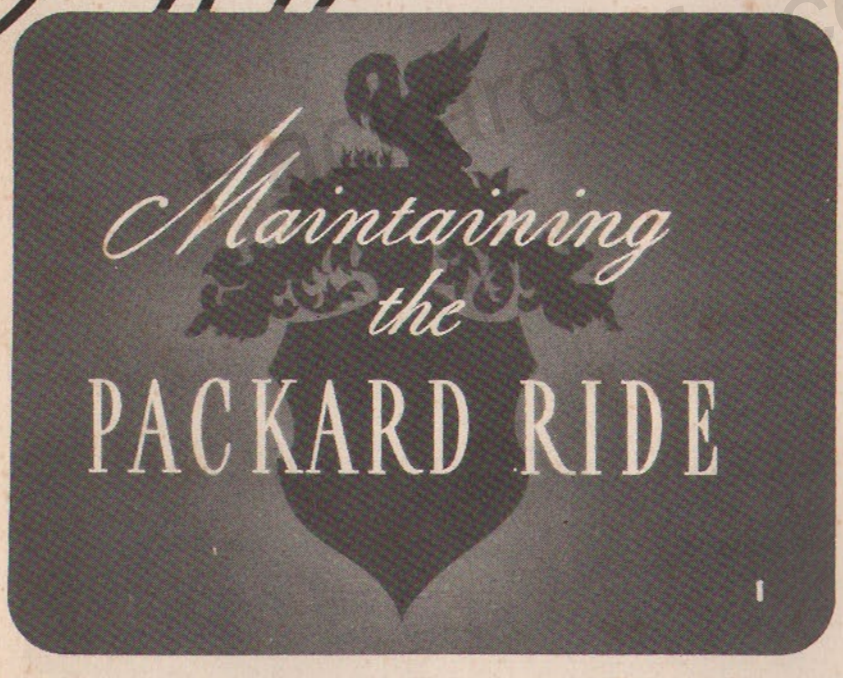
SERVICE TRAINING

Film Supplement



VOL. 4
FILM 3
JANUARY 1940

by the SERVICE PROMOTION DEPARTMENT
PACKARD MOTOR CAR COMPANY - DETROIT

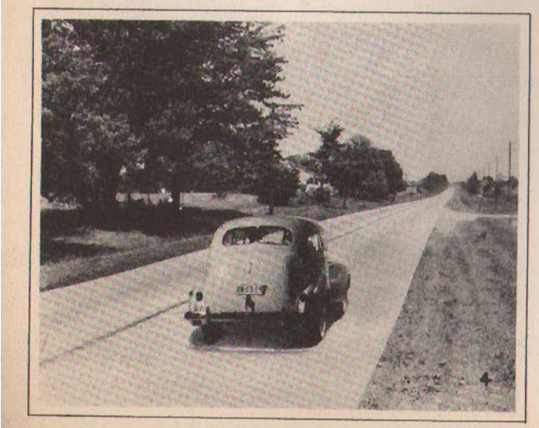
MRS. JONES: Jack--

JACK: Yes, dear?

MRS. JONES: Don't ever buy any other kind of a car but a Packard.

JACK: Not a chance, honey--why, I've driven Packards for years.

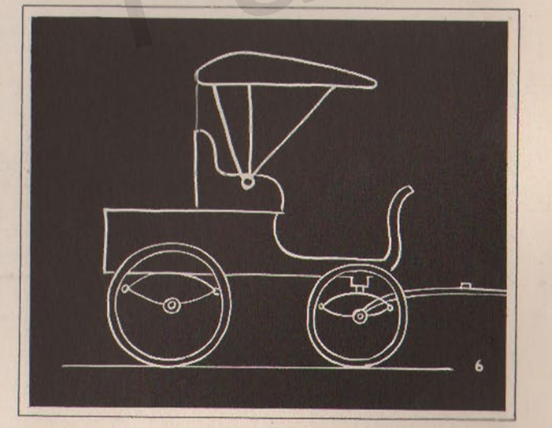
MRS. JONES: I know and keep on driving Packards, because I'm sure this is the finest riding car in the world.



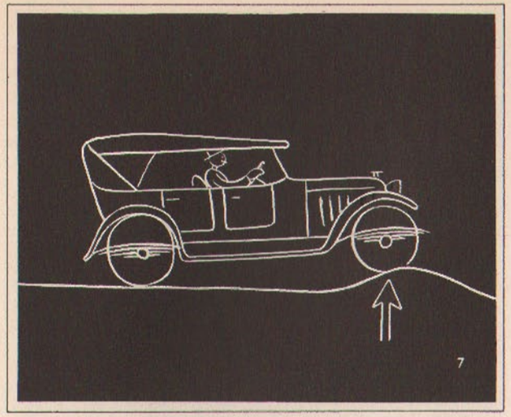
ANNOUNCER: Well, well! Was that a picture of complete owner satisfaction? You can just bet that as long as Mrs. Owner feels that way about their Packard there's not much doubt that Mr. Owner will keep on buying Packards. To keep all Packard owners just as thoroughly satisfied. . .

ANNOUNCER: . . .servicing and maintaining the Packard ride is just as important as tuning the engine or adjusting the brakes. To give Packard service men the latest information about the Packard ride, we've asked a ride engineer to tell us something about the principles involved. Come in, Sam.

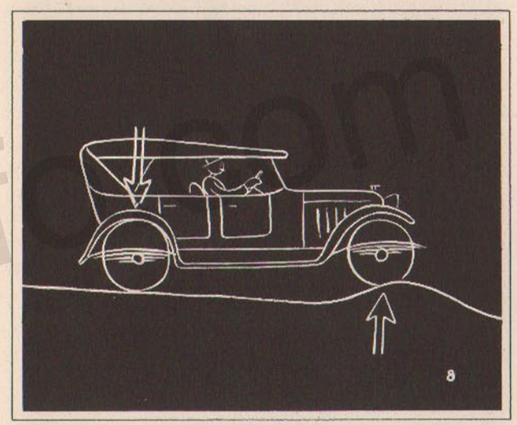
SAM: Okay, fellows--suppose we start. . .



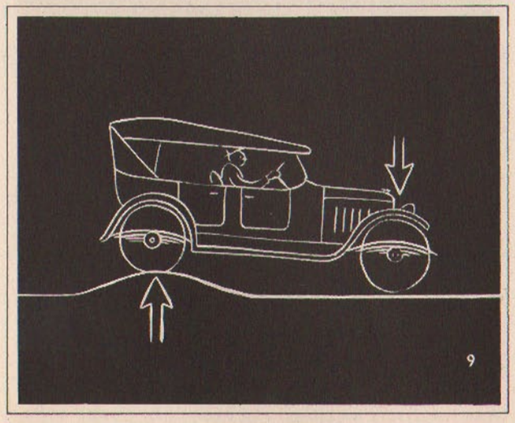
SAM: . . .by going back to the old horse-and-buggy days. Grandpa's convertible roadster rode fairly well because it was equipped with springs between the axles and the frame or body. That was the first step in ride engineering, but when the same design was used on the early automobiles it didn't do the whole trick--and here's why. . .



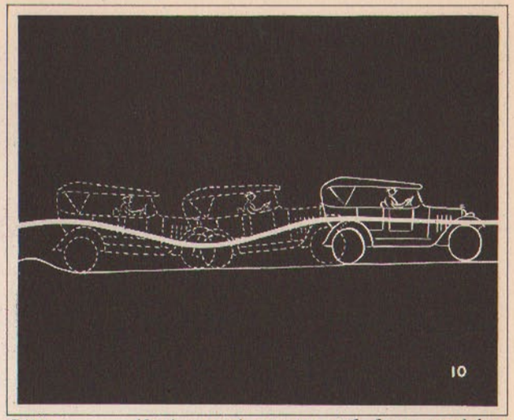
SAM: . . .as the front wheels go over a bump, the first action is to compress the springs and push the front end of the car up. And at the same time. . .



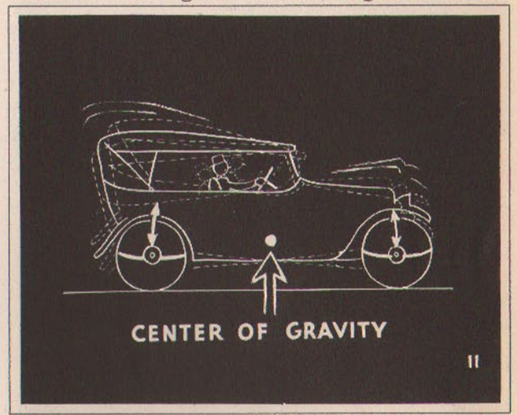
SAM: . . .there's a reaction to this front end movement which pushes the rear end downward and compresses the rear springs.



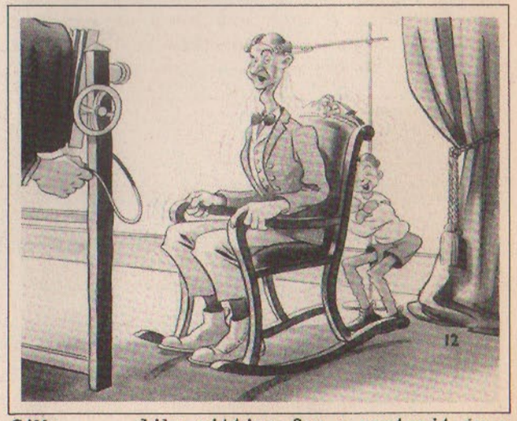
SAM: Then when the rear wheels hit the bump, the action is reversed--the rear end is thrown upwards and the front end is pushed down. The net result is. . .



SAM: . . .that we get an up and down rocking motion which continues for a time but gradually dies out, as the car goes on along the road. Throughout this rocking motion. . .



SAM: . . .the car pivots around its center of gravity, which is near the front seat, and in consequence the driver gets a fore-and-aft rock and "Neck Whip," because he instinctively tries to hold his head steady, and that puts a strain on his neck. . .



SAM: . . .like sitting for a portrait in a rocking chair--where the head is held steady while the body rocks. To avoid this uncomfortable motion. . .

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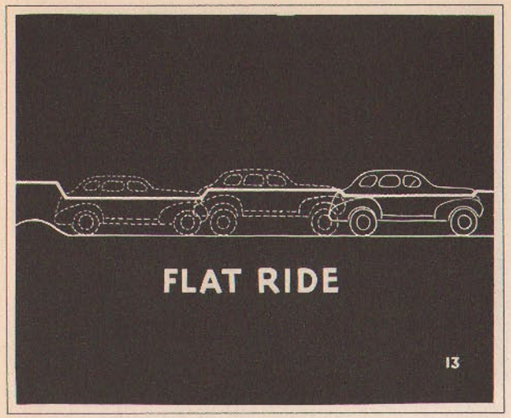
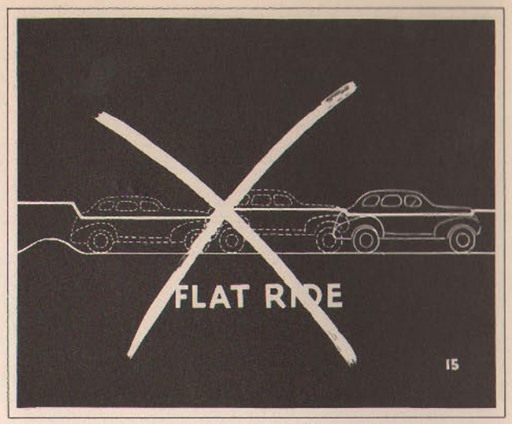
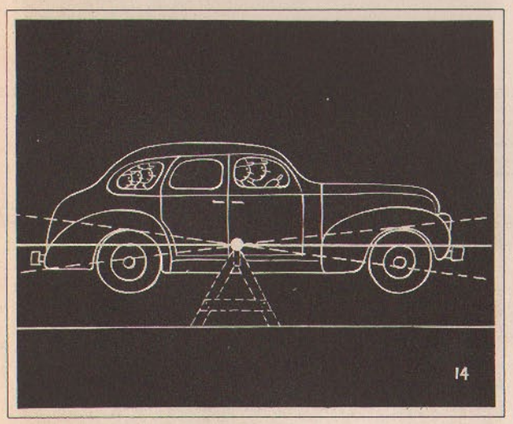


SAM: . . .the car should be so designed that the body will remain horizontal, and move up and down vertically, without pitching or rocking. Ride engineers call this ideal type of motion the "flat ride." It's a swell theory, but it doesn't work out that way in practice, and here's why. . .

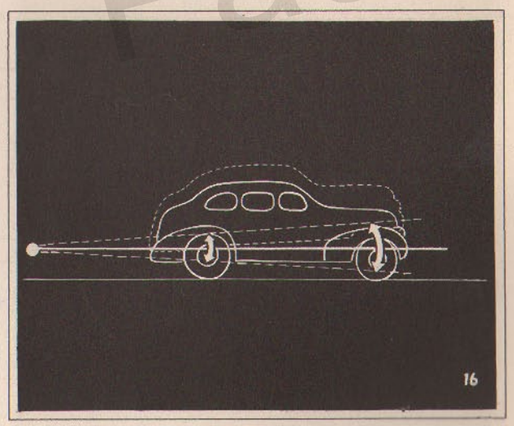


SAM: Well, Packard engineers realized that a truly "flat ride" could not be obtained--that you just can't make both ends of the car go up and down at exactly the same time--so the question was, how to live with these conditions and still provide a really good ride. They found that the answer. . .

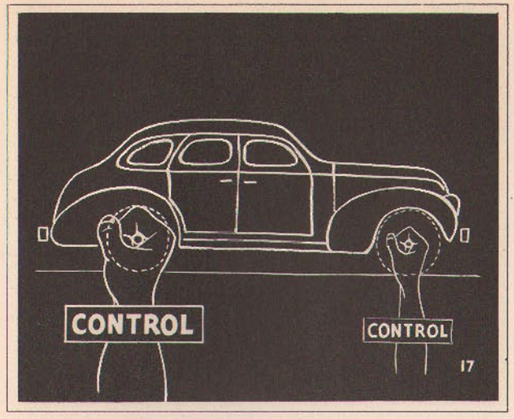


SAM: . . .A suspension that's balanced for full passenger load in both front and rear seats will be thrown out of balance by every change in the load, or even by a heavy trunkfull of luggage in the rear.

ANNOUNCER: You're going great guns so far, Sam. Now will you tell us how all these difficulties have been overcome in the Packard ride?



SAM: . . .was to locate the pivot point farther back so that movement of the car would always tend to be around this point rather than at the center of gravity. To produce this kind of a ride. . .

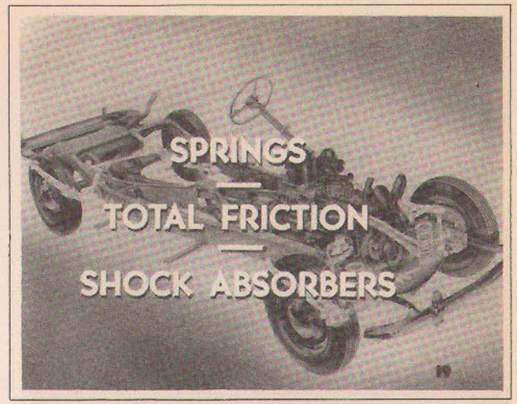


SAM: . . .it is essential that the rear suspension provide greater control than the front--the rear control functions must dominate the front for all road conditions--and this gives the name to the principle on which the Packard ride is based.

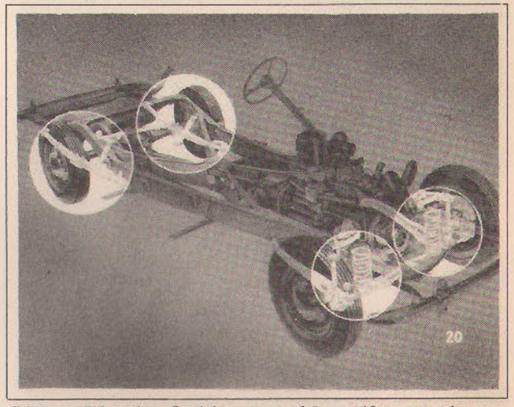
SAM: . . Rear End Dominance! This principle minimizes rocking, and in effect provides the much sought-after "flat ride."

ANNOUNCER: How is this principle applied to get the Packard ride, Sam?

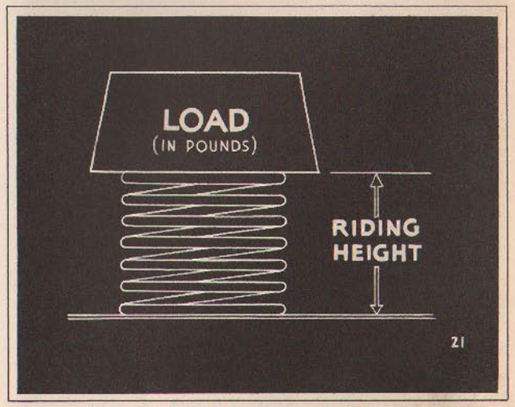
SAM: By properly balancing the control functions of the suspension system that control the ride. . .



SAM: . . .the springs, the total friction in the suspension system, and the shock absorbers. Each of these must be balanced so that in every function, the rear is always just enough greater than the front to provide exactly the right degree of rear end dominance.



SAM: First, let's consider the springs. There are two basic characteristics by which all springs, front or rear, are rated. The first of these. . .



SAM: . . .is the load or capacity--that is, the weight or load the spring will support, and maintain the specified riding height. Now, of course, the load on the springs will vary on different models and body types.

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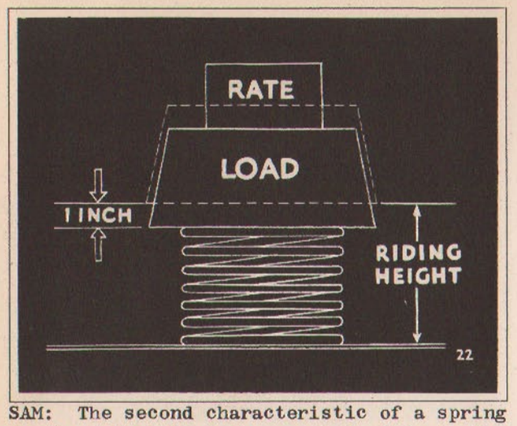
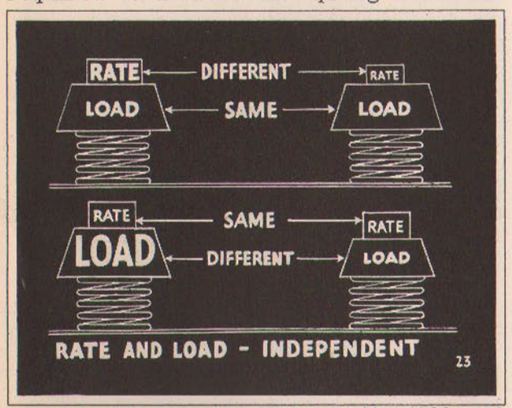
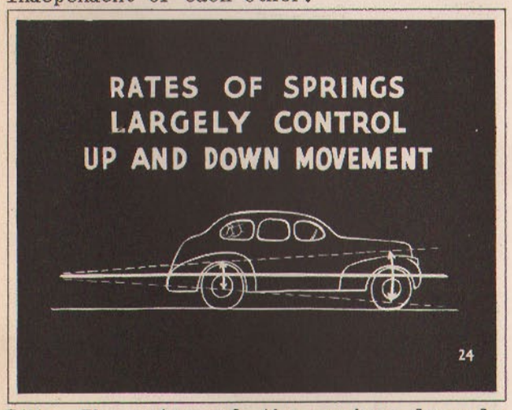


SAM: The second characteristic of a spring is its deflection rate, or just plain "rate" for short. This is the load, in pounds, required to deflect the spring one inch.

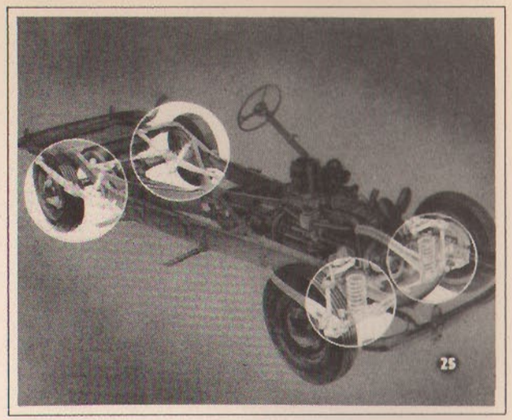


SAM: You may have two springs with different rates and the same load capacities,--or two springs of the same rate but different load capacities, because rate and load are independent of each other.



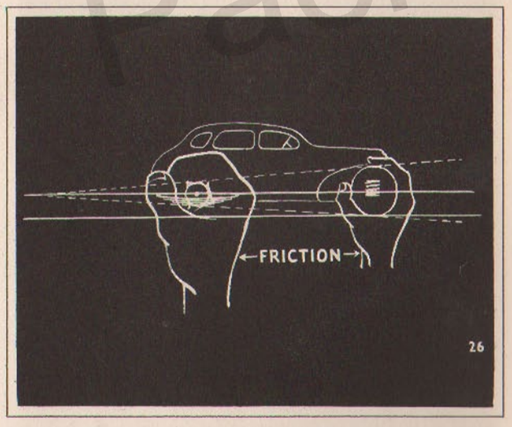
SAM: The rates of the springs largely control up and down movement of the body. So, in order to have the desired rear end dominance, the rate must be greater in the rear than in the front.

ANNOUNCER: Speaking of springs, Sam. . .

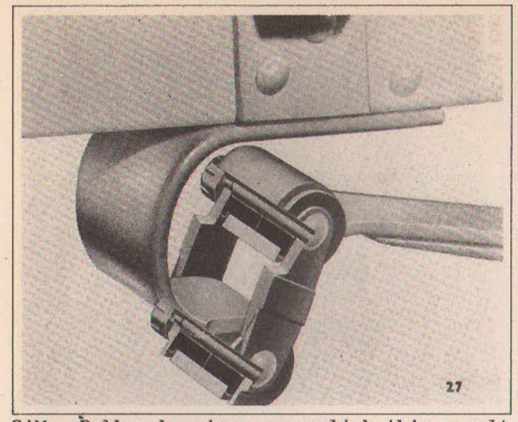


ANNOUNCER: . . .why do you use coil springs at the front and leaf springs at the rear?

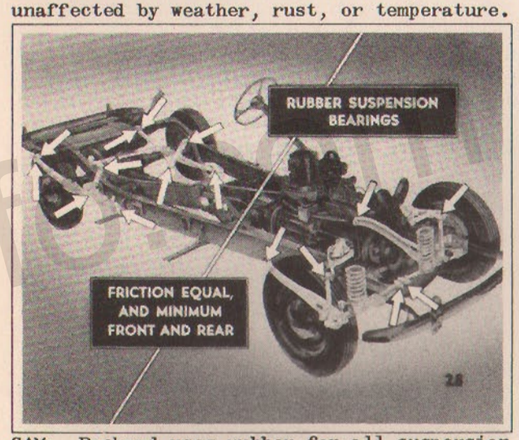
SAM: Both types are essential in Packard's principle of rear end dominance, to balance and control the friction.



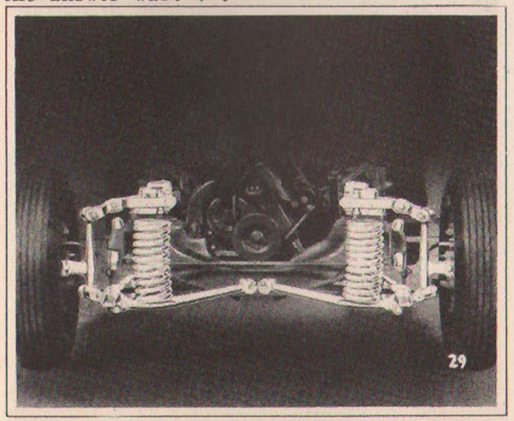
SAM: Friction is needed in the suspension system for its controlling effect on spring movement. To be useful however, the friction in the entire suspension must be properly divided between front and rear, and it must be kept constant.



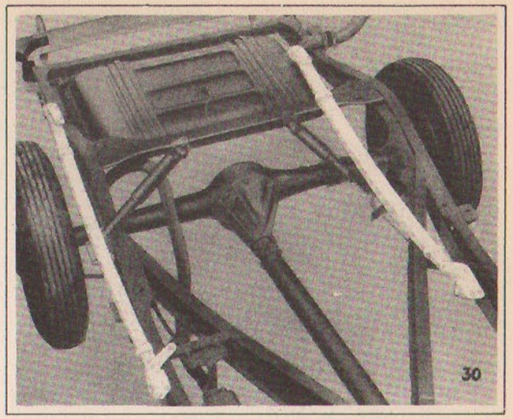
SAM: Rubber bearings accomplish this result by keeping suspension friction to a minimum. They avoid the need of lubrication; and are unaffected by weather, rust, or temperature.



SAM: Packard uses rubber for all suspension bearings, and in consequence, the friction is about equal, and at a minimum, front and rear. To provide the extra friction needed at the rear, Packard ride engineers found the answer was. . .

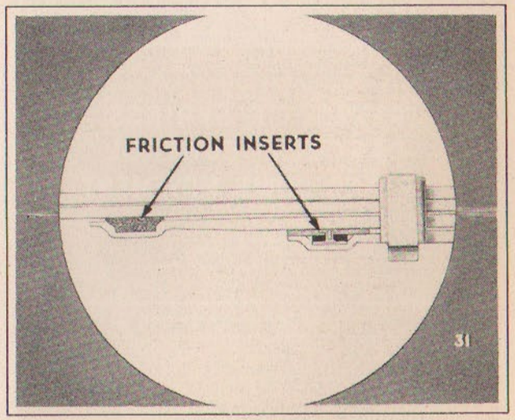


SAM: . . .to use coil springs, which have practically no internal friction, at the front end, where they wanted softer springs, more spring travel and minimum friction. . .



SAM: . . .and in the rear, where firmer control and more friction is needed to give the desired rear end dominance, they used leaf springs, because of their inter-leaf friction.

ANNOUNCER: Well, that explains why different springs are needed, Sam--but how do you get the controlled friction at the rear?



SAM: By using inserts between the rear spring leaves. These inserts are of different friction materials to provide the several types of control needed.

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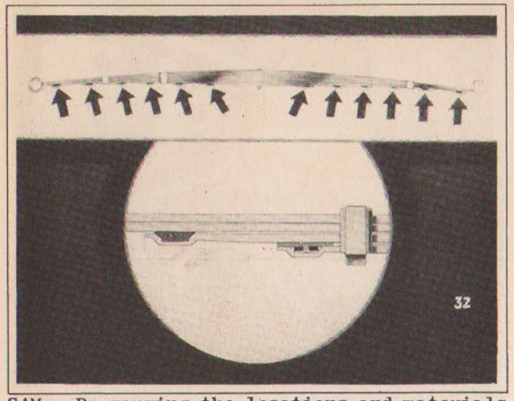
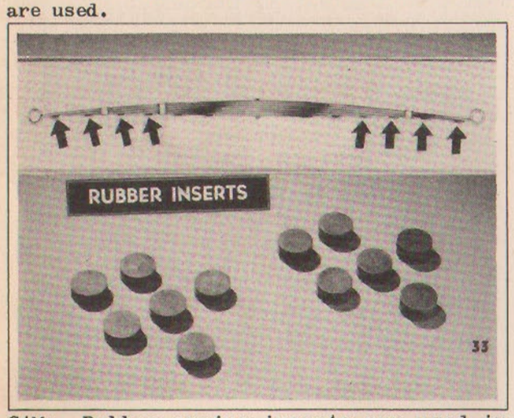
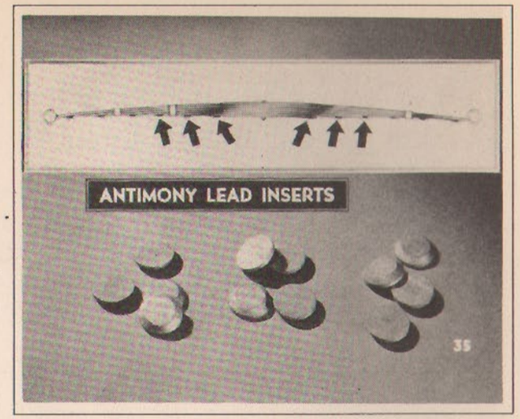


SAM: By varying the locations and materials of the different inserts, springs can be tailored to give the exact amount and type of friction required for each model and body type. Three different insert materials are used.

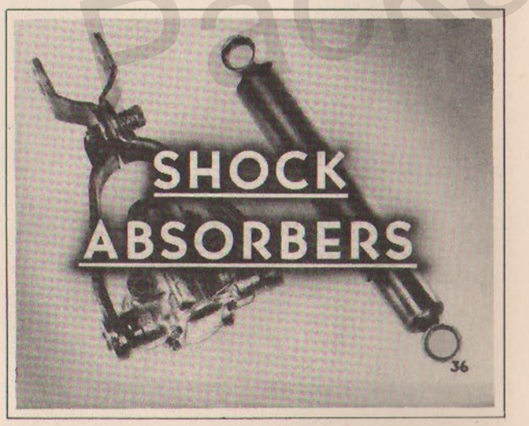


SAM: Rubber spring inserts are used in certain positions to produce a soft ride with minimum resistance to slight spring movements.

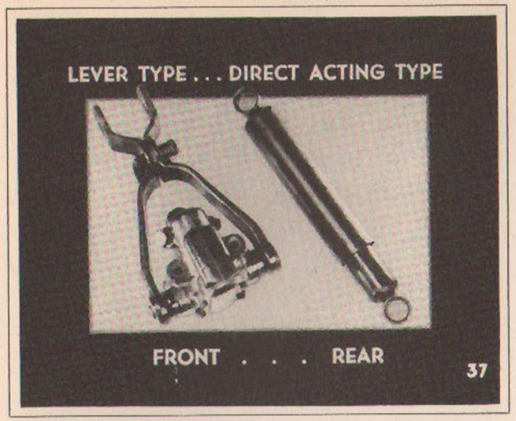
SAM: Silenite inserts--made from a material that looks like brake lining--are used at certain points because this material offers a definite high resistance to short, choppy spring movements such as wheel bounce, but comparatively little resistance to slow movements. The third material --



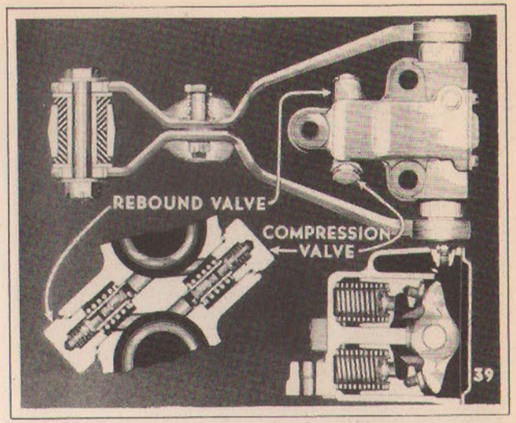
SAM: Antimony Lead alloy, on the other hand, offers little resistance to short, choppy movements, but offers high resistance to slow movements, and thus controls the long slow spring motions.



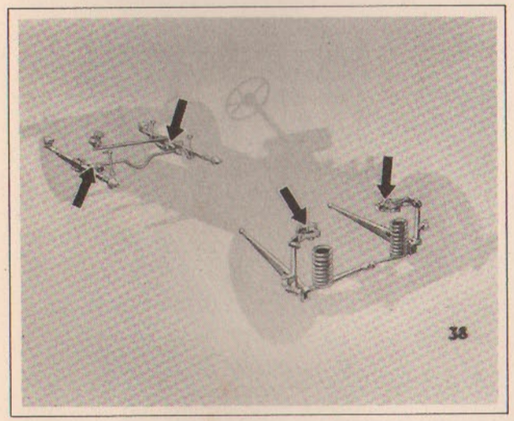
SAM: Shock absorbers are the third important unit in the suspension system. Shock absorber action depends upon the amount of movement or displacement of fluid per inch of vertical wheel travel, so to get rear end dominance, the displacement of the rear shock absorbers is made greater than that of the fronts.



SAM: This is done by using lever type shock absorbers in front, and direct acting units, which have about two and one-half times the fluid displacement of the lever type, in the rear.



SAM: Shock absorbers are equipped with separate valves for the rebound and compression strokes. These valves are balanced with the spring and insert combinations front and rear for each model and body style, to provide the proper degree of rear end dominance.



SAM: On the long wheel base models, the correct proportion between front and rear is obtained by using lever type shocks all around, with those in the rear having one quarter inch larger cylinders than the fronts.

SAM: Now in addition to up and down motion, the body may also be subjected to sideways or lateral movements, and control must be provided to dampen this lateral motion before it can become uncomfortable to the car's passengers.

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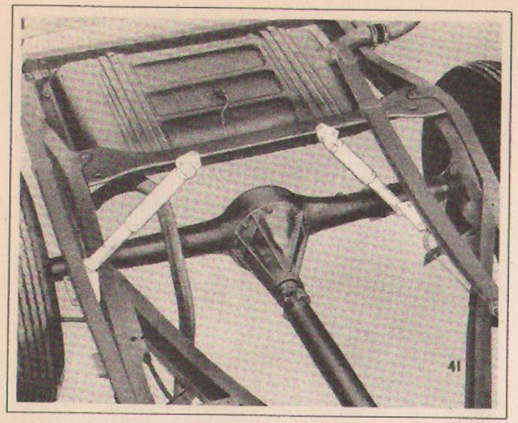
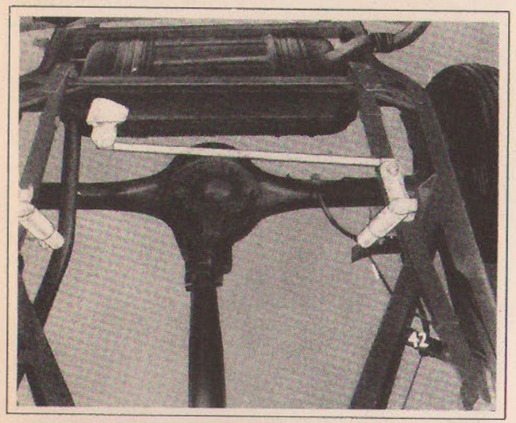
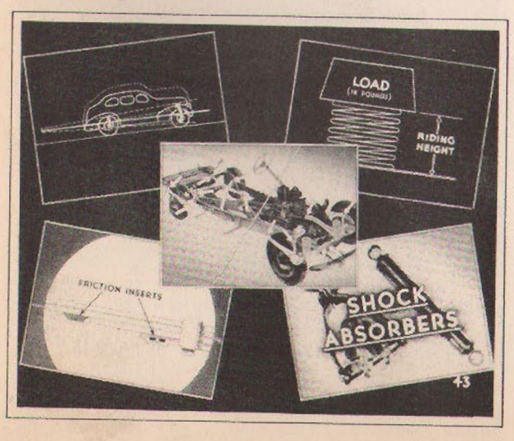


SAM: On the "one-ten" models, the rear shock absorbers are mounted like an inverted "V", so that any lateral movement between the body and the axle is dampened by the shocks, independent of any vertical movement.

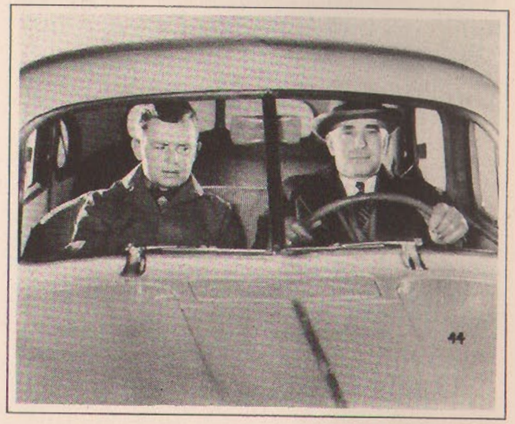


SAM: On the larger models, the rear shock absorbers are mounted parallel to the frame, and the lateral stabilizer and fifth shock absorber is used to dampen out and control any lateral motion.

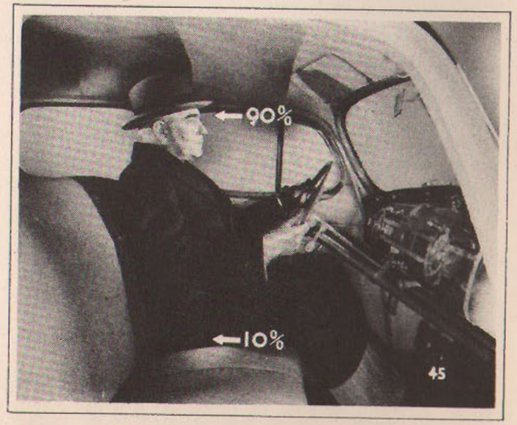


ANNOUNCER: That's the story of what's back of Packard ride engineering. And now we're going to get some practical working facts on how to keep that ride one hundred per cent perfect, from a service man who's had a lot of successful experience on ride complaints. Take it away, Bill.

BILL: The first thing I always do on a ride complaint. . .



BILL: . . .is to insist that the customer take a ride with me and point out just what it is that's bothering him. He may have a legitimate ride complaint, but it may be just an idea, or something entirely different from ride. That's why I say. . .



BILL: . . .ride is ninety per cent in the owner's head, and only about ten per cent in the seat of him pants! And that's why you've got to fix both ends before he's satisfied. For that reason. . .

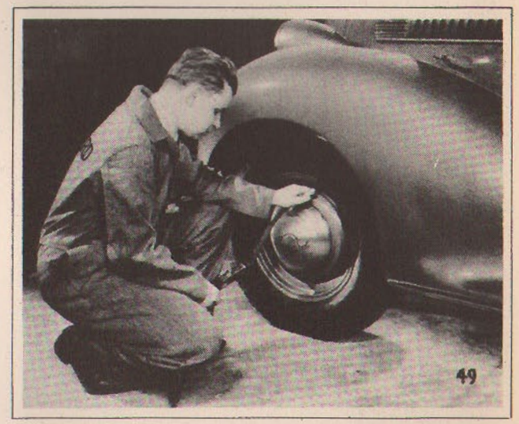
BILL: . . .I always ride the car with the customer again, after the work is done, to make sure it's fixed right and that he knows it's right.

ANNOUNCER: In other words, you sell him at both ends too, eh Bill? Now of course. . .

ANNOUNCER: . . .different types of owners have different ride complaints. Will you tell us something about how you handle them?

BILL: Sure thing. On any type of ride complaint, the most important thing is. . .

BILL: . . .to bring the ride up to standard in every respect. The first step, after riding the car and classifying the complaint, of course. . .



BILL: . . .is to check the tire pressure all around. I make it a point to impress on the owner that tire pressure has a lot to do with ride, so it should be kept right "on the mark" all the time, otherwise. . .

BILL: . . .the first gas station he goes into may put in too much pressure, if he doesn't watch the boys, and that may undo all the work we've done to make the ride right.

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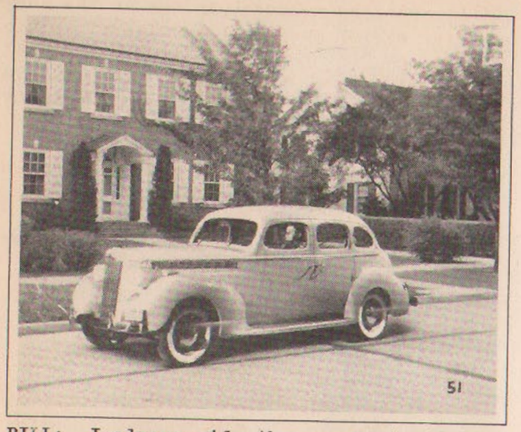
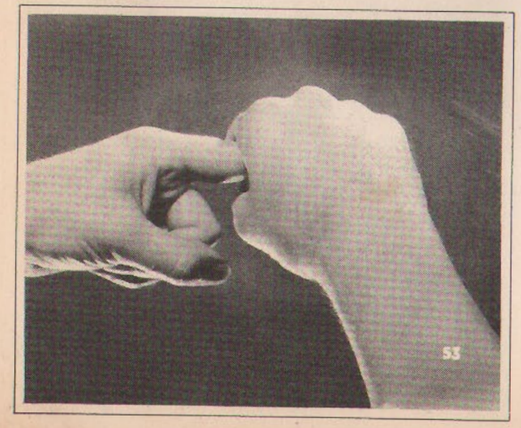


BILL: I always ride the car again if I've had to change the tire pressure. If that doesn't do the trick, the next step. . .

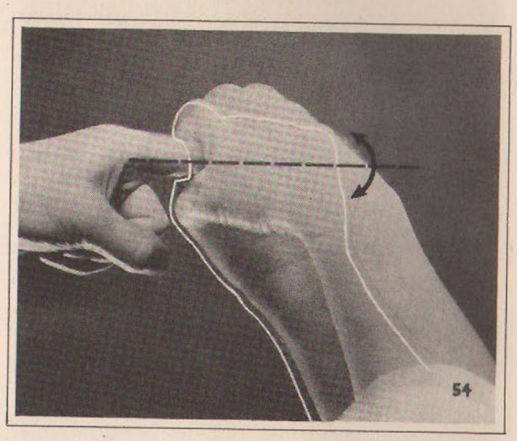
BILL: . . .is to neutralize the front and rear suspensions.

ANNOUNCER: Hey, wait a minute, Bill--what do you mean by "neutralize?"

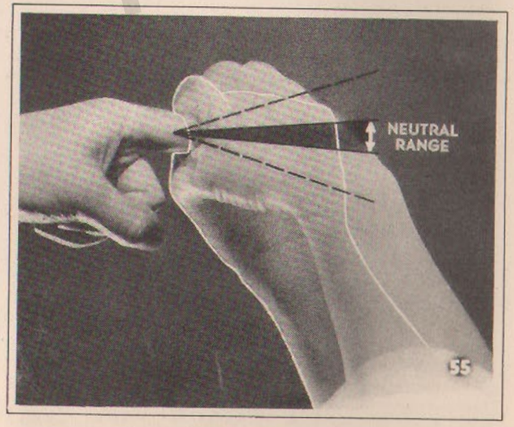
BILL: Well, maybe I can illustrate by comparing a rubber suspension bushing with your finger.



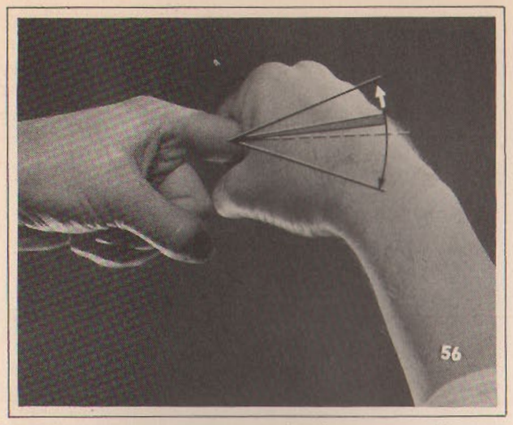
BILL: Take hold of the forefinger of your left hand like this. If you fellows in the audience try it yourselves, you'll get my idea a lot easier. Now when you just hold your finger this way there's no twisting strain, is there? That's because you're holding it at the "neutral point."



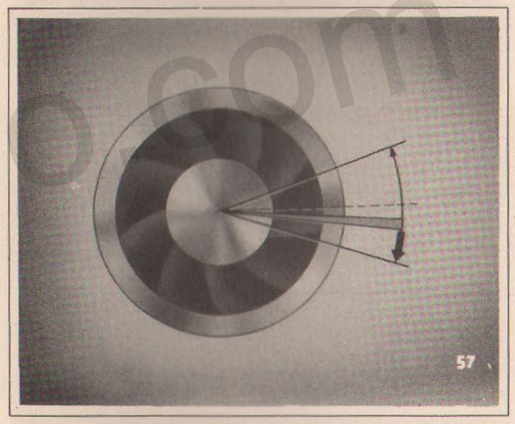
BILL: Now twist your forefinger as far as you can in one direction. Now back in the other as far as you can. The flesh twists around on the bone, doesn't it?



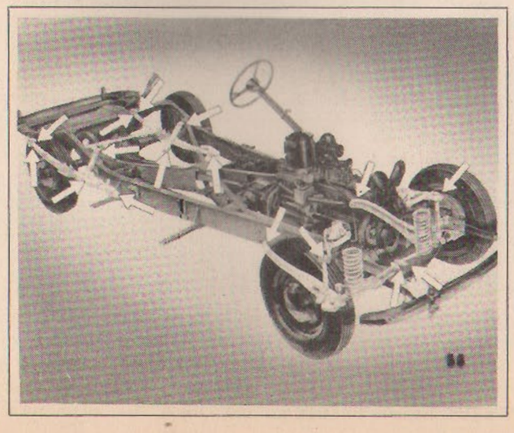
BILL: Now turn your finger back again and you'll notice that halfway between the two extremes is a neutral point, or rather a neutral range, where you can move it a little bit without any effort. Well, rubber suspension bushings act just the same way.



BILL: If you start twisting your finger from a position halfway between the neutral point and one extreme, you can't twist it much farther in that direction, but twice as far in the opposite direction and with less effort.



BILL: In the same way if a rubber bushing is clamped so that in the normal position it is "off-center," or wound up, it can't move as freely as it should. It'll have too much resistance in one direction and not enough in the other.

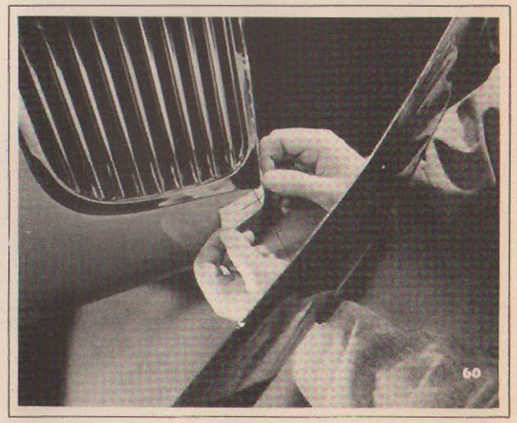


BILL: All the rubber bushings in the suspension system must be properly set in the neutral or "on center" position so they'll work freely, and with equal resistance in both directions. That's what we mean by "neutralizing."

ANNOUNCER: How can you tell when the bushings are neutralized, Bill?

BILL: To check the neutralization we measure the friction lag of the suspension.

BILL: The friction lag should be not over half an inch at both front and rear. Here's how I measure it.



BILL: First, I stick a piece of adhesive tape on the bottom of the radiator shell for the front measurement. . .

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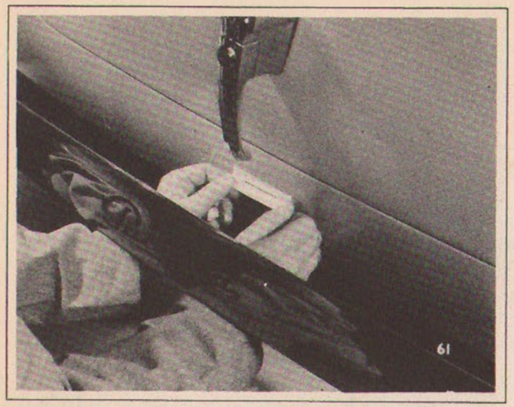
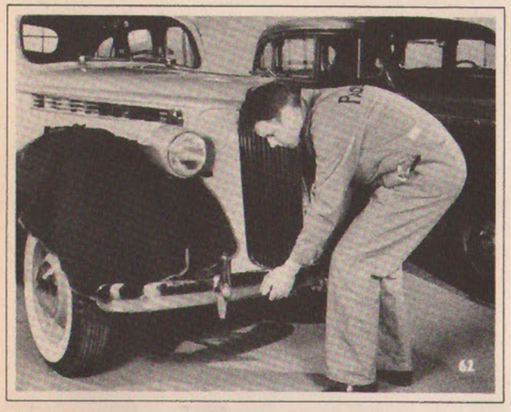
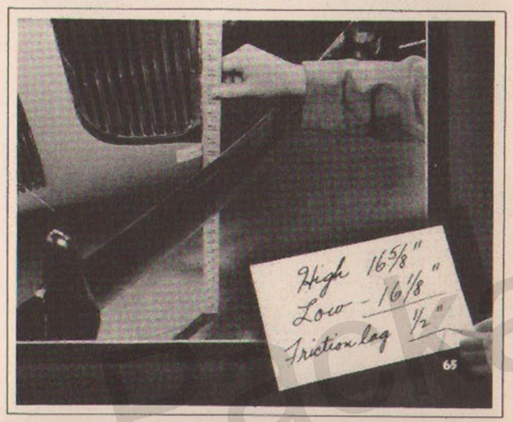


BILL: . . .and on the rear body panel below the trunk door for the rear, and put a pencil line on each tape for a reference mark.

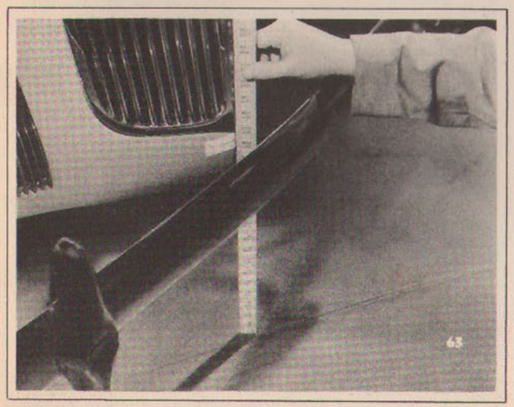
BILL: . . .and then repeat the operation, only this time the man pushes down on the bumper and lets it come up very very gently--



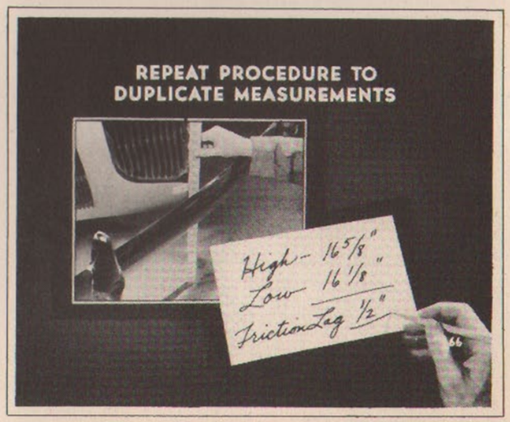
BILL: Next I get a husky mechanic to lift the end of the car just as high as he can, and then let it down again very, v-e-r-y slowly--so gently that the car can't tell when he finally lets go. The trick to this operation is to get the car to remain as high as possible.



BILL: . . .and again measure the distance from the floor to the reference line. The difference between the high and low figures is the friction lag.



BILL: Then I measure the distance from the floor to the reference mark on the adhesive tape. . .

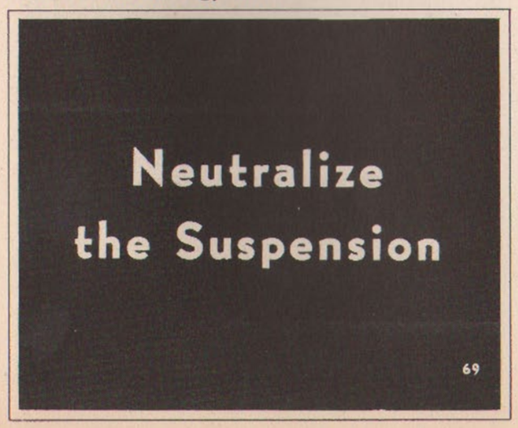


BILL: To play safe, we repeat this entire procedure and measure the friction lag two or even three times on each end of the car, until we duplicate the upper and lower measurements. And we can't be too careful.

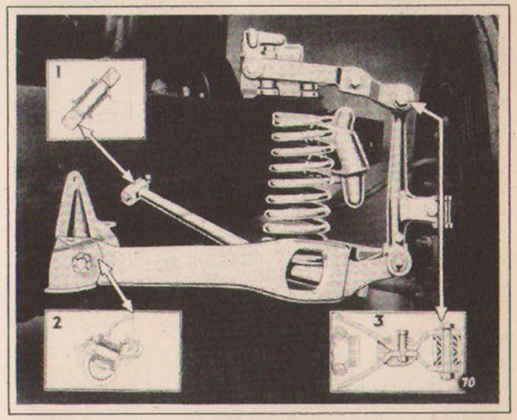
BILL: For, if the man is the least bit rough when he lets go of the bumper, the car will bounce back to center instead of stopping at the edge of the neutral range, and we'll get a false measurement which shows very low friction lag. . .

BILL: . . .--but if we were more careful we might find that actually the friction lag was three quarters of an inch or more, which is too much.

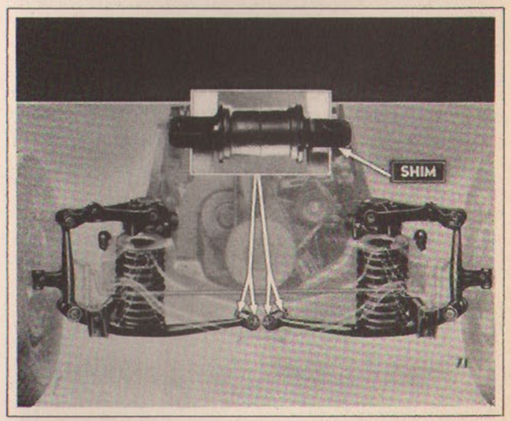
ANNOUNCER: What do you do if there is too much friction lag, Bill?



BILL: We have to neutralize the suspension. If it's the front end, we start by lubricating all the steering and suspension points, to make sure they work freely.



BILL: There are three points around the front suspension to be neutralized--first, the inner support arm pins; second, the torque arm rear bearings; and third, the upper wheel support arm bushings.



BILL: The first step is to loosen the inner support arm bearings under the front cross member, and make sure the flats on the pins rest flat on the frame at both ends. If they're cocked or either end is high, we use shims to get a square solid seat, then tighten both ends again.

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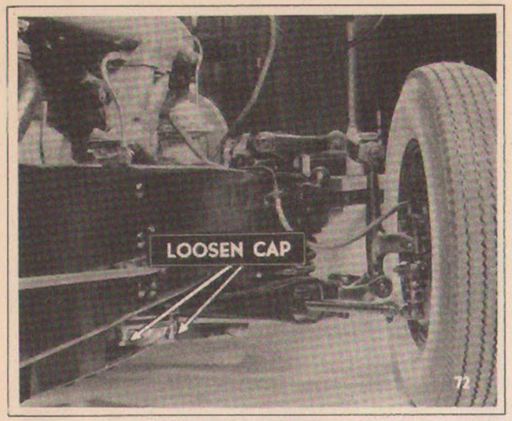
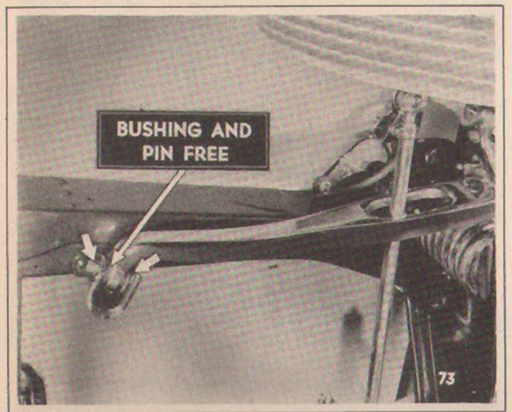
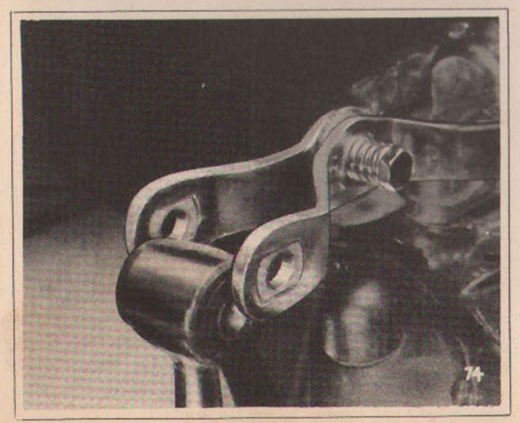


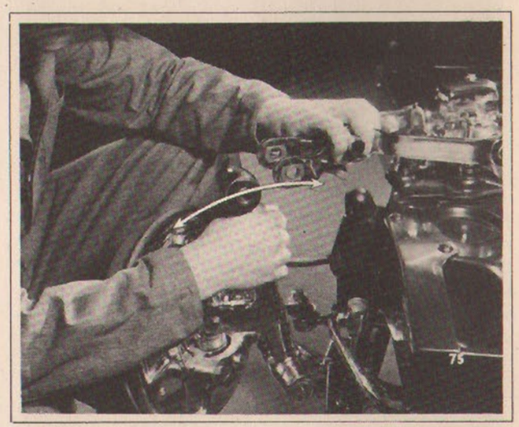
BILL: Next we loosen the torque arm rear bearings on both sides. If it's a ball and socket joint we just loosen the cap screws a few turns and knock the cap loose, and make sure the lugs on the rubber bearing are in position.



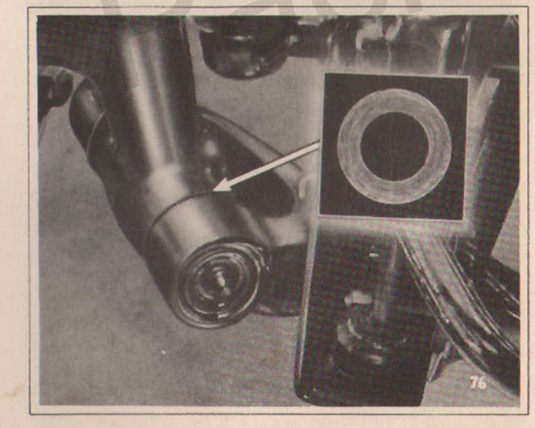
BILL: If it's a Harris bushing and pin type, we loosen the nut a few turns and give it a tap or two with a hammer to be sure the bushing and pin are free in the bracket, and leave them free. Then take off the front wheels to line up the shocks and wheel supports.



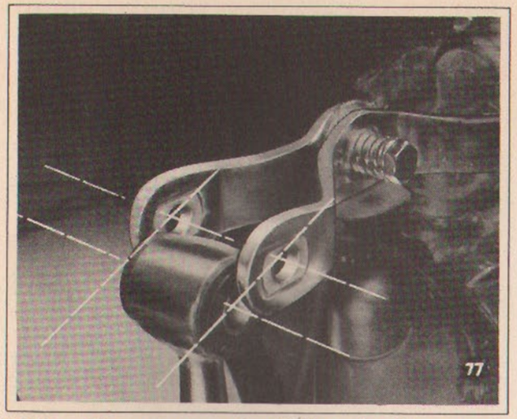
BILL: Now we disconnect the shock arm from the wheel support, and always mark the position of the off-set camber adjusting washers. If they should come out, they must go back in the same position or it'll throw the wheel camber off.



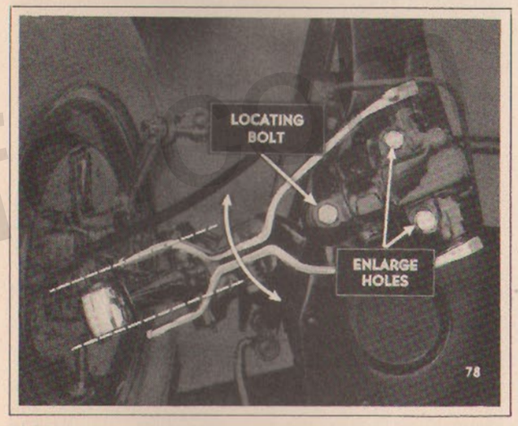
BILL: We make sure that the wheel support swings freely around the lower bearing with the proper pre-load or resistance. If it's stiff, we grease it and try again.



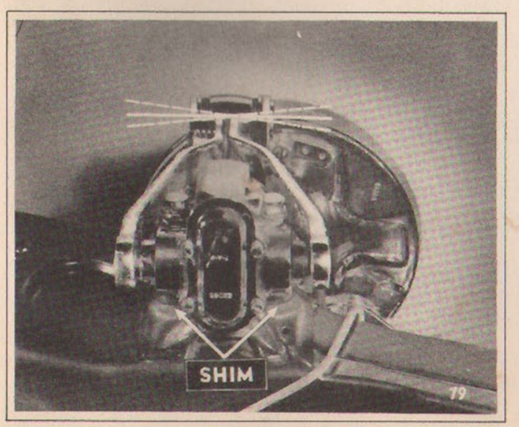
BILL: But if the motion is jerky and stiff, it indicates a galled spacer in the lower bearing, or one with rough spots on it, and of course it must be replaced with a new one. If that's necessary, be careful to install a spacer of the proper thickness to give just the right amount of resistance --one to six pounds, measured as specified in the shop manual.



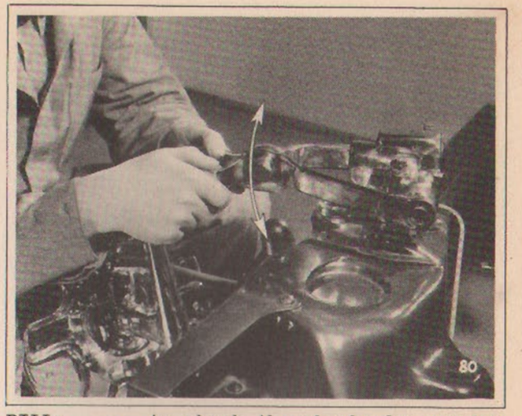
BILL: The upper end of the wheel support must line up with the shock absorber arm, both horizontally and vertically. If it's out of line either way. . .



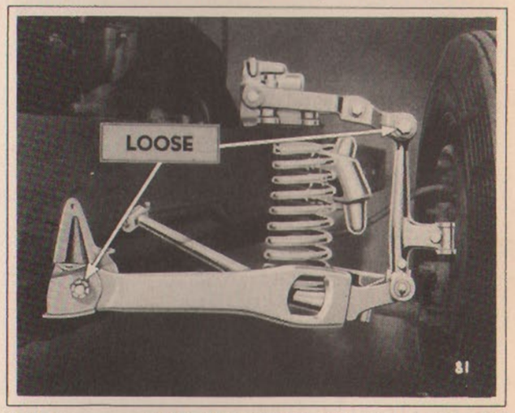
BILL: . . .we line it up horizontally by swinging it around on the locating bolt. If it's necessary, we enlarge the holes for the other bolts.



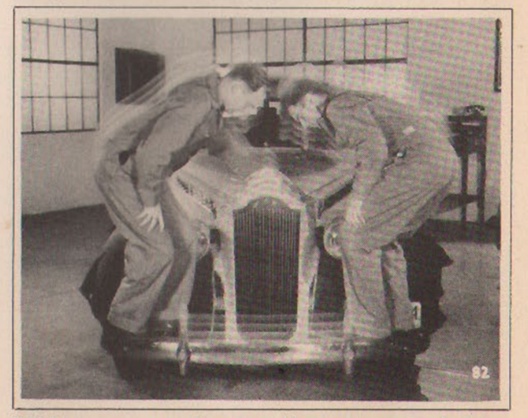
BILL: To align the arm vertically, we shim under one side of it so it won't pinch and bind the rubber bushing. Now while we've got everything disconnected is a good time



BILL: . . .to check the shocks by pumping the arms to the extremes of their travel. Uneven, jerky motion indicates air in the shock, and in that case we refill it and work out the air by more pumping. Then we reconnect the shock arm, leaving the nut loose, replace the wheels, and then. . .



BILL: . . .with the upper support arms and torque arm rear bearings loose. . .



BILL: . . .we bounce the car up and down hard--and I mean hard--to allow the rubber bushings to find their neutral positions. After we have given it a real good shaking, we tighten everything up again. . .

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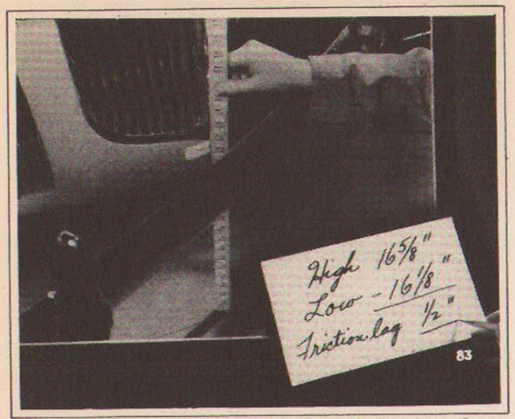
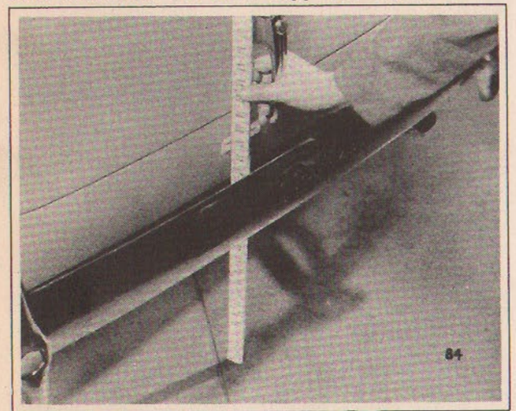
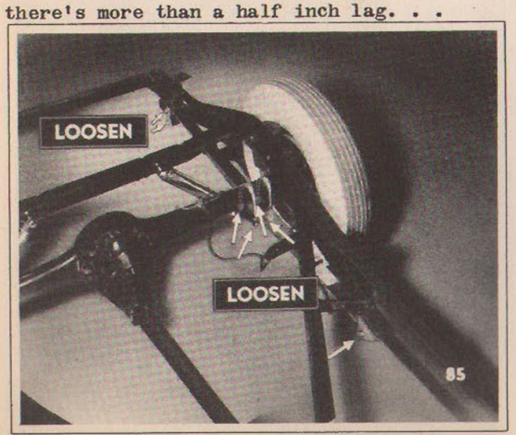


BILL: . . .and recheck the friction lag. If we've done a good job, that'll bring her down to a half inch or less.

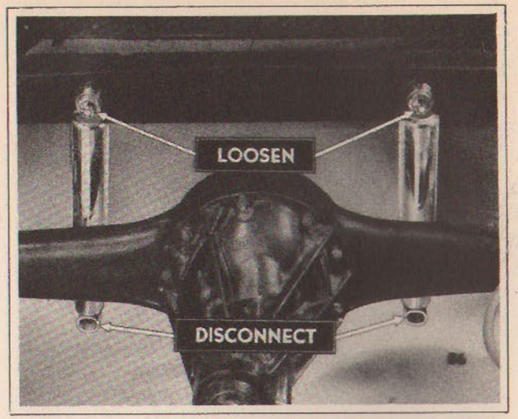
ANNOUNCER: I suppose you neutralize the rear end much the same way, don't you, Bill?



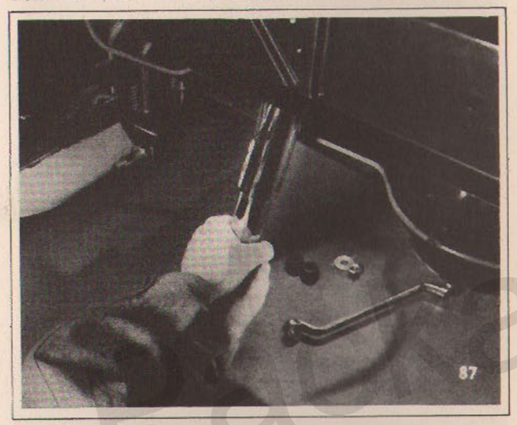
BILL: Well, there's some difference, of course. In the first place, the friction lag must be measured with the adhesive tape on the rear body panel below the trunk. If there's more than a half inch lag. . .



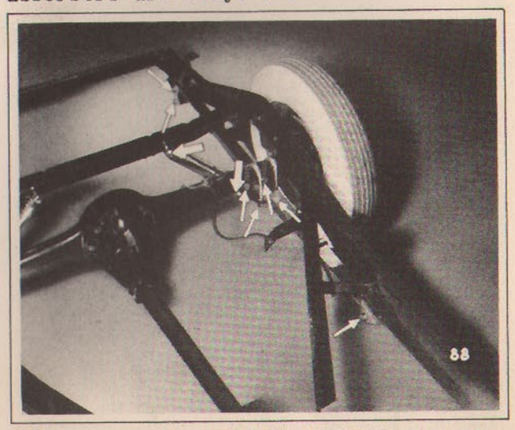
BILL: . . .we have to neutralize the rear end. First we loosen the rear spring shackles, the axle U-bolts, and the front eye bolts.



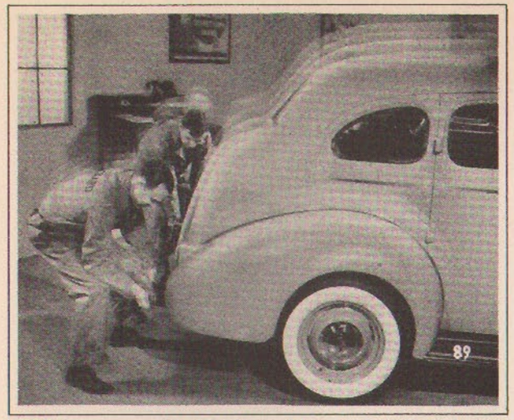
BILL: On models with direct acting shocks we also loosen them at the top, and disconnect the bottom ends from the studs.



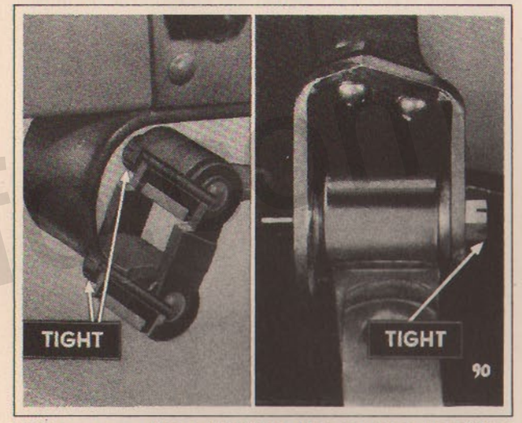
BILL: While the shock absorbers are disconnected is a good time, too, to check them for smooth action, air bubbles or low fluid level. When we're sure the shock absorbers are okay. . .



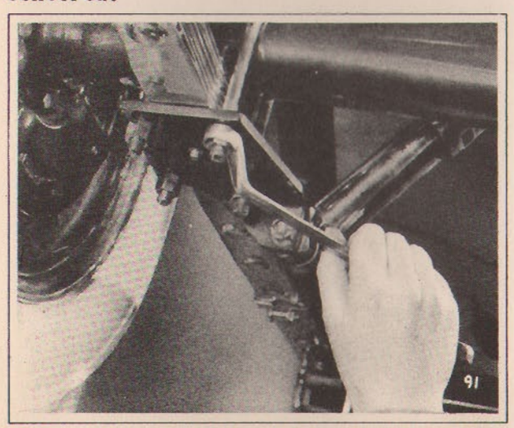
BILL: . . .we connect them up loosely, and while all the rubber bushings are loose, at both ends of the springs and at all the shock absorber mountings, and with the U-bolts loose. . .



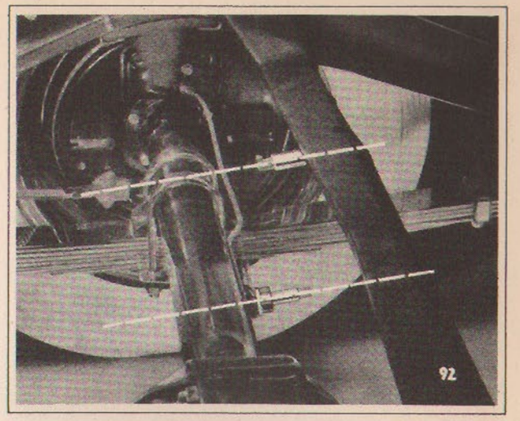
BILL: . . .we bounce the car real hard several times, to allow the bushings to find their neutral position. . .



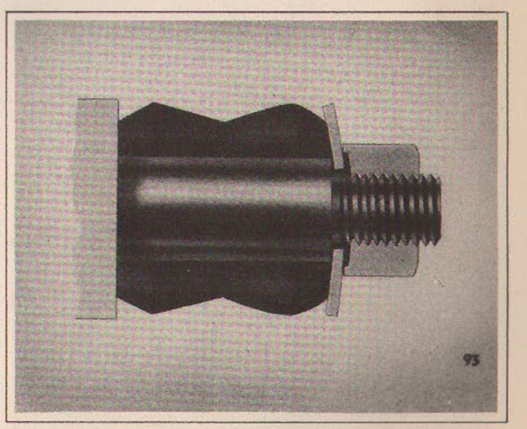
BILL: . . .then tighten the spring shackles and eyebolts. We draw them up tight so that the shoulders on the bolts seat on the brackets, and make sure the springs are centered.



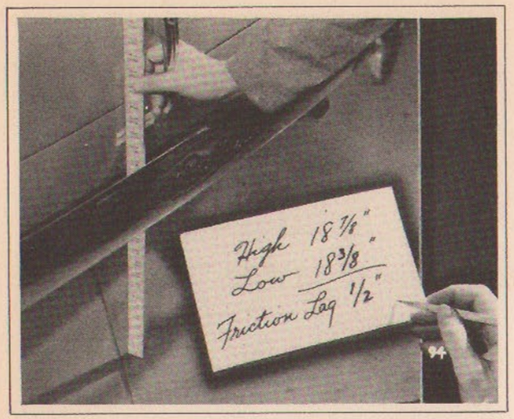
BILL: Next, we tighten the U-bolts, being careful to pull them up evenly and not so tight that we bend the plate, because that would throw the shock absorber stud out of line.



BILL: The studs should be lined up, by shifting the lower plate on the U-bolts, and if necessary, bending the upper stud with a piece of pipe. Now, when we're tightening the shock absorber studs we have to be careful not to draw them up too tight. . .

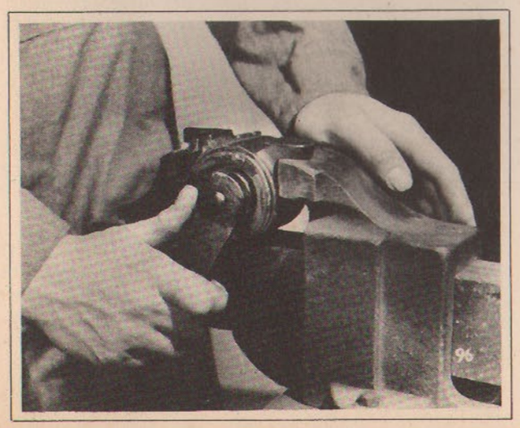


BILL: . . .because that might cup the washer over the shoulder on the stud, and put too much pressure on the rubber bushing, resulting in excessive friction. The final step in neutralizing the rear suspension. . .

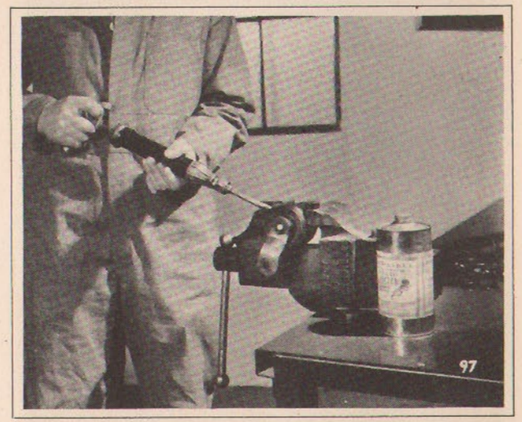


BILL: . . .is to measure the friction lag again to make sure it's within the required limits, and then ride the car as a final check. That'll take care of most ride complaints, but once in a while. . .

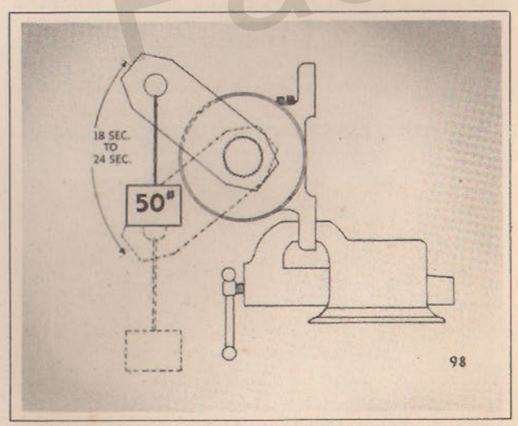
BILL: . . .you'll run into a lateral shake at the rear seat, and perhaps an under-car rattle along with it. This requires a check of the lateral stabilizer.



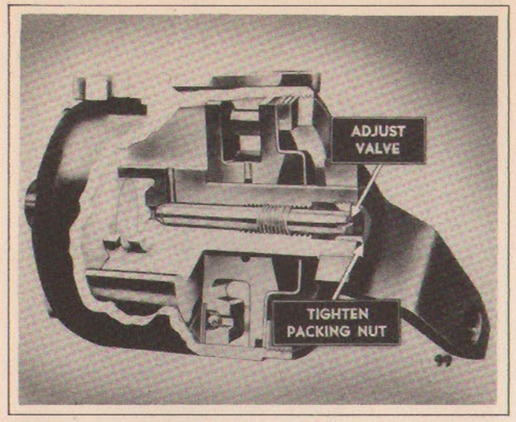
BILL: Remove the fifth shock absorber and clamp it in the vise with the filler plug in the same position as in the car. Work the arm back and forth. It should have considerable resistance to motion, and no freeplay. If there is any freeplay. . .



BILL: . . .fill the unit up to the bottom of the filler plug hole and move the arm through several full strokes, to pump out all the air.

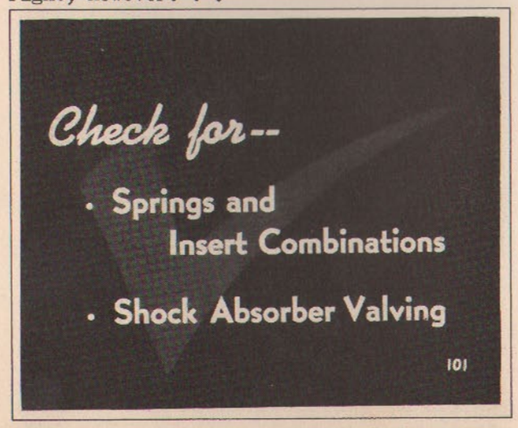


BILL: After freeplay has been corrected, mount the shock vertically in a vise, and check its resistance with a fifty pound weight hung on the arm. If it takes more than twenty-four seconds or less than eighteen seconds to move all the way down from the top position. . .



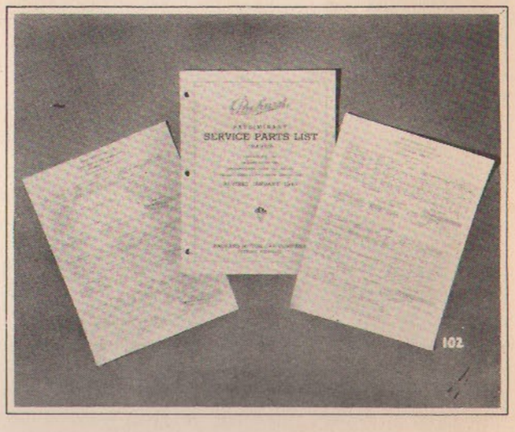
BILL: . . .adjust the valve till it comes within these limits--and always tighten the packing nut in the valve opening to make sure there are no leaks.

BILL: In my experience, correcting the tire pressure and neutralizing front and rear to within a half inch or less will take care of most ride complaints. If the road test shows that the ride still isn't right, however. . .

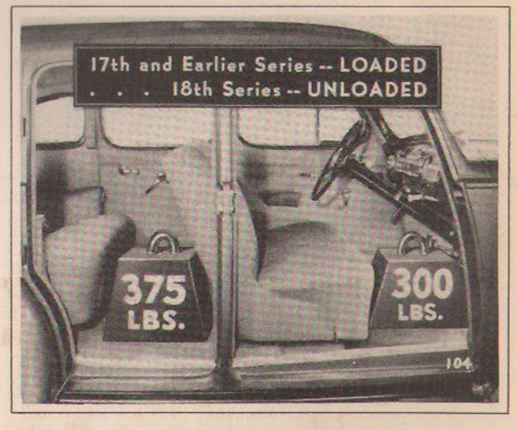


BILL: . . .you'll have to check for proper springs and insert combinations, and shock absorber valving.

BILL: Here's where these new charts, included in the revised preliminary eighteenth series parts book just issued, come in mighty handy. They show the proper spring equipment, riding height, spring insert combination, and shock absorber valves for each current model and body type.



BILL: The shop manual contains similar information on models prior to the eighteenth series--but here's one thing you don't want to slip up on. . .



BILL: . . .riding height on the seventeenth and earlier series cars is measured with the car loaded, while the riding height figures on eighteenth series cars are based on measurements with the cars unloaded.

ANNOUNCER: Where do you measure riding height, Bill?

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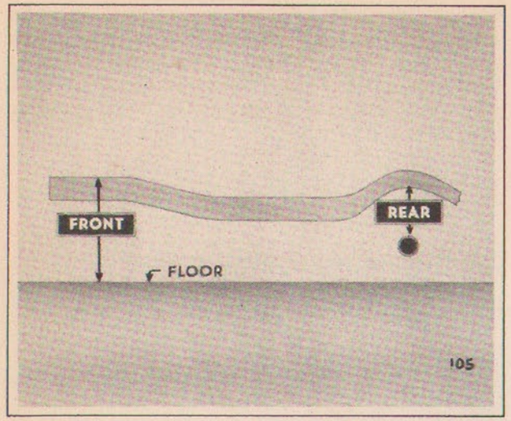
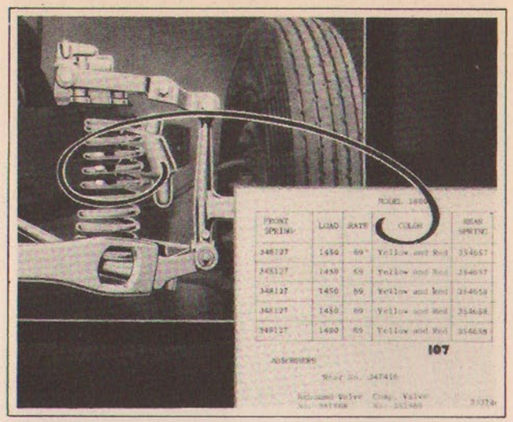
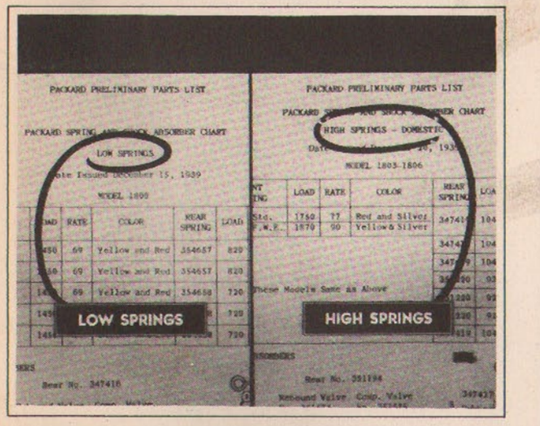


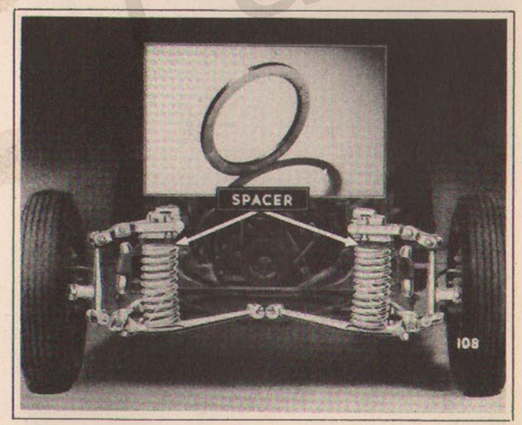
BILL: Front riding height is measured from the floor to the top of the frame, opposite the center line of the wheels. The rear riding height is measured on each side from the bottom of the frame to the top of the axle housing. Riding heights should be within half an inch plus or minus of the specified limits. Here's another thing to watch out for. . .



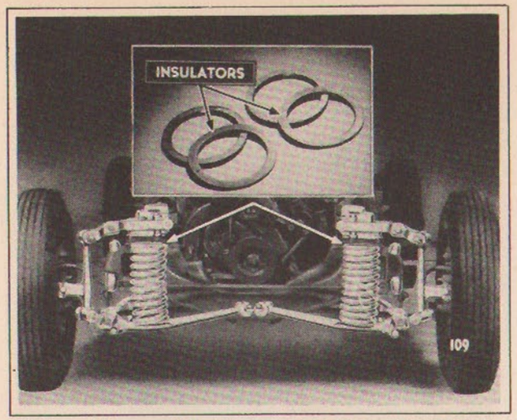
BILL: If the front riding height is below the limit, the springs should be checked against the charts. The various springs are identified by paint marks on the coils and this color marking is shown in the charts. If correct springs are in the car. . .



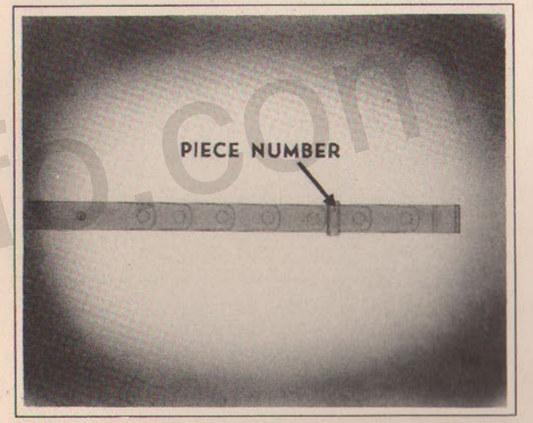
BILL: Springs on the eighteenth series cars were lowered during production, and there are two sets of charts, one for "low" springs and another for "high" springs. So if your figures are "off" for one chart, they may be just right for the other.



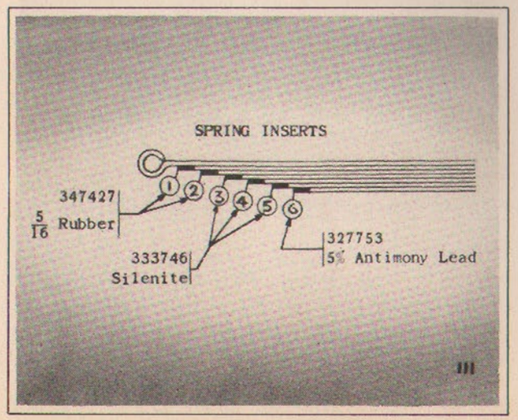
BILL: . . .spacers can be installed between the top of the springs and the frame to restore the correct riding height. One spacer raises the car about three-eighths of an inch. Never use more than two spacers.



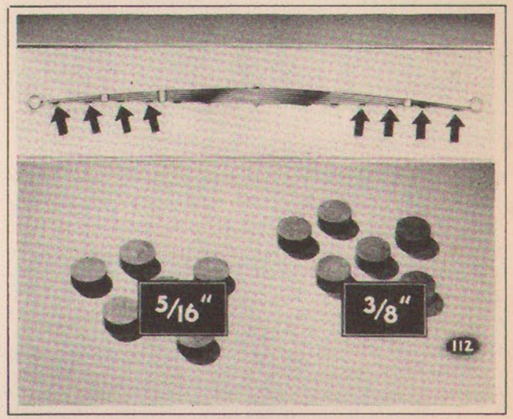
BILL: Along with these spacers, insulators should be used to prevent squeaks--one insulator between the spacer and the spring, and also between spacers, if you have to put in two spacers on one spring.



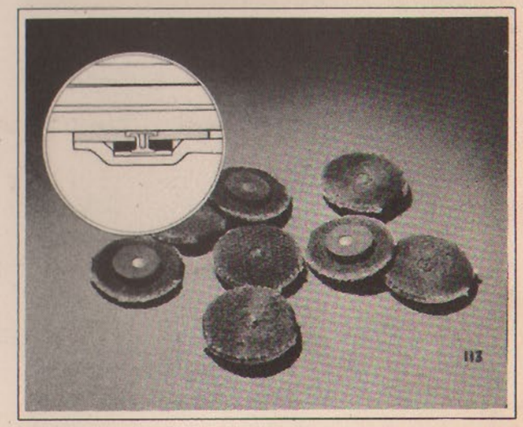
BILL: Checking the piece numbers of the rear springs will tell you whether it's a high or low spring job and if the right springs are installed in the car. The piece numbers are stamped on the under side of the spring clip. The next important thing . . .



BILL: . . .is to check the rear spring insert combinations, and make them standard according to the charts. The type and position of the inserts is extremely important. See that all inserts are centered and are actually separating the leaves properly.



BILL: Rubber inserts are used in two thicknesses--on the eighteenth series--five-sixteenths and three-eighths of an inch--so make sure that they are of correct thickness according to the charts. They must be properly centered to avoid pinching one side, which would cause excessive resistance.



BILL: Silenite inserts, if not properly centered, will wear unevenly and reduce the friction area. A glazed surface is normal after the first few hundred miles of service, and does not indicate need of replacement.

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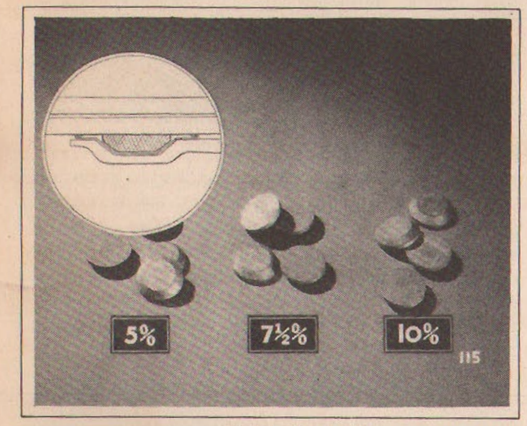
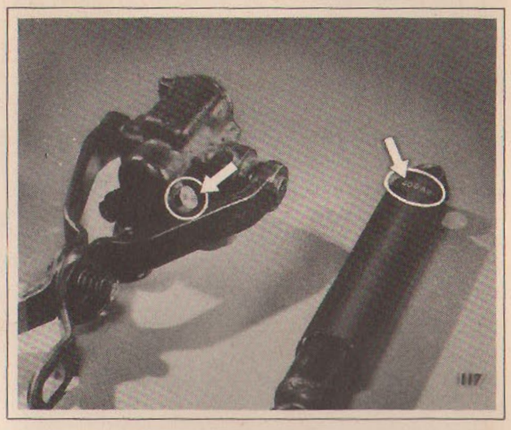
BILL: When putting in new Silenite inserts we put a light coating of "Lubriplate" on both surfaces. Without this, their action would be harsh until they became broken in or glazed.

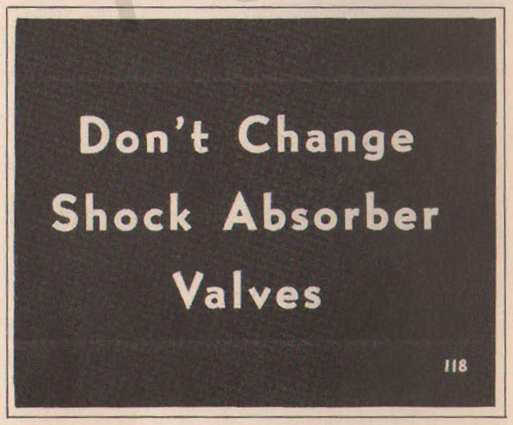


BILL: Antimony Lead inserts are marked five, seven and a half, and ten, according to the percentage of antimony in the alloy, and should be checked against the charts accordingly. If installed only slightly off center, they will straighten themselves in operation.

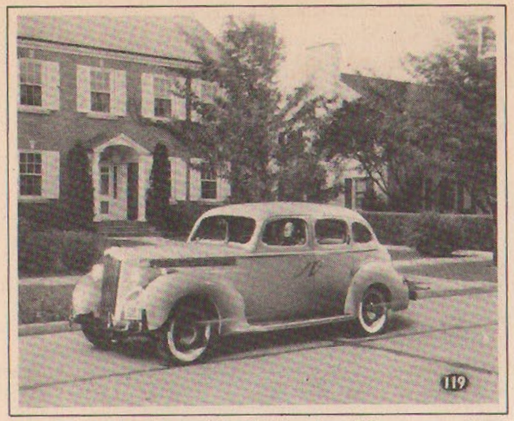
BILL: Antimony Lead inserts are enclosed in cups which are packed full of grease. This is not for lubrication but to protect them against air and oxidation, which turns them black and results in snaps or clicks. When they are removed for inspection, the old grease should be cleaned out and replaced with fresh grease.



BILL: Now for the shock absorbers. The valving of the lever type is stamped on the valve cover-nuts. On the direct acting type it is stamped on the dust shield. Check them against the chart. If you have the right shock valving for the job, and if they have the right amount of fluid and all the air is worked out, they should be all right.



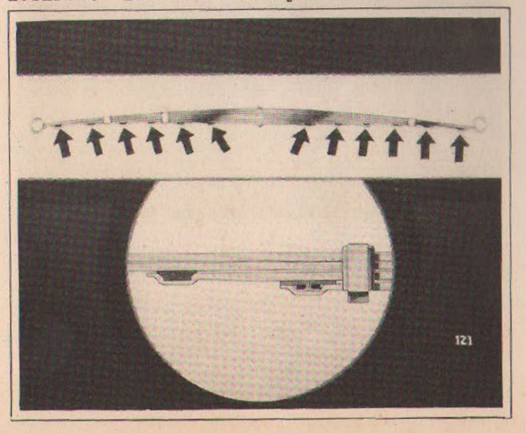
BILL: Now, don't start changing shock absorber valves--that's a complicated engineering job. After you get the car standard in every respect, if the owner still is not satisfied, get in touch with your service supervisor and ask him to help you work out a new combination of spring inserts.



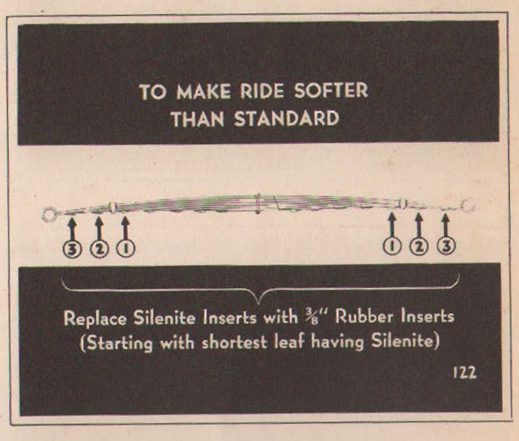
BILL: A final road test should prove when the car is right up to standard in every Packard Ride feature--and the standard ride is just what the great majority of owners want.

ANNOUNCER: That's fine, Bill--but what about the minority--the owners who want something different?

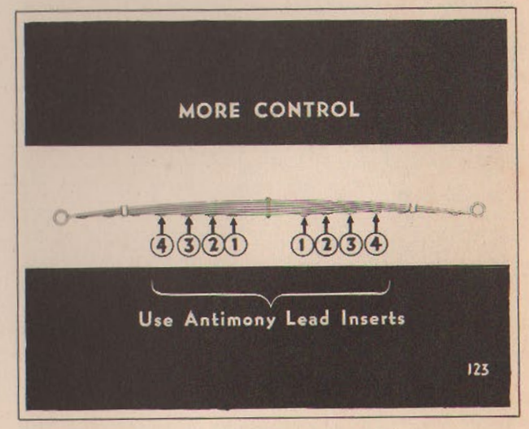
BILL: Well, you may find a case once in a while where the owner demands something special in the ride to meet him own peculiar desires. But even then you're not licked--



BILL: By changing the insert combinations in the rear springs, you can meet these occasional demands for a special type of ride. If it's a high spring job, changing the inserts to the standard combination for the corresponding low spring may do the trick.



BILL: Now, to make the ride still softer, replace Silenite inserts at both ends of the spring with three-eighths inch rubber inserts. Try it one leaf at a time, starting with the shortest leaf having Silenite. Of course, using three-eighths inch rubber inserts instead of five-sixteenths inch will also soften the ride slightly.



BILL: If you want more control to cut down rear seat up and down movement or float--use additional Antimony Lead inserts on both ends of the shortest leaves not so equipped. Usually lead in a total of three leaves will do the job--but you should never have lead in more than four leaves.

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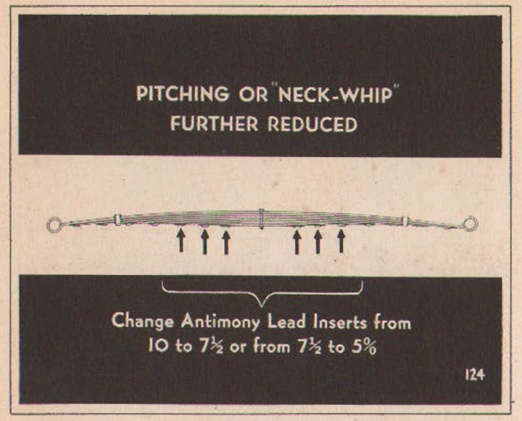
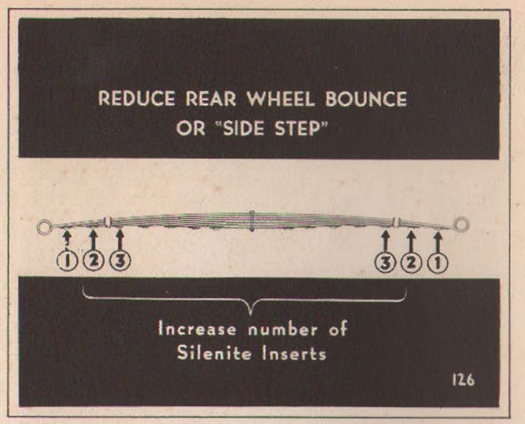
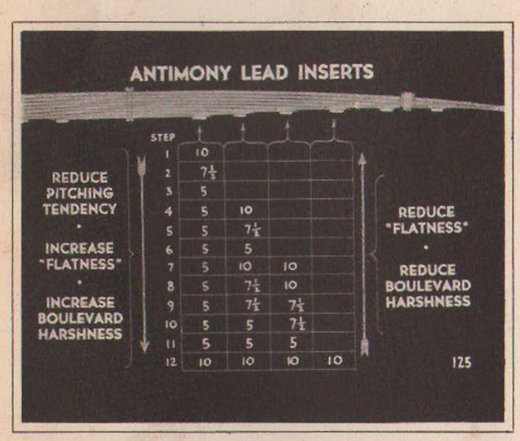


BILL: If after the job is neutralized front and rear, you still have some pitching or neck whip, it can be further reduced by changing the Antimony Lead inserts already in the job to a lower percentage--from ten to seven and a half or from seven and a half to five.

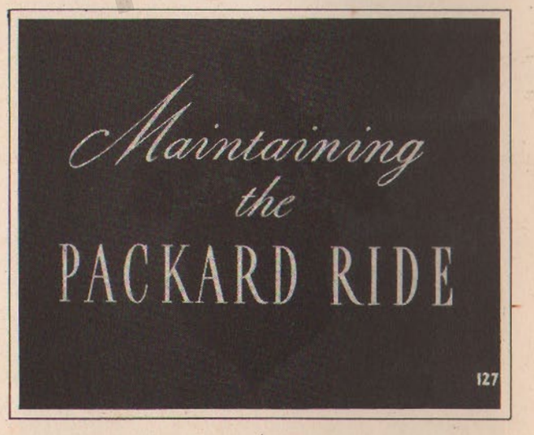


BILL: To reduce rear wheel bounce or "side step," increase the number of pairs of Silenite inserts used. Try it one leaf at a time starting with the longest leaves not so equipped.

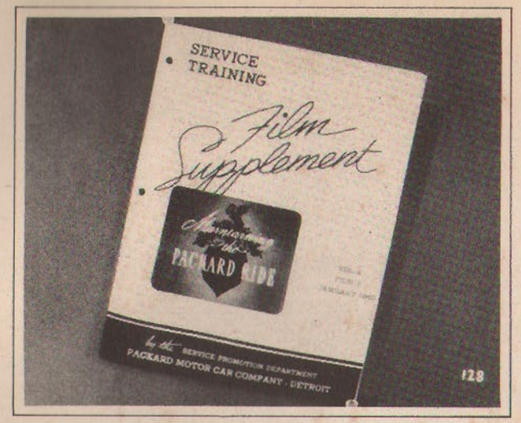
ANNOUNCER: Thanks a lot, Bill. That covers the more important angles of. . .



BILL: As this chart shows, increasing the number of Antimony Lead inserts or reducing the percentage of antimony, working from the shortest leaf outward, will progressively reduce pitching tendency, and at the same time increase boulevard harshness. And the opposite is true when you work in the reverse direction, as shown by the arrow at the right.



ANNOUNCER: . . ."Maintaining the Packard Ride". It's such a timely subject, however, that we recommend that every Packard service man. . .



ANNOUNCER: . . .carefully study the Film Supplement. It gives the complete ride story. Use it as a reference. . .

ANNOUNCER: . . .to help you keep owners so thoroughly satisfied with the Packard Ride that every last one of them will say. . .

MRS. JONES: Don't ever buy any other kind of a car but a Packard.

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