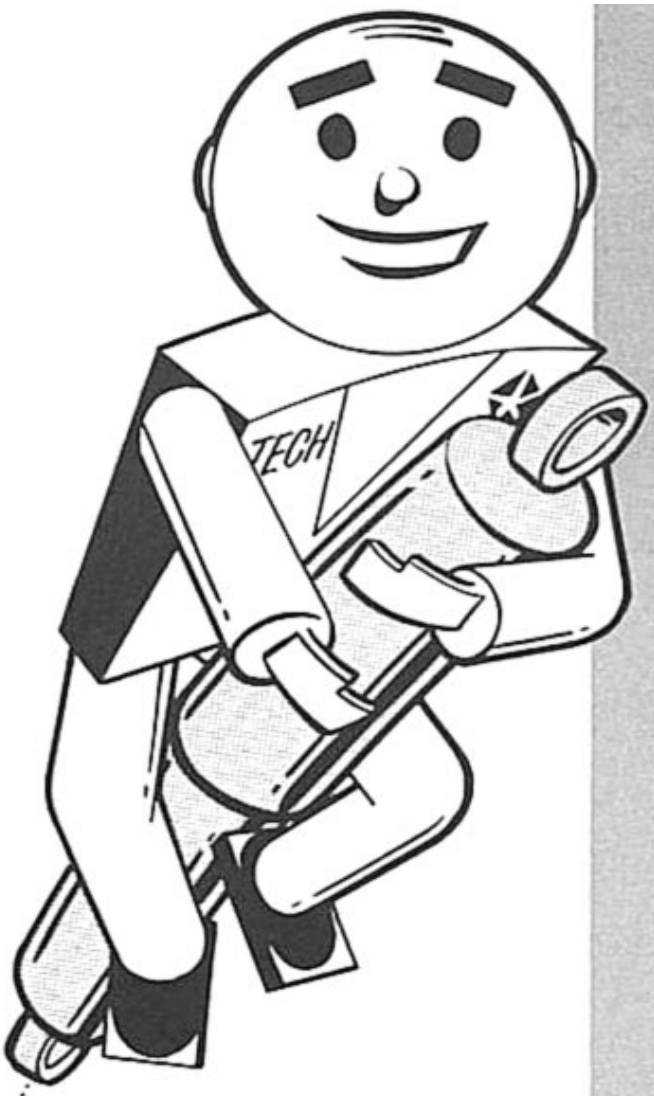
MASTER TECHNICIANS SERVICE CONFERENCE

REFERENCE BOOK 70-3

SHOCK ABSORBER FACTS

CHRYSLER MOTORS CORPORATION

PLYMOUTH • DODGE • CHRYSLER
IMPERIAL • DODGE TRUCK



WOULD YOU BELIEVE . . .

. . . that damaged, worn or leaky shock absorbers won't cause a car to droop or sag . . . that shocks don't have anything to do with supporting your car and, consequently, have nothing to do with the height of it?

. . . that a shock absorber which shows fluid on the outside is not necessarily leaking or faulty . . . that a certain amount of seepage is normal and necessary for lubrication?

. . . that a noisy shock absorber doesn't mean that the shock is damaged and should be replaced . . . that shocks tend to be slightly noisy in the winter months and a few miles of driving should eliminate the noise?

. . . that you really can't test shock absorbers by bouncing the car up and down . . . that the only real way to test shocks is by road-testing and comparing a test car with a car you know has good ride and handling characteristics?

. . . that it is seldom necessary to replace shocks in pairs, and rarely ever necessary to replace a complete set of four . . . that except for physical damage or extensive leakage, a shock will last indefinitely regardless of the number of miles it has been used.

Believe it or not, these are some of the wrong ideas most owners and possibly some of you technicians have regarding shock absorbers. The shock absorbers are a very important part of the suspension system. They are necessary for good ride and handling of the car. You'll learn from this reference book exactly what a shock absorber is supposed to do and how it does it. Along with this, there will be complete coverage of the most common service problems you may run into related to shock absorbers; and some important tips about installation.

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INTRODUCTION

Shock absorbers are probably one of the most misunderstood components of an automobile. Although it is not a complicated part, most people just don't understand what the shock absorber does or how it does the job it's supposed to do. This reference book will give you the complete story on shock absorber function and, what's more important, how to test and service them.

IT'S AN ALIAS

Actually, the name "shock absorber" is somewhat of a misnomer. The shock absorber really doesn't absorb shock at all. The springing system, or as it's more commonly called, the suspension, does the shock absorbing. What is commonly referred to as a shock absorber is really a device to dampen spring movement. In fact, in England and Europe they are referred to as "dampers". However, the name "shock absorber" has been around a long time, so let's stick with it and discuss what they do and how they do it.

LET'S CLEAR THE AIR

If you read the inside cover of this reference book, you have a pretty good idea of some of the wrong ideas that many owners and possibly some technicians have about shock absorbers. Probably the most common misunderstanding is that if a shock absorber is worn out, damaged, or has lost its fluid, the car will sag closer to the ground.

Fig. 1—Springs and torsion bars support the body

THE SPRINGS DO THE JOB

Most of you technicians are aware of the fact that the shock absorber does not support the weight of the car body in any way, shape, or form. The car body is supported completely by the rear springs and front torsion bars. While the car is standing still, the shock absorber is loafing and doesn't go into action until the car is moving.

THE TIRES GET INTO THE ACT FIRST

The suspension does the main job of absorbing road shock as the wheels roll over bumps or go into holes; but, some of the minor road shock is absorbed by the tires before it is transmitted to the suspension. The larger the tires, the more road shock they will absorb, but handling and safety considerations limit how large a tire you can use.

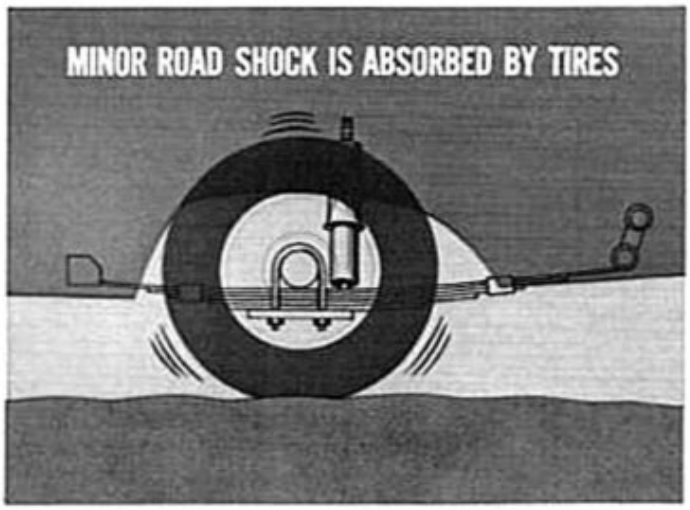


Fig. 2—The tires work along with the springs

HERE'S WHAT HAPPENS

Basically, there are two spring movements that occur when the wheels hit any surface irregularities in the road. If the wheel hits a bump, the wheel moves upwards towards the body. This action is called *jounce*. When the wheel moves away from the body, as when going into a rut or chuckhole, it is referred to as *rebound*.

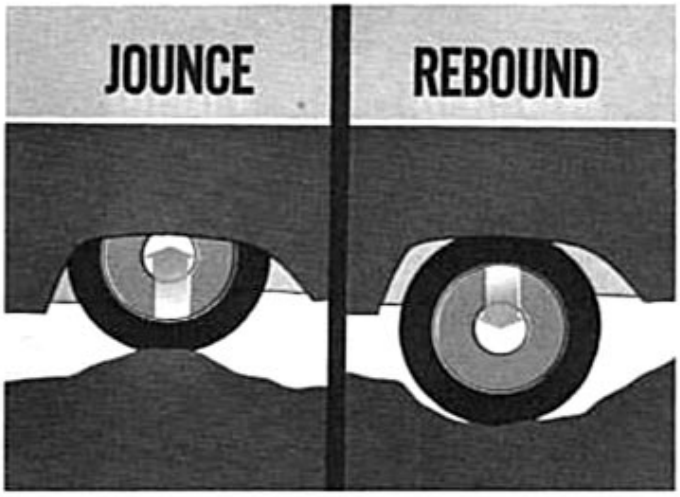


Fig. 3—Two spring movements take place

THE BOUNCE GOES ON

Jounce *and* rebound happen whenever there is enough force encountered to flex the spring. The spring will then continue to flex in opposite directions until the force is completely dissipated. If the load that is applied to the spring is great enough, the spring reaction is transmitted to the body. Body movement is, in most cases, opposite of wheel and spring movement.

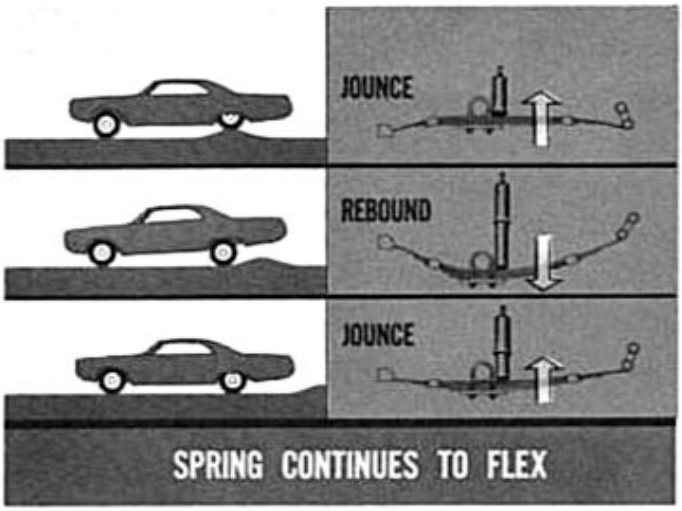


Fig. 4—Spring flexes until force is dissipated

BODY WEIGHT ADDS TO IT

When a car travels over a sizeable bump, you know that the wheels will cause the spring to flex toward the body. The upward flexing happens at the axle, or near the middle of the spring. The weight of the body causes the forces and movement at the ends of the spring to be in the opposite direction. The exact opposite happens when the wheels travel down or away from the body as in a rebound condition. When this happens, the weight of the body *adds* to the spring action and makes bouncing even more difficult to control.

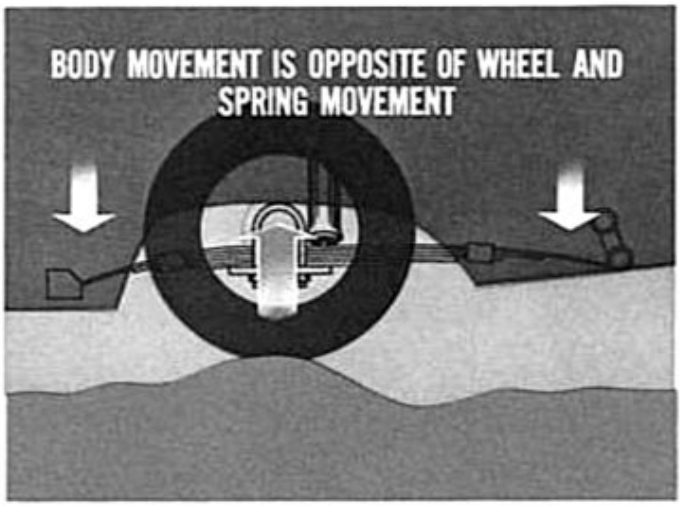


Fig. 5—Body weight adds to spring action

SPRING RATES

Today's suspension systems are designed with a low spring rate to give what is generally referred to as a soft ride. A low spring rate simply means that it doesn't require much of a load to flex the spring. On smooth pavement, today's standard springs are flexible enough to allow the wheels to follow slight irregularities without transmitting their movement to the car body. This eliminates road shock or what might be considered a harsh ride.

WHY SHOCKS ARE NEEDED

The real purpose of the shock absorber is to control suspension and body movement. The shock absorber controls or dampens the jounce

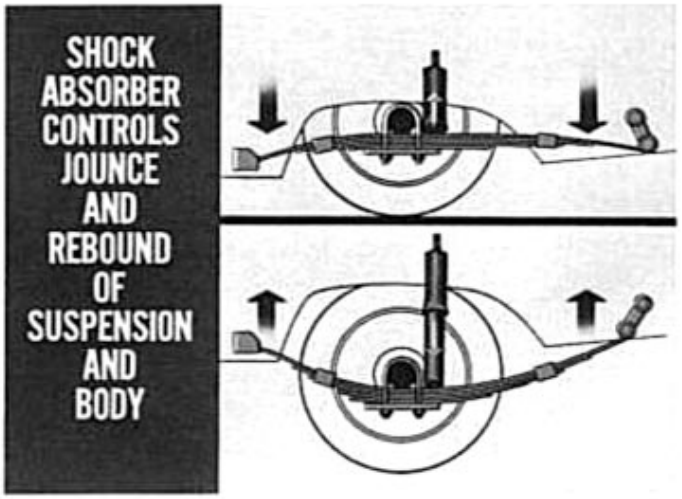


Fig. 6—Shocks are basically hydraulic snubbers

and rebound of the car's suspension and body. The shock absorber is basically a hydraulic snubber which acts to dampen spring action and retard body movement when necessary. Without shocks, the suspension and body would continue to bounce up and down until the internal friction of the spring leaves and torsion bars, along with the subtle damping characteristics of the tire, brought the spring back to its normal position.

WHAT THE SHOCK ABSORBER DOES

With a low spring rate it would be pretty easy for the car to bottom against the rubber bumpers if it went over a good-sized bump or into a chuckhole. Along with damping spring action, this is another reason why shock absorbers are important to the suspension system. So, the shock absorber has two jobs—to snub or restrict the initial flexing of the spring and to dampen the resultant jounce and rebound action of the spring and body.

SHOCK ABSORBER MUST VARY CONTROL

The shock absorber must not only provide snubbing control, but must also vary the amount of control to different car speeds and road conditions. A modern piston-type hydraulic shock absorber is designed to automatically provide the right amount of resistance for all normal road conditions.

LIGHT SNUBBING ACTION

On a smooth road surface, only slight snubbing action is required by the shock absorber. On smooth pavement, suspension movement is slight, therefore body movement will almost be non-existent. Nevertheless, because of low spring rates, it doesn't take a real severe bump to flex the springs; so shock absorber action is necessary.

INCREASED SNUBBING ACTION

Obviously, rougher road surfaces require stronger snubbing action by the shocks to keep body and suspension movement under control. The shock absorbers must automatically increase their resistance many times more to cushion or dampen increased spring action. The following paragraphs will explain how a shock can adjust the amount of resistance or snubbing action to the amount of spring action.

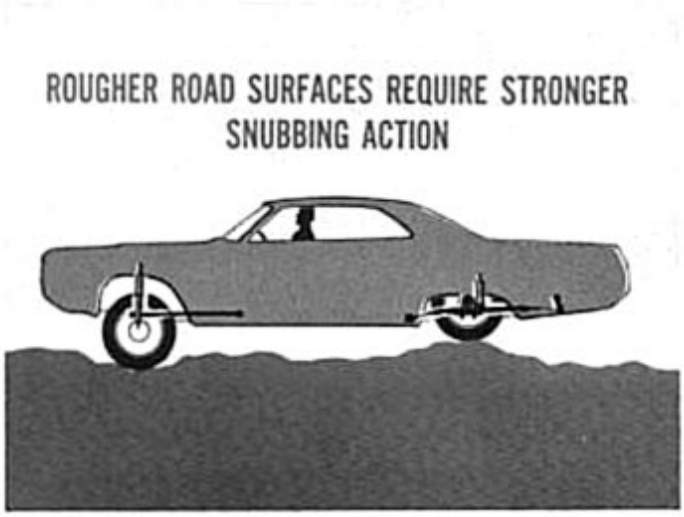


Fig. 7—Shocks must automatically increase resistance

HOW RESISTANCE IS BUILT UP

A shock absorber is basically a piston within a cylinder filled with hydraulic fluid. The action of the piston forcing the fluid through a restricted passage, or valve, achieves the damping effect. The damping effect, or resistance, is

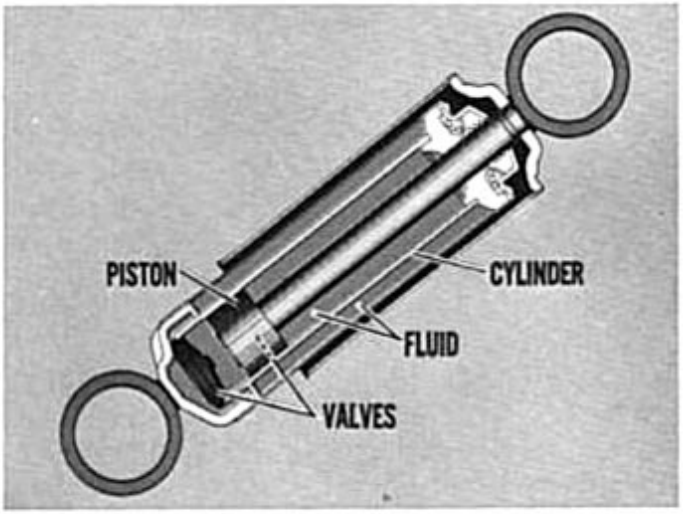


Fig. 8—Damping effect is caused by back pressure

caused by back pressure which builds up as the fluid is forced through the small opening in the valve.

VELOCITY INCREASES PRESSURE

Fluid pressure builds, or increases, as the velocity of the piston increases. A very good comparison to illustrate this is a hand-operated bug sprayer. If the handle is pumped slowly, there is very little resistance. Maximum flow of air is also accomplished.

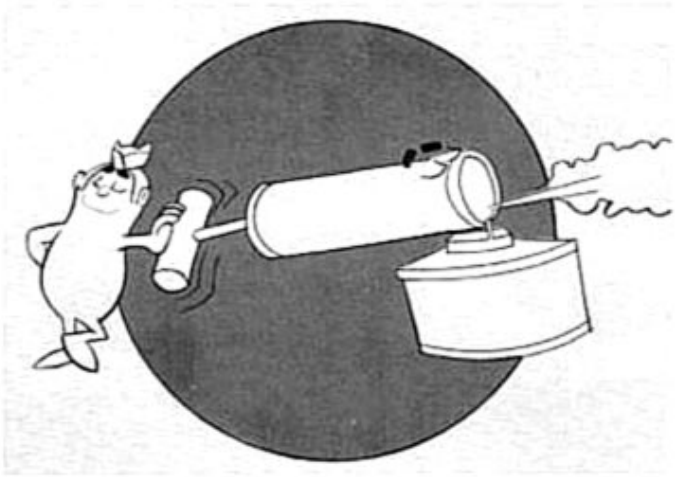


Fig. 9—Little resistance when pumped slowly

TRY PUMPING IT FAST

If the handle of the bug sprayer is given a very fast stroke, you will be able to notice a considerable increase in resistance. The built-up pressure is caused by the restrictive nozzle of the bug sprayer. The nozzle can only allow so much air through it, so if you try to force more, the nozzle will build back pressure.

THE SHOCK IS PRETTY MUCH THE SAME

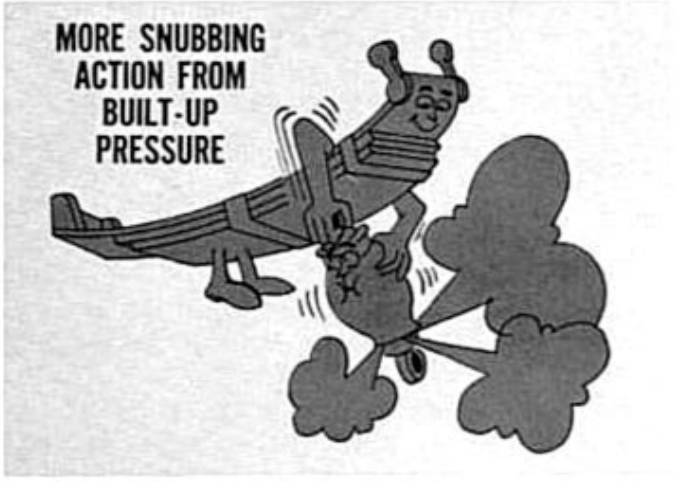


Fig. 10—Valves in shock give desired restriction

The shock absorber functions almost the same way as the bug sprayer. The faster the piston moves, the more snubbing action you get from built-up pressure or resistance. In a shock absorber, this is accomplished with valves which give the desired restriction to fluid flow.

A WORD ABOUT BUMPERS

By varying valve and orifice sizes, engineers can design a shock absorber to provide control to suit the requirements of any vehicle. However, there are times when the spring force is such that it is too much for the shock alone to control. Rubber devices known as bumpers are installed on the car for this reason.

WHAT THE BUMPER ACCOMPLISHES

A shock absorber can only be compressed or extended so far without ruining it. Some jounce and rebound conditions are so extreme that the suspension and the body will come into contact. Obviously, the impact would be a pretty bone-jarring experience. The bumpers act to cushion the blow if this happens in either jounce or rebound.

THE BUMPERS DO TWO JOBS

The bumpers not only cushion the impact when the suspension comes into contact with the body; they also decelerate the movement. The bumpers are not merely a pad to prevent metal-to-metal contact. By nature of their cone-shaped design, the bumpers are put to use long before suspension and body contact is made. As contact is approached, the bumper "squashes" to slow down suspension or body movement; then in the case of contact does soften the blow. Actually, the bumper increases its cushioning effect automatically much the same as the shock absorber.

HOW THE SHOCK ABSORBER WORKS

The best thing to do is to start with a physical description of the shock absorber and its internal parts. Then a detailed explanation will follow of how the valving within the shock absorber varies the amount of control for different road conditions.

MOST SHOCKS ARE NEARLY IDENTICAL

The body of the shock is the logical place to start a description of a typical shock. For the most part, current shock absorbers are nearly all identical externally apart from length. They differ internally according to how they were intended to be used. Make sure you have the proper size shock for each application.

CHRYSLER USES ORIFLOW

Chrysler Corporation uses what is known as an "oriflow" shock absorber for all standard applications. This is the type of shock that will be the subject of discussion from here on. Other types of shocks are used on Chrysler products as optional equipment; but they will not be covered in this reference book.

THREE CONCENTRIC TUBES

The body of the shock absorber usually consists of three concentric steel tubes. The innermost tube is what is called the pressure tube. The pressure tube is actually a hydraulic cylinder where the actual snubbing action is performed. The inside diameter of the pressure tube is what determines the size designation of the shock absorber.

RESERVOIR TUBE

The second tube, or the one next to the pressure tube is the reservoir tube. The reservoir tube is necessary because the piston rod displaces fluid from the pressure tube and this fluid has to have somewhere to go. As the piston moves within the pressure tube, the fluid flows to and from the reservoir.

A PROTECTIVE SHIELD

The outer tube is a shield to protect the piston rod as it extends during operation. In some cases, the piston rod extends into a protective housing and the shock is not equipped with a protective shield. This usually occurs on the front suspension systems rather than the rear.

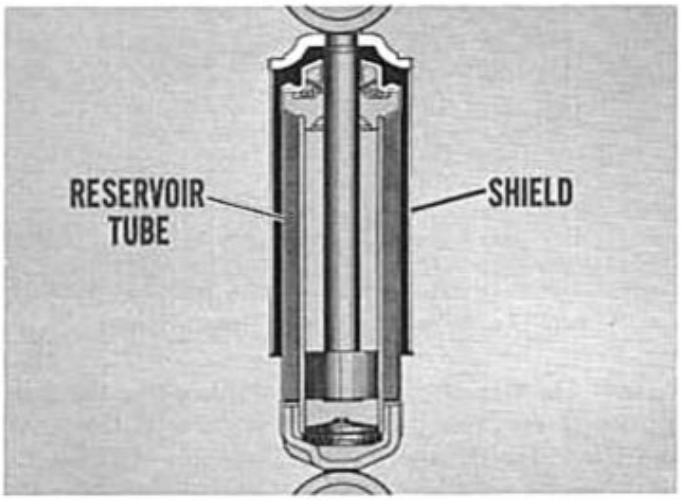


Fig. 11—Shield protects extended piston rod

MOUNTING DEVICES

At the bottom of the shock absorber is a ring or mounting eye welded to the reservoir tube. The lower mounting eye is used to attach the shock to the rear spring clamp or the lower control arm on the front suspension. The top of the shock absorber can have either a mounting eye the same as the bottom, or can have a threaded stud for mounting purposes.

LET'S LOOK INSIDE

Inside the pressure tube is where the actual damping or snubbing takes place. The piston within the pressure tube is subjected to the laws of hydraulics that resist its movement to a degree determined by the size of the valves or orifices.

PISTON ROD, SEAL

The piston rod is what moves the piston up and down as the shock functions. There is an oil seal and rod guide at the top of the shock. The inside of the seal has three wiping edges which prevent loss of fluid as the rod is extended. Between the wipers are spaces that hold just enough fluid to keep the rod lubri-

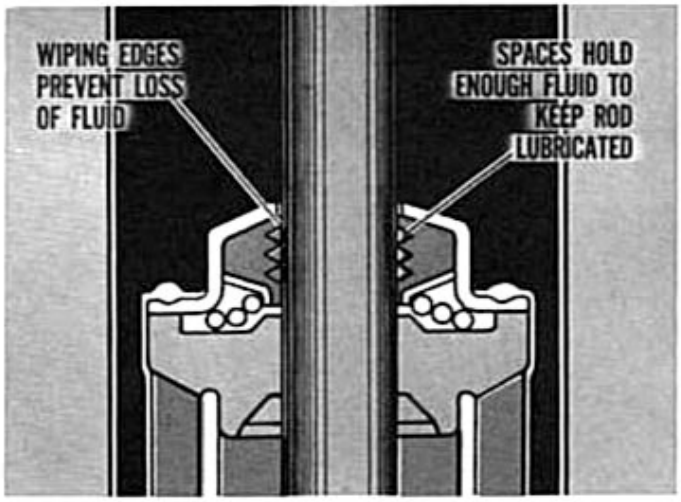


Fig. 12—The piston rod seal does two jobs

cated. On the compression stroke, the fluid is pumped from between the wipers in the seal back into the pressure tube.

PISTON ROD GUIDE

The main job of the piston rod guide is just what the name implies. It also prevents fluid leakage and maintains pressure in the pressure tube. A certain amount of fluid seepage through the seal is not abnormal, but it doesn't automatically mean that the shock should be replaced. Fluid seepage and the reasons that cause it will be discussed in more detail later in the book.

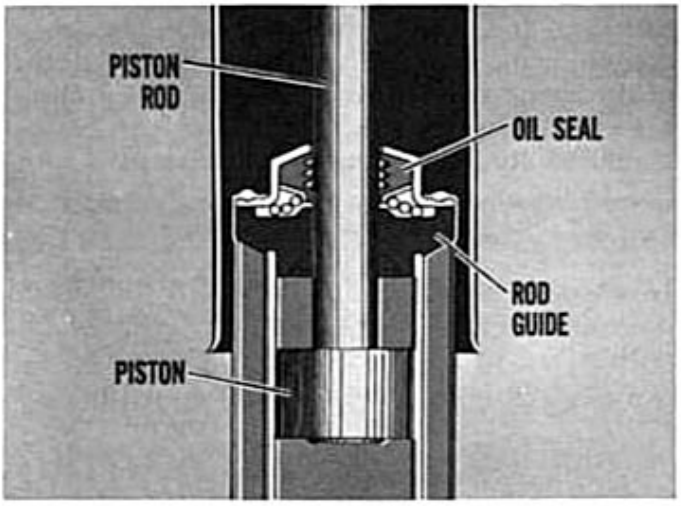


Fig. 13—Piston rod guide maintains pressure

BASE VALVE

You all know that the snubbing action is accomplished through the use of valves. Let's discuss what happens on jounce, or when the shock is compressed. There is a valve at the bottom of the pressure tube which is generally referred to as the base valve. The base valve provides about 90% of the control in a jounce condition. Valving within the piston provides the remainder of the jounce control.

HIGH- & LOW-VELOCITY JOUNCE CONTROL

The base valve provides both high- and low-velocity jounce control. The base valve varies the amount of control through back pressure alone. The faster the piston travels, the more control you have. If you remember the bug sprayer earlier in the book, you'll understand how the base valve works.

THE FLUID JUST CAN'T MOVE FAST ENOUGH

What exactly happens on jounce is that . . . as the piston speed increases, the fluid reaches a point where it cannot flow through the base valve as quickly as the piston is trying to force it. Under normal road conditions, the fluid moves quite readily and has little restrictive effect. But when the shock receives a sharp blow, the fluid provides increased restriction.

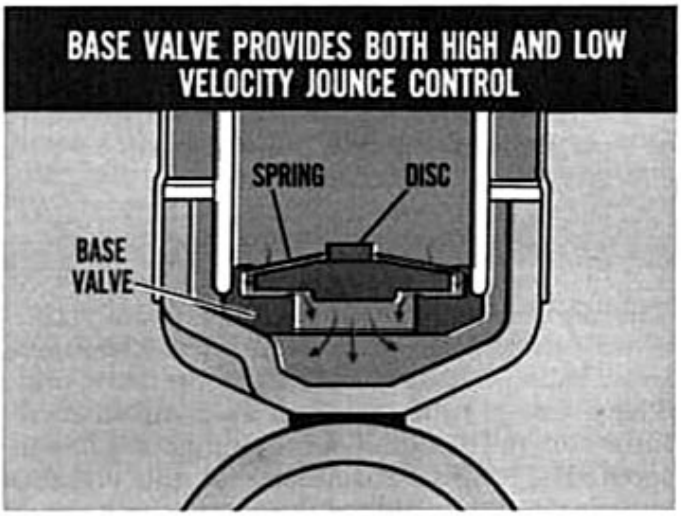


Fig. 14—Base valve provides about 90% jounce control

REBOUND CONTROL

Valving within the piston provides rebound control. Remember, there is fluid both above and below the piston. As the piston travels upward, the fluid flowing through the orifices within the piston offers the necessary resistance. Basically, it is the same as the base valve.

HIGH-VELOCITY REBOUND

On high-velocity rebound the disc in the base valve lifts for additional flow from the reser-

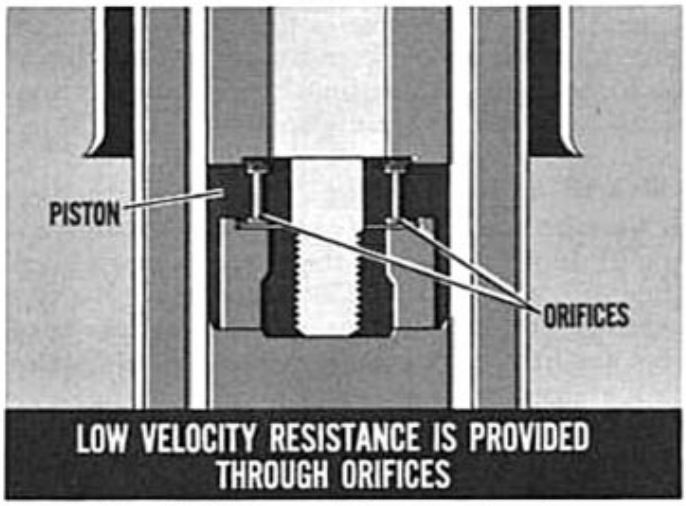


Fig. 15—Piston provides rebound control

voir. The piston is also equipped with a blow-off disc which deflects for additional flow through the piston. This prevents the rebound action from becoming too harsh or stiff.

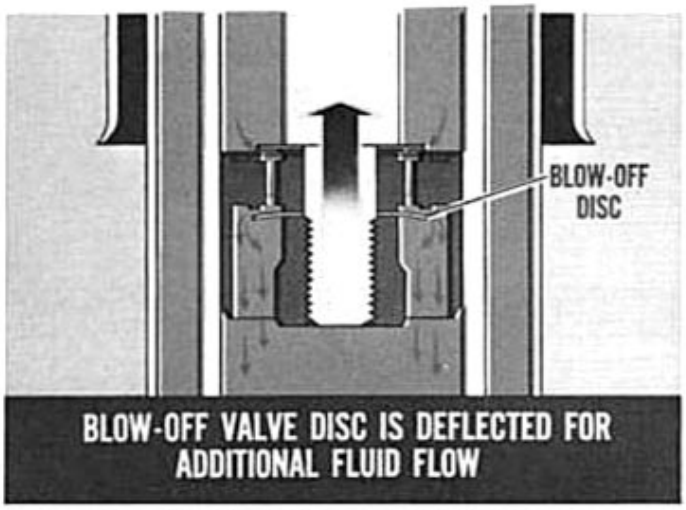


Fig. 16—Disc deflects for additional flow

WHY A LARGER OPENING?

You're probably thinking that if more resistance is needed to dampen high-velocity motion, then wouldn't a larger opening provided by the blow-off valve decrease resistance? Well, you're right. But . . . on high-velocity jounce or rebound strokes, the resistance would be so great that the harshness of the ride would be uncomfortable.

CONTROLLED BLOW-OFF

If a larger orifice were used for high-velocity shock action, the shock action would be too soft or "mushy" at low-velocity operation. So, by controlled blow-off, adequate control and comfort are achieved under all conditions.

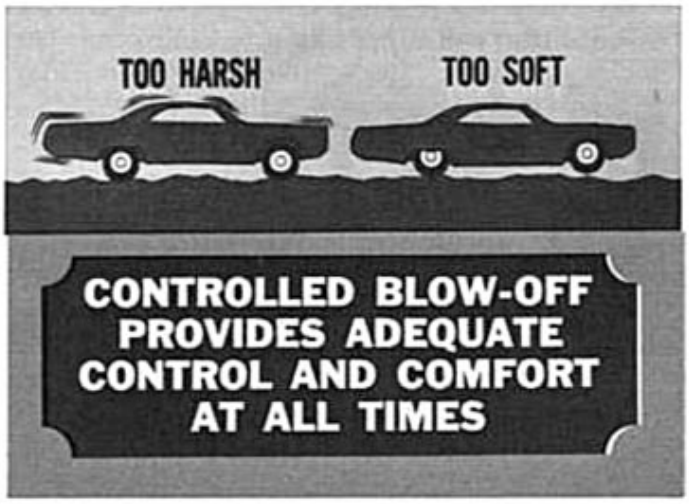


Fig. 17—Ride is neither too harsh nor too "mushy"

COMMON SERVICE PROBLEMS

By now you should be convinced that the shock absorber serves a definite purpose and is pretty important to the car's ride. You should also know by now that today's shock absorbers are designed to handle the job. A lot of owners don't realize this; and are too quick to blame the shocks when the car's ride is not what they think it should be. Right now, let's cover some common service problems you may experience regarding shock absorbers.

MOST COMMON COMPLAINTS

You're liable to run into quite a variety of shock absorber problems; but the most common conditions will be shocks that are either

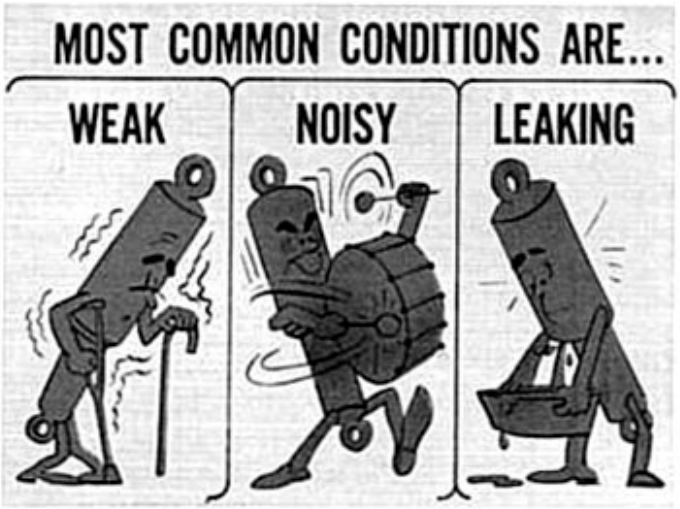


Fig. 18—Shock problems you're likely to hear about

weak, noisy, or leaking. New-car owners are the ones that are most likely to claim that the shocks are weak. Let's cover that particular condition first.

IT'S ONLY NATURAL

Virtually all of today's cars are designed to give a *soft* ride. There is a reason for this. First of all, most owners desire this type of ride. Secondly, today's improved road conditions allow this type of suspension design. Some owners are simply not aware that the ride is normal for most new cars, and that if there was something wrong with their shocks they wouldn't be getting such a smooth ride.

WHEN SHOCK COMPLAINTS ARE MOST FREQUENT

There are two instances when the owner is most likely to think that he has weak shocks. After about five thousand miles, spring stiffness and friction will work out and the ride of a new car may become noticeably softer. The rate of weak shock complaints is also likely to increase in the springtime when warmer weather decreases fluid viscosity.

CHECK FRONT SUSPENSION

If the owner complains of frequent bottoming, the problem may be in the suspension and not the fault of the shocks. Check the front suspension height; and if necessary, adjust to the correct height. Check your Service Manual for the proper specifications.

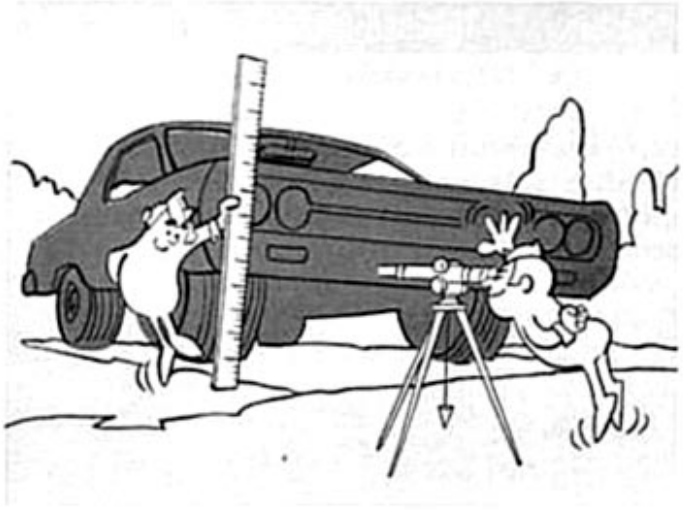


Fig. 20—Adjust front suspension to correct height

LEAKY SHOCK ABSORBERS

Springtime is when you may notice what seems to be abnormal seeping of shock fluid. That doesn't mean that you won't get seepage at any other time; but, there's a good reason why it's common at this time of the year. In winter

Fig. 19—New-car stiffness and friction will work out

Fig. 21—Fluid loss will be greater in winter

the seal gets a little stiffer and fluid loss will be greater than usual. A certain amount of fluid seepage is normal and necessary for lubrication, and does not mean that the shock is bad and should be replaced.

SHOCKS HAVE A FLUID RESERVE

Shock absorbers actually have more fluid than is really necessary. The average new shock has about a 30% fluid reserve, so a minor loss of fluid won't affect operation. A clear indication that the shock is bad and should be replaced is when leakage is sufficient for fluid to be dripping from the bottom of the shock.

NOISY SHOCK ABSORBERS AREN'T ALL BAD

Noisy shock absorbers should be replaced only if they are consistently noisy. The shock may make some noise if the car has been sitting for some time, especially in cold weather. However, a couple miles of driving should warm the shock up and eliminate the noise. If it doesn't, you should replace the shock.

INSPECTION AND TESTING

The toughest owner complaint to handle is when he says that he *thinks* the shocks are bad. Usually, the only reason that he gives is that he isn't satisfied with the ride and handling of the car.

Fig. 22—Eliminate other causes before blaming shocks

ELIMINATE OTHER POSSIBLE CAUSES

The first rule to follow in a ride and handling complaint is that the shock absorber is innocent until proven guilty. So, eliminate all *other* possible causes before blaming the shocks.

THE BEST PLACE TO START . . .

. . . is with the tires. Make sure they are properly inflated and check the treads for flat spots or uneven wear. Uneven tread wear can be the result of improper inflation, incorrect wheel alignment, or unbalanced wheels. The tread wear and the condition which caused it will affect both the ride and handling of the car.

Fig. 23—Check for flat spots or uneven wear

IT'S WORTH REPEATING

The next thing to check is one that was mentioned earlier, but it's worth repeating. Check the front suspension height and make the necessary correction. This is a *must* so that you won't mistake low or uneven suspension for poor shock absorbers when road-testing the car. We'll cover road testing later.

TAKE A QUICK PEEK

If the car is older, or has run up a lot of mileage, a visual inspection is probably the most prac-

tical thing to do first. A quick look under the car will let you spot an extremely leaky or damaged shock absorber.

TOGETHERNESS IS "OUT OF IT"

The old question is: *Do you* or *don't you* replace shock absorbers in pairs? Well, the chances of shock absorbers going bad in pairs are few and far between. Except for leakage or physical damage, a shock will last indefinitely. So, don't waste your time by replacing a good *old* shock with a good *new* one.

BOUNCING IS FOR RUBBER BALLS

Don't try to test the shocks by bouncing the car, you'll only be wasting your time. You really can't check shock absorbers by bouncing the front or rear of the car. About all this will show up is a shock that is *completely* shot.

BOUNCING PROVES VERY LITTLE

However violent, the bouncing that you can apply in the shop can only make the shocks work enough to check the least amount of snubbing action. To produce the abrupt suspension and body movements to check the *complete* control ability of the shock absorber, it's necessary to drive the car.

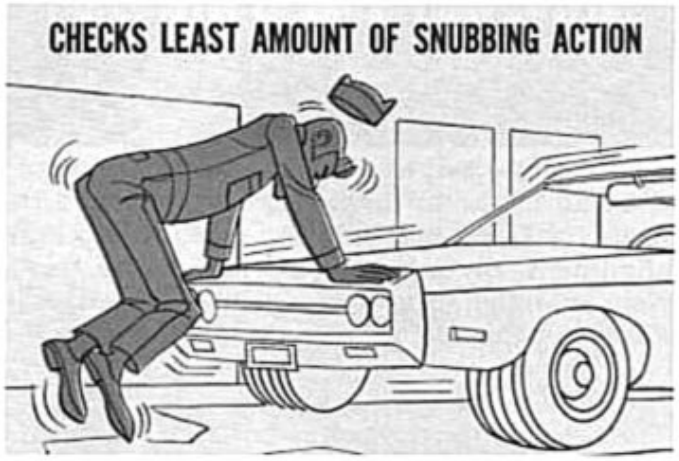


Fig. 24—Bouncing will be a waste of time

THE ONLY SURE WAY . . .

. . . to test shock absorbers is by making a thorough ride test. Because the shock absorbers must control a wide range of ride conditions, the testing procedure should cover their *minimum, intermediate* and *maximum* control functions to provide a complete checkout.

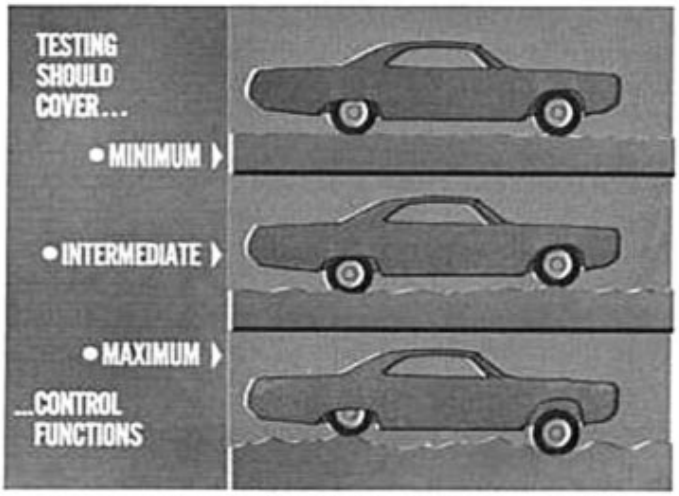


Fig. 25—Shocks control a wide range of conditions

PICK A REGULAR ROUTE

The first thing to do is to pick a route that you can use regularly for all of your road tests. Both smooth and rough stretches of pavement are a must to check the wide control range of the shock absorbers. If possible, work in a fairly rough railroad crossing. The railroad crossing can be very helpful for particular testing.

Fig. 26—Include smooth and rough stretches of pavement

THEN PICK A WINNER

The next thing is to find a car that you know is right in the suspension department, and in particular, the shock department. If you are sure the car has good ride and handling characteristics, take it for a ride over the test route you picked out. By driving the car at different speeds over the test route, you'll know what to expect when you test others of the same model.

REMEMBER AND COMPARE

When making a test run, remember the ride of your standard car and compare it with the one you're testing. Shock absorber action over minor bumps, such as expansion joints, shouldn't be harsh or stiff in comparison. The smooth rolling bumps you may find at street crossings, or low spots, should be controlled equally as well.

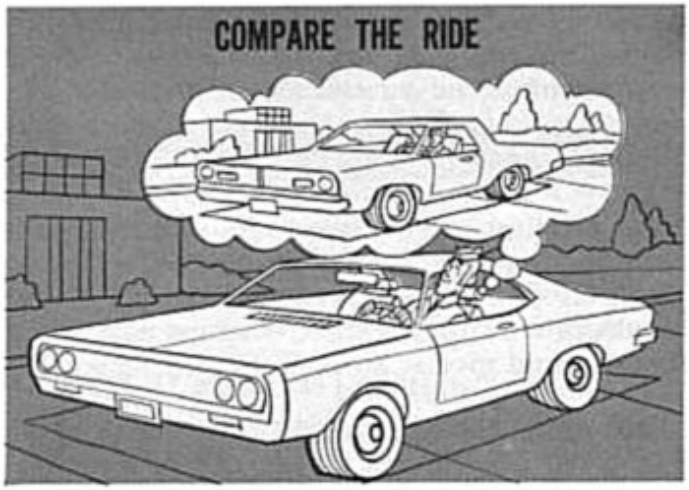


Fig. 27—Remember the ride of your standard car

MAKE A MENTAL NOTE

As you're driving over the test route, be sure to note and remember the rough spots along the way. If a car with adequate shock absorber action is able to handle suspension and body movement, then any car which you test in the future should do as well if the shocks are not faulty. You might even want to mark the test route and note the rough spots for future reference or to loan to one of your fellow technicians.

HOW TO SPOT THE BAD ONE

Once you establish the fact that the ride is below standard, you have to determine whether the trouble is front or rear, and right or left. The only way to compare individual shock action is to make repeated runs over the rough spots and check for excessive "hop" at each wheel.

SPECIAL CONDITIONS

There are some special conditions that will be very essential to your road test and will immediately tip you off to poor shock action. The two most important parts of a road test are smooth, rolling bumps and railroad crossings.

WHY SMOOTH, ROLLING BUMPS

Driving over a smooth rolling bump is one of the most important parts of the test. This type of bump will cause considerable body and suspension movement. In other words, it will cause close to maximum shock travel. Adequate shock absorber action will make the car body level out almost immediately.

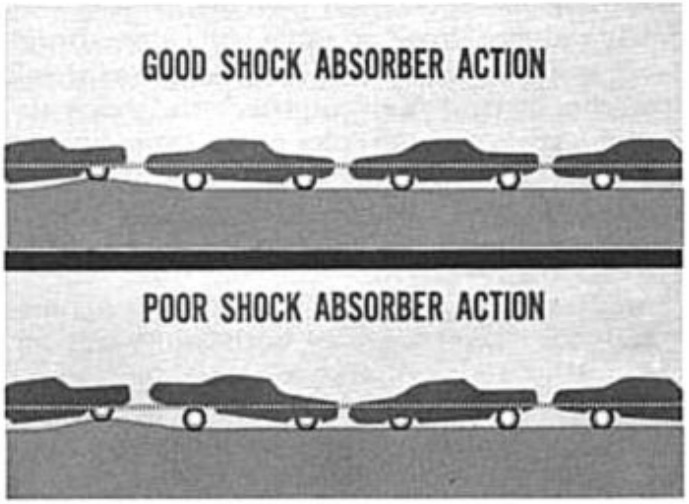


Fig. 28—A smooth, rolling bump is a good test

ONE IS ENOUGH

Poor shock absorber action in either the front or rear will cause a pitching motion as you come off of the smooth rolling bump. Incidentally, this type of bump is usually experienced in the curb lane at a street intersection. A slight warning: Don't take a series of these bumps in rapid succession; that won't prove anything and you'll be defeating your purpose.

ANOTHER WARNING

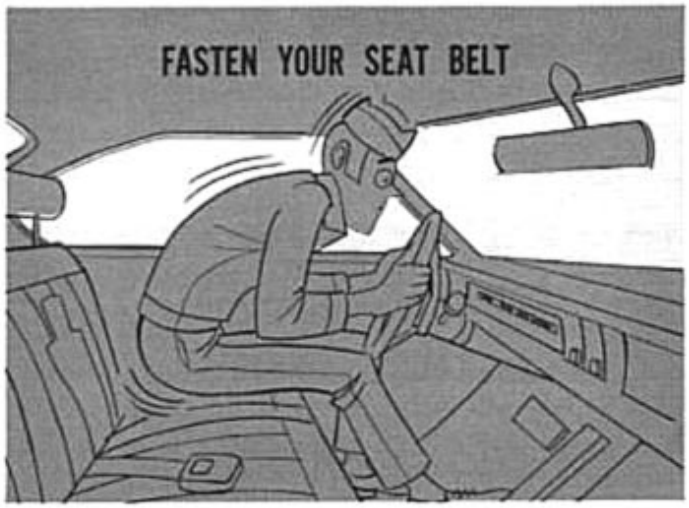


Fig. 29—Don't be alarmed if car bottoms

Be careful not to take smooth, rolling bumps too fast. The resultant pitching motion can be enough to lift you off the seat. So, *remember to fasten your safety belt*. And, don't be alarmed if the car bottoms out over a smooth, rolling bump. Remember, today's springs aren't designed to absorb that much of a load.

WHY A TRAIN CROSSING?

A train crossing will let you test things that both smooth and rough pavements won't. A fairly rough railroad crossing will cause abrupt level changes which call for *maximum* shock absorber control. You can check the shock absorber action on both sides at the same time as the front, and then the rear, wheels pass over a straight rail crossing.

IT'S A GOOD TEST FOR STRIKE-THROUGH

A multi-rail crossing is also a good test for suspension strike-through or bottoming. Driving over several sets of tracks can allow violent pitching motion if shock control is poor. Even at low speeds, this movement can cause much the same action as a smooth, rolling bump.

TRY 'EM AT AN ANGLE, TOO

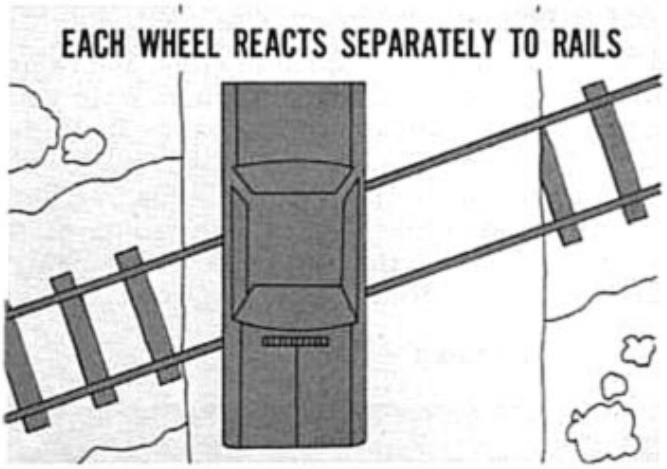


Fig. 30—You'll need some experience at this test

Driving across an angled rail crossing will let you pick out any difference in shock action between each wheel. Drive slow enough across the tracks so that each wheel reacts separately to the rails. This is kind of tricky, so you'll have to get a little experience at this test before you're able to spot a bad shock quickly.

BODY ROLLING

If either side of the car has a weak shock absorber, you'll notice that that side has a greater tendency to bounce. Improper shock absorber control on one side will allow a body rolling movement as the car crosses the tracks.

DISCONNECT THE SHOCK AND CHECK IT

You may thoroughly road-test a car and still not be sure that the shock absorbers are at fault. If you suspect a shock, but have any doubts about its condition, disconnect it at the bottom and give it an operational check.

REARS ARE EASIER THAN FRONTS

To check a front shock absorber, the suspension and wheels must hang free; so, you'll have to raise the front end of the car. Dropping the suspension gives you enough room to work the shock by hand. The rear shocks can be disconnected and hand-operated with the suspension either loaded or hanging free.

WHAT TO LOOK FOR

As you compress and extend the shock, you should feel a smooth and consistent resistance to movement. Any soft spots in the movement or overall lack of resistance, except near the end of the stroke, is a good indication that a new shock should be installed.

INSTALLATION TIPS

There are only a couple tips to follow when installing shock absorbers; but they *are* important. One is to make sure the shock is not aerated and the other concerns the bushings.

AERATION

When installing new shock absorbers, always purge the operating cylinder, or pressure tube, so that the shock is not installed on the car in an aerated condition. Air in the pressure tube can make shock operation soft, spongy, or spotty. It's also likely to be noisy, and you'll have the owner back with another complaint.

HOW TO PURGE A SHOCK

Hold the shock absorber right side up, or in the normal operating position, and extend it all the way. Turn the shock over and compress it until it is completely collapsed. Extend and compress the unit several times . . . at least a half a dozen times. What little, if any, air that remains in the fluid will be purged after a short period of operation. Remember—make sure the shock is *vertical;* and always extend the shock *right-side-up* and compress it *upside-down.*

NOW YOU'RE READY TO INSTALL

When you're ready to install the shock, always extend it in the upright position . . . *never* in a horizontal or inverted position. If you do, you'll aerate the shock all over again. If you remove a shock and plan on reinstalling it, the first thing to do is to invert it and compress it.

DON'T GET CARELESS

Be extra careful not to ever throw any shock around or get careless and drop it on the floor. The pressure tube could be damaged or the piston rod bent. A bent piston rod will put abnormal pressure on the rod guide and seal and will ruin the shock in no time.

BUSHINGS

Fig. 31—Center bushings in their normal load position

The bushings which are used inside the mounting eyes of the shock *must* be installed properly. There are also a variety of bushings that are used for different applications. Make sure you use the correct bushing and tighten the mounting nut to the correct torque.

THE BUSHING MUST BE CENTERED

Another important factor about the bushings is that they must be centered radially in their normal load position before they are tightened. The rubber bushing in the shock absorber mounting ring twists to allow movement between the shock and the part it's connected to. The bushing must be able to twist equally in either direction from the normal load position as the suspension moves up and down. This twisting action is known as "wind-up".

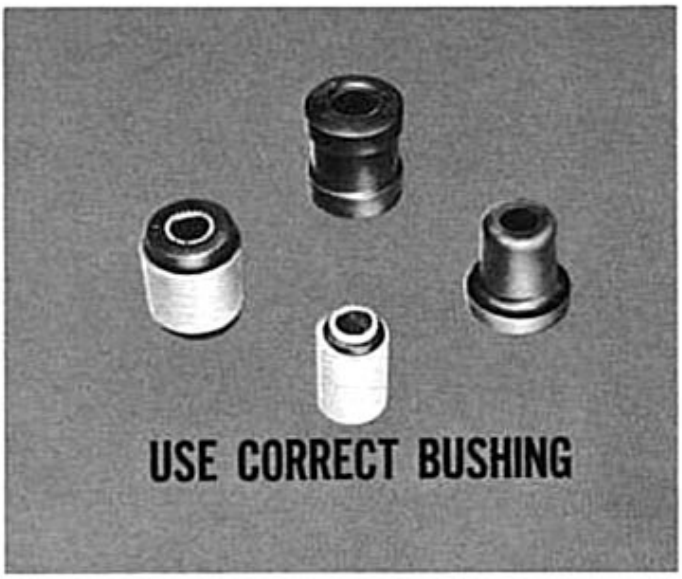


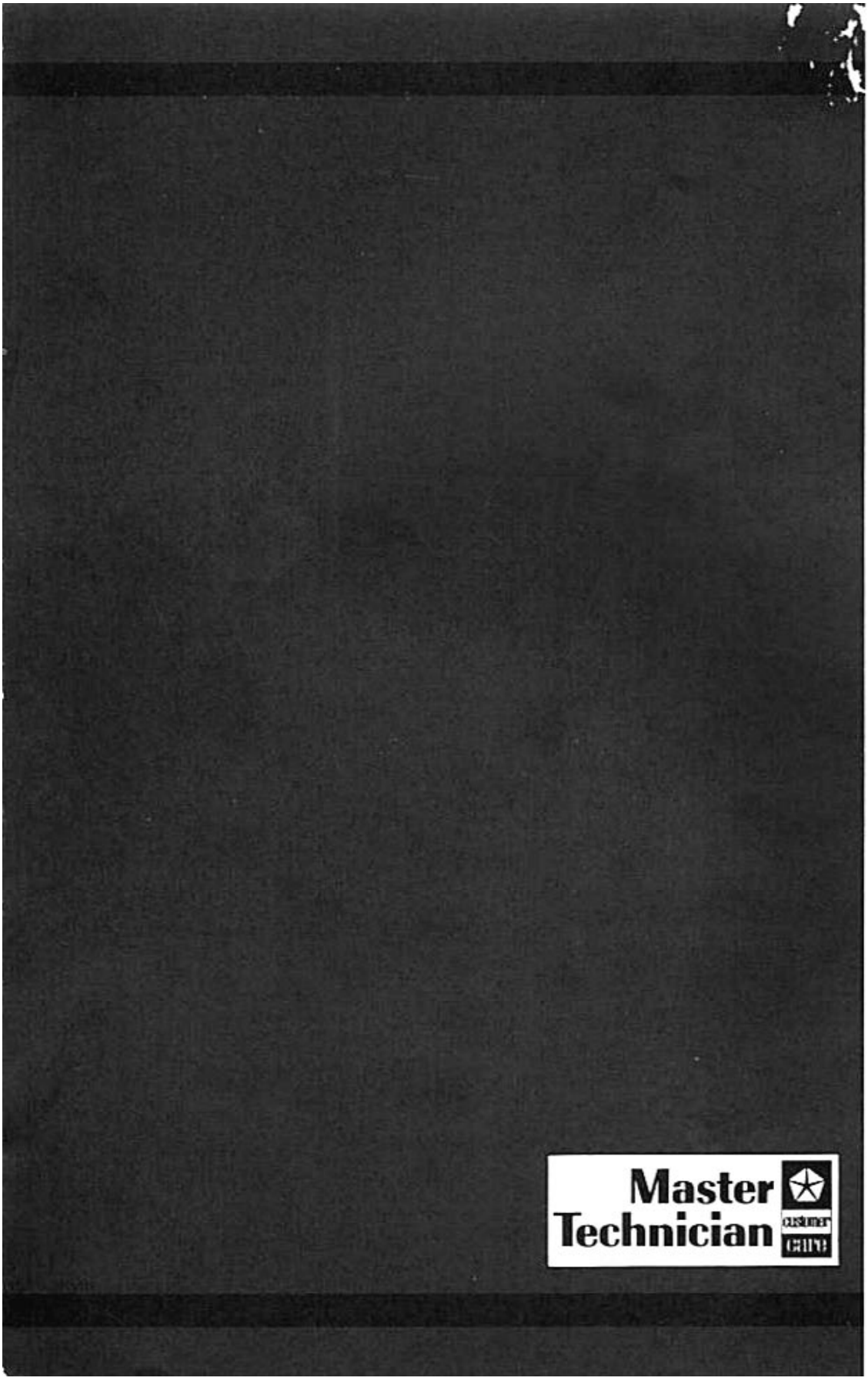
Fig. 32—There is a variety of mounting bushings

WRONG "WIND-UP" CAN CAUSE PROBLEMS

If the bushing mounting nut is tightened when the car is raised off the wheels, the bushing will wind up in one direction when the wheels and suspension return to the normal load position. The resultant wind-up puts a constant strain on the bushing as well as the piston rod and seal; which can shorten the service life of the shock considerably.

A FINAL REMINDER

Never use *any kind* of lubricant other than water or soapy water on rubber bushings *before* or *after* they are installed. A lubricated bushing may slip and wear out instead of flexing normally.



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