# MASTER TECHNICIANS SERVICE CONFERENCE 66-2

REFERENCE BOOK

# DISC BRAKES

CHRYSLER CORPORATION

PLYMOUTH · DODGE
CHRYSLER · IMPERIAL

# STOP!

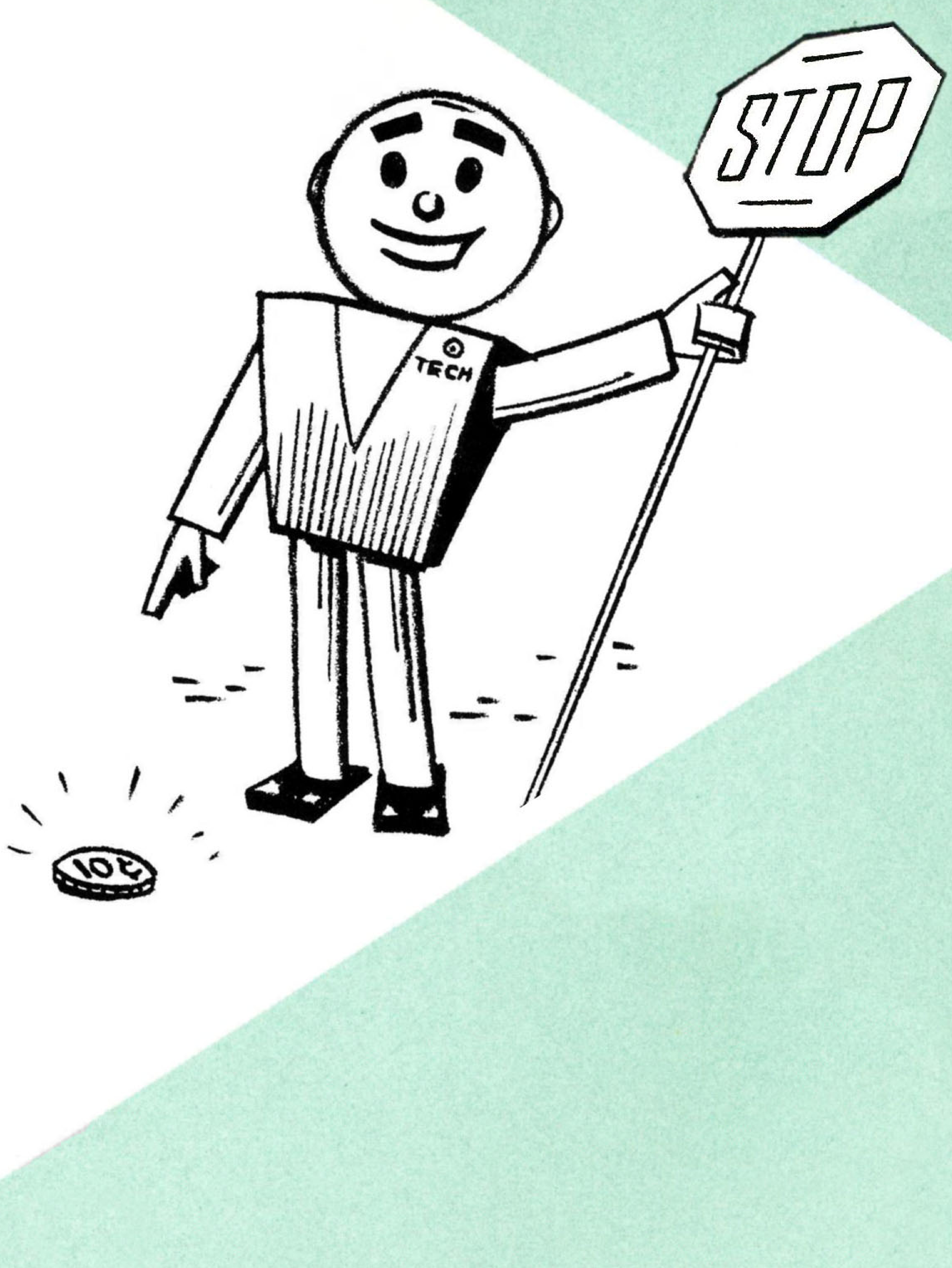
That's what our customers expect when they push the brake pedal. And, that's what they get: a safe, stable stop every time. Even after a panic stop, the car is in its own lane, instead of being slewed around crosswise to the road.

In keeping with the tradition of providing the best braking systems in the automobile industry, Chrysler Corporation is offering, as optional equipment, caliper-type disc brakes on some 1966 models. Specifically, the Valiant, Dart, Barracuda, Fury, Polara, Monaco and all Chryslers have disc options in their lines.

Tech predicts that you'll enjoy working on disc brakes. And, as they become better known to the buying public as the safest, most dependable brakes available, there is little doubt that you'll be seeing more and more of them.

This reference book describes the operation of the two disc brake systems available in 1966. (One system for the smaller cars, another for the larger cars.) Although the principles of operation of the two systems are very similar, there are some structural differences that vary servicing procedures. For instance, replacement of shoes on either of the units is very simple, and takes only a few minutes. But, there is a different procedure for each type that you'll want to know about.

The book contains some other tips on service procedures, so be sure to look it over carefully and add it to your reference book library.

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# THIS BUSINESS OF STOPPING

There isn't much doubt that the best safety device on any automobile, old or new, is a careful, skilled driver. Even the most carefully designed car can become a thing of danger in the wrong hands. On the other hand, the most careful and highly skilled driver has to rely upon the dependability of all the components of his car to keep him and his passengers safe.

## A SPRAG BRAKE

A few thousand years ago, a man with a name something like Ogachuk Gug discovered that a round wheel was a mighty handy gadget for transporting dinosaur steaks back to the cave. It was tough going on the uphill grades, but it was almost as tough going downhill, until he discovered that a log sprag worked fine as a method of preventing a runaway wagon.

## FRICTION SHOES

A few thousand years later, Wells Fargo was using a friction-type brake to control the speed of the Overland Stage. Some of those old trails covered some mighty rough country, and the horses needed help to hold the stage from running away down the side of a mountain. The driver stepped on a pedal and a shoe rubbed a wheel rim to help slow the stage.

## SELF-POWERED VEHICLES

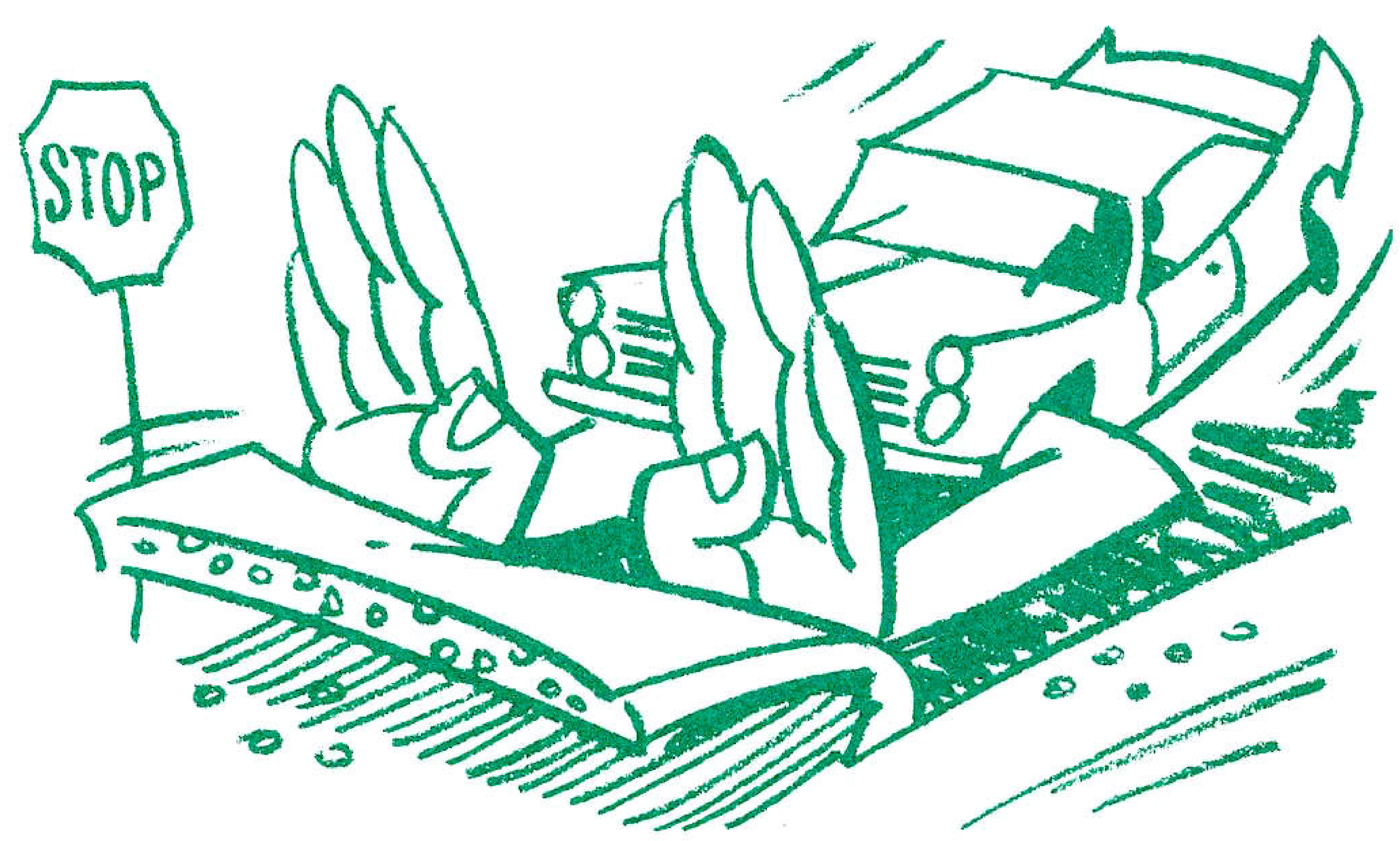
As the world progressed into the age of the automobile, the need for more powerful brakes soon became evident. Vehicles were heavier, and they moved faster. In a few short years, the brake shoe was moved from the outer wheel rim to the inside of an auxiliary rim attached to the wheel, the forerunner of our modern drum-type brake. In the mid-thirties, hydraulic power was added to the drum brake system, providing more stopping power.

## THE CHRYSLER RECORD

The cars of Chrysler Corporation have always had a very good reputation in the brake department. Among the more notable systems were our Total Contact Safe Guard, Center Plane, Three Platform and the currently used Servo-Contact brakes. In every case, Chrysler met the need for safe, dependable straight-line stopping. There's no question that our cars have led the industry.

## HEAVIER DEMANDS

A recent survey proved that there is an automobile for every 2½ people in America. And, these automobiles are on the move. Every year more people travel more miles, and at higher speeds. The cars are heavier, and they're very often loaded down with vacation gear. A three-hundred horsepower engine is no longer unusual. With all this additional "GO" power, it follows that we also need more "WHOA" power.




## HOW MUCH BRAKE POWER?

How much braking power is needed in an automobile? Consider the amount of power required to accelerate a car from a standstill to 60 miles an hour in, say, 15 seconds. Let's assume, for illustration, that it takes 100 horsepower. Now, after the car is moving at 60 miles per hour, it will take an additional 100 horsepower to bring it to a standstill in 15 seconds. As you know, you seldom have 15 seconds to stop. Again for illustration, let's assume that the stopping time is 5 seconds—one-third of the acceleration time. Horsepower is a measurement of work done in a given period of time, and the brakes must do the same amount of work that the engine did, but in one-third of the time. This means that the horsepower requirement is tripled. The brakes exert 300 horsepower in stopping the car.

### HEAT ENTERS THE PICTURE

In stopping an automobile, the brake drums and linings absorb a lot of mechanical energy and convert it to heat. For example, stopping a 4,000-pound car from a speed of 60 miles an hour develops about 620 BTU. That's enough heat to raise the temperature of the drums about 170 degrees. Repeated brake applications, such as might be encountered in mountainous country, multiply the heat load. Unless this heat is dissipated rapidly, the linings may deteriorate, the drums become distorted and, in extreme cases, the brake fluid may boil.

### DISSIPATION PROBLEMS

Way back when we had 30-inch wheels, getting rid of the heat generated by the brakes wasn't much of a problem. First of all, there wasn't as much heat to get rid of. And, the wheels and drums were well exposed to the air. The heat problem became more severe with the introduction of new suspension systems, which required that the drums be almost encased by the wheels. To add to the problem, more and more sheet metal was installed around the wheels, reducing the flow of air around the drums. Bigger tires, smaller wheels and higher speeds also presented brake heat difficulties, which in turn cause brake fade.

## ENTER DISC BRAKES

With the introduction of disc brakes, the heat dissipation problem is greatly reduced. A major portion of the disc is exposed to the air to throw off accumulated heat. The opposing action of the shoes on the disc eliminates distortion. The absence of distortion permits the use of much greater application force and special lining material with stable friction characteristics, which simply means that the gripping ability of the linings is not affected by temperature extremes.

### A GOOD BATH DOESN'T HURT

Even though the discs are exposed to road splash and dirt, the braking efficiency is not affected. Centrifugal force throws most of the water and mud off the disc, and high lining application force and temperature quickly dries the disc and pads. In addition, the pads clean the disc, even when the brakes are not applied. In the unit used on Valiant, Dart and Barracuda, there is only about five-thousandths of an inch clearance between the pads and the disc. In the other unit, the pads actually ride lightly against the disc. A spring behind each piston applies just enough force to keep the pads in light contact, without causing any noticeable drag or lining wear.

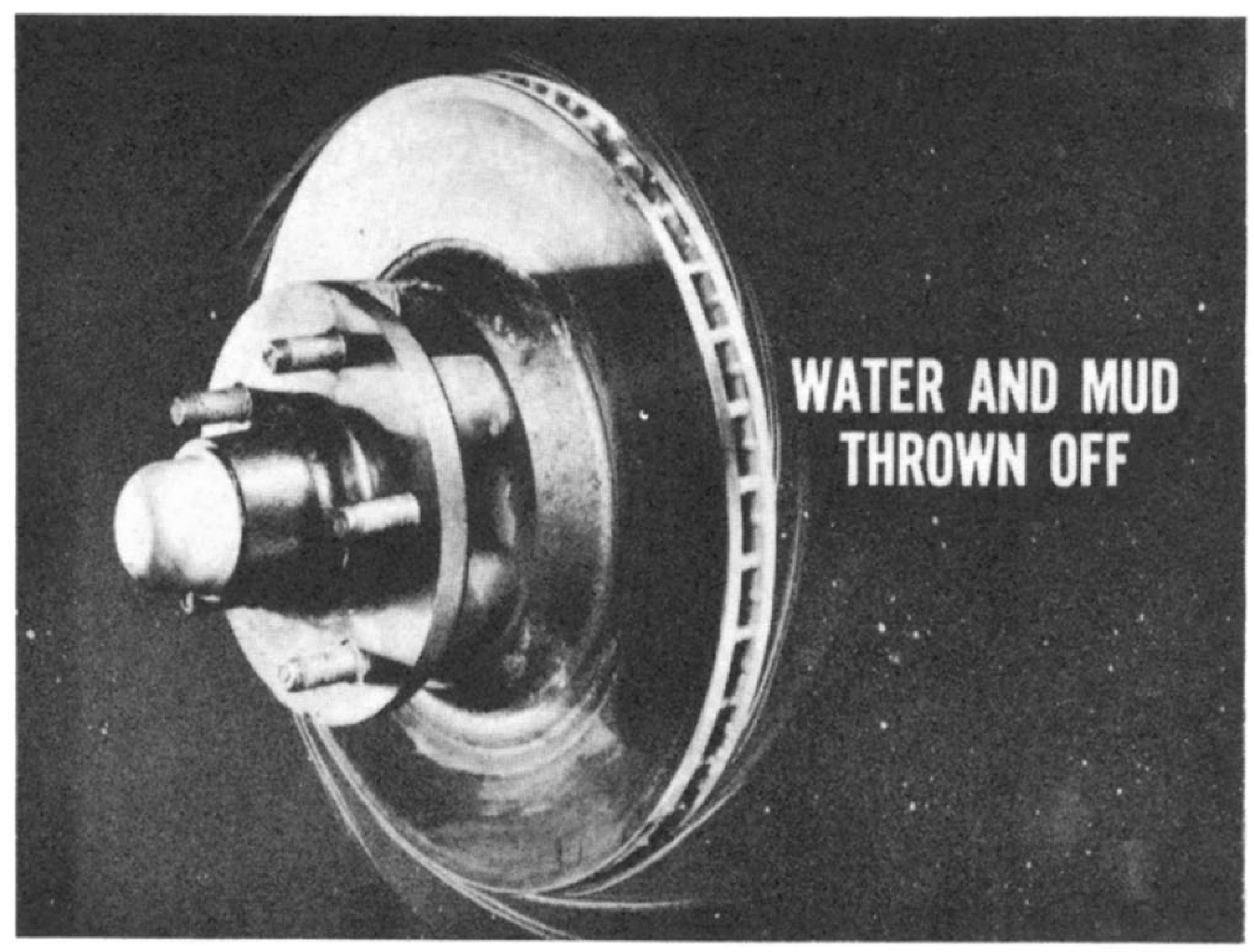



Fig. 1—Discs are self-cleaning

### WHY ONLY IN FRONT?

One of the first questions usually asked about our disc brake system is, "Why are discs used only on the front wheels?" As you know, when the brakes are applied, especially in a sudden stop, much of the car weight is thrown forward. So, most of the tire-to-road friction is at the front wheels, where the weight is, and where the most braking power is needed. If an equal amount of braking power were applied to the rear wheels, with less weight on them, they would have a strong tendency to slide, probably resulting in an uncontrolled skid.


Fig. 2—Most weight is on front wheels

### PARKING BRAKES

Another very good reason for using drum brakes on the rear wheels is that drums provide an excellent mechanical parking brake. It would be very difficult to obtain equal results from disc brakes through mechanical linkage.

### THE COST FACTOR

It's obvious that disc brakes are more expensive to build than drum brakes. There are four cylinders and pistons per wheel, and the manufacturing tolerances are very close. Since most of the braking force is applied at the front wheels, it would be highly uneconomical to use discs at the rear wheels. Any additional braking power at the rear wheels just wouldn't be worth the extra cost.

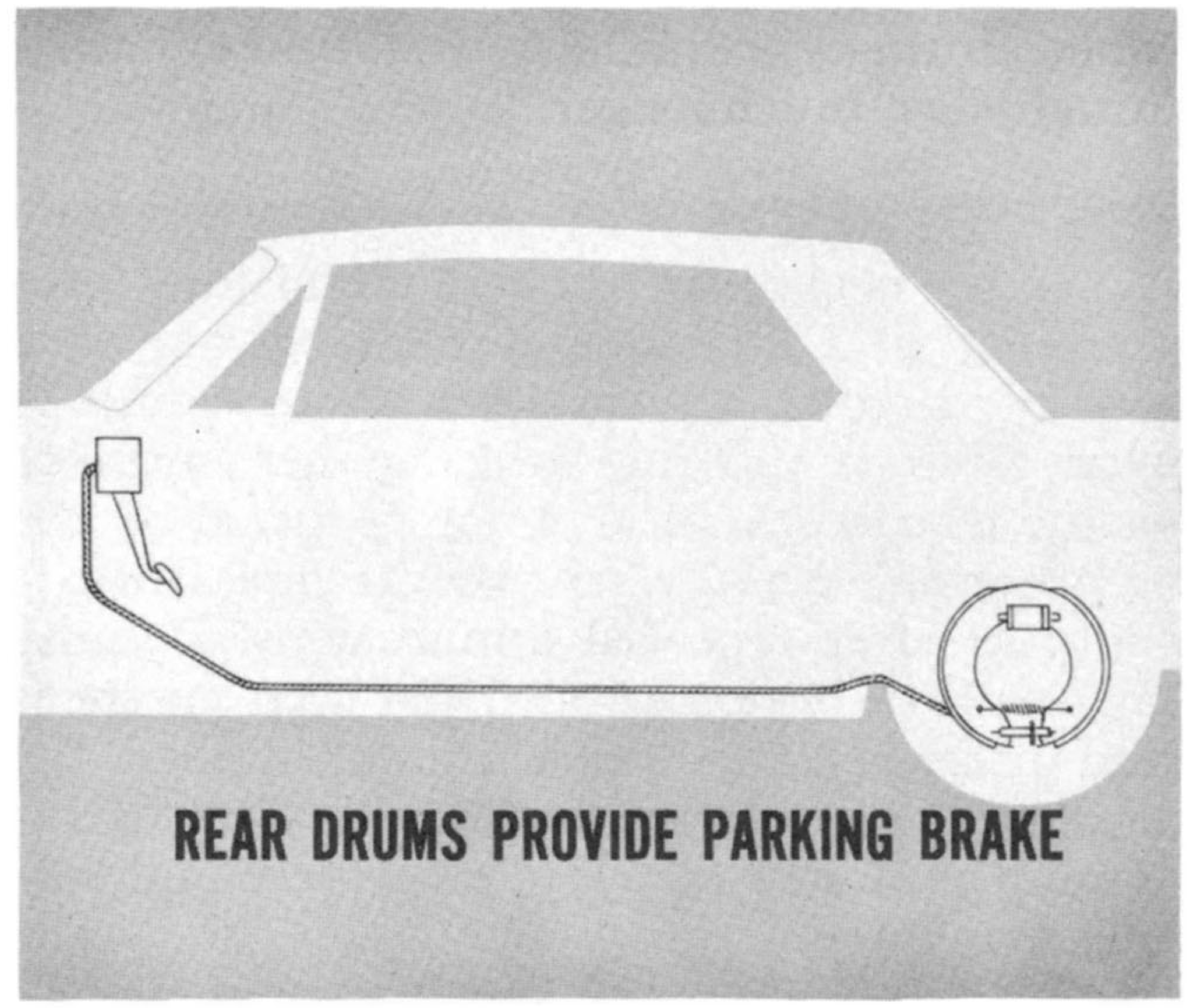



Fig. 3—Drum brakes for parking


## DISC BRAKE OPERATION

There are two different disc brake systems available in 1966. The Kelsey-Hayes-type system is used on the Valiant, Dart and Barracuda. The other unit, a Budd type, is used on the Fury, Polara, Monaco and Chrysler. Although they are structurally different, the operation of the calipers is very similar.

### THE PARTS

The basic disc brake assembly consists of a hub and disc assembly, a caliper assembly, four pistons and two shoes. The disc is bolted to the hub, and is serviced as an assembly only. The caliper assembly, containing the pistons and shoes, bolts to the steering knuckle and steering knuckle arm, and straddles the

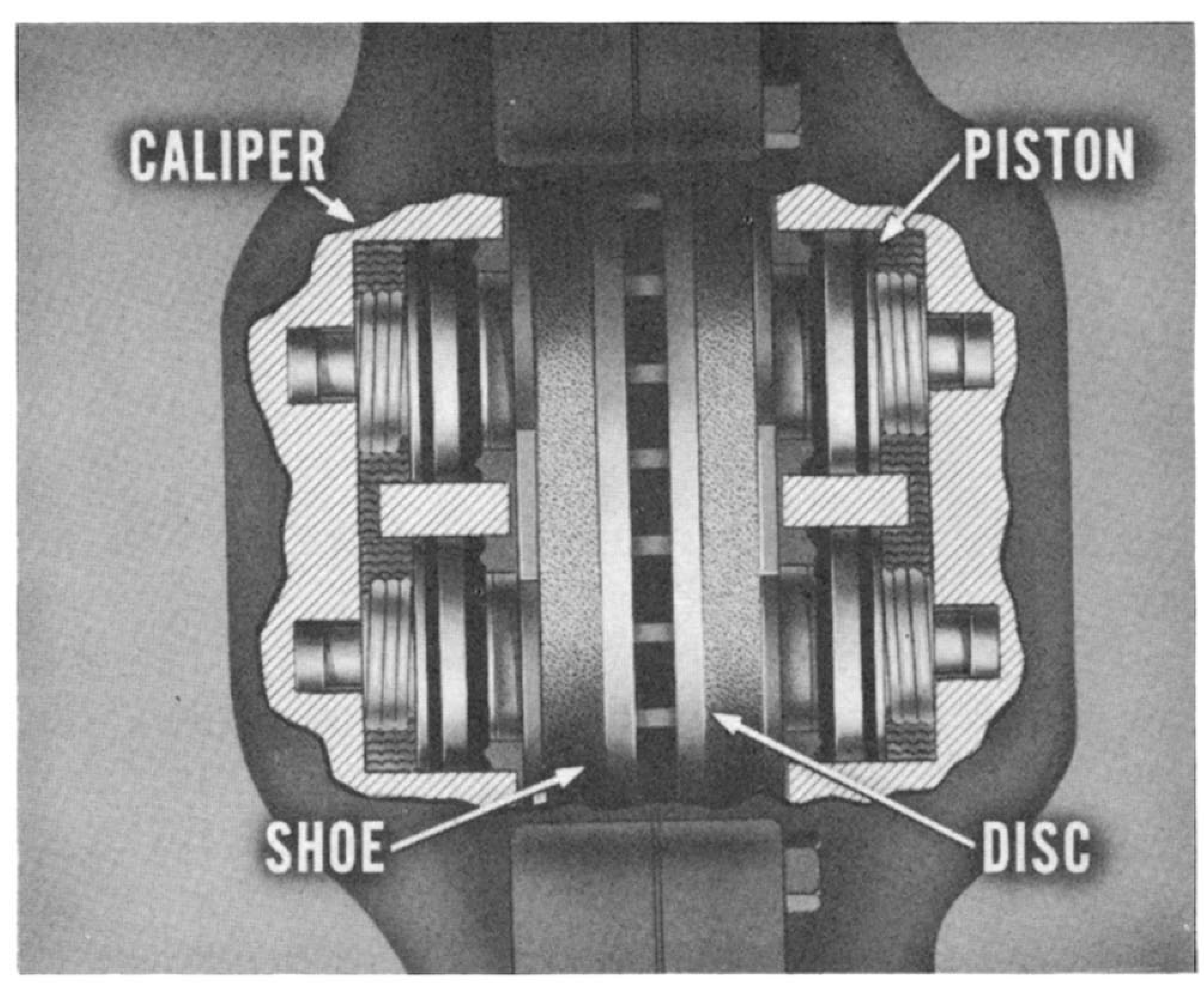



Fig. 4—Disc brake components

has a very important function. The residual pressure keeps the wheel cylinder cups against the cylinder wall, so no dirt or moisture can enter the system. But, most important, the residual valve makes it possible to pump the brakes when the linings have worn somewhat. Here's how it works.

When the brake pedal is pressed, the master cylinder piston forces the fluid in the cylinder through the residual valve and into the lines. As the pedal is released, the shoe return springs in the wheels force the fluid back out of the wheel cylinders and lines and back into the master cylinder. The residual valve maintains from 12 to 18 psi in the lines by closing when the line pressure drops to the valve capacity. If the brake pedal is pumped, the fluid return will be delayed by the residual valve, and the master cylinder will be refilled from the reservoir, through the compensating port. On the next pedal stroke, this fluid will also be forced into the lines, building up the pedal height.

### THE VALVE HAS BEEN MOVED

The residual valve has been relocated for disc brake systems. Residual pressure is highly undesirable in the disc brake calipers. Because of the large diameter of the pistons, and since there are no return springs in the calipers, residual pressure would cause a heavy brake drag. For example, if there were 18 psi residual pressure in the front wheel cylinders of a Fury or Polara equipped with discs, the shoes would exert 320 pounds of force on each disc. However, residual pressure is still necessary for the drum brakes at the rear wheels. So, the valve is located between the "T" connection and the brake line to the rear wheels.

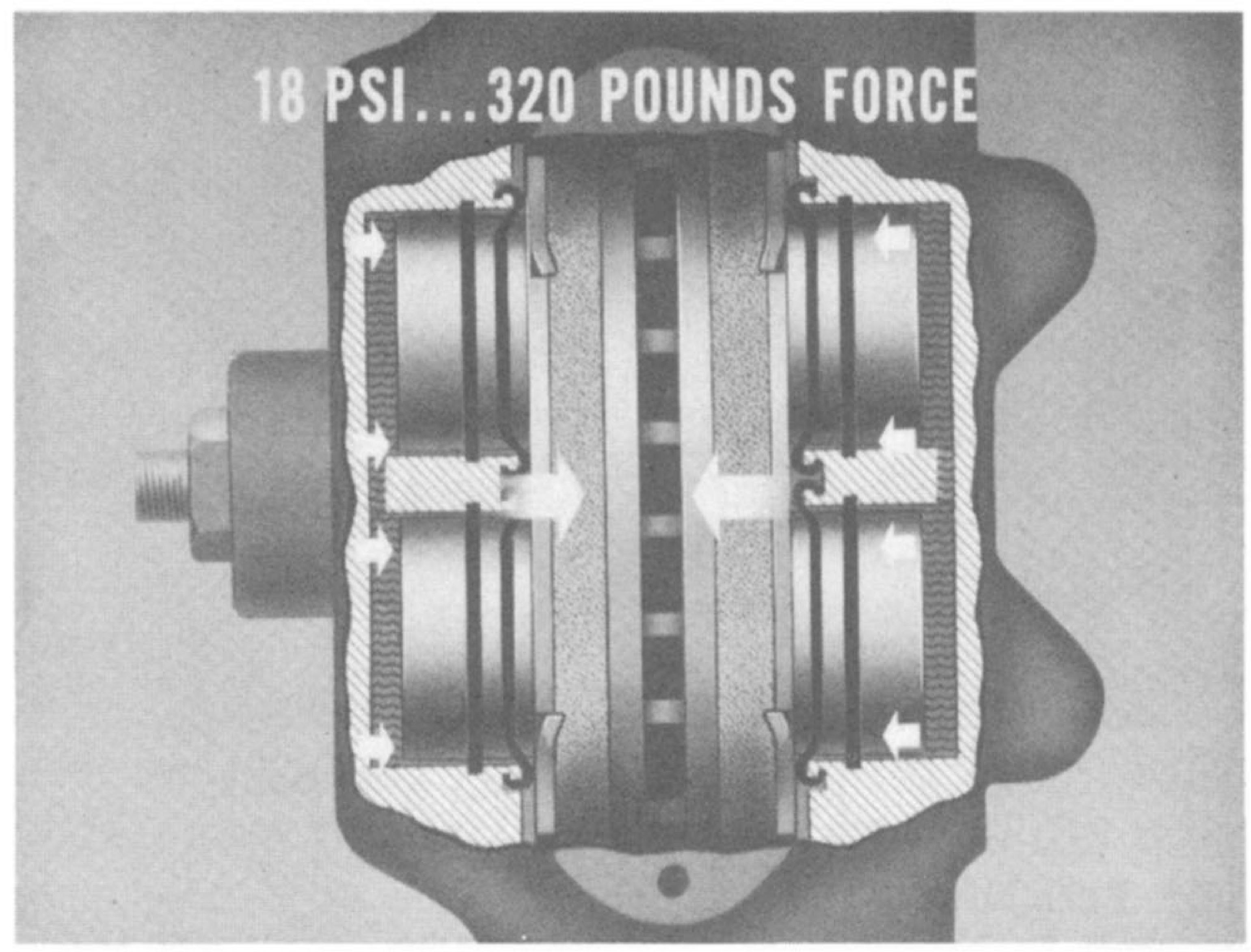



Fig. 8—Residual pressure would cause drag


## DIFFERENCES IN THE SYSTEMS

### KELSEY-HAYES

The Kelsey-Hayes-type unit, used on the Valiant, Dart and Barracuda, has 1⅝-inch-diameter pistons. Each lining has 8½ square inches of braking surface. The rear wheels have 10-inch brakes, with 1¾-inch-wide linings. Fourteen-inch wheels are used with this disc brake system.

When the brakes are applied, the four pistons press the shoes against either side of the disc. The square piston seals, in the walls of the cylinders, move slightly with the pistons. When the brakes are released, the elasticity of the seals pulls the pistons back away from the shoes about five thousandths of an inch.

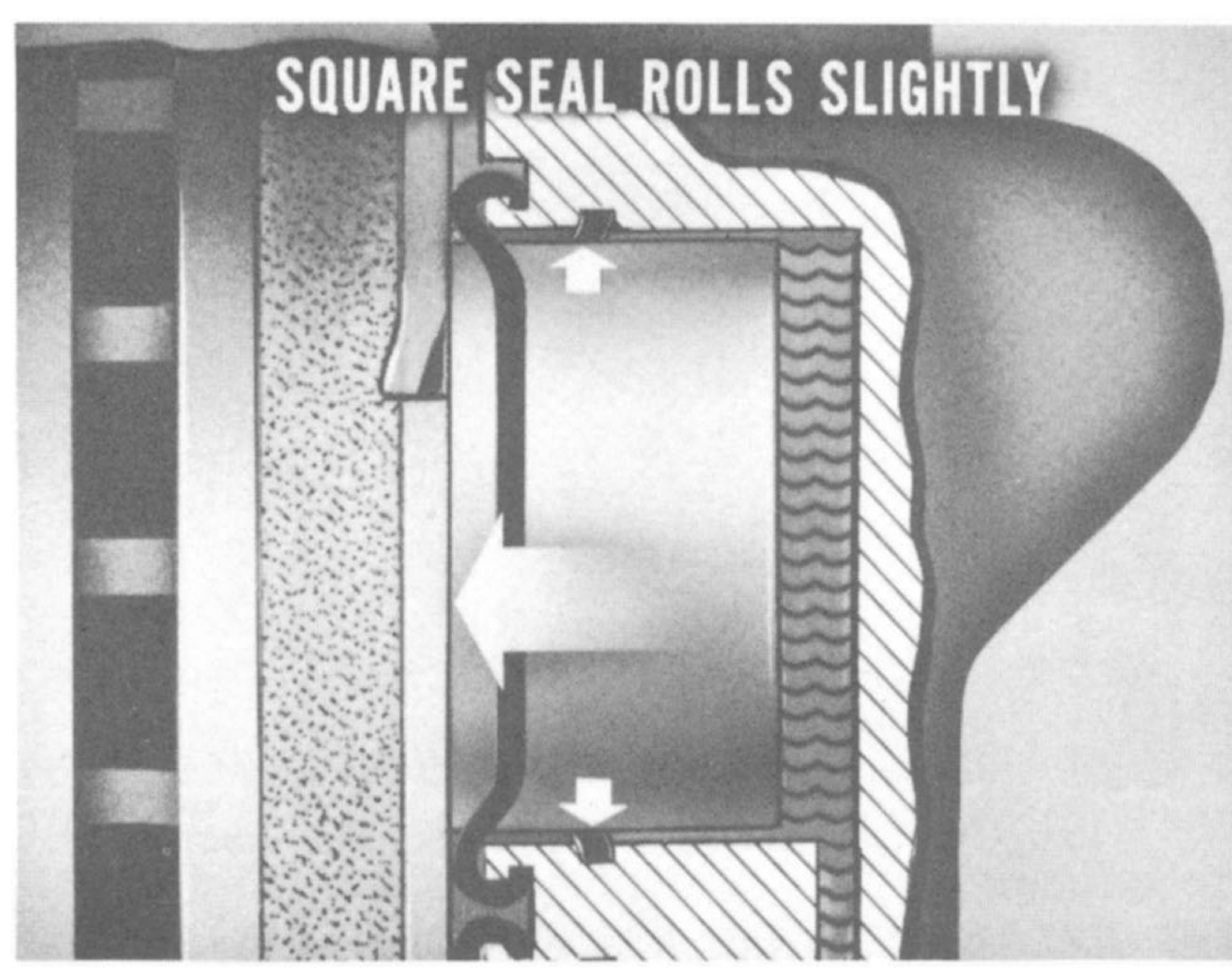



Fig. 9—The piston rolls the seal

pressure seldom exceeds 300 psi. Under these light braking conditions, the weight differential between front and rear wheels is much less than during heavy applications, so a larger percentage of the braking force can be applied to the rear wheels without fear of sliding the rear wheels. However, as brake application increases in intensity, more weight is thrown onto the front wheels, and correspondingly less on the rear wheels. So, the greatest force must be applied to the front wheels. And, although the piston area in the disc front brakes is much greater than in the rear drum brakes, remember that the discs have a much smaller lining area.

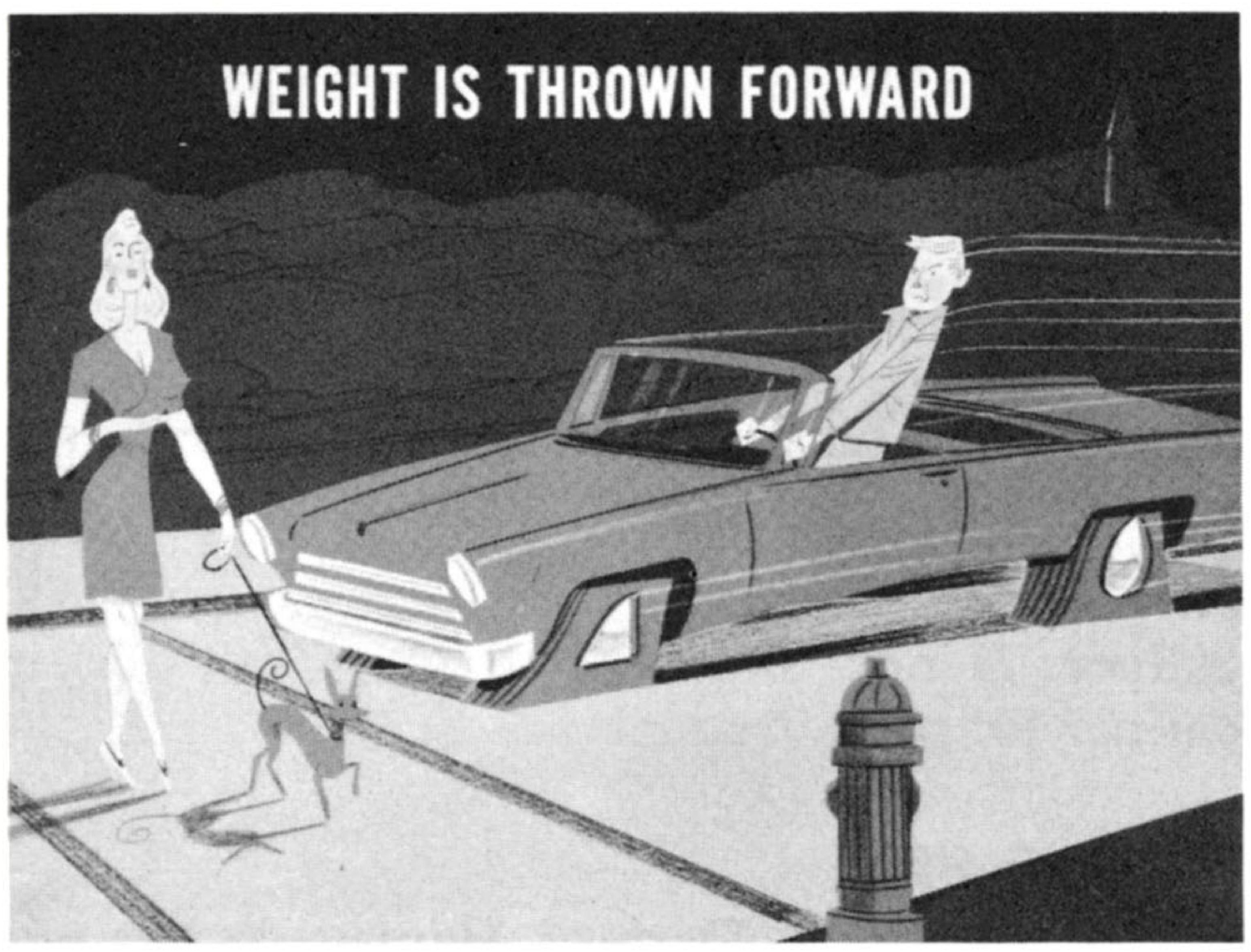



Fig. 14—Weight distribution is important

### THE PRESSURE LIMIT

To demonstrate the function of the proportioning valve, let's assume some braking applications of different intensities. First, a light application, with up to 300 psi line pressure from the master cylinder. This would be typical of a gradual stop at an intersection in a residential area. As mentioned before, there isn't much weight differential between front and rear wheels, so equal pressure is supplied to all four wheels.

A traffic light that changes unexpectedly presents a good example of a moderately heavy brake application, with perhaps 600 psi line pressure from the master cylinder. This puts a higher percentage of the car weight on the front wheels, so the braking force required at the rear wheels will be proportionately less than at the front. The proportioning valve allows only 450 psi to the rear cylinders, even though the caliper cylinders get the full 600 psi.

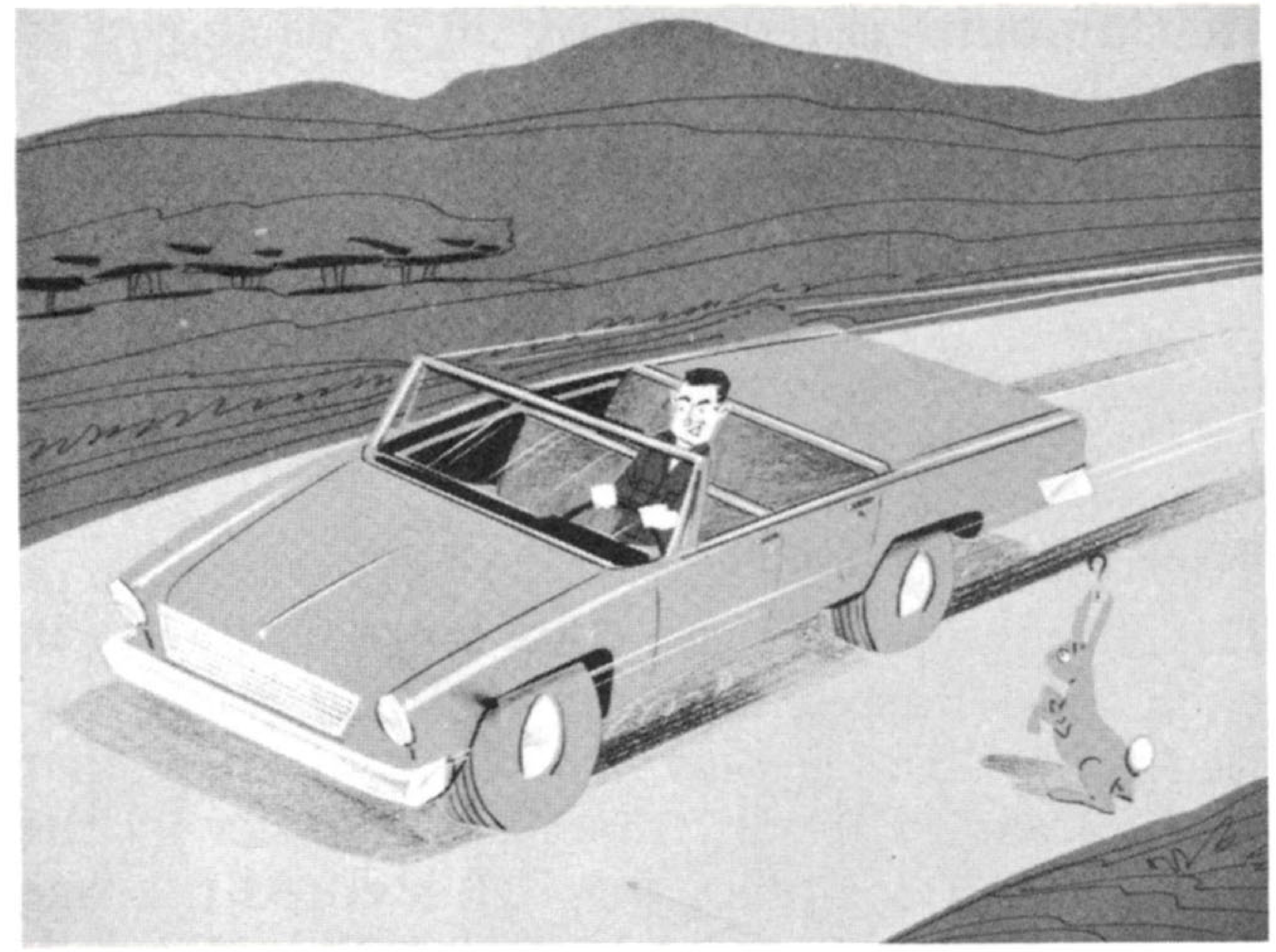


Fig. 15—Moderately heavy stop

When that crazy driver pulls out of a stop street without looking, you have to really clamp down on the stoppers. Again, the weight shift is greater, so the braking proportion changes, too. Let's say you're standing on the pedal, and producing 900 psi master cylinder pressure. You sure don't want that much pressure at the rear wheel cylinders, so the proportioning valve cuts it down to 600 psi.

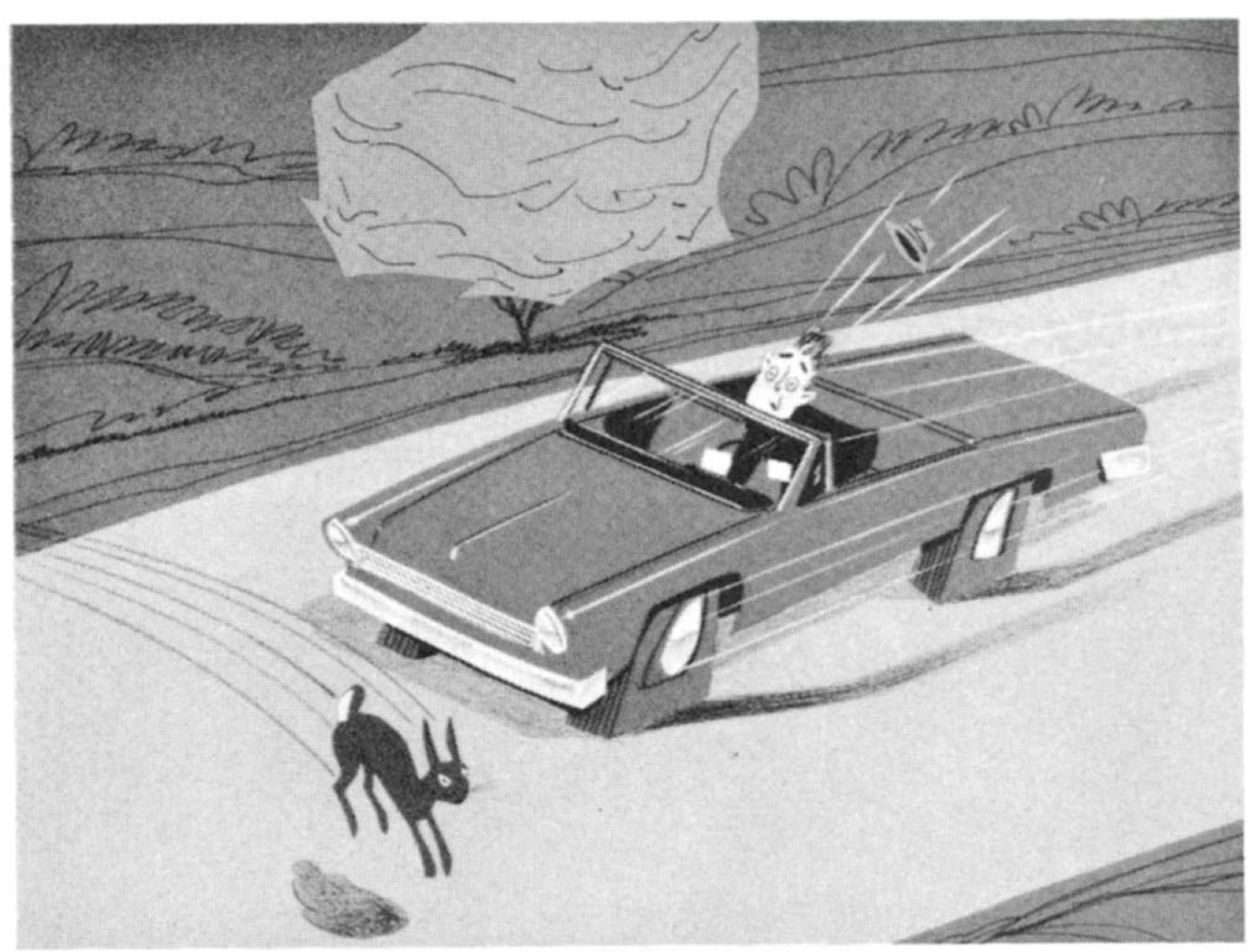


Fig. 16—A panic stop

### OVER 300 PSI, REDUCES 50%

As you can see by the examples given, at pressures of 300 psi or less, the proportioning valve doesn't do a thing for us. When pressures go higher than 300 psi, the valve allows the 300 to the rear cylinders, but anything greater than that amount is reduced by 50%, as shown in the following chart.

| LINE PRESSURE | REAR PRESSURE |
|---|---|
| 300 | 300 |
| 500 (300 + 200) | 400 (300 + 100) |
| 700 (300 + 400) | 500 (300 + 200) |
| 900 (300 + 600) | 600 (300 + 300) |

### INTER-CYLINDER SUPPLY

Even though there are four large cylinders in each caliper assembly, there is a single hydraulic feed line to the bottom cylinder in the inner half of each caliper. The top cylinder in the inner half is supplied through a cored passage in the casting. The cylinders in the outer caliper half are supplied through a transfer tube from the inner half.


Fig. 17—Tube supplies outer caliper half


## SERVICE INSTRUCTIONS AND PRECAUTIONS

### SERVICING KELSEY-HAYES

Disc brake linings on the Valiant, Dart and Barracuda should be replaced when they are worn to the point where the combined thickness of the shoe and lining is 3/16-inch or less. Inspection and replacement of the shoes is very simple. Just remove the front wheel and the caliper splash shield anti-rattle spring assembly. You should be able to measure the shoe and lining thickness while they're in the caliper. If not, simply pull them out of the caliper for measurement.

### WARNING SIGNAL

When a Valiant, Dart or Barracuda has accumulated a lot of mileage, the customer may complain of a scraping noise when the brakes are applied. The noise is probably caused by signal tabs in the brake shoe. They are stamped into the shoe to act as a signal to the driver

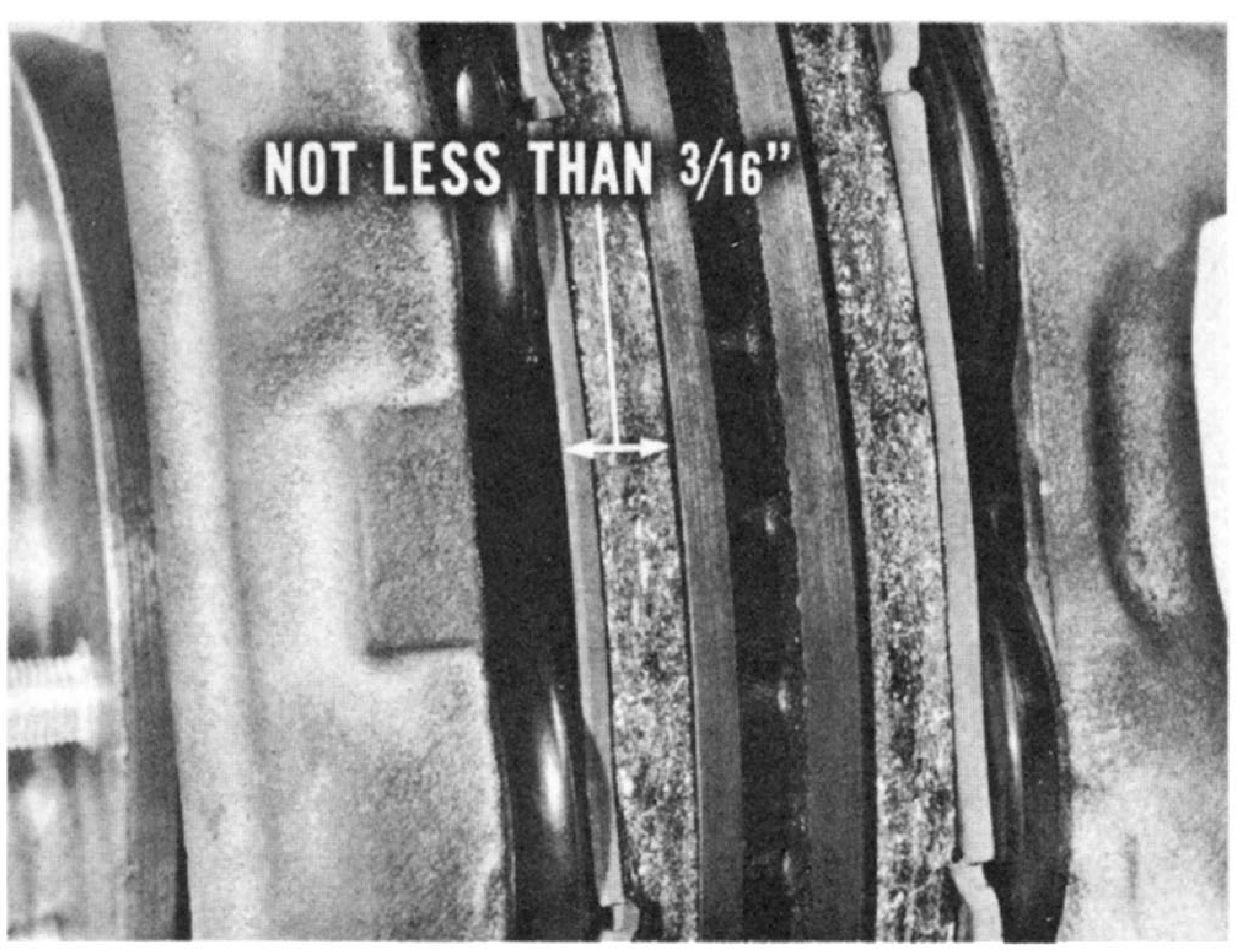



Fig. 18—Time to replace linings

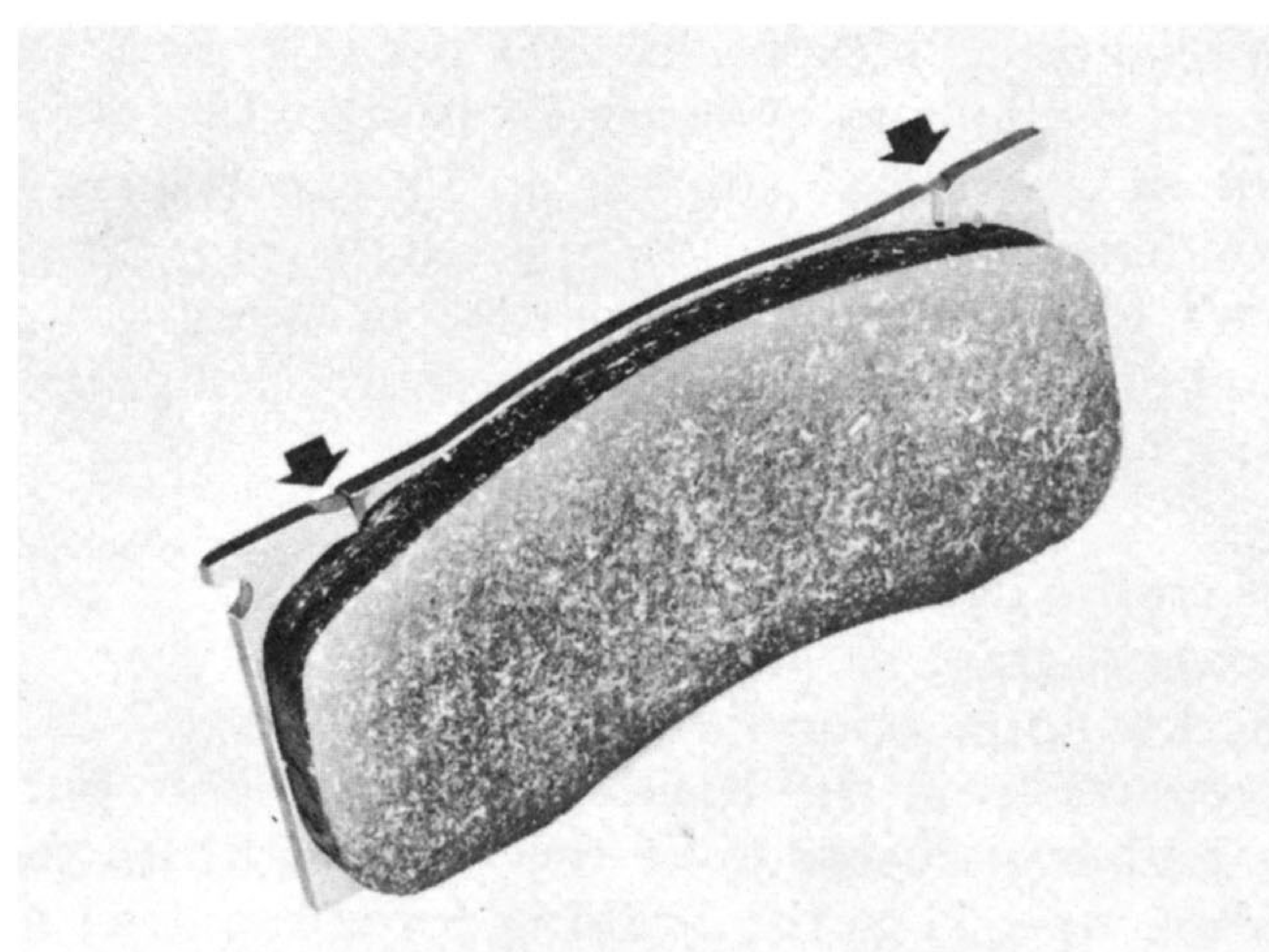


Fig. 19—Tabs signal worn out shoes

when the linings are worn down to the danger point. When the brakes are applied, the tabs contact the disc to produce the scraping sound. This won't affect the braking or harm the disc, provided the linings are changed within a short length of time.

### LINING REPLACEMENT

To replace the linings in the Kelsey-Hayes unit, remove the wheel and the caliper splash shield anti-rattle assembly and pull the worn linings out through the splash shield opening. You'll find that two pairs of pliers make it a little easier to grip the shoes. Always inspect the caliper carefully for signs of fluid leakage.

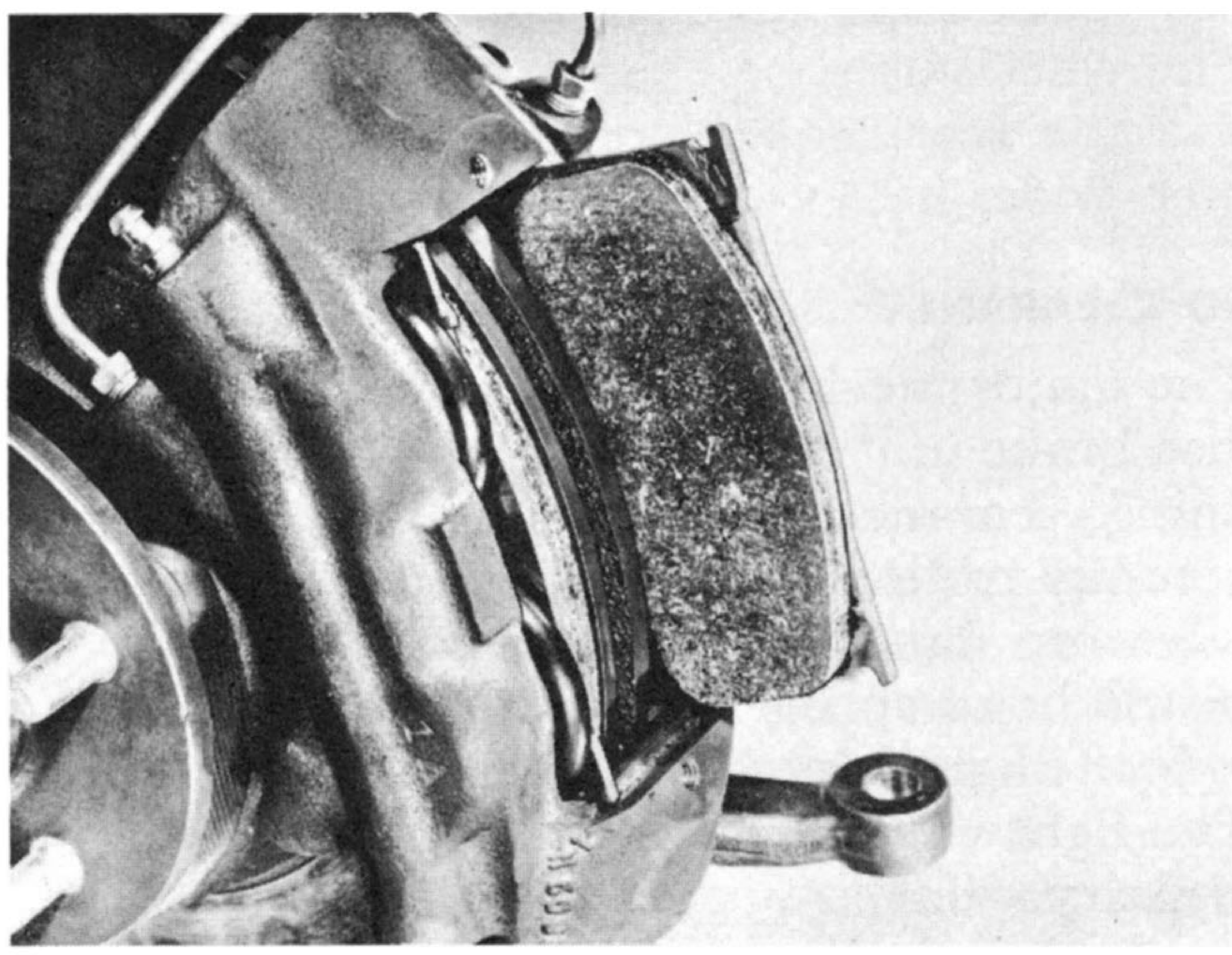


Fig. 20—Shoe replacement is an easy job

You may need to remove the caliper for seal replacement. To install the new shoe and lining assemblies, force all four pistons back into their bores and simply drop the new shoes into the caliper through the splash shield opening.

### DRAIN SOME FLUID

As the brake linings wear down, it takes more fluid to fill the cylinders. Since there are four large cylinders at each front wheel, and there is about 3/8-inch difference between the thickness of a worn lining and that of a new lining, you can see that a lot of fluid can be added to the reservoir during the lining wear period. When you try to force the caliper pistons back into their bores, this extra fluid has no place to go. So, before installing new linings, drain most of the fluid from the master cylinder reservoir. Just be mighty careful not to get any dirt in the reservoir. When the new shoes are installed and you have a firm pedal, refill the reservoir with *new* brake fluid.

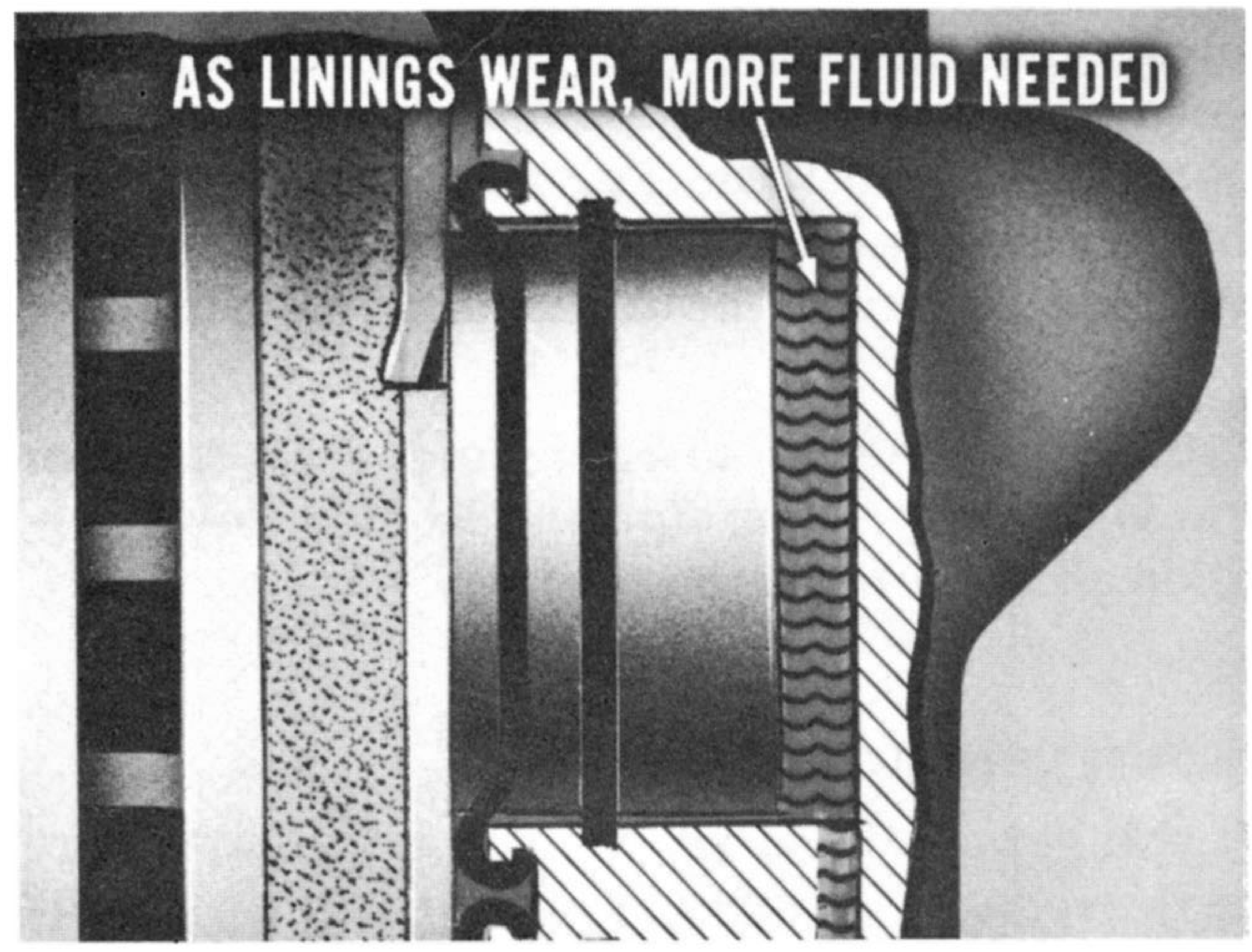



Fig. 21—Fluid level should be checked often

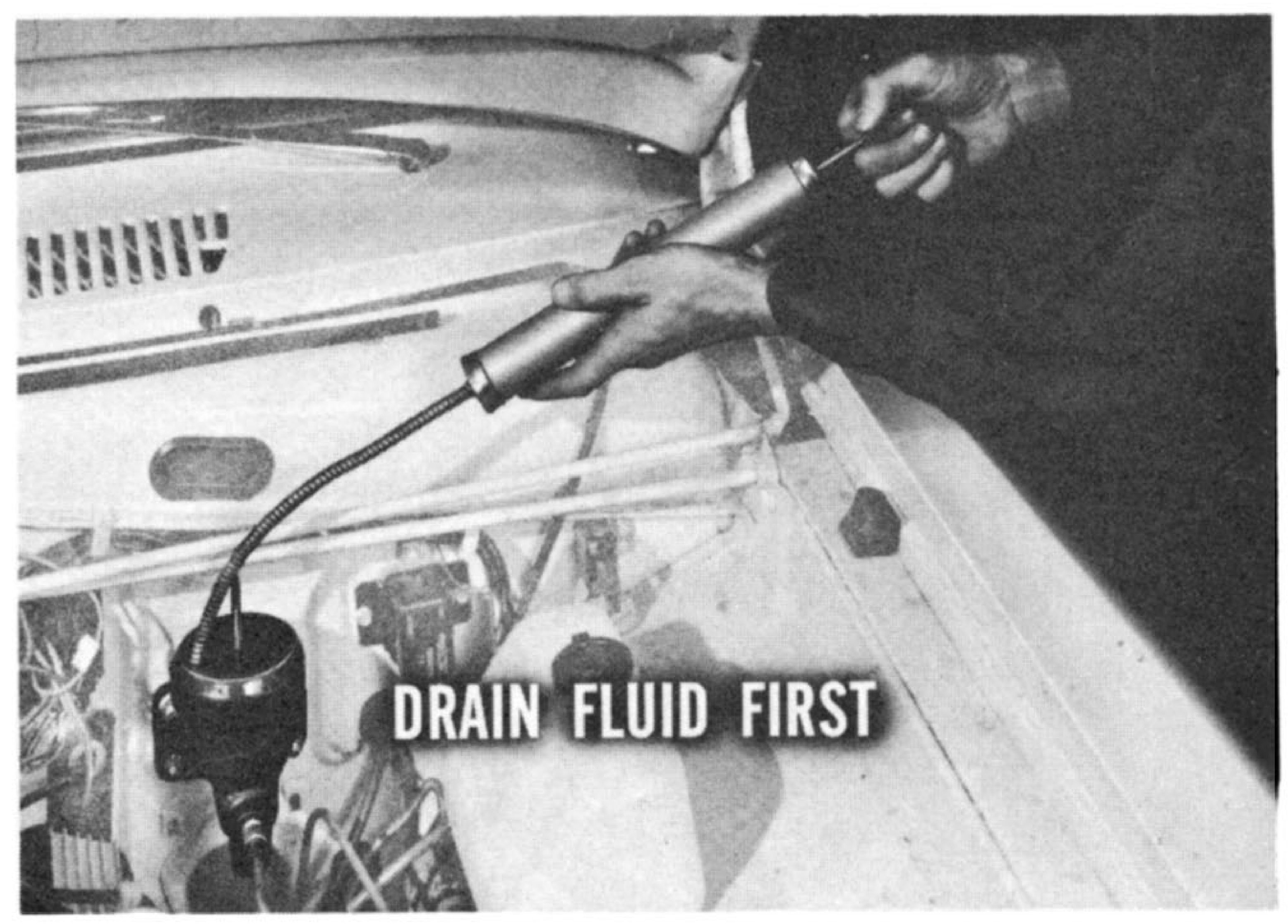



Fig. 22—Make room for fluid in the calipers

### BLEEDING

The bleed screw on Valiant, Dart and Barracuda disc brakes is located at the top of the

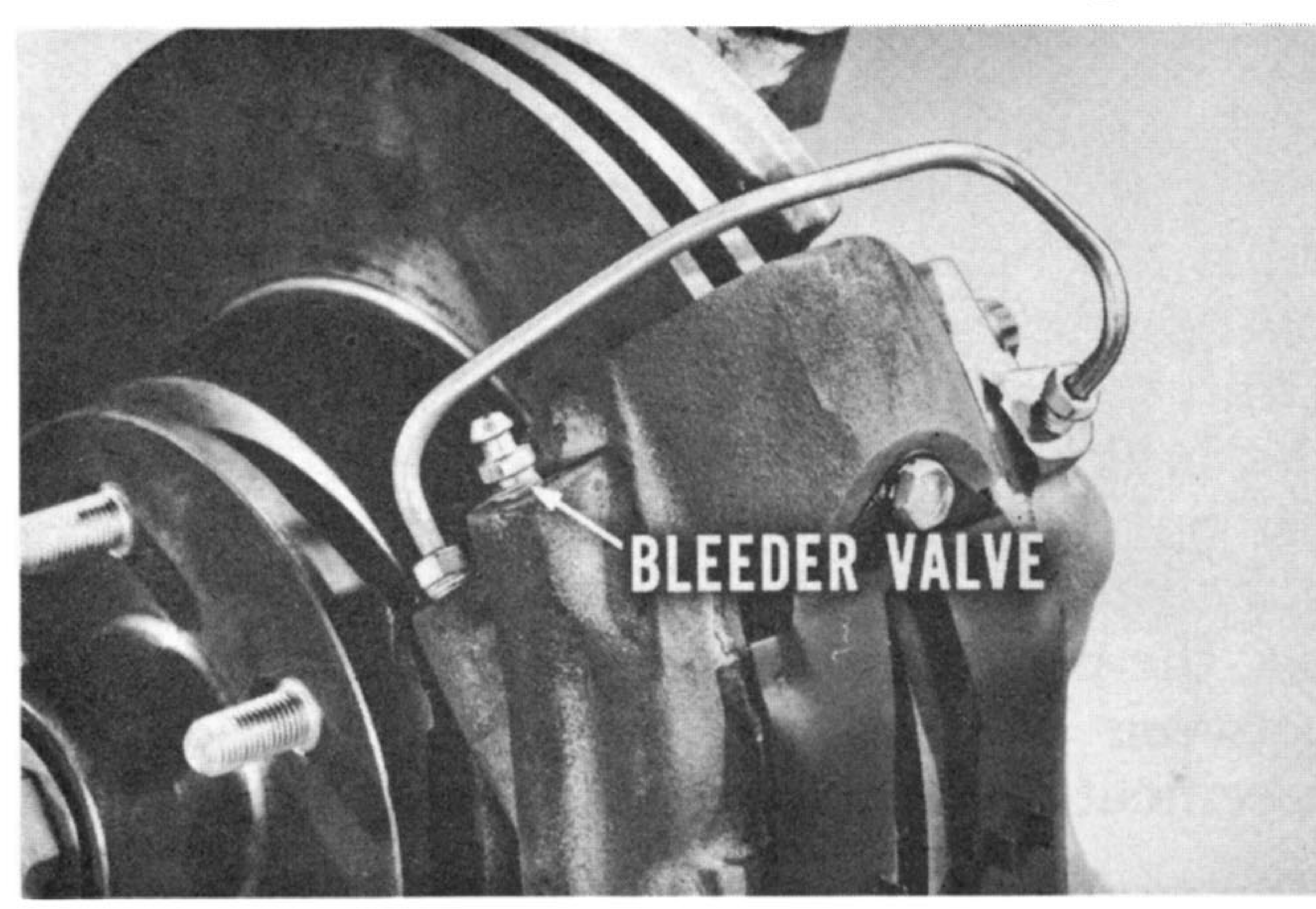



Fig. 23—Remove the wheel to bleed caliper

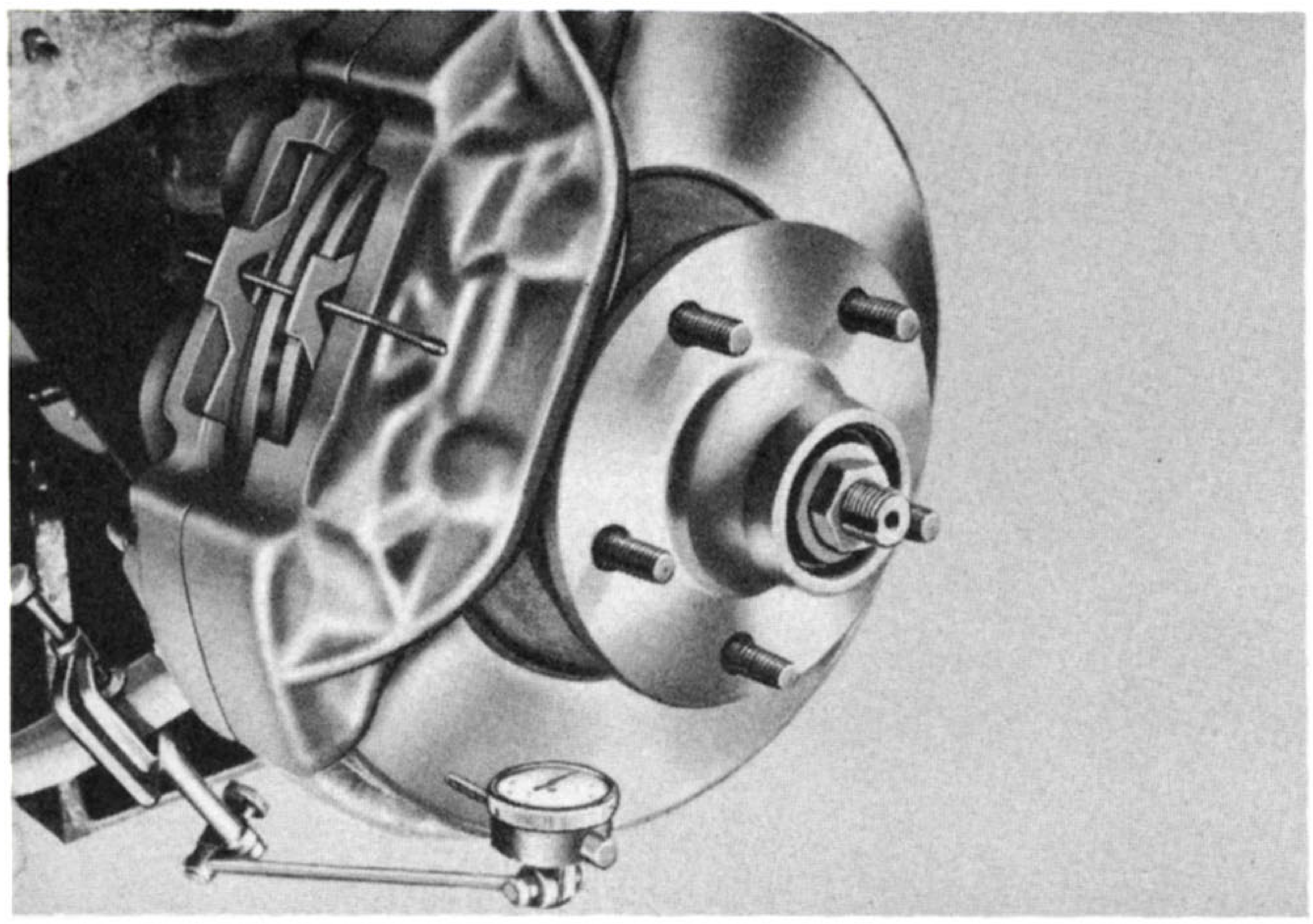


Fig. 33—Check lateral runout of disc


Fig. 35—Used on Valiant, Dart and Barracuda

## BEARING SERVICE

It is not possible to remove the wheel and hub as an assembly. If you have to service front wheel bearings, you must first remove the wheel to gain access to the caliper. After the caliper is removed, then the hub and disc are removed as an assembly.

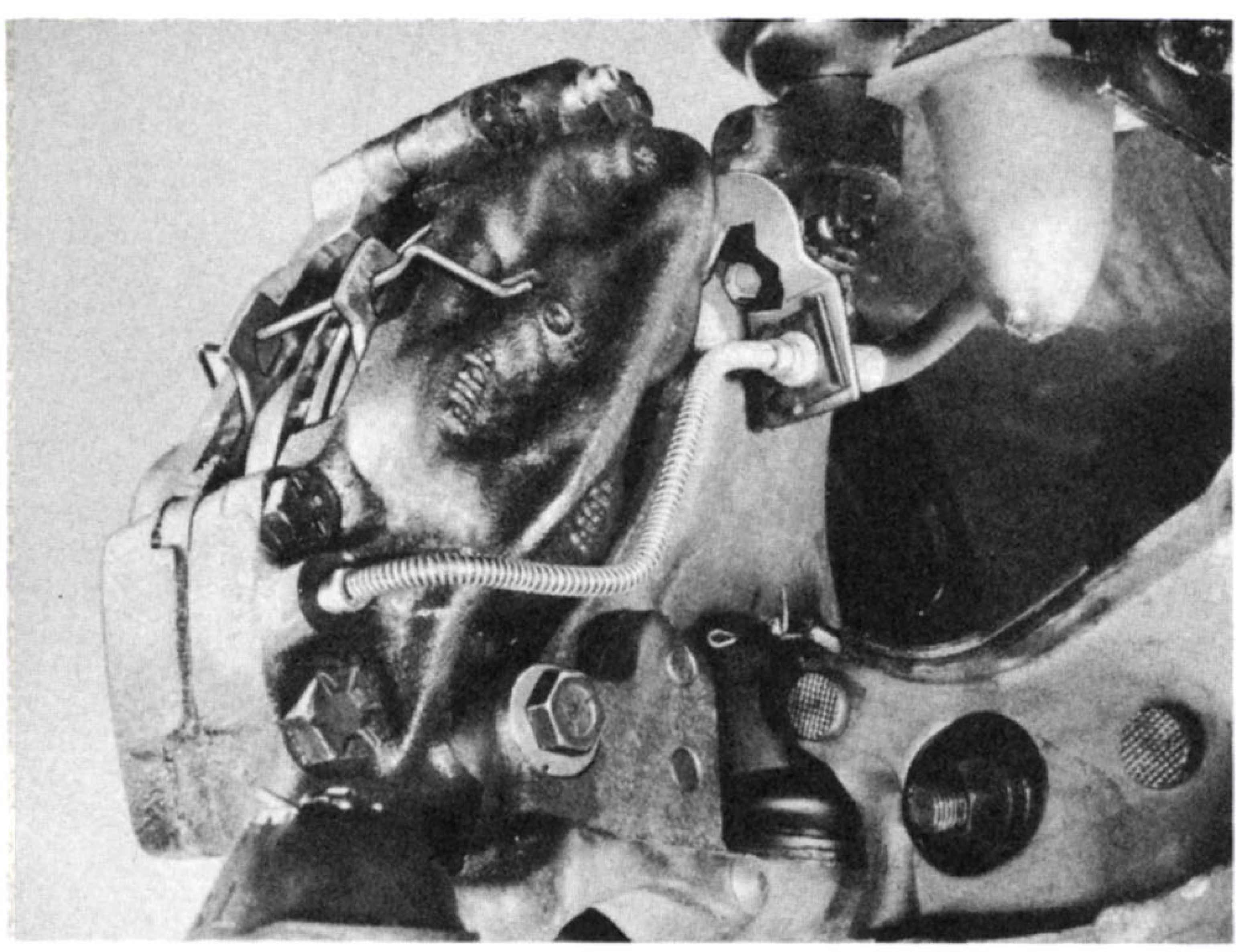


Fig. 34—Remove wheel first

## OTHER SPECIAL TOOLS

There are two other special tools in addition to the proportioning valve gauges (C-4007) and the piston compression tool (C-3992). A piston remover, C-3999, is used on the Kelsey-Hayes unit to remove the pistons from the caliper. It's very difficult to get the pistons out without the tool, since the square seal rolls with the piston and grips it. The other tool, C-3993, is a caliper cylinder hone, which is used on both units. If a cylinder gets a light scratch, the seal might be damaged, causing a leak. The hone will clean up the scratch, but you should never remove more than .002 inch from the cylinder. Always install the hone baffle to avoid damaging the stones when they hit the bottom of the bore.

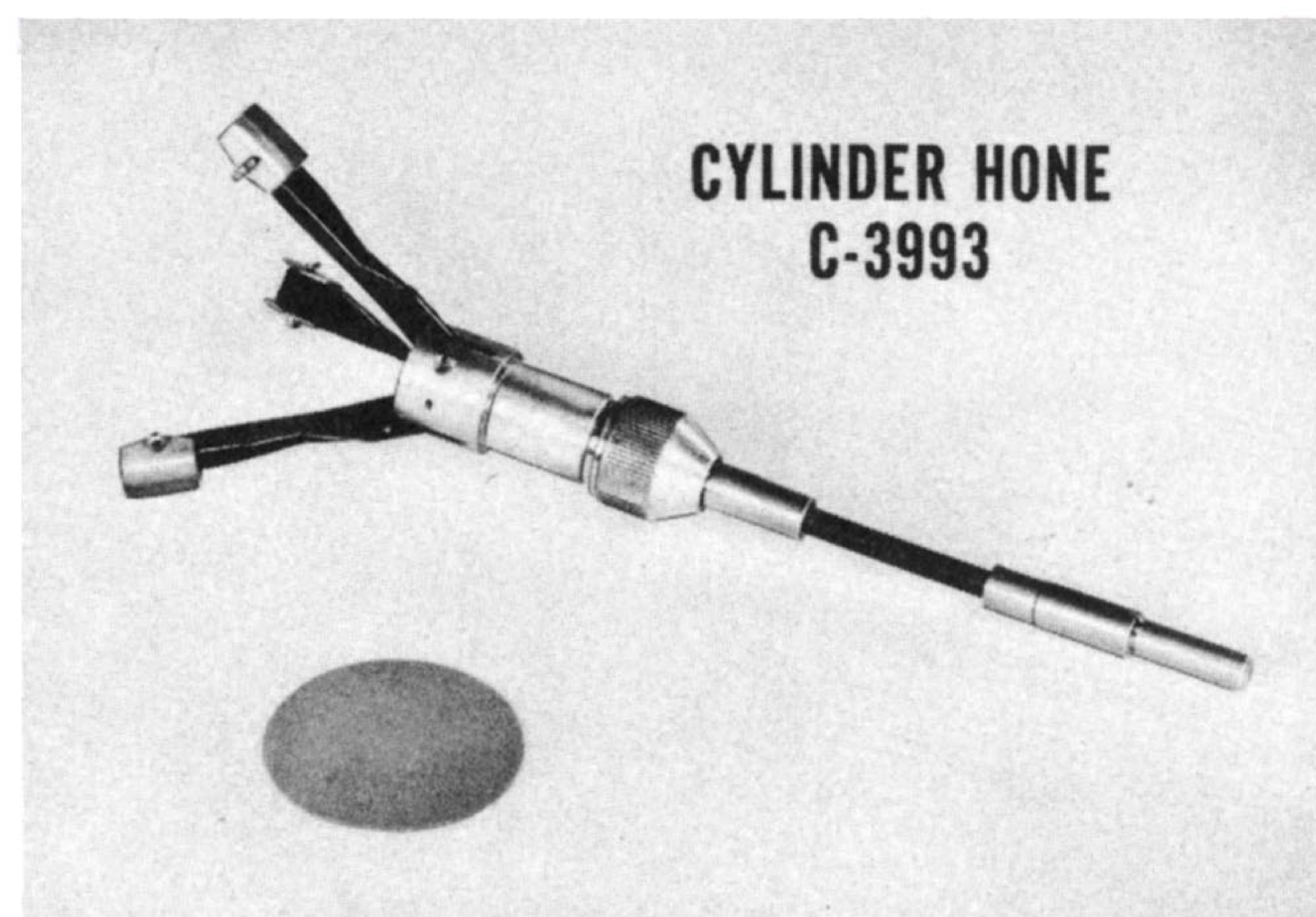



Fig. 36—Cylinder hone for both calipers

## BRAKE FLUID

There are many brake fluids on the market with a variety of specifications. They are not all compatible with Chrysler Corporation brake systems. So, play it safe. Use only Chrysler-approved HiTemp brake fluid, with an SAE 70R3 rating.

## POWER ASSIST

The Fury, Polara, Monaco and Chrysler disc brake installations include a dual diaphragm power booster as standard equipment. A single diaphragm power booster is optional with the Valiant, Dart and Barracuda disc brakes. Service on these two boosters is very well covered in your 1966 Service Manual.

Litho in U.S.A.