

SERVICE DEPARTMENT

WILLYS-OVERLAND MOTORS
INCORPORATED
TOLEDO

GENERAL LETTER NO. 588

TO All Distributors and Dealers

FROM Mr. D. A. Walters

DATE Nov. 9, 1938

WILLYS
Motor Cars

SUBJECT Adjusting and Servicing of Hydraulic
Brakes on the Overland Model 39

In order that you may be prepared to service and adjust Wagner Lockheed Hydraulic Brakes with which the 1939 Overland cars are equipped, we are attaching hereto full instructions covering the brakes.

Please circulate these brake instructions through your Service Department and have everyone concerned study the information contained in the instruction booklet so that they will be familiar with the hydraulic brakes that we are using.

DAW...jrp

Wagner
Lockheed Brake Service
Instructions

FOR

Overland—Model 39

HU-15

November, 1938

AUTOMOTIVE PARTS DIVISION
Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, U.S.A.

Overland Brake Instructions

The 1939 Overland Model 39 is equipped with Wagner-Lockheed hydraulic two-shoe brakes of single anchor pin design and, because they are new to the Overland, service men should familiarize themselves with every feature of their operation and construction. This data, together with detailed instructions covering service and adjustment, is set forth in the following paragraphs.

The brake shoes are brought in contact with the drums by means of a column of liquid forced through tubing. This liquid transmits pressure applied by the foot pedal to the two shoes in each wheel brake assembly by means of displacement of pistons in the master and wheel cylinders. Inasmuch as the pressure must be equal in all parts of the system, no braking action can take place until all the shoes are in contact with the drums; therefore, the system is self-equalizing.

The system consists of a master cylinder in which hydraulic pressure is originated; a wheel cylinder operating the brake shoes against each wheel brake drum, in which wheel cylinder the hydraulic pressure is applied; a supply or reserve tank by which the operating fluid is maintained at a constant volume, and the "line," consisting of tubing, flexible hose, brackets and unions, connecting the master cylinder and wheel cylinders.

The master cylinder is fitted with a piston, and the wheel cylinders are each fitted with

opposed pistons. All of the pistons are provided with cup packings which act as seals to maintain pressures and prevent loss of brake fluid.

The brake pedal, when depressed, moves the piston within the master cylinder, thus displacing the brake fluid from the master cylinder through the tubing and flexible hose connections, into the four wheel cylinders.

The brake fluid enters each of the wheel cylinders, causing the pistons to move against the brake shoes, thus bringing the shoes into contact with the drums. As pressure on the brake pedal is increased, greater hydraulic pressure is built up within the wheel cylinders, and, consequently, greater force is exerted by the shoes against the brake drums.

When the pressure on the foot pedal is released, the return springs on the brake shoes retract and return the wheel cylinder pistons to their normal or "off" position, thus forcing the brake fluid back through the flexible hoses and tubing into the master cylinder.

Master Cylinder—Description

The master cylinder assembly (Fig. 1) consists of a fluid reservoir which is cast integral above the master cylinder proper. The standard compensating features are incorporated in the fluid reservoir. If the fluid reservoir contains fluid, the master cylinder will maintain a constant volume of fluid in

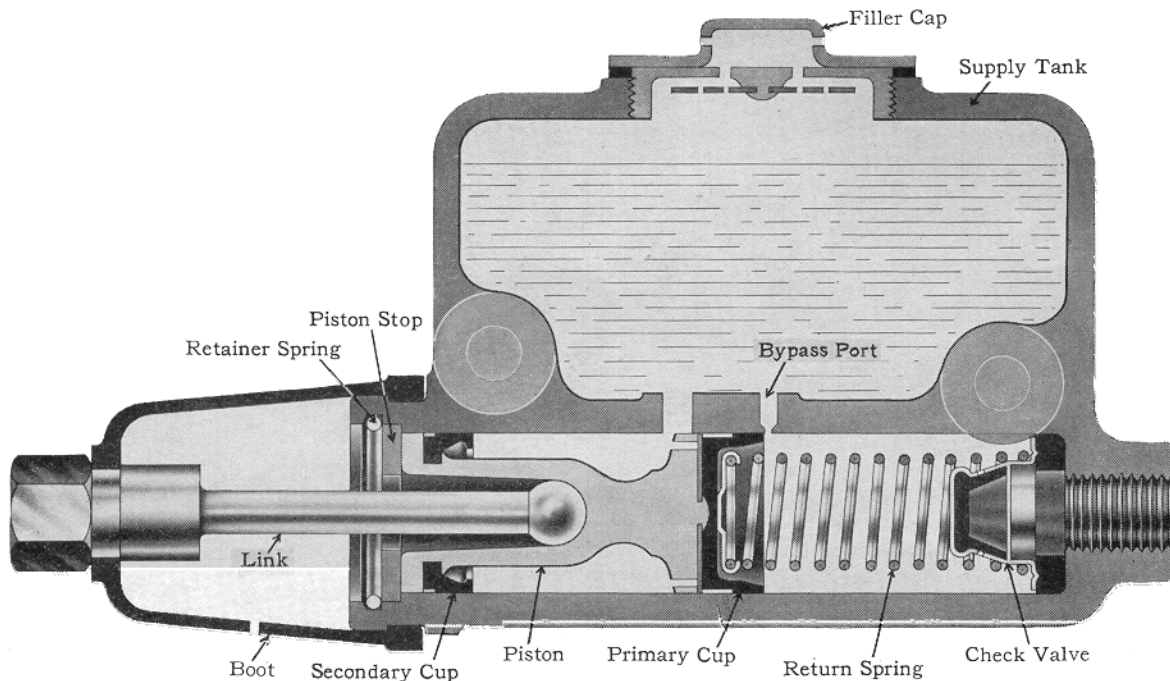


FIG. 1—MASTER CYLINDER

the system at all times, regardless of expansion (heat) or contraction (cold).

The return to the "off" position (as shown in Fig. 1) of the piston and primary cup is much faster than the return of the fluid through the fitting into the master cylinder. A momentary vacuum is created in the cylinder barrel and additional fluid is drawn into the system through the drilled holes in the end of the piston and past the lip of the primary cup. Any excess fluid is passed by the by-pass port into the reservoir, thus a cylinder full of fluid is assured for the next brake application.

It is imperative that the connecting link, which is attached to the brake pedal operating rod, be adjusted for clearance where it seats in the piston. There should be $\frac{1}{4}$ " to $\frac{1}{2}$ " (6.350 to 12.7 mm.) free movement of the brake pedal before the pressure stroke starts.

The primary cup must be clear of the by-pass port when the piston is in its "off" or returned position, as shown (Fig. 1), otherwise the compensating action of the master cylinder will be destroyed and the brakes will drag. This can be determined by making sure that there is from $\frac{1}{4}$ " to $\frac{1}{2}$ " (6.350 to 12.7 mm.) free movement of the brake pedal before the piston starts to move. The secondary cup prevents the fluid from leaking out of the master cylinder into the boot. The fluid reservoir filler cap is conveniently located for checking the fluid level. The reservoir should be kept full of fluid at all times, and should be checked for fluid level each 2,500 miles (4,023 km.) of operation.

CAUTION: Extreme care must be used in removing the fluid reservoir filler cap to prevent dirt from entering the master cylinder.

Master Cylinder Disassembly and Reassembly

The use of other than Genuine Lockheed Fluid or the introduction of an oil with a mineral base into the system will cause the rubber parts to swell and become inoperative. Grit and abrasive substances permitted to get into the fluid reservoir will cause the cylinder barrel to become scratched and pitted. When either of these conditions occur it becomes necessary to remove the master cylinder for inspection.

After removing the master cylinder from the car, the unit is disassembled as follows: Remove the boot and connecting link. With a sharp-pointed screw driver remove the retainer spring from its groove. This permits the removal of internal parts. Rubber parts and the cylinder bore are then checked.

If inspection shows the cylinder walls scratched or pitted, it will be necessary to

have the cylinder walls honed to renew the highly polished surface necessary for efficient operation. All Wagner Branches have the equipment necessary to recondition the cylinders.

After the cylinder has been honed and new cups procured, it is recommended that the reassembling operation be performed in the following manner: Wash the casting and parts in clean alcohol, dip the casting and parts in Genuine Wagner-Lockheed Fluid for lubrication purposes. Install the valve and return spring as shown (Fig. 1). Assemble the primary cup and the piston assembly, including the secondary cup and piston stop. Snap the retainer spring in the groove. Assemble the boot and link in place. The unit is now ready for installation on the car.

Wheel Brake Units

The wheel brake units are composed of a

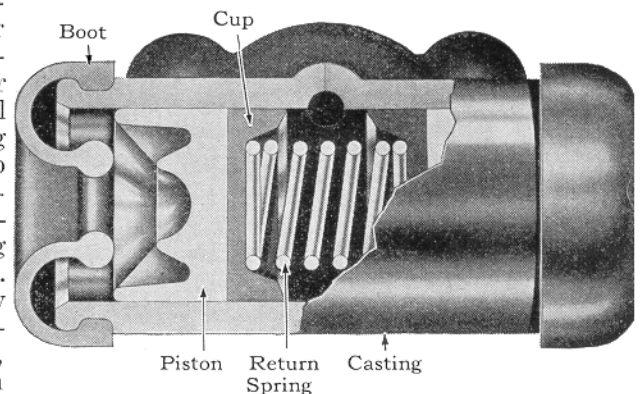


FIG. 2—WHEEL CYLINDER.

dust shield assembly, or backing plate, two brake shoes pivoted at the bottom or heel on an eccentric anchor pin, a wheel cylinder and a brake shoe retracting spring. Fig. 3 shows the front brake assembly, and Fig. 4 shows the rear brake assembly with hand brake linkage.

Description of Wheel Cylinders

The wheel cylinder (Fig. 2) is of the cylinder bore construction. Attention should also be given the fact that the front and rear wheel brake cylinders are not the same. The front wheel brake cylinder bore size is 1" (25.4 mm.). The rear brake cylinder bore size is $\frac{7}{8}$ " (22.2 mm.). Under no circumstances should a rear wheel brake cylinder be installed on a front wheel, or a front cylinder on a rear wheel. Such an error would cause badly unbalanced brakes.

Inspection of Wheel Cylinder

After removing the wheel cylinder (Fig. 2) from the brake assembly, remove the boots from both ends of the cylinder. The pistons and cups are forced out of the barrel

SHOE ADJUSTMENT (MINOR)

Normal Lining Wear

When the brake lining becomes worn, as indicated by the foot pedal going almost to floor board, necessary adjustment can readily be made to bring the brake shoes closer to the drum, as described in the following paragraph.

Jack up the wheels to clear the ground. Adjustment is made by rotating the adjustment cam or bolt (Fig. 5) against the shoe. Rotate the shoe adjustment cam or bolt with a wrench until the shoe comes in contact with the drum, then back off the adjustment slightly until the wheel rotates freely in either direction of rotation. Proceed in a like manner on the brake shoes of all wheels. To bring the shoe into closer relation with the drum, the adjustment cam or bolt must be turned towards the nearest point of the wheel rim when the wrench is pointing upwards. The tension of the friction spring automatically keeps the cam locked in any position.

BRAKE SHOE ADJUSTMENT (MAJOR)

In the event the eccentric anchor pin has been incorrectly adjusted, or when relining the brakes, it is necessary to readjust the eccentric anchor pin to relocate the shoe within the drum, as described in the following paragraph.

With the shoe and lining assemblies installed and the adjusting fixture or brake drum in place, loosen the anchor pin locknut

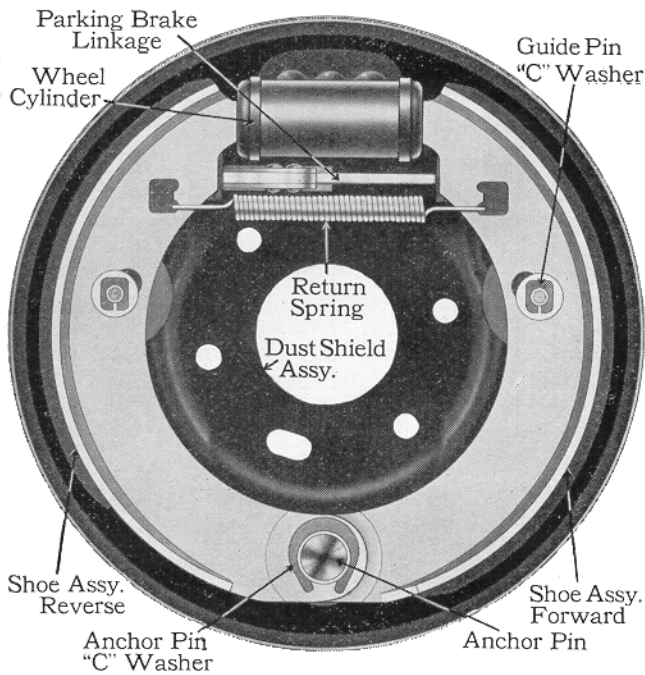


FIG. 4—REAR WHEEL BRAKES

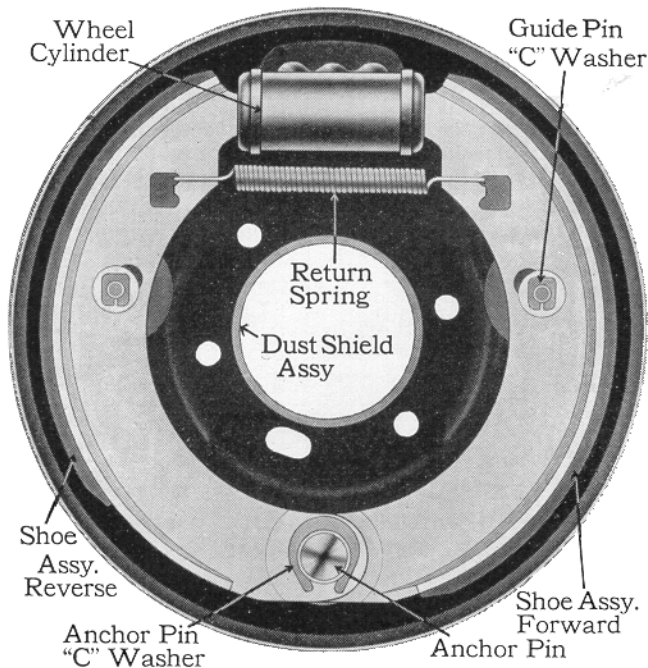


FIG. 3—FRONT WHEEL BRAKES.

by the return spring pressure. Inspect the cups for ragged edges and the bore for smoothness. Should the bore be scratched or pitted, it will be necessary to have the bore honed to prevent loss of fluid or excessive cup wear.

When reassembling the wheel cylinder, all parts must first be washed in clean alcohol. All parts must then be dipped in Genuine Wagner-Lockheed Fluid for lubrication. The unit is now ready for installation. New inlet fitting gaskets should be used when connecting the cylinder to the system.

Brake Pedal Adjustment

The brake pedal should be adjusted to approximately $\frac{1}{4}$ " (6.350 mm.) to $\frac{1}{2}$ " (12.7 mm.) free motion before the pressure stroke starts. More free motion than $\frac{1}{4}$ " (6.350 mm.) to $\frac{1}{2}$ " (12.7 mm.) reduces the effective travel of the master cylinder piston, which, in turn, reduces the movement of the shoes to the brake drums. On the other hand, if the pedal does not return to its proper position, as assured by the $\frac{1}{4}$ " (6.350 mm.) to $\frac{1}{2}$ " (12.7 mm.) free motion, the bypass in the cylinder (Fig. 1) will be blocked by the piston cup. The pressure in the system will then be gradually built up to a point where the brakes drag.

Adjustment of the pedal movement is accomplished by loosening the locknut on the piston rod and turning the larger adjusting nut to obtain the desired setting.

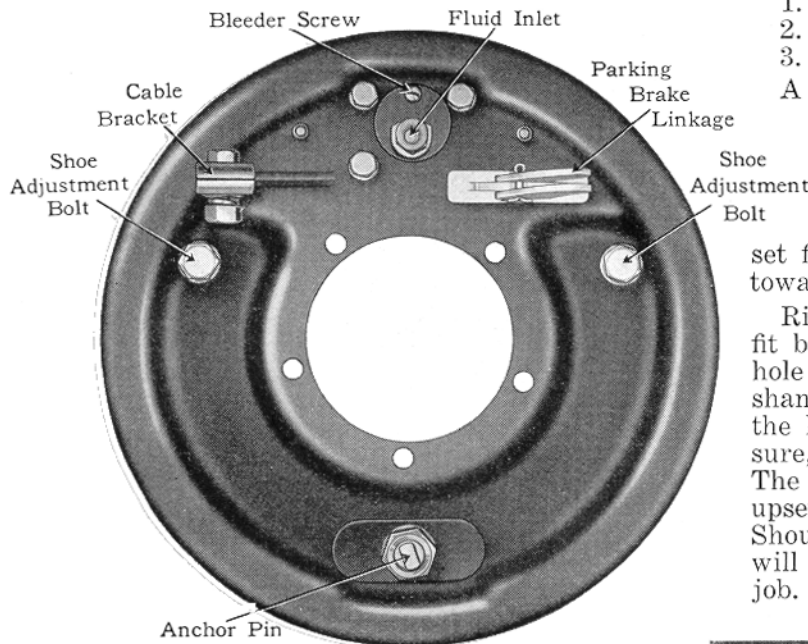


FIG. 5—REAR VIEW, DUST SHIELD ASSEMBLY

(Fig. 5) on the rear of the backing plate. Adjustment is made by turning the eccentric anchor pin and rotating the shoe adjustment cam bolt (Fig. 5) until the shoes are set to the proper clearance, as determined by feeler gauges. The recommended shoe setting is .006" (.152 mm.) clearance at the heel or lower end, and .010" (.254 mm.) at the toe or upper end of forward brake shoe assembly. The shoe to fixture clearances should be measured with a feeler gauge $1\frac{1}{2}$ " (38.1 mm.) from the ends of the lining. A slot is provided in the brake drum for checking.

Note: In the event that a rear brake assembly is removed for rear axle work, the brake shoes on that wheel should be re-adjusted as outlined in the preceding paragraphs.

To Remove Brake Shoes

To remove the brake shoes for relining, proceed as follows: Remove the anchor pin locknut (Fig. 5). Remove the "C" washers and plain washers (Figs. 3 or 4). Remove the brake shoe return spring (Figs. 3 or 4). The top of the shoe is removed from the wheel cylinder piston slot. Remove the anchor pin "C" washer (Figs. 3 or 4). The shoes may then be removed. To reassemble, reverse these operations.

Relining Shoes

When it becomes necessary to reline brake shoes the following fundamentals must be kept in mind, if a satisfactory job is to be obtained.

1. Snug fit between linings and shoes.
2. Selection of proper rivets.
3. Removal of high spots on lining.

A snug fit is absolutely necessary between the linings and the shoes if maximum efficiency is expected. Loosely applied linings contact only a small part of their area, due to the humps between rivets. The center rivets in the lining should be set first and the operator should then work toward both ends of the lining.

Rivets should be used which insure a close fit between the rivet shank and the drilled hole in the lining and shoe. Rivets with small shanks, which are loose in the holes, permit the lining to shift on the shoe under pressure, resulting in unsatisfactory brakes. The rivets should be long enough to properly upset the end, securely binding the lining. Should the rivet be too long, the upset end will split, materially weakening the riveting job.

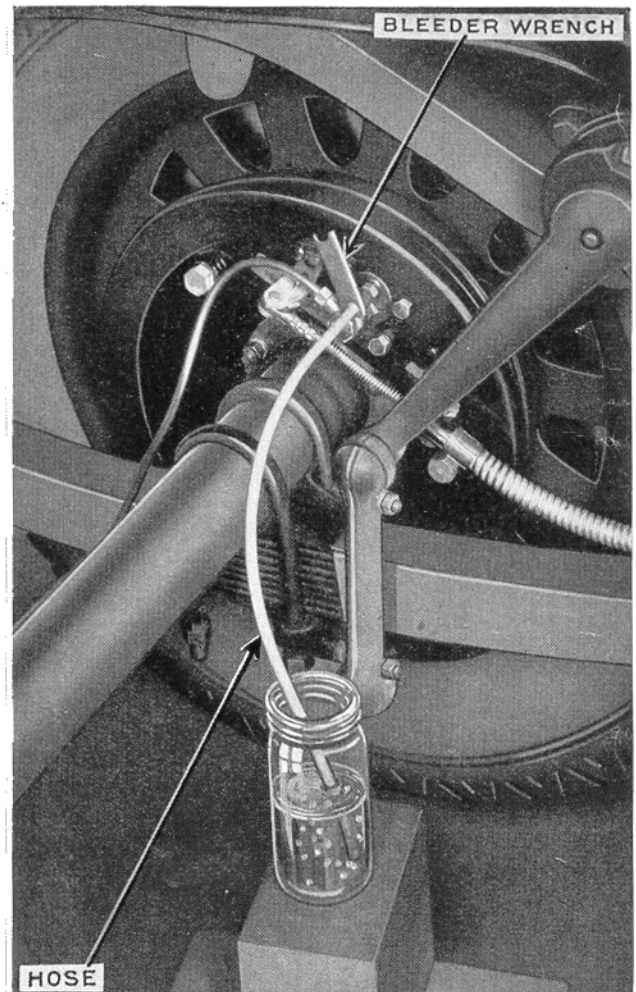


FIG. 6—AIR BLEEDING OPERATION.

High spots, if present, must be removed from the linings with a file or by grinding, before assembling the shoes to the backing plates. This operation gives the linings greater contact area and reduces the possibility of a minor adjustment after a few hundred miles.

Description—Bleeding of Line

Whenever a main pipe line is removed from the master cylinder, the brake system must be air-bled at ALL four wheels. Whenever a line is disconnected from any individual wheel, that wheel cylinder ONLY must be air-bled. Fill the fluid reservoir with Genuine Wagner-Lockheed Brake Fluid before commencing this operation, and keep the reservoir at least half full of fluid during the bleeding operation. Attach the bleeder drain tube as shown in Fig. 6. Allow the tube to hang in a clean container, such as a glass jar. Unscrew the bleeder connection three-quarters of a turn with the special bleeder wrench and depress the foot pedal by hand, allowing the pedal to return slowly to the "off" position. This gives a pumping action which forces the fluid through the tubing and out at the wheel cylinders, carrying with it any air that may be present in the line.

CAUTION: After the brake pedal is depressed, it must be allowed to return slowly, otherwise air may be drawn into the system.

Watch the flow of fluid from the bleeder drain tube, the end of which should be kept below the surface of the fluid. When all air bubbles cease to appear, or when the stream is a solid fluid mass, close the bleeder connection.

Fluid withdrawn in the "bleeding" operation should not be used again. The fluid should be replenished in the fluid reservoir after each cylinder is bled. Should the supply tank be drained during the bleeding operation, air will enter the system and "re-bleeding" will then be necessary. When the bleeding operation is completed, the fluid reservoir must be refilled to within $\frac{1}{4}$ " (6.3 mm.) of the top.

Use Genuine Wagner-Lockheed Fluid

It is of vital importance that only Genuine Wagner-Lockheed Fluid be used. Any deviation from this recommendation may not only render the brakes inoperative but also automatically cancels the Standard Warranty.

Flushing the Braking System

As previously indicated, the use of fluid other than Genuine Wagner-Lockheed Fluid is likely to render the foot braking system entirely inoperative. Any mineral base

oil, for example, not only causes deterioration of the rubber in the connections, and eventual failure, but will cause the rubber cups in the cylinders to soften and expand within a very short period of time.

In any case where oil has been used in the braking system through error, it is important that the system be thoroughly cleaned and new piston cups installed, as set forth in the following operations:

1. Attach the air bleeder tube to the fitting on one wheel cylinder, open the fitting and pump out all old fluid by alternately depressing and releasing the foot brake pedal.
2. Fill the master cylinder reservoir with a good quality alcohol and pump it through the system and out the open bleeder connection. Add alcohol and continue the operation until all traces of the oil or other foreign matter have been flushed from the master cylinder and tube to the wheel.
3. After removing the bleeder tube and closing the bleeder fitting, proceed to the other wheels and repeat the flushing operation as described until all four tubes to the wheels are clean. But one bleeder fitting should be opened at a time — to maintain a maximum pressure in the tube to the open fitting.
4. Remove all wheel cylinders and the master cylinder and disassemble them.
5. After removing the old piston cups, thoroughly wash and clean all parts in a good quality alcohol.
6. Install new piston cups. (New cups should be installed in every case where a mineral oil has been introduced in the system, even though there are no visible signs of failure.)
7. Reassemble the wheel cylinders and the master cylinder and install them on the car. (Dip all parts in clean Lockheed Fluid before reassembling.)
8. Install Genuine Wagner-Lockheed Fluid and air-bleed the system as described in a preceding operation.

With further reference to the preceding operations, in the event of complete failure of the master cylinder cups, it will be necessary to clean the master cylinder and replace the cups before proceeding with the flushing operation.

Hand Brakes

The hand, or parking, brake lever operates the shoes of the two rear wheel brakes through cables to each brake assembly. The parking brake cables should be adjusted

when it is necessary to make any minor adjustment, or when new shoes are installed.

Pull the hand brake lever up three notches. Shorten the brake cables by adjusting the yoke located at the forward end of the cables until a slight drag is felt on the rear wheels. The rear brakes should be free from drag when the hand brake lever is released.

Brake Fluid

The use of Genuine Wagner-Lockheed Brake Fluid assures the car owner of maximum performance. We urge that no substitute be used.

MAINTENANCE HINTS

No. 1—Pedal Goes to Floor Board

CAUSE

- A—Normal wear of lining.
- B—Brake shoes not properly adjusted.
- C—Leak in system.
- D—Air in system.
- E—Pedal improperly set.
- F—No fluid in supply tank.

REMEDY

A—When brake linings become worn it is necessary to set the shoes into closer relation to the brake drums. This condition is usually accompanied by the remark that it is necessary to pump the pedal several times before a brake is obtained. Shoes should be set as close to the brake drum as possible without drag. Do not disturb the anchor pins when making this adjustment. Adjustment must be made while the drums are cool.

B—In cases where the eccentric anchor pins have been disturbed and the relation of the arc of the shoes to drums changed, so the heel or lower lined section of the shoe is engaging the drum while the toe, or upper section, of shoe remains out of contact, a tendency to spring the shoes and distort the drums will result and the pedal movement necessary will allow the pedal to go to the floor board. Shoes should be readjusted with the aid of an adjusting fixture.

C—A leak in the system will allow the pedal, under pressure, to go to the floor board gradually. If no leaks are found at the wheels or joints, remove the master cylinder and check the bore of barrel for score or scratches.

D—Air in the system will cause a springy, rubbery action of the pedal. Should a sufficient quantity be introduced into the system, the pedal will go to the floor board under normal pressure. The system should be bled.

E—The brake pedal should be set with approximately $\frac{1}{4}$ " (6.350 mm.) to $\frac{1}{2}$ " (12.7 mm.) free motion before the pressure stroke starts. Additional free motion reduces the

effective travel of the master cylinder piston, which, in turn, determines the amount of working fluid to be expelled from the master cylinder into the lines or system.

F—The fluid level in the supply tank should be checked at regular intervals. Should the tank become empty, air will be introduced into the system, necessitating bleeding.

No. 2—All Brakes Drag

CAUSE

- A—Mineral oil in system.
- B—Pedal improperly set.

REMEDY

A—The introduction of mineral oil, such as engine oil, kerosene, or any fluid with a mineral base, into the system will cause the cups to swell and distort, making it necessary to replace all cups and flush the system as described in a preceding paragraph.

B—Directly ahead of the master cylinder piston cup (when in normal released position) is a relief port. It is imperative that this port be open when the brakes are released. The brake pedal should be set with $\frac{1}{4}$ " (6.350 mm.) to $\frac{1}{2}$ " (12.7 mm.) free movement before the pressure stroke begins. Should this port be blocked by the piston cup not returning to its properly released position, the pressure in the system will gradually build up and the brakes drag. Opening a bleeder screw (Fig. 5) will allow built-up pressure to escape and give temporary relief. The bleeder screw must be secure before car is driven.

No. 3—One Wheel Drags

CAUSE

- A—Weak brake shoe return spring.
- B—Brake shoe bearing seized to anchor pin.
- C—Brake shoe set too close to drum.
- D—Piston cups distorted.
- E—Loose wheel bearings.
- F—Hose blocked.

REMEDY

A—Springs sometimes lose their contracting power and take a set. Replace the spring.

B—Lubricate the bearing at anchor pins with penetrating oil.

C—Readjust the shoes to proper clearance. Do not change anchor pin setting.

D—If in repairing the wheel cylinders, kerosene, gasoline and other fluids are used as a cleaner, instead of alcohol, the cups will swell and distort. The return action of the shoes will be retarded and the brake drum will heat. Replace the cups, wash the unit in alcohol and dip all parts in Fluid before reassembling. (Refer to "Flushing the System." described in a preceding paragraph.)

- E—Tighten the bearings.
- F—Remove and replace hose.

No. 4—Car Pulls to One Side CAUSE

- A—Grease-soaked lining.
- B—Forward shoe improperly set.
- C—Backing plate loose on axle.
- D—Front spring U-bolts loose (front axle).
- E—Different makes of lining.
- F—Tires not properly inflated.
- G—Hose blocked.

REMEDY

A—Replace with new lining, as procured from our Parts and Accessories Division. Grease-soaked linings cannot be salvaged by washing or cleaning.

B—The average shoe setting is .006" (.152 mm.) at the heel or lower end, and .010" (.254 mm.) clearance at the toe or upper part of the forward shoe. The construction of the brake is such as to cause a slight pull or drift if the shoes are improperly set on the front wheels. On the rear wheels there will be no drift noticed, but one wheel will slide before the other. Readjust the shoes to proper clearance. It will be necessary to use an adjusting fixture and to shift the anchor pin setting.

C—Loose backing plates permit the brake assembly to shift on the locating bolts. This shifting changes the predetermined centers and causes unequal efficiency. Tighten the backing plates and readjust shoes with an adjusting fixture.

D—Loose spring U-bolts on the front axle permit the axle to shift on the springs and run out of line. This is noticed especially when a high braking torque is developed. Tighten U-bolts at their proper location on spring.

E—Different makes of linings have different efficiency. Two different makes, one with high efficiency and one with low efficiency, would cause the car to pull to one side.

- F—All tires should be properly inflated.
- G—Remove and replace hose.

Overland Brake Service Instructions

No. 5—Springy, Spongy Pedal CAUSE

- A—Brake shoes not properly adjusted.
- B—Air in system.

REMEDY

- A—Consult remedy B under No. 1.
- B—Consult remedy D under No. 1.

No. 6—Excessive Pressure on Pedal, Poor Stop CAUSE

- A—Brake shoes not properly adjusted.
- B—Improper lining.
- C—Oil or grease on lining.
- D—Lining making partial contact.

REMEDY

- A—Consult remedy B under No. 1.
- B—Improper grades of brake lining lose their gripping qualities after a few thousand miles. As the frictional quality decreases, the pressure on the brake pedal is naturally increased to get the equivalent stop.
- C—Replace lining if badly oil-soaked.
- D—Remove high spots.

No. 7—Light Pressure on Pedal, Severe Brakes CAUSE

- A—Brake shoes not properly adjusted.
- B—Loose dust shield on axles.
- C—Grease-soaked lining.

REMEDY

- A—Consult remedy B under No. 4.
- B—Consult remedy C under No. 4.
- C—Consult remedy A under No. 4.

Caution your owners to permit nothing but Genuine Wagner-Lockheed Brake Fluid to be placed in the braking system of their cars. Advise them that engine oil or any mineral oil will render the brakes inoperative and will necessitate replacement of all rubber parts in the system.