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BRAKE LINING

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AMERICAN BRAKE SHOE COMPANY
AMERICAN BRAKEBLOK DIVISION
DETROIT 9, MICHIGAN

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BRAKE SERVICE GUIDE

1947

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Ready Reference Brake Service Guide

FOREWORD

This Brake Service Guide has been prepared for the assistance and information of brake service stations and other organizations and individuals interested in the relining and maintenance of automotive brakes.

No attempt has been made to go into complete details of the full maintenance of the various types of brakes. The instructions and recommendations have been confined entirely to friction recommendations, adjustments, and service helps.

In preparing this guide an effort has been made to so arrange the contents that information is easily available and is not complicated. All of the principal types of brake equipment have been covered. Those found only on a few makes or models of cars or cars produced some years ago have been omitted. Adjustment instructions and recommendations for these can be supplied on application.

All mechanical recommendations such as clearances, etc., are based on the practice of the American Brakeblok Service Engineers and will be found to be practically the same as those recommended by the brake manufacturers.

It is the hope of the manufacturers of American Brakeblok that this Guide will be found helpful and useful to all those engaged in brake service work.

American Brake Shoe Co.
American Brakeblok Division

GENERAL INSTRUCTIONS

Brake Control System—It is important that the brake control system of a motor vehicle operates properly at all times. A freely operating brake control system allows its return to the stop provided. This may be the toe-board, a set screw at the foot pedal, or some sort of lever return rest at a point on the chassis. When a brake control system returns to its maximum released position a longer period of operation can be expected before adjustment is necessary. On mechanical brake systems, it is very important to obtain the correct angle between the various rods and levers. For the best brake operation, the angle between a rod and lever should be 90 degrees when the brake is applied. On mechanical brakes no backlash or play should be present at the brake pedal or at the operating lever. On Bendix two-shoe brakes, when shortening linkage to remove backlash the mechanic must be sure that he does not expand the shoes from the anchor pins. The cam should just come in contact with the ends of the brake shoes.

On hydraulic brake systems, there should be about ¼″ free play in the brake pedal before the piston in the master cylinder begins to move.

The hook-up linkage on both mechanical and hydraulic brake systems should be carefully examined. Sometimes the brake levers have more than one hole in which the clevis pin may be placed. These different positions produce a softer or harder brake pedal, as desired.

Lubrication—Regular lubrication of the necessary parts of a brake system is important, in order to get free operation of the system. Such parts as the cross shaft bearings, clevis connections, cable and conduit controls, or any other moving part must be lubricated. Over-lubrication of the front wheel bearings, outer rear axle bearings, and differential must be guarded against to insure against grease-soaked brake lining. When doing a brake job, the mechanic should inspect the grease retainers and replace them if necessary.

Return Springs—To hasten the release action of a brake control system that has been in long service, the uninformed mechanic sometimes will install additional return springs at various points in the brake control system. This is detrimental to satisfactory brake performance, increases the pedal pressure and is unnecessary. It usually will be found that correct lubrication, and proper adjustment, will produce satisfactory operation of the brake control system. All return springs should be checked and weak or broken ones replaced.

Greasy Linings—Much braking trouble will be avoided if the lubrication of the rear axle and front wheel bearings is held to the correct amount and not overdone. Where it is found that the brake lining has become excessively saturated with oil or grease, heavy pedal pressure or possible sensitive brake action will result and the only cure is replacing the brake lining. If molded lining becomes not overly saturated with the lubricant it may be possible to remove the lubricant from the lining with high test gasoline.

Brake Drums and Shoes—When brakes are serviced, the drums should be carefully examined for scoring, heat checking or pitting of the surface. In addition, the drums should be inspected for signs of distortion including warping, bell-mouthing, barrel-shaping and out-of-roundness.

Brake drums can be reconditioned, providing the score marks are not too deep and the drums are not too much out of shape. Care should be taken not to remove too much metal because drums which are too thin heat up rapidly and distort under braking pressures.

It is extremely important to obtain the smoothest finish possible on reconditioned brake drums. Whenever possible, they should be ground to a smooth finish.

Before replacing the drums, all abrasive and metal particles should be removed. During the first few hundred miles of driving, the brakes should not be applied any harder than necessary for a reconditioned brake drum is similar to a rebored engine and must be "broken in" gently.

Brake drums should be reconditioned equally in pairs, so that the two front drums are similar and the two rear drums are the same. Otherwise, the braking effect on one side of the car may not be equal to that on the other side.

When brake drums have been turned out, it is necessary to use brake lining which is oversize in thickness or else place shim stock between the lining and shoes. If shim stock is used, care should be taken

to choose a shim stock which is not compressible and will not soften under brake temperatures.

The brake shoes should be thoroughly cleaned and a brake lining clamp should be used to hold the lining tightly against the shoe for the drilling and riveting operation.

Drill the lining so that rivet heads may be placed down in the material as deeply as it is safe to go without danger of the lining pulling off the shoes. By following this procedure, we leave as much usable thickness as possible for wear purposes. The depth at which rivets may be safely placed varies, depending upon the make and type of brake lining. With some linings, it is safe to drill to a depth of from only about one-half to two-thirds of the total thickness of the material. With American Brakeblok, which has a wire cloth reinforcing back, it is best to drill until the wire cloth is just barely visible. Then the head of the rivet will seat squarely on the reinforcing back, the riveting job will be tight, there will be a maximum of friction material for wear purposes and the braking strains will be evenly distributed throughout the entire segment of lining.

It is especially important to obtain 100% contact between the brake lining surface and the brake drum. Whenever possible, it is helpful to grind the lining on the shoes to the correct drum radius. Machines which mount on the axle spindle and grind the lining on the shoes while they are in place in the assembly do an especially fine job, providing a good quality machine is used.

Chamfer the ends of each brake lining segment back past the centerline of the end rows of rivets. This eliminates end contact which is a frequent cause of brake squeaks. All bolts and nuts in the brake, wheel and drum assembly should be securely tightened.

Factors Affecting Brake Systems—A motor vehicle should leave the service station with the brake control system bearings well lubricated, each wheel free of brake drag and the four brakes balanced. The spring clips holding the chassis springs to the axle must be tight. The wheel bearings must be accurately adjusted to prevent brake drag, due to loose bearings.

Braking sometimes is unjustly blamed when the fault lies with the steering apparatus of the motor vehicle. Front wheels are mounted with a definite amount of caster, camber, and toe-in. After considerable mileage or due to accidents these necessary adjustments become disturbed. Therefore, when the brakes are applied the motor vehicle swerves and becomes difficult to control. Caster and camber as well as toe-in of the front wheels should be periodically checked to insure proper brake performance.

Tire inflation, tire tread wear, condition of brake drums, one front or rear spring more flexible than the other, improperly adjusted road shock dampeners, etc., affect brake systems. These items should always be checked.

Brake Linings—It is important to use a high quality brake lining on all jobs. This insures that the final result will be *safe* brakes, which after all, are one of the greatest features which a motor vehicle can have.

Not only does high quality brake lining produce the maximum degree of *safety* because of its better performance, but it also gives longer life and freedom from noise and scoring. Customer satisfaction is greater and there are fewer complaints and requests for no-charge adjustments.

For best results it is important to reline all shoes of all brakes of a vehicle at the same time. Even though the old brake lining is not completely worn out, it is difficult to obtain the correct adjustment and the proper braking power distribution unless all shoes are relined at the same time.

Removing Brake Lining which has been cemented to the shoes—Some vehicles are in service which have brake lining cemented to the brake shoes. One company which has manufactured vehicles of this kind, recommended that the following method to be used for removing the brake lining from the shoes.

The most satisfactory way to remove the lining from the shoes is by heat. Clamp the shoe in a vice. Grip it by the center reinforcing rib with the toe end of the shoe pointing up. Apply heat evenly on the under side of the flange at each side of the rib. Distribute the heat as evenly as possible so that the shoe will not warp.

When the shoe and the lining are evenly heated, the lining is easily pried loose with a screwdriver or by means of similar tool. Buff the shoe clean so that all trace of the old lining and cement is removed before applying the new lining.

The new lining can be riveted to the shoe in the same manner as in the past, inasmuch as the rivet holes are already drilled in most shoes. Naturally, in those cases where the shoes are not drilled, it will be necessary to drill them in order to use rivets to attach the lining.

Many mechanics prefer to remove lining which has been cemented on to the shoes by grinding it off.

LOCKHEED Hydraulic Brakes

Lockheed Internal Type Hydraulic Brakes—The later models of this type of Lockheed Brake use a Master cylinder which is always in direct contact with the source of supply of the brake fluid. Fig. 3, shows a typical master cylinder of late model cars using Lockheed Internal Hydraulic Brakes. A cross-sectional view of the wheel cylinder used to actuate the brake shoe is shown in Fig. 2.

Some cars are equipped with straight bore wheel cylinders using a piston of the same diameter for operating each shoe. Other cars are equipped with stepped bore wheel cylinders which have pistons of different diameters. In cases where the manufacturer has attempted to secure more equal wear on the two shoes, we find the larger diameter pistons operating the Reverse Shoes. In cases where the manufacturer has attempted to obtain a softer brake pedal we find the larger pistons operating the Forward Shoes. Often the diameters of the front wheel brake cylinders are larger than those of the rear wheel brake cylinders in order to obtain better brake distribution.

For the above reasons, it is always im-

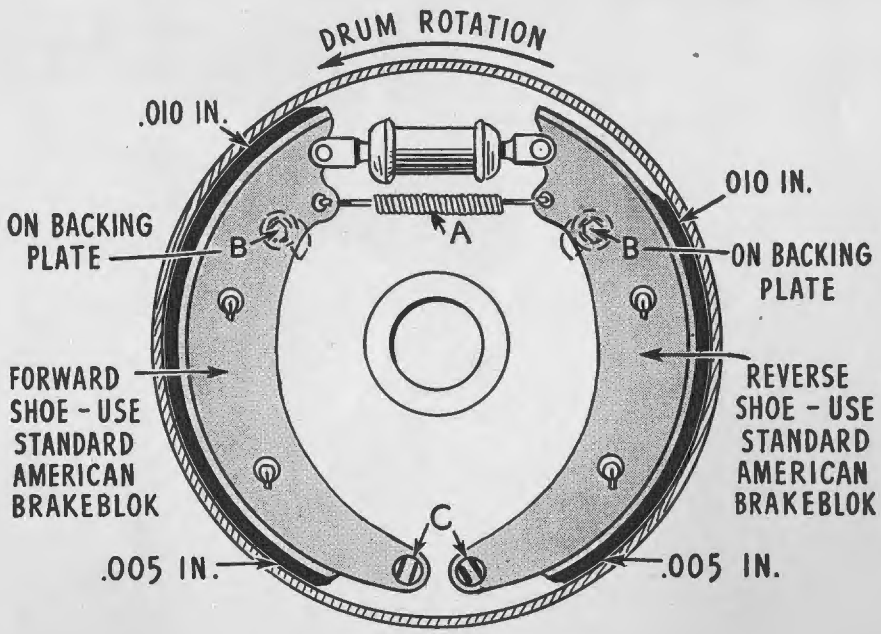

Figure 1
Lockheed Hydraulic Brake

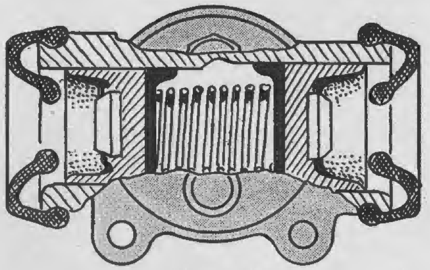

Figure 2
Wheel Cylinder

portant to make sure that wheel cylinders are put back in place properly in cases where they have been removed.

The fluid is non-compressible assuring equal pressure at each brake. The return spring A (Fig. 1), should have equal tension in each brake to insure proper balance of the braking system. Although there is some variation in design of Lockheed Brakes, in general the adjustments are made as follows:

MINOR ADJUSTMENT

1. Cam adjustments are provided on each brake shoe to compensate for lining wear. Jack up car and turn cam B (Fig. 1), outward at the top, away from the center of the axle, until the lining contacts the drum sufficiently to stop the wheel from spinning. Back off on cam until lining clears drum and wheel just turns freely. The adjusting cams are held in position by friction springs on some cars and locking is not required. A lock nut is used on other models.

2. Check master cylinder for correct fluid level. The fluid supply tank should be filled to within ½" of the top.

MAJOR ADJUSTMENT

1. The eccentric mounting of the two anchor pins C (Fig. 1), allows recentering of the brake shoes. If there are no inspection holes in the brake drums they should be removed and a ring gauge used (Fig. 4).

2. Place ring gauge in position and insert a .005-inch feeler between ring gauge and lining about 1 inch from the lower end of the shoe. Leave feeler guage in place and turn eccentric anchor C (Fig. 1), until gauge is gripped.

3. At a point 1 inch from upper end of lining insert a .010-inch feeler gauge. If this cannot be done turn cam B (Fig. 1), a little and try again. Correct adjustment is obtained when the .010-inch gauge just enters at the toe or upper end of lining and the .005-inch at the lower end. Both shoes of each wheel are adjusted in this manner.

4. Replace brake drums and proceed as outlined above for "MINOR ADJUSTMENT."

If a ring gauge is not available a major adjustment can be made by turning the eccentric anchor from outside the backing plate. On some cars it is not possible to turn the eccentric anchors from the outside without removing the anchor pins and slotting them for a screw driver. In order to do this it is necessary to grind off the case-hardened surface and slot the end by using two hacksaw blades placed side by side in the same handle. The anchor pins are then replaced and the adjustment made as follows:

1. Turn anchor pins C (Fig. 1) and cams B (Fig. 1) until shoes are as far as possible away from drums.

2. Adjusting one shoe at a time, turn cam B until a slight drag is obtained. Then turn eccentric anchor C until this drag has been relieved. Thus it is seen that the movement of eccentric anchor C not only affects the position of the heel of the shoe, but also the toe of the shoe near cam B.

3. Repeat these operations of obtaining a drag by turning cam B and relieving the drag by turning anchor C, until further turning of anchor C will not relieve the drag.

4. Then back off cam B and anchor C just slightly until wheel turns freely.

5. Repeat at other wheels. This method produces clearances very close to the recommended values of .005 and .010 inch.

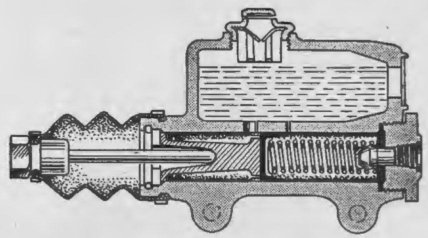

Figure 3
Integral Tank Type Master Cylinder

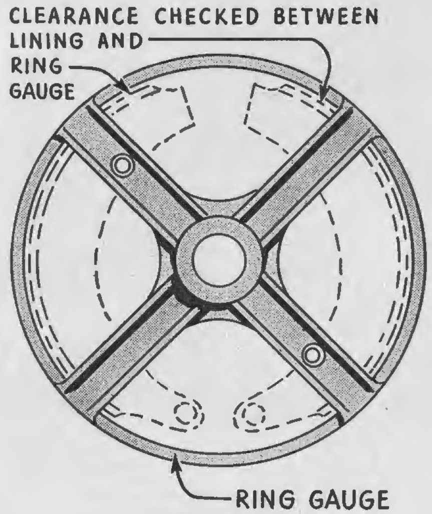

Figure 4
Ring Gauge in Place

6. Check fluid level in master cylinder and add fluid if necessary.

BLEEDING

Air can be removed from the brake lines by bleeding. This is necessary after lines have been disconnected or if the fluid in the master cylinder has been allowed to run too low.

Bleeding can be done through a rubber tube, the end immersed in a clean (1-pint glass bottle) container partially filled with brake fluid.

When bleeding, the bleeder valve A (Fig. 5) in the wheel cylinder should be opened one-half to three-quarter turn, but not completely removed.

Bleeding is done by pressing the brake pedal slowly to half the limit of its travel after making sure that master cylinder reservoir (Fig. 3) is full of fluid. If reservoir filler opening plug is left out during the bleeding the fluid can be watched to see that it does not get below the half way point. An automatic refiller for master cylinders (Fig. 6) prevents the master cylinder from running dry during the bleeding operation.

With master cylinder reservoir full the brake pedal can be given 6 or 10 half strokes before it is necessary to refill the reservoir.

This pumping action forces the liquid and air through the system and out of the bleeder hose. The process is continued until the fluid runs clear without air bubbles.

It is best to bleed one wheel cylinder at a time to make sure all air is expelled.

Bleeding tanks are available which permit the bleeding to be done under air pressure in a much shorter time than by pumping with the brake pedal.

SERVICE HELPS

If, after bleeding, the pedal still feels spongy, the condition may sometimes be

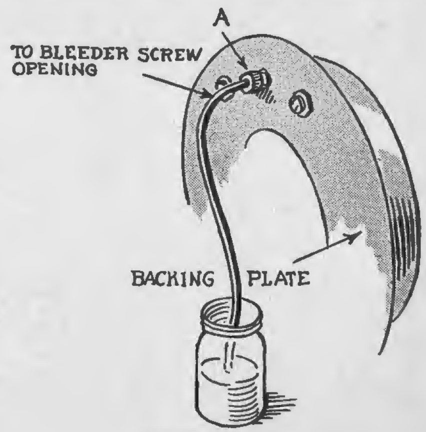

Figure 5
Method of Bleeding Hydraulic Brakes

relieved by holding bleeder valve A (Fig. 5) open until fluid appears, with the rubber tube not screwed in place. Bleeder valve is then closed. This operation should be performed with a pedal pressure of only a few pounds.

When removing the shoes from a hydraulic brake assembly it is best to clamp the wheel cylinders in order to prevent the accidental blowing out of the pistons, making a bleeding operation necessary.

On all hydraulic brake systems only an approved hydraulic fluid should be used.

If there is any doubt about the purity or quality of the fluid in the lines, it is best to flush out the entire hydraulic system using a good 188 proof alcohol. In some cases, it is necessary to remove the master and wheel cylinders and clean them thoroughly, using alcohol or brake fluid. Inferior brake fluids damage the rubber parts of a hydraulic system and it is often necessary to replace the rubber caps. If the cylinders have been scored or pitted, they should be honed to a mirror finish.

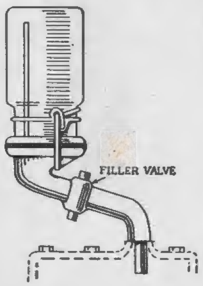

Figure 6
Automatic Refiller for Master Cylinder

After adjusting the cams always press the brake pedal two or three times after spinning the wheel by hand. Then check the wheel to make sure that it is still free of drag.

On Lockheed Hydraulic Brakes, there are sometimes cases of squeaks caused by binding of the tops of the Reverse Shoes where the Reverse Shoe lining is the same length as the Forward Shoe lining. This squeak can be eliminated by using a shorter piece of lining on the Reverse Shoe, as shown in Fig. 1.

Sometimes this shorter piece of lining is placed so that the open space is at the toe, as shown, and in other cases the open space is at the heel end of the shoe.

On some cars fitted with Lockheed Hydraulic Brakes there is only one anchor pin in each wheel brake. Both the forward shoe and the reverse shoe in each brake are anchored to this same pin. The turning of this eccentric anchor pin controls the position of the heel ends of both shoes. However, there is no brake lining on the

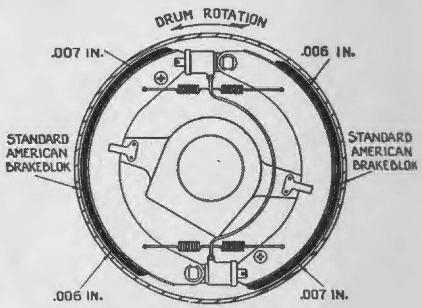

Figure 6A
Two Forward Shoe Brake Used on Front Wheels of Late Model Chrysler Corporation Cars

heel end of the reverse shoes and the eccentric anchor pins are adjusted to obtain .005″ clearance between the lining and the drum at the heel ends of the forward shoes. The only adjusting on the reverse shoes is done by means of the cams in order to obtain .010″ clearance at the toe ends of these shoes.

On late model Chrysler Corporation cars the front wheel brakes have two Forward Shoes. On these cars the recommended clearances are .007″ at the toes and .006″ at the heels on all Forward Shoes, and .007″ all around on Reverse Shoes. In bleeding these front wheel brakes, bleed the top cylinders first and then bleed the lower cylinders. This brake assembly is shown in Figure 6A.

American Brakeblok, as well as most other lining manufacturers, recommend a fairly high friction lining on both for-

ward and reverse acting shoes of the Lockheed Hydraulic Brake. Figures 1 and 6A show the recommended brake lining when roll stock is used.

American Brakeblok also furnishes brake lining segments in boxed car sets especially prepared for cars equipped with Lockheed Hydraulic Brakes.

FORD Hydraulic Brakes

Ford cars are equipped with hydraulic brakes which are very similar to the Lockheed brakes just described. A left rear 1939-42 Ford brake assembly is illustrated in Figure 7 and shows the mechanism which operates the shoes through the hand brake lever for parking or emergency purposes.

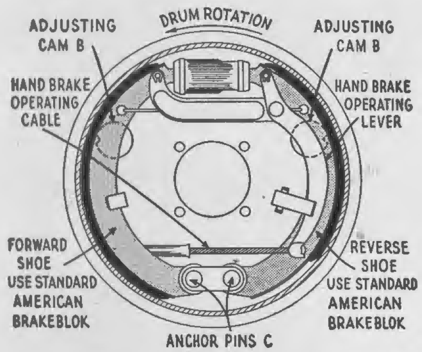

Figure 7
1939-1942 Ford Hydraulic Brake Showing Mechanical Operation of Rear Wheel Brakes for Parking

ADJUSTMENTS

The major and minor adjustments on Ford hydraulic brakes through 1942 models are made in the same manner as on the Lockheed brake described on page 7.

The 1946 Ford brakes have brake shoes which are self centering at the anchor pins and therefore there is no anchor pin adjustment to be made on these brakes.

SERVICE HELPS

The hand brake lever on all recent Ford passenger car and light trucks operates the brake shoes in the two rear wheels for parking or emergency purposes. When making service brake adjustments, it is advisable to disconnect the hand brake cables.

In order to adjust the hand brake on these vehicles, proceed as follows:

1. Release the hand brake lever completely and then place it in the first notch.

2. Apply a pressure of about 30 pounds to the brake pedal and hold at approximately this pressure throughout the hand brake adjustment.

3. Take all slack out of the hand brake cables and adjust conduits so that cables are exactly the right length.

4. Remove the pressure from the brake pedal and release the hand brake lever completely and check the rear wheels to make sure they do not drag.

The 1½-ton Ford trucks have separate brake bands located in the rear wheels and operated through the hand brake lever for parking or emergency purposes. The hand brakes on the 1½-ton trucks are adjusted as follows:

1. Release hand brake lever completely.

2. Adjust brake rods so that an equal drag is produced at each rear wheel when hand brake is applied.

American Brakeblok, as well as most other brake lining manufacturers, recommend the use of a fairly high friction lining on both shoes of the Ford and Studebaker hydraulic brakes.

In addition to material in rolls, American Brakeblok also furnishes brake lining segments in boxed car sets especially prepared for these brakes.

LOCKHEED Self-Adjusting Hydraulic Brakes

In this type brake, conventional brake shoe anchor pins have been eliminated. The lower ends of the shoes butt against a solid block rigidly attached to the backing plate. This block is machined so that its sides are aligned radially to the axle. Rounded abutments on the lower ends of the shoes, allow the shoes to rock laterally on the sides of the blocks. When the brake is applied, the shoes center themselves by moving radially until the shoes are in their proper positions in relation to the drum. This self-centering feature requires no maintenance.

SELF-ADJUSTING DEVICE

The self-adjusting device automatically compensates for the lining wear and virtually maintains the original pedal travel throughout the entire life of the lining. As shown in Figure 7A, the device is located on the Forward Shoe only. Since the lining on the Reverse Shoe wears so slowly, it is usually unnecessary to adjust it until relining of the Forward Shoe is required. Basically, the self-adjusting device consists of a contact plug, one end of which extends through a hole in the center of the shoe and lining. The other end of the plug is centrally pinned to a lever, which in turn, is pinned at its lower end to the brake shoe. The upper end of the lever bears upon the brake eccentric, when the brake is in the released position. A spring actuated wedge is inserted between the plug and lever pin and a wedge guide fastened to the shoe.

The function of the self-adjusting device is to closely maintain constant shoe clearance by advancing the shoe toward the drum as lining wear occurs. The brake eccentric is adjusted when the brake is installed, and no further manual adjustment of the eccentric is necessary until the shoes need relining.

Assuming no drum distortion or expansion, the contact plug and lever always move the same distance from the brake eccentric when the shoes are applied. During a brake application, the shoe is forced against the drum by fluid pressure, and carries with it the contact plug which is held at its original position in relation to the lining surface by means of a light holding spring (Figure 7A). For the purpose of explanation, we can assume that the contact end of the plug does not wear, inasmuch as the actual wear has been found to be very slight, and is compensated for by the lever.

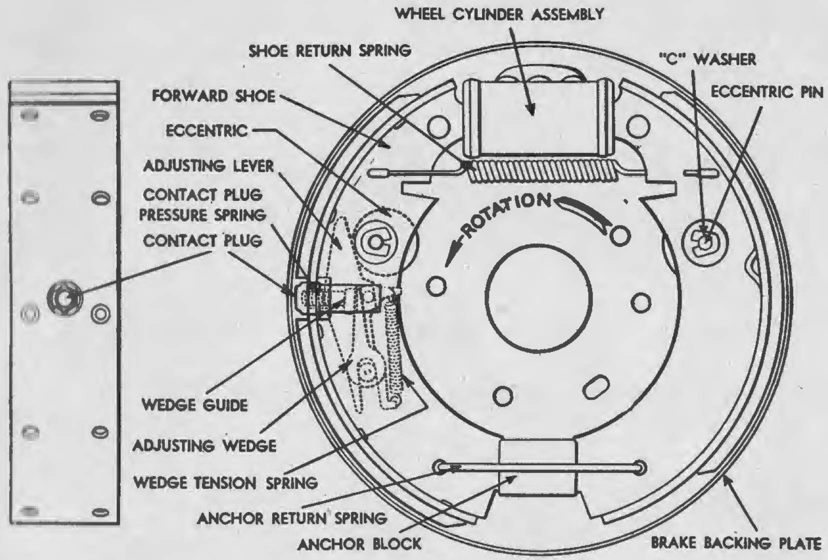

Figure 7A
Lockheed Self-Adjusting Hydraulic Brake.

With subsequent brake applications, and as lining wear occurs, the contact plug moves the adjusting lever in relation to the wedge guide, allowing the adjusting wedge to advance upward by spring action, thereby taking up the clearance between the plug and lever pin and the wedge guide. The wedge holds the lever in its adjusted position in relation to the shoe.

When the brake is released, the adjusting lever resumes contact with the brake eccentric, this limits shoe return to its original drum clearance. Thus, the shoe has been adjusted in an amount equal to the lining wear. This action continues with the wedge gradually advancing upward until the lining has worn to the point where the contact plug has reached maximum travel, at which time the plug contacts the web of the shoe.

WHEN TO RELINE BRAKES

After the plug contacts the web of the shoe, additional brake applications will force the shoe and plug against the drum with equal pressure causing the plug to wear at the same rate as the lining. The contact end of the plug is made of an anti-frictional material which permits this wear and prevents drum scoring. The shoe clearance will therefore increase with lining wear, and the brake pedal travel will also begin to increase. When this occurs, the driver is warned that the brakes need relining.

Drum distortion or expansion has no effect upon the self-adjusting device, since the mechanism is attached to the shoe and does not alter its position, even when the shoe is forced into the distorted or expanded contour of the brake drum. The movement of the contact plug depends entirely upon the lining wear. Over-adjustment is thereby prevented.

REMOVING BRAKE SHOES

First place a wheel cylinder clamp across the wheel cylinder boot on each brake, before attempting to remove the brake shoes.

A. Front wheel brakes

Remove anchor return spring and shoe return spring (Figure 7A). Remove "C" washers from shoe eccentric cams. Each shoe is removed by pulling the heel of the shoe away from the anchor block, lifting from the backing plate until clear of the eccentric cam spindle, and then pulling away from the wheel cylinder.

B. Rear wheel brakes

Remove the anchor return spring, and shoe return spring and pull the parking lever towards center of the brake and unhook cable. Remove hairpin cotters from the shoe adjusting eccentric cam. Remove each shoe in the same manner as followed for the front wheel brakes.

C. Disassembly of the self-adjusting device

Remove the hairpin cotters. Press the contact plug inward until the plug contacts web of shoe. Maintain pressure on contact plug while removing wedge tension spring and while withdrawing adjusting lever. Remove wedge, wedge guide, contact plug and contact plug pressure spring.

RELINING BRAKE SHOES

A. Remove the old lining

B. Reline the shoes. American Brakeblok carsets for these brakes are provided with contact plug clearance holes already cut in the brake lining for use on the forward shoes.

Rivet the linings to the shoes.

If the lining is to be ground on the shoes do not reassemble the self-adjusting mechanism until after the grinding operation unless special grinding equipment is used which provides a means for clamping the self-adjusting mechanism.

C. Reassemble the self-adjusting device as follows:

Step 1: Use a new contact plug. Each car-set of American Brakeblok Brake Lining, for use on these brakes, contains four new contact plugs for use in the self-adjusting mechanisms on each of the forward shoes. Insert the pressure spring in the contact plug, and slip the contact plug into place making sure that the contact plug is on the correct side of the shoe.

Step 2: Replace the wedge guide.

Step 3: Place the wedge into position so that it clears the lever pin hole in the shoe.

Step 4: Replace the adjusting lever while depressing the contact plug. Make sure the wedge is flat against the shoe between the adjusting lever and the wedge guide.

Step 5: Fully advance the wedge, and replace the wedge tension spring. To avoid damaging the wedge tension spring, use a hook to stretch the spring from wedge to lever.

Step 6: Complete the reassembly of the self-adjusting device by turning the shoe over and installing the hairpin cotters.

D. Completely retract the adjusting wedge while pressing the contact plug. Clamp the shoe in a vise so that the jaws of the vise are directly beneath and bearing against the adjusting lever to prevent movement of the contact plug. Then file the contact plug to within .005" of the lining surface.

INSPECTION OF SELF-ADJUSTING DEVICE

A. For the self-adjusting device to function properly, the end of the contact plug must either be level with or extend not more than .005" above the lining surface.

B. To test the wedge action, press the end of the contact plug while completely retracting the wedge. Release the contact plug, and then the wedge. Manually push the contact plug inward, at the same time noting whether the wedge advances. Repeat test.

C. To test contact plug pressure spring, depress contact plug, fully retract wedge, and hold it in fully retracted position while pressing and releasing contact plug.

Both tests B & C should reveal positive spring action. Worn, or defective parts should be replaced when there is failure of either the contact plug pressure spring or the wedge tension spring to function properly.

BRAKE ASSEMBLY AND INITIAL ADJUSTMENT

Do not lubricate any part of the brake. Before mounting the shoes upon the backing plate, fully retract the adjusting wedge while pressing on the contact plug. Then mount the shoes. Remove wheel cylinder clamps. Rotate shoe adjusting eccentric cams to the released position. Approximately centralize the shoes.

The initial adjustment is made by manually setting the forward and reverse shoe eccentric cams (Figure 7B). Caution—Parking brake must be in released position during adjustment. Adjust lining clearance by rotating the eccentric cam adjustment away from the wheel cylinder with the wrench handle pointed outward. (Figure 7B) *Use screw driver if cam eccentric adjustment has slot instead of hex type head.*

To centralize the brake shoes, the drums must be rotated forward while adjusting the forward shoes and must be rotated backwards while adjusting the reverse shoes. Bring each shoe into contact with the drum, noted by a decided drag, then back off until the drum turns freely.

PARKING BRAKE ADJUSTMENT

On all rear wheel brakes equipped with mechanical linkage to operate the brake shoes for parking, the cables should be adjusted whenever new or relined shoes are installed. The hydraulic brake adjustment should be made first in accordance with the adjustment procedure recommended. Never attempt

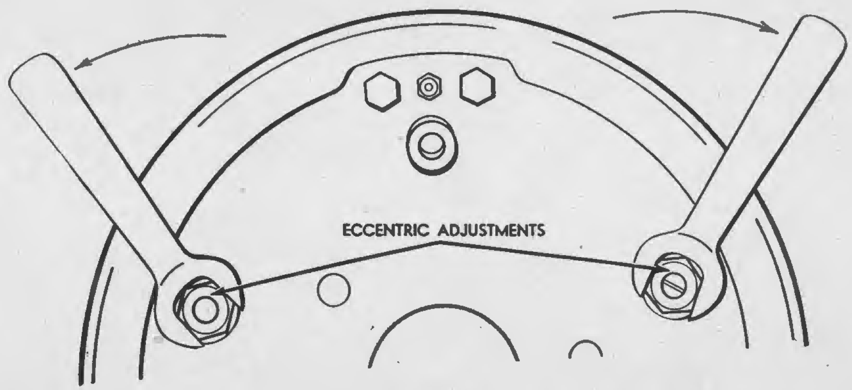

Figure 7B
Method of adjusting eccentric cams on Lockheed Self-adjusting Brakes

parking brake adjustment without first adjusting for proper brake pedal operation.

Make certain that the parking brake cables operate freely. Disconnect the cables and work them back and forth by hand to be sure the cable is not binding. Set the hand brake lever four or five notches from the released position. Then loosen the nut on the threaded end of the cable at the cable clip and tighten the rear nut until a heavy drag is felt when rotating the rear wheels by hand.

Tighten the front nut to maintain the adjustment. Release the hand brake fully and make sure there is no brake shoe drag as the rear wheels are rotated.

The hydraulic system is serviced the same as the standard Lockheed hydraulic system previously described.

BENDIX Hydraulically Operated Brakes

MINOR ADJUSTMENT

1. Jack up all wheels. See that brakes are fully released. Pedal should have ¼" play.

2. Loosen locknut E (Fig. 8) on eccentric adjustment and place a .010-inch feeler between lining and drum at adjusting screw end of that shoe which bears against eccentric.

3. Turn E in forward direction of wheel travel until feeler gauge just tightens. Tighten locknut on eccentric adjustment E. Repeat at each wheel.

4. Turn star wheel A (Fig. 9) until a slight drag is felt at each car wheel. Back off one notch at a time until wheels are free.

5. Hand or parking brake cables should be checked and adjusted, if necessary, by disconnecting them at the cross shaft, expanding the shoes by means of star wheel A until it is impossible to turn car wheel, and then removing slack in cable. Star wheel A should then be backed off until wheel is free.

MAJOR ADJUSTMENT

1. Disconnect parking brake cables and proceed as in 1, 2, and 3 under "Minor Adjustment."

2. Loosen anchor locknut F (Fig. 8) one turn and insert a .010 feeler gauge between lining and drum at anchored end of eccentric-controlled shoe.

3. On sliding anchor type tap anchor slightly with soft hammer until feeler gauge just tightens. Recheck clearance at adjusting screw end of shoe and if correct tighten locknut F with a large wrench. Repeat at each wheel. See instructions on page 15 for Bendix Brakes with eccentric type anchors.

4. Turn star wheel A (Fig. 9) until a slight drag is felt at car wheel. Back off until wheel is free of drag.

5. Check and reconnect parking brake cables as described in 5 under "Minor Adjustment."

6. The hydraulic part of the system is serviced the same as with Lockheed Hydraulic Brakes.

Most of the late model Bendix Hydraulic Brakes do not have the eccentric adjustment "E" shown in Figure 8. On these brake assemblies, all the mechanic has to do is adjust the star wheel A (Fig. 9) and the anchor pin F (Fig. 8). For a major adjustment the drum inspection hole is placed opposite the center of the Secondary Shoe. A screw driver is placed between the Secondary Shoe and the brake drum in order to force the Primary Shoe tightly against the drum. The adjusting screw is turned and the anchor pin moved if necessary in order to obtain .015" clearance between the drum and each end of the Secondary Shoe. The Primary Shoe is kept in close contact with the drum throughout the adjustment procedure. In some cases the anchor pin is eccentric and in other cases it is movable in an elongated slot. (See page 15.)

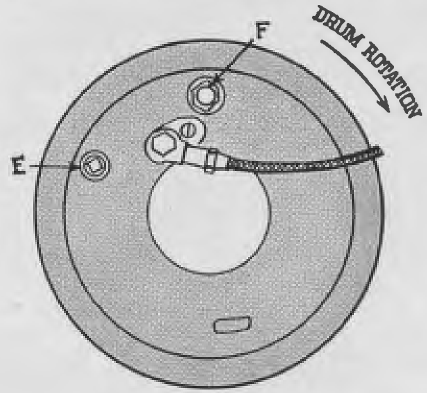

Figure 8

View from Backing Plate Side of Bendix Hydraulically Operated Brake

On the type of Bendix Hydraulic Brakes used on some Hudson cars, there are two floating anchors instead of a single eccentric anchor pin. These two floating anchors are used only to absorb the braking strains and they are not adjustable. In place of the adjustable anchor pin there are two eccentric cams, one for each shoe. The clearances at the anchor ends of the Primary and Secondary shoes are controlled by these eccentric cams and the clearances at the other ends of the shoes are controlled by the star wheel adjustment.

SERVICE HELPS

On Bendix Two-Shoe Brakes, both hydraulically and mechanically controlled types, one shoe is known as the Primary Shoe and the other as the Secondary Shoe. Primary and Secondary brake shoes are usually marked with a "P" and "S" respectively. Irrespective of the position in which the brake assembly is mounted on the axle, the Primary Shoe is always the one "ahead" of the anchor in the direction of forward rotation of the drum.

Figure 9 shows the recommended brake lining when the material is cut from roll stock.

American Brakeblok also furnishes brake lining segments in boxed car sets especially prepared for the more popular cars equipped with Bendix Hydraulic Brakes.

If the brakes are not effective enough with the recommended material to satisfy

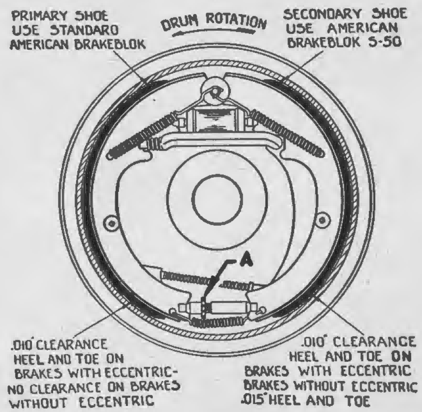

Figure 9

Bendix Hydraulically Operated Brake—Showing Mechanical Operation of Rear Wheel Brakes for Parking certain drivers it is possible to correct this by using Standard American Brakeblok on all the shoes.

If the brakes are too effective for certain drivers or if there is a tendency for the car to pull to one side when the brakes are applied, the following remedies may be tried:

1. Check shoe return springs. If any of them appear weak they should be replaced with springs of the correct stiffness.

2. If the brake is too effective with the recommended clearances of .010" all around, this clearance between drum and lining may be reduced. Clearances should be equal on all wheels.

3. The lining on the Primary Shoes of the front brakes may be cut off at the second row of rivets.

4. American Brakeblok No. S-50 may be used on both shoes of front wheel brakes.

5. Shock absorbers should be checked for equalization.

6. Wheel alignment should also be checked.

On some Packard cars the brake shoe return springs are painted as follows: Primary—blue (lighter spring). Secondary—yellow (heavier spring). The hold down springs should be installed as follows: Yellow at top end of each shoe—black at bottom of front wheel shoes—blue at bottom of rear wheel shoes.

BENDIX Two-Shoe Single Anchor Brake . . . Mechanically Operated

This brake is mechanically-controlled, but in other respects it is similar to the Bendix Hydraulically-Operated Brake.

MINOR ADJUSTMENT

1. Jack up all four wheels and loosen lock-nut on adjustment A (Fig. 10). Turn eccentric adjustment A, in forward direction of wheel travel until lining can be felt gripping a .010-inch feeler gauge inserted through brake drum inspection hole. Inspection hole should be placed in a position near the center of the shoe. Hold eccentric in this position and tighten lock nut. Revolve wheel to make sure it is free. This is done on all wheels.

2. Turn star wheel B (Fig. 10) until a slight drag is felt when turning car wheel by hand. Back off slightly on B until car wheel is free. This is done at each brake.

3. With car jacked up hold pedal in depressed position and try each wheel by hand. Each wheel should feel alike. Loosen (not tighten) adjusting screws on the tight wheels until drag is the same on all wheels.

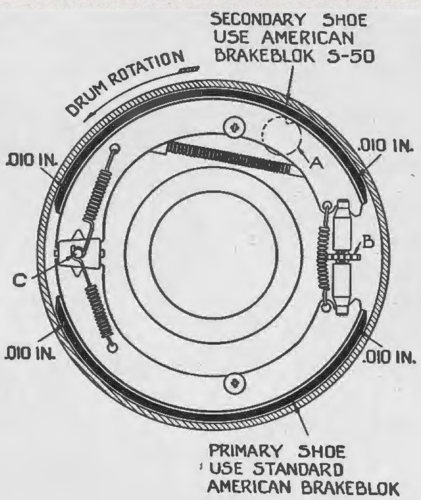

Figure 10
Bendix Two-Shoe, Single Anchor Brake Mechanically Operated

MAJOR ADJUSTMENT

When shoes have been relined or when other adjustments fail to give desired results the anchor pin should be adjusted as follows:

1. Disconnect cables at cross shaft levers. Make sure cross shaft returns to its stop. Remove backlash from linkage between cross shaft lever and pedal.

2. Loosen anchor pin nut C (Fig. 10) completely from lock washer.

3. With a screw driver or suitable tool turn star wheel B (Fig. 10) toward rim of backing plate until both shoes expand against drum, making it impossible to turn wheel with both hands. With a soft hammer tap anchor pin on threaded end. Anchor pin will shift in elongated hole when tapped.

4. Tighten anchor pin nut as tightly as possible with a large wrench.

5. With brake shoes fully expanded readjust cable lengths so clevis pin barely enters clevis and cross shaft lever while holding cable tight, to remove backlash. This is done at each wheel.

6. Back off adjusting screw B, until wheel is just free of drag. This is done at each wheel.

7. Follow with procedure given under "Minor Adjustment."

SERVICE HELPS

Figure 10 shows the recommended brake lining when material cut from roll stock is used.

American Brakeblok also furnishes brake lining segments in boxed car sets especially prepared for the more popular cars equipped with Bendix Brakes.

Further information on Bendix Two-Shoe Brakes may be found by referring to the Service helps on page 13.

Two arrangements of the shoe return springs were used on this brake. The earlier arrangement had a short spring from one shoe to the anchor pin, and a long spring between the two shoes. The later brakes of this type have two short springs, one from each shoe to the anchor pin, as shown in Figure 10. One of these springs is painted red and is heavier than the other spring. The Bendix Company recommend that this heavier shoe return spring always be attached to the shoe which "hides" the brake operating lever.

Brakes with Eccentric Type Anchor—Some of the Bendix Single Anchor Brakes have eccentric type anchors, instead of the sliding type. The eccentric type anchor is identified by the screw driver slot in the threaded end. Instead of tapping this type anchor pin with a soft hammer as described in step 3 of the "Major Adjustment," the anchor pin itself is turned by means of a screw driver until the correct clearances are obtained. It is usually necessary to alternate between eccentric A (Fig. 10) and the eccentric anchor pin in order to obtain the correct adjustment. Both the eccentric A and the eccentric anchor pin rotate in the same direction to reduce clearances.

BENDIX Two-Shoe, Double Anchor, Brakes (MECHANICAL)

MINOR ADJUSTMENT

Adjustments to compensate for lining wear are made as outlined for Bendix Two-Shoe Single Anchor Type Brakes, except that on Double Anchor Brakes the clearance is held at .008 inch at the anchor ends of the shoes, and .014 inch at the adjusting screw ends.

MAJOR ADJUSTMENT

When shoes have been relined or when other adjustments fail to give desired results the anchor pins should be adjusted as follows:

1. Follow instructions given for "MINOR ADJUSTMENT." If brakes are operated by cables, disconnect cables of all four brakes at cross shaft levers. If brakes are operated by rods, make sure that shoes are not being expanded away from the anchor pins.

2. Loosen anchor pin nuts D (Fig. 11) free of lock washer.

3. Remove cover plates and with screw driver or tool turn star wheel B, of adjusting screw toward rim of backing plate until both shoes expand against drum making it impossible to turn wheel with both hands. With a soft hammer tap anchor pins at threaded ends to insure pins assuming correct position.

4. Tighten anchor nuts D (Fig. 11) as tightly as possible with a large wrench.

5. On cable-operated types, with brake shoes in expanded position, readjust cable lengths so clevis pin barely enters clevis and cross shaft lever while holding cable tight to remove backlash. This is done at each wheel. On rod-controlled types, all backlash should also be removed.

6. Back off adjusting screw star wheel B (Fig. 11) until brake is just free of drag. This is done at each wheel.

7. Follow adjusting instructions given for "MINOR ADJUSTMENT."

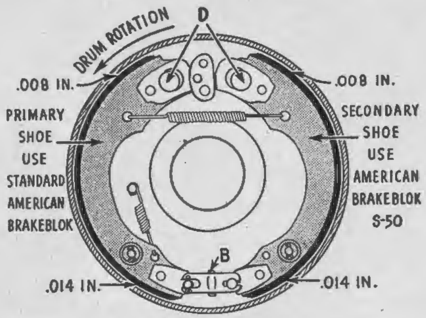

Figure 11

Bendix Two-Shoe, Double Anchor Brake

SERVICE HELPS

If difficulty is experienced in getting brakes balanced remove cover plate from drum-inspection hole. Shoe clearance can be checked with feeler gauges. With correct adjustments feeler gauges will show about twice as much clearance between the drum and lining at the screw adjusting ends of the shoes as at the anchor ends. Normally the clearances are about .008 inch at the anchor end and about .014 at the screw adjusting end.

Figure 11 shows the recommended brake lining when material cut from roll stock is used.

It is important to have the operating cam installed so that the curved portion of the cam operates against the toe of the primary shoe, as shown in Figure 11, with the straight side of the actuating cam on the secondary shoe side.

American Brakeblok also furnishes brake lining segments in boxed car sets especially prepared for the more popular cars equipped with Bendix Brakes.

Further information on Bendix Two-Shoe Brakes may be found by referring to the Service Helps on page 13.

FORD Brakes—1932-33-34

(MECHANICAL)

MINOR ADJUSTMENT

1. Adjust lining-to-drum clearance at external adjusting screw A (Fig. 13). Turn A until brake drags, then back off until wheel is free.

2. Test brakes for equalization and back off on tight wheel.

MAJOR ADJUSTMENT

1. Test front wheel and spindle pin bearings for excessive looseness.

2. Examine spring shackle studs, shock absorber links, and front radius rod mountings for looseness.

3. Disconnect brake rods at wheel end at each wheel.

4. Screw in the brake adjusting screw A (Fig. 13) until brake drags. Back off enough so that brakes do not drag.

5. Adjust length of brake rods so that they are 1/32 inch short when all backlash in brakes has been taken out, and install clevis pins and cotters.

6. Equalize by backing off adjusting screw A on tight wheel.

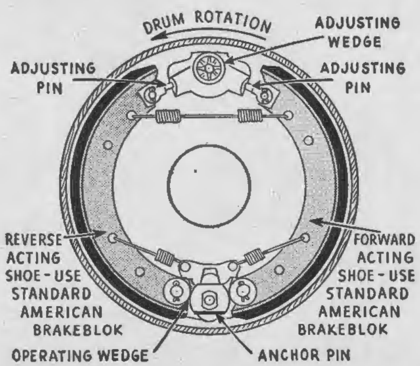

Figure 12

Ford Brake (1932-34)—Left Front

SERVICE HELPS

Chatter on the front wheels of 1932, 1933, and 1934 Ford V-8 cars is often caused by the shoes not being properly centralized. There are replacement operating and adjusting wedges and anchor pins on the market which allow the shoes to centralize themselves properly. These replacement wedges and pins allow the shoes to float in a manner similar to that present on the later model Ford brakes. The ears which make up the shoe support bracket also become worn or bent down and the result is poor shoe centralization and chatter. If the ears are bent down they may be bent back up, but if they are badly worn the backing plate should be replaced. It is also possible to use oversize roller pins in the bottoms of the shoes in order to raise the shoes. It is best to check the shoe centralization with a dummy drum or centering gauge.

Another remedy which has been very successful in eliminating chatter is to leave out the pins which are used to attach the tops of the shoes to the adjusting pins. This allows the tops of the shoes to float and thus properly centralize the shoes. It is usually only necessary to do this on the front wheel brakes.

In cases of bad chatter on the front wheels it is also possible to drill holes in the backing plate opposite the holes in the shoes, and use Bendix hold-down springs, such as those used on Bendix two-shoe brakes to hold the shoes more firmly in place. Removing the lining from the tops of the front shoes and the bottoms of the rear shoes also helps to eliminate front wheel brake noises. The lining should be cut back to the next row of rivets and then well chamfered.

The shoe roller pins should always be placed with the cotter pin end away from the backing plate.

If the levers on front wheel brakes pull past their centers with the brakes applied, the push rod should be lengthened by placing a shim or the head of a 3/16 inch stove bolt in the hole of the wedge applying cam, between the push rod and the wedge cam.

On early 1933 Fords a softer pedal may be obtained by replacing the cross shaft lever with a 1934 assembly which has two pedal lever holes. The top hole should be used when a softer pedal is desired.

Figure 14 shows the recommended brake lining when material cut from roll stock is used.

American Brakeblok also furnishes brake lining segments in boxed car sets especially prepared for Ford cars.

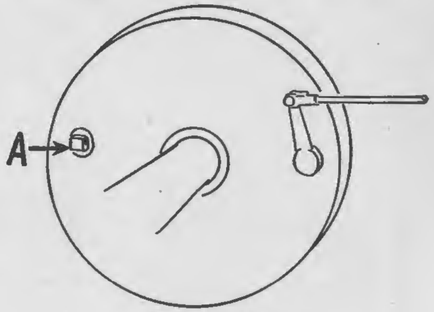

Figure 13
View from Backing Plate Side of Left Rear Ford Brake

FORD Brakes—1935-36
(MECHANICAL)

MINOR ADJUSTMENT

To avoid a false adjustment when drums are expanded by heat, adjustment should only be attempted when the brakes and drums are cold.

1. Raise car so that all 4 wheels are free.

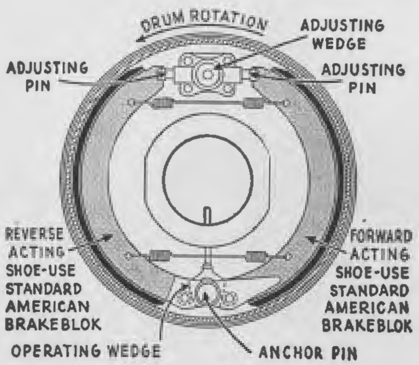

Figure 14
Ford Brake (1935-36)—Left Front

2. Adjust lining-to-drum clearance by screwing in the adjusting screw A (Fig. 15) until brake drags, then back off until wheel is free.
3. Test brakes for equalization and back off on tight wheel.

MAJOR ADJUSTMENT

1. Set hand lever in full release position, making sure that the brakes are fully released with hand lever in this position.
2. Raise car so that all 4 wheels are free.
3. Test front wheel and spindle pin bearings for excessive looseness.
4. Examine spring shackle studs, shock absorber links, and front radius rod mountings for looseness.
5. Disconnect brake rods at wheel end on all four wheels.
6. Screw in the brake adjusting screw until brake drags, then back off enough to free each wheel.
7. Adjust length of brake rods so that

they are 1/32 inch short when all backlash has been taken out, and install clevis pins and cotters.

8. Equalize by backing off adjusting screw on tight wheel.

SERVICE HELPS

The most frequent complaint on these models is hard pedal. Pedal travel is also a frequent complaint. Adjustment will help both complaints to a certain degree, i.e., the lining-to-drum clearance and taking up slack in rods.

In any number of 1935 and 1936 Fords, the pedal can be pushed to the floor when the car is standing still, even when an adjustment has been made. This is due to the rods stretching and also distortion of the drums, and cannot be helped very much unless integral parts of the brake system are replaced.

Improper shoe centralization also frequently causes brake noises on the 1935-36 Ford brakes. The remedies described on page 17 under Service Helps for 1932-33-34 Ford brakes are also useful in eliminating brake noises on 1935-36 Ford brakes.

There are also several types of replacement adjustment pins and wedges on the market for 1935 and 1936 Fords which allow better centralization of the shoes. When the floating adjusting pins are used the brakes become similar to 1937-1938 Ford brakes and the 1937-38 friction material should be used.

It is also especially important to make sure that the brake rods are not binding in the anti-rattle devices.

Figure 14 shows the recommended brake lining when material cut from roll stock is used.

American Brakeblok also furnishes brake lining segments in boxed car sets especially prepared for Ford cars and it is particularly recommended that these car sets be used on 1935 and 1936 models.

FORD Brakes—1937-38
(MECHANICAL)

MINOR ADJUSTMENT

To avoid a false adjustment when drums are expanded by heat, adjustment

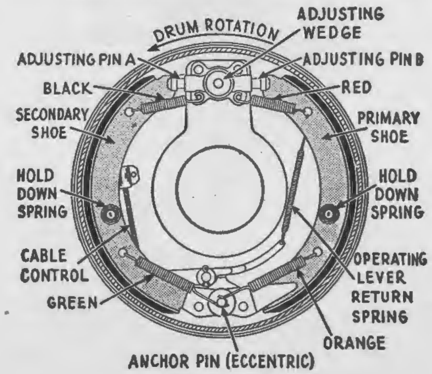

Figure 15
Ford Brake (1937)—Left Front

should only be attempted when the brakes and drums are cold.

1. Raise car so that all 4 wheels are free.
2. Adjust lining-to-drum clearance by screwing in the adjusting screw until brake drags, then back off until wheel is free.
3. Test brakes for equalization and back off on tight wheel.

MAJOR ADJUSTMENT

1. Set hand lever in full release position, making sure that the brakes are fully released with hand lever in this position.
2. Raise car so that all 4 wheels are free.
3. Test front wheel and spindle pin bearings for excessive looseness.
4. Examine spring shackle studs, shock absorber links, and front radius rod mountings for looseness.

5. Disconnect brake cables to all four wheels at the cross-shaft.

6. Screw in brake adjusting screw until wheel cannot be turned by hand.

7. Adjust length of cables at cross-shaft so that clevis pin can be installed with 25-lb. pull on cable.

8. Back off adjusting screw on each wheel until free.

9. Equalize brakes by backing off adjusting screw on tight wheel.

SERVICE HELPS

In cases on 1937 Fords where the brakes are too effective or grabby, the pedal leverage can be changed to remedy this. The pedal rod which connects the cross-shaft lever and the pedal lever can be placed in the bottom hole on the cross-shaft lever. This will make a harder pedal action necessary for a given deceleration.

There has been some confusion in the brake service field regarding the correct manner in which to install the various colored springs in the 1937 Ford brake. In each brake assembly there are seven springs and the correct position of these springs may be determined by referring to Figure 15.

It will be noted that there are two long and two short brake shoe return springs. The two short brake shoe return springs are attached at the top of the brake assembly and go from the shoes to the adjusting screw bracket with the red spring on the primary shoe and the black spring on the secondary shoe.

The two long brake shoe return springs are attached at the bottom of the brake assembly and go from the shoes to the eccentric anchor pin with the orange spring on the primary shoe and the green spring on the secondary shoe.

The primary shoe is the first shoe we come to after leaving the anchor pin and traveling in the direction of forward drum rotation. Thus we see that starting at the anchor pin and moving in the direction of forward drum rotation the order of the brake shoe return springs is ORANGE, RED, BLACK, GREEN.

Then there are two short black hold-down springs, one going to each shoe.

The last spring is a long, small diameter, black spring which is attached to the operating return lever.

The 1937-1938 Ford brakes have a certain amount of transfer of force from one shoe to the other. If the springs are not correctly installed, this transfer of force will not take place and the brake will be ineffective.

Another cause of hard pedal through reduction in force transfer on 1937 Ford brakes is due to improper setting of the adjusting wedge mechanism. The adjusting wedge is covered by a small metal disc as shown in Figure 15. On the early 1937 models when the shoes were not in place it was possible to turn the adjusting nut and destroy the setting of the adjusting mechanism. On these cars, the adjusting nut should not be turned unless the shoes are in place. In case of doubt regarding the correct setting of the adjusting mechanism, it is necessary to remove the metal disc covering the adjusting wedge. The ends of adjustment pins A and B (Fig. 15) fit into half-round depressions in the adjusting wedge mechanism. The adjustment pin A (front shoe) should always fit into the smallest depression with the rear shoe adjusting pin B fitting into the larger depression. This allows both pins to protrude an equal amount from the adjusting wedge housing when the springs are correctly installed.

It is especially important to have 1937-38 Ford brakes well lubricated and properly adjusted with all slack removed from the brake pedal in order to eliminate hard pedal complaints.

When the eccentric anchor pin needs adjusting it is best to do this by using a dummy drum or brake shoe concentricity gauge.

With the dummy drum or concentricity gauge installed, the adjusting screw and the eccentric anchor pin should be set to obtain .005″ clearance at the upper and lower ends of both brake shoes.

American Brakeblok furnishes special material in boxed car sets for 1937 and 1938 Ford brakes, but Standard American Brakeblok roll material may be used if desired.

HUCK Brakes—Mechanically Operated

Several different types of Huck brakes are found on General Motors cars and while there is a slight difference in design the general operating principle is the same and adjustments are made substantially in the same manner. In one type of this

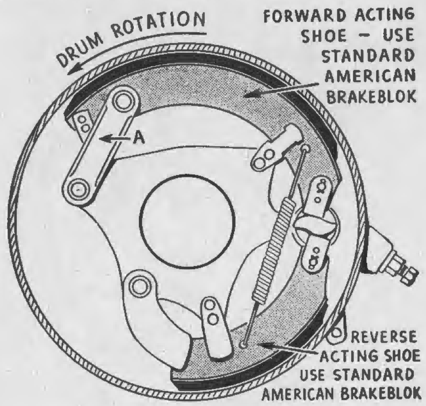

Figure 16
Huck Brake—Long and Short Shoe Type Mechanically Operated

brake a long brake shoe anchors against the backing plate by means of articulated link A (Fig. 16). Therefore, when the brakes are applied with the brake drum revolving in the forward direction there is a tendency to swing the shoe more tightly against the drum. This brake is highly energized. The later models of this brake have two long shoes instead of a long and short shoe.

MINOR ADJUSTMENTS

1. Jack up all four wheels.

2. Loosen lock nut B (Fig. 17) on brake cam operating lever and turn the adjusting screw C (Fig. 17), to the right until wheel can barely be turned by hand. Release drag and then tighten lock nut B. Repeat on other wheels.

3. Equalize brakes at adjusting nuts C (Fig. 17) by leaving off on tight wheel. (A pedal jack for exerting pressure on the brake pedal can be used to apply the brakes.)

MAJOR ADJUSTMENT

1. Jack up all four brakes.

2. Adjust front wheel bearings to proper tension.

3. Disconnect rods or cables at clevises.

4. Loosen centralizer clamp bolt D (Fig. 17) making sure that the centralizer is free to move by tapping cam operating lever lightly with hammer.

5. Adjust screw C (Fig. 17) until wheel can just be turned by hand. Tighten centralizing bolt D (Fig. 17).

6. Adjust cables or rods for this setting and reconnect them.

7. Back off adjusting screw C (Fig. 17) until wheel is free.

8. Check brakes for equal drag making final adjustment at adjusting screw C (Fig. 17).

SERVICE HELPS

The lining-to-drum clearance with brakes properly adjusted is about .010 inch to .012 inch at all points. Less clearance than this defeats the energizing action and may cause a hard pedal. If trouble occurs from chronic unequalization the wheel camber, caster, and toe-in should be checked and corrected if necessary.

All cable operated systems should have the cables well lubricated in order to avoid hard pedal complaints.

On Buick cars fitted with Huck brakes there is a lubricating fitting on the cable assembly. Care should be taken against over-lubrication at this point, as the lubricant will get to the lining.

Worn bushings in the knee-action assembly on Chevrolet cars equipped with Huck Mechanical Brakes will also cause hard pedal complaints.

Squeals or squeaks in Huck brakes are generally caused by incorrect adjustments, improper shoe condition, or by looseness in the brake assemblies. Spring guide clips should be squeezed together and spring washers should be checked to see that they are not loose.

Figure 16 shows the recommended brake lining when roll stock is used. American Brakeblok also furnishes boxed car sets of material especially designed for these brakes.

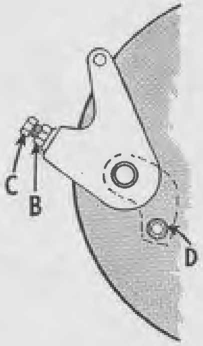

Figure 17
View Showing Backing Plate Side of Huck Brake

HUCK Brakes—Hydraulically Operated

The recent Chevrolet cars are equipped with Huck brakes having two long shoes and hyraulically operated, (Fig. 18). Figure 19 shows a sectional view of the wheel cylinder. The pistons press against an end cap which is piloted over a machined surface of the cylinder. The adjusting screw has a slotted end which fits over the web of the shoe and prevents the screw from turning. The screw threads into the hub of the end cap which has an adjustable wheel welded to it. The adjusting wheel has teeth on its flanged periphery which are used for adjusting the shoes.

The end caps are locked by a steel lever which is riveted to the brake cylinder and engages flutes on the outside diameter of

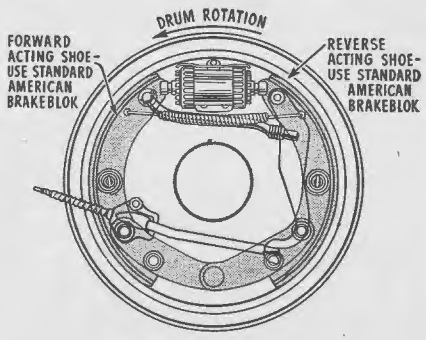

Figure 18
Chevrolet Huck Brake, Hydraulically Operated, Showing Mechanical Operation of Rear Brakes for Parking

each end cap. The wheel cylinder is mounted on the backing plate by means of two cap screws, with bleeder valve and fluid line connection extending through the backing plate.

Shoe adjustment is very simple, in fact not even a feeler gauge is required. Adjustment is confined to turning the adjusting wheels at each shoe. The operation is performed by turning the adjusting wheels with a screw driver used as a lever inserted through the adjustment opening as shown in Figure 20. This opening is located in the web of the drum on some models and in the backing plate as shown in Figure 20 on other models.

In adjusting the shoes, the adjusting

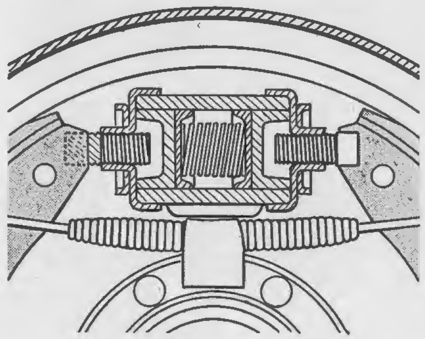

Figure 19
Sectional View of Hydraulic Wheel Cylinder on Huck Hydraulically Operated Brakes

wheels are turned to back the shoes away from the drum to be sure there is no drag at either shoe. One adjusting wheel is then

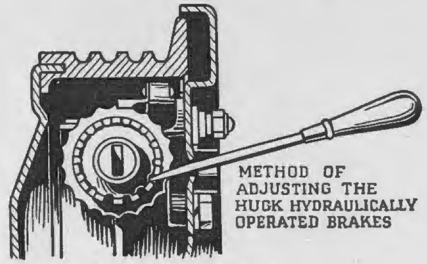

Figure 20

turned to bring its shoe into contact with the drum with just sufficient drag so that the car wheel can just be turned by hand, then backed off until the wheel is just free of drag. The same procedure is followed with the other shoe. Check the shoe adjustment by applying the brake two or three times and making sure that each shoe is set as close to the drum as possible without dragging. The hydraulic system on these brakes is serviced in the same manner as described under Lockheed brakes.

Figure 18 shows the recommended material when roll stock is used. American Brakeblok also furnishes boxed car sets of brake lining especially designed for these brakes.

EXTERNAL TYPE Band Brakes

Although the external type of hand brake has not been used as standard equipment on motor vehicles for several years, there still are some motor cars in daily use with mechanically or hydraulically operated external band brakes. There are many types of design and various means for operating but in general the principle is the same. A typical external type band brake is shown in Fig. 21.

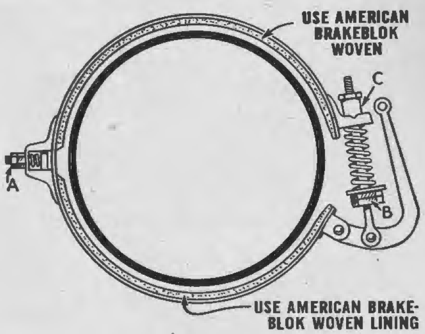

Figure 21
External Type Brake Mechanically Operated

In order to better understand the general layout of the conventional mechanically-operated external-type band brake reference should be made to Fig. 22. This shows the correct relative position of the mechanism. When the brakes are released and the adjustments are correct the equalizer bar is kept parallel with the cross shaft by lengthening or shortening the right and left brake rods. Clevises are provided at the ends of the rods for doing this.

NECESSITY OF CORRECT LEVERAGE

Satisfactory brake adjustment and operation requires proper leverage. The various cranks and levers shown in Fig. 22, must be set at such angles or in certain positions relative to one another to get the desired pressure of the bands against the brake drums when the brake pedal is depressed. Although the positions of brake levers and arms vary with different motor vehicles, a safe rule for the mechanic to follow is to see that the levers do not pull past a straight up and down position when the brakes are fully applied.

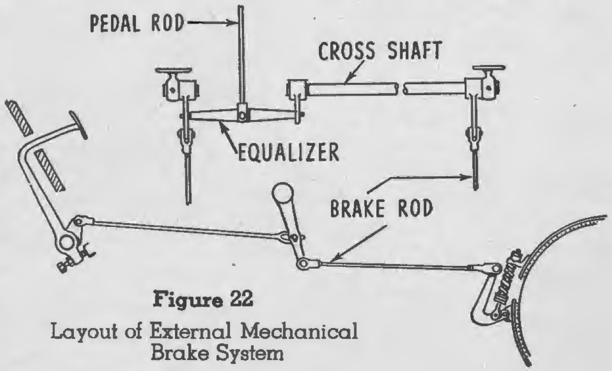

Figure 22
Layout of External Mechanical Brake System

LINING-TO-DRUM CLEARANCE

External type band brakes have more lining-to-drum clearance than internal types because the hotter the brake drums get, the greater the chance for brake drag.

In connection with lining-to-drum clearance, brake drums must be checked for out-of-round condition. Out-of-round or scored drums can be reconditioned by turning or grinding. In some cases a new drum must be used.

EXTERNAL BAND BRAKE ADJUSTMENT

1. Jack up wheels and lubricate all working parts of brake system.
2. Try working parts to see if all connections and each shaft is free. Brake pedal should be snapped on and off to see if linkage is sluggish.
3. Test wheel bearings. Adjust if bearings are loose.
4. Disconnect brake pull rods.
5. Note whether band operating levers are against their stops.
6. Turn anchor adjusting screw A (Fig. 21) to get a .015 inch clearance between drum and lining.
7. Turn nut B (Fig. 21) to get a .030 inch clearance between drum and lining at the lever end of the lining.
8. Turn nut C (Fig. 21) to get a .030 inch clearance at other end of the lining.
9. Reconnect pull rods and note angle of operating levers. Equalizer bar must be parallel with brake cross shaft.
10. Test brakes. If pedal goes to toe board before brakes are applied, disconnect pedal rod and take up play by clevis adjustment or renewal of parts.

SERVICE HELPS

Relined brake bands should be reshaped to proper drum fit before they are applied. The hydraulic system on hydraulically-operated external brakes is serviced in the same manner as the Lockheed system previously described except that the fluid reservoir is usually separated from the master cylinder and equipped with a hand pump for use in bleeding lines and replacing fluid. To eliminate chatter, squeal or other noises the toe-ends of the brake band should be bent away from the drums. A little oil at nuts B and C (Fig. 21) as well as on the clevis pins reduces brake noise and makes for better brake operation. A better action usually is obtained by cutting the lining at the anchor and chamfering the ends of the lining.

American Brakeblok, as well as most other lining manufacturers, recommend the use of a woven lining on external type brakes.

We do this because external brakes are, as a general rule, not very well protected against the entrance of sand, dirt and other foreign materials. When abrasive substances, such as particles of sand or dirt enter the brake assembly and contact the brake lining, there is much less likelihood of damage to the lining if woven material is used. This is true because woven brake lining is soft and more or less porous and under the pressure of braking the abrasive substances imbed themselves in the lining and do little damage unless they are hard enough to cut the steel brake drum. With a molded brake lining, however, the sand and dirt are unable to imbed themselves because the molded lining is hard and non-porous. As a result, these abrasive substances remain on the surface and are rubbed along the face of the brake lining. The effect is much like that of sandpaper and under these sand and dirt conditions we find molded lining wearing out faster than woven lining. However, if external brake assemblies were especially protected against the entrance of sand and dirt it would be found best to use a molded brake lining.

WAGNER HI-TORK BRAKES

The Wagner Hi-Tork brake is used at the present time on the rear wheels of certain models of trucks, in conjunction with standard Wagner Lockheed hydraulic brakes on the front wheels. The bleeding of the hydraulic system is done in the same manner as with the standard Lockheed system described in the early part of this booklet.

In the Wagner Hi-Tork brake (Figure 23), both shoes operate as Forward Acting Shoes when a stop is made with the vehicle going in the forward direction. During such a stop the front shoe anchors against the anchor pin (A) and the rear shoe is anchored by the anchor pin (B). When a

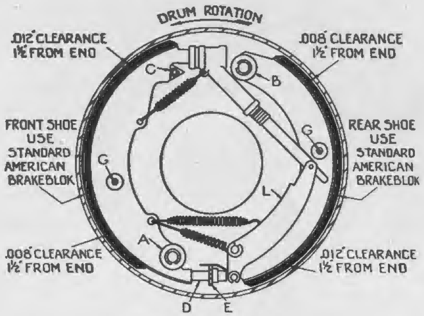

Figure 23
Wagner Hi-Tork Brake

stop is made in reverse, the front shoe operates as a Forward Acting Shoe and anchors up against the reverse anchor pin (C). During a reverse stop, the rear shoe operates as a Reverse Acting Shoe and is anchored in the conventional manner by the anchor pin (B). This action can probably be better understood by referring to the cut-away diagram (Figure 24).

It will be noted that the wheel cylinder used in the Wagner Hi-Tork brake is different than the conventional stepped-bore cylinder in that the cylinders are at an angle. It will also be noted that the small wheel cylinder piston does not operate directly against the rear shoe but instead transmits its force to the rear shoe through a system of levers consisting of the lever (L) and the star wheel connector shaft (D). This action can also be more clearly understood by referring to Figure 24.

On a forward stop the force from the small piston operating through (L) and (D) will cause the rear shoe to move into contact with the drum, but it will not cause the front shoe to leave the anchor pin (A) because the large piston has forced the toe of the front shoe into the drum and the front shoe is held tightly against the anchor (A) by the energizing force of the rotating drum. However, when a stop is made in reverse, there is no energization of the front shoe and the small piston is able to force the heel of the front shoe into the drum and the front shoe anchors up against the reverse anchor pin (C). Thus, it can be seen that on a reverse stop, the small piston operates both the front and the rear shoe.

Although there is considerable difference in the size of the large and small pistons used on the Wagner Hi-Tork brake, the leverages used and the diameters of the piston are such that the pressure on the toe of the front shoe is exactly the same as the pressure on the toe of the rear shoe. This results in both shoes doing the same amount of work in forward stops where both shoes operate as Forward Acting Shoes and this tends to keep the lining wear practically equal on both shoes. The

brake is also very effective because all of the lining is energized on forward stops, due to the two forward shoe action.

The Wagner Electric Corporation, manufacturers of the Wagner Hi-Tork Brake, have published the following instructions covering the servicing of this brake:

Minor Adjustment—These adjustments should be carried out in sequence as outlined below. First make sure that wheel bearings are in good condition and properly adjusted and that the lining is free from grease.

1. Loosen reverse anchor nut (C) (Fig. 25) sufficiently to allow rotation of anchor pin. It will be necessary to tap anchor pin to loosen it in the backing plate before it can be rotated. With an adjustable wrench, turn anchor pin in direction of forward wheel rotation, as shown by arrow, until a brake drag is felt. Then back off anchor until drag is relieved and a .012 feeler gauge can be inserted through the drum inspection hole 1½" from the toe end of the lining. Lock anchor nut securely. Rotate drum to check for high spots or drum eccentricity.

2. Remove adjusting hole cover (F) (Fig. 25), insert a screwdriver and rotate the star wheel (E) (Fig. 23), moving the handle of the screwdriver upward in direction of the axle, until a drag is felt. Release rear shoe (Fig. 23) from drag by rotating star wheel (E) in opposite direction from above, moving screwdriver handle downward away from axle, until the drag is relieved and a .012 feeler gauge can be inserted through the drum inspection hole 1½" from the toe end of the lining adjacent to the star wheel. Rotate drum to check for high spots or drum eccentricity. Replace adjusting hole cover.

Note: Anchor pins (A) and (B) are not to be disturbed unless new lining is installed or other adjustments fail to give results. No adjustments should be made unless drums are at normal temperature.

Major Adjustment—It is imperative that the following adjustments be carried out in sequence as outlined below:

1. Loosen the rear shoe heel anchor pin nut (B). Loosen the front shoe heel anchor pin nut (A) and reverse anchor nut (C) sufficiently to allow rotation of the anchor pins. With an Allen wrench, turn the anchor pins (B) and (A) to their off positions, which may be determined by ob-

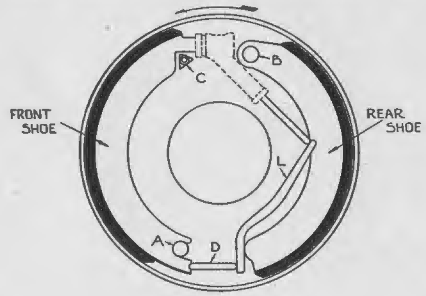

Figure 24
Diagram Showing Action of the Wagner Hi-Tork Brake on a Forward Stop

serving the brake shoe movement. It will be necessary to tap reverse anchor pin (C) to loosen it in the backing plate before it can be rotated. With an adjustable wrench, turn reverse anchor (C) to its off position. Remove adjustment hole cover (F). Insert a heavy screwdriver through the adjustment hole in the backing plate and engage star wheel (E). Move screwdriver handle downward away from the axle and rotate the star wheel (E) (Fig. 23) to contracted position. This position of anchors and shoes permits the assembly of hub and drum over newly relined shoes.

2. Insert .012 feeler gauge through inspection hole in drum approximately 1½" from toe end of front shoe lining. Rotate anchor pin (C) in direction of forward rotation of the drum until feeler gauge is just free between the lining and the drum.

3. Move drum inspection hole to approximately 1½" from heel end of front shoe lining. Insert .008 feeler gauge be-

tween drum and shoe. Rotate anchor pin (A) in reverse drum rotation until the feeler gauge is just free. Recheck toe end of lining. If clearance of .012 does not exist, repeat operations until .012 is obtained at toe and .008 clearance at the heel of front shoe lining. Tighten anchor pin nuts securely with 18" or 24" box wrench.

4. Insert screwdriver through adjusting hole in the backing plate and rotate star wheel (E) by moving handle of screwdriver upward in direction of axle until a .012 feeler gauge is just free 1½" from toe end of rear shoe. Place .008 feeler gauge 1½" from heel end of lining of rear shoe and rotate anchor (B) in reverse drum rotation until the feeler gauge is just free. Recheck the toe end of lining. If proper clearance does not exist, repeat above operation until .012 clearance is obtained at the toe and .008 clearance at the heel of rear shoe.

Tighten anchor pin nut securely, using 18" or 24" box wrench. Replace adjusting hole cover in the backing plate.

DISASSEMBLY OF BRAKE SHOES FROM BACKING PLATE

1. Remove all springs and the two shoe guides (G) (Fig. 23). The brake must be fully collapsed before the springs are removed. The front shoe may now be removed from the backing plate.

2. Care must be exercised in removing the lever actuating push rod from the small bore of the hydraulic cylinder to eliminate any chance of scoring the cylinder wall, which would result in a fluid leak.

To remove the rear shoe, first remove the ("C") washer at anchor pin (A) (Fig. 23). Then compress the shoe actuating lever (L), which is attached to the rear shoe and actuating push rod, downward. Move this lever in extreme applied position in direction of the drum. Holding the lever in this position, rotate the brake shoe outward. This allows the actuating push rod to leave the cylinder bore without interference. The shoe may now be removed from anchor pin (B).

To reassemble, reverse the above operations, making sure that the toe end of the front shoe web is in the slot of the hydraulic piston. Lubricate all bearing surfaces sparingly, with approved type lubricant. Do not lubricate the tapered

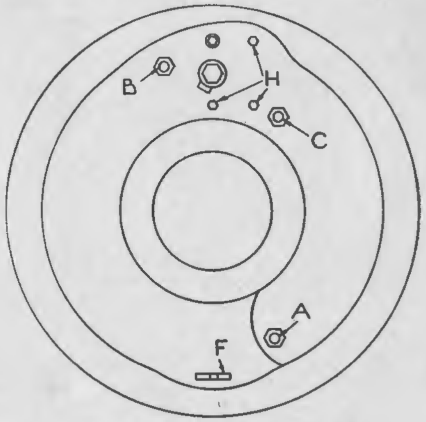

Figure 25
View From Backing Plate Side of Wagner Hi-Tork Brake

seat of the anchor pin (C). Care should be taken in rehooking the shoe return springs so as not to stretch them.

Adjust the shoe guides (G) so that a "U" shaped .010 feeler gauge may be inserted between the shoe guide washer and the shoe web. Lock jam nuts securely.

To Remove Cylinder—After removal of brake shoes, disconnect tubing or hose at wheel cylinder inlet. Remove the three cap screws (H) (Fig. 25) which hold wheel cylinder to the backing plate and the cylinder may be withdrawn for inspection. Caution must be exercised to prevent brake fluid from coming in contact with the brake lining, during the service operations, either from dripping or from soiled hands.

The use of a cylinder clamp is recommended.

Disassembly of Wheel Cylinder—Remove boots from cylinder casting. The large piston is readily removed. To remove the small piston, form a short right angle bend in a length of small wire and engage the hole provided in the inside body of the piston. Withdraw the piston and cup. The cup, of the collar-button type, is attached to the piston and is easily removed. CAUTION—When removing the small piston, exercise care and do not scratch the cylinder bore with the tool employed.

Cylinder Inspection—After dismantling the cylinder, inspect for the following:

(a) If mineral oil is present in the system, the rubber cups will be enlarged and very soft. They must be discarded and replaced with new parts.

(b) Cylinder walls must be smooth and not pitted or scratched. If these conditions exist, the cylinder must be renewed.

(c) Pistons must be free from burrs.

(d) Occasionally, grease retainers become worn, allowing the grease from the wheel bearing to leak through into the brake drums. When grease comes into contact with the rubber boots, they become soft and enlarged, preventing them from protecting the cylinder from foreign matter. In cases of this nature, replace boots and grease retainers.

Cylinders and parts must be washed in clean alcohol and dipped in an approved hydraulic fluid. Do not wash cylinder or parts in gasoline, kerosene, or oil.

TIMKEN "DP" (Dual Primary) BRAKES

The design of the Timken Dual Primary hydraulic brakes provides easy maintenance not complicated by special tools or heel and toe adjustments. As illustrated in Figure 26, the shoes are fitted with liners of equal length and identical material and are not anchored but "float" in the lever arms. The single straight bore hydraulic wheel cylinder actuates the lever arms which in turn apply pressure at the center of the shoes by means of the movable pressure blocks. The shoes are self centered at the time of contact with the drums. Shoe rotation is prevented by the self aligning abutment blocks which bear against the angled face of the shoes. The principal parts of the Timken "DP" brake are shown in Figure 26 as follows:

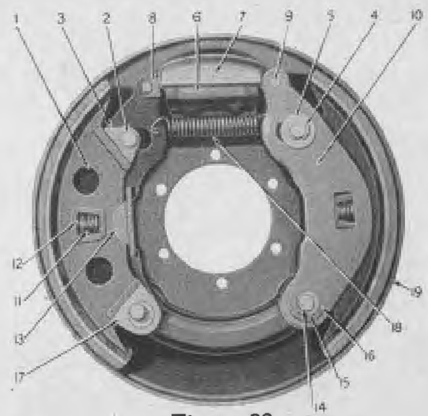

Figure 26
Timken Standard sized "DP" type brake. Half of left brake lever has been removed to show brake shoe abutment blocks, pressure blocks, and other parts which otherwise would be concealed from view.

1. Brake Shoe and Lining Assembly.
2. Brake Shoe Anchor Pins—stationary.
3. Brake Shoe Anchor Pin Abutment Blocks.
4. Brake Shoe Anchor Pin "C" Washer.
5. Brake Shoe Anchor Pin Washer—Plain.
6. Wheel Cylinder Assembly.
7. Wheel Cylinder Cover.
8. Wheel Cylinder Push Rod.
9. Wheel Cylinder Push Rod Pin.
10. Brake Shoe Lever Assembly.
11. Brake Shoe and Lever Spring.
12. Brake Shoe and Lever Spring Retainer.
13. Brake Shoe Lever Pressure Block.
14. Brake Shoe Anchor Pin—Lower—Adjustable.
15. Brake Shoe Anchor "C" Washer.
16. Brake Shoe Anchor Pin Washer—Plain.
17. Brake Shoe Abutment Block—Lower.
18. Brake Shoe and Lever Spring—Upper.
19. Brake Dust Shield Assembly.

MINOR ADJUSTMENTS

In Figure 27 the letter "A" indicates the eccentric anchor pins that control the shoe movement toward or away from the drum. To decrease the lining to drum clearance—proceed as follows:

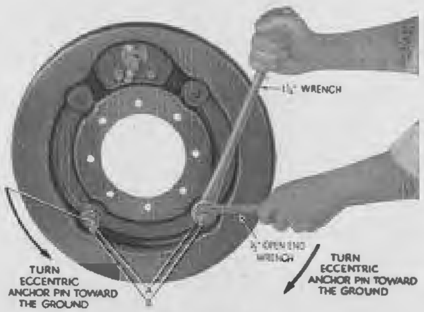

Figure 27
Method of Adjusting Timken "DP" Brakes

1. Raise vehicle so wheels are free to rotate.

2. Use a 1¼" wrench to loosen nut "B."

3. Position a ½" open end wrench on the flat section of anchor pin "A" so that the wrench hand extends away from the vertical line of the brake. Apply pressure toward the ground until shoe contacts drum, then back off to a minimum running clearance. (Approximately 1½" travel at end of 8" wrench.)

4. Lock adjustment with nut "B" and rotate wheel in both directions and check for free running clearance.

5. Each brake is equipped with two brake shoes and eccentric adjusting pins. Adjust each shoe in the manner described above, which is illustrated graphically in Figure 27.

CAUTIONS

1. Make sure wheel bearing adjustment is correct before attempting brake adjustment.

2. Make sure the adjustment is securely locked.

3. Make sure liners are not worn excessively permitting rivets to contact drums.

MAJOR ADJUSTMENTS

As illustrated in Figure 28, it is not necessary to disturb the main retracting spring when removing shoes for relining. Shoe assemblies are removed as follows:

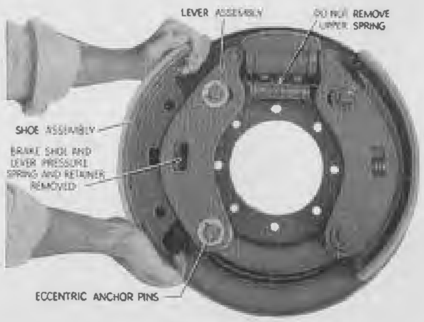

Figure 28
Removing Brake Shoes for Relining

1. Remove brake shoe and lever pressure spring and retainer by inserting a screw driver under the side of the spring near the retainer and prying them out of the recess. Do not remove main retracting springs.

2. Shoes can now be removed from levers. The pressure block may also be removed if desired.

3. When re-assembling the shoes, apply brake grease lubricant to both angle faces and the pressure block surface of the shoe. If the pressure block has been removed, it can be "stuck" in position on the shoe by means of the grease.

4. Rotate the eccentric pins to full release position.

5. Insert the shoe spring and retainer in the lever slot and force into central position.

NOTE

As illustrated in Figure 29, the spring and retainer must be compressed completely to permit insertion in the slot. For field servicing where a tool with a square tapered hole is not available, the use of a "plier wrench" or "crescent wrench" will be found very satisfactory for compressing and holding the spring and retainer. With the compressed spring in the wrench, it can be placed against the lever and aligned with the slot. A small hammer can be used to tap the spring

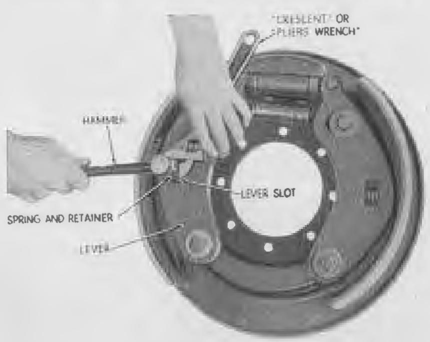

Figure 29
Installing Brake Shoe and Lever Spring and Retainer

and retainer from the wrench into the lever slot.

CAUTIONS

Make sure there is a free movement of abutment blocks on the upper and lower anchor pins. Make sure the spring retainer is properly seated in the lever arm. The retainer should be flush with the outside of lever arm.

ARM REMOVAL INSTRUCTIONS

To disassemble the lever arm, first remove the brake shoes as described under "Major Adjustments." Then remove upper, or stationary anchor pin "C" washer No. 4 and flat washer No. 5 shown in Figure 26. Remove "C" washer No. 15 and flat washer No. 16 which will permit the removal of the arms and links from the upper and lower anchor pins, No. 2 and No. 14.

Heavy Duty Type Timken "DP" Hydraulic Brakes

Figure 30 is an illustration of the heavy duty "DP" hydraulic brake. It will be noted that this brake is similar to the standard "DP" brake, except that it is larger. The service instructions are the same for both type brakes, except for a few additional operations to be made on the larger brake to compensate for slight variations in design.

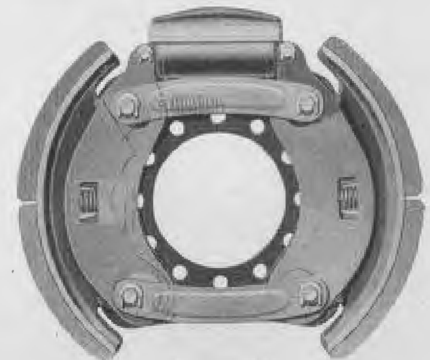

Figure 30
Heavy Duty "DP" Brakes

While the smaller brakes are mounted on backing plates incorporating dust shields as an integral part, the larger brakes are mounted on a flat plate spider with the dust shield being manufactured separately as an optional feature. These dust shields are secured to the spider by means of the stationary anchor pin locking nuts and the eccentric anchor pin adjusting nuts.

The heavier type brakes are equipped with two anchor pin straps secured to the anchor pins with "C" washers. To remove the brake levers it will be necessary to remove the "C" washers and then lift the straps off the anchor pins.

The wheel cylinder push rod on the heavier type brake is secured to the brake lever by a push rod pin which is inserted through the brake lever and the drilled end of the push rod is fastened with a "C" washer.

It should be noticed that in Figure 26 showing the standard "DP" brake, the push rod, No. 8, is designed with an open end that is not secured to the brake lever, but has free movement on the push rod pin.

Although the method of adjustment of the anchor pin is the same on both brakes, larger wrenches will be required on the heavy duty type "DP" brake. A 5/8" open end wrench will be required on the flat section of the anchor pin, and a 1 5/8" wrench will be required to loosen the anchor pin locking nut. Because of the increased sizes of the brake shoes, wheels and tires on the heavier brake, it will also be necessary to use wrenches with a greater offset to obtain clearances for this adjustment.

VACUUM POWER BRAKE EQUIPMENT

There are two general types of vacuum power brake systems. One is known as the air suspended or single line system and the other is known as the vacuum suspended or double line system. However, both types use the vacuum in the engine manifold as the source of power which helps the driver's foot apply the brakes.

It should be remembered that when it is said that a vehicle has vacuum power brake equipment, it is meant that the engine vacuum is used to help the driver apply the brakes. Vacuum power brake equipment does not mean a certain type of brake assembly. In fact, the vacuum brake equipment has nothing to do with the type of brake shoes or brake drums used. A vacuum power brake system may be used on a vehicle equipped with any type of mechanical or hydraulic brake. When it is used on a vehicle fitted with mechanical brakes, the vacuum equipment is used to help apply the brakes by adding its power to the

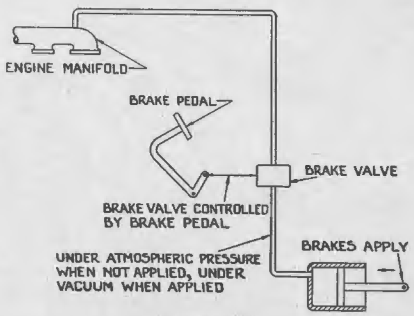

Figure 31
Layout of Atmospheric Suspended Vacuum Brake System (Single Line)

driver's force applied to the brake cables or rods. When a vacuum system is used on a vehicle fitted with hydraulic brakes the vacuum equipment adds its power to the driver's push on the master cylinder piston rod, thus making it easier for the driver to build up a high pressure in the hydraulic brake system.

ATMOSPHERIC SUSPENDED (SINGLE LINE) SYSTEM

Figure 31 shows the layout of a single line (atmospheric suspended) vacuum power brake system. When the driver presses the brake pedal the brake valve is opened and the vacuum from the engine manifold causes the piston in the booster cylinder to move and thus help apply the brake. This system is called "Atmospheric suspended" because when the brake is off there is atmospheric pressure on both sides of the booster cylinder piston. When the driver presses the brake pedal opening the brake valve there is vacuum on one side of the piston and atmospheric pressure on the other side. Naturally under these conditions the piston moves and helps apply the brakes. As can be seen from the diagram this atmospheric system can be set up, using only a single line from the brake control valve to the booster cylinder. Instead of "single line" or "atmospheric suspended," this system is sometimes referred to as simply an "air suspended" system. In certain installations, especially on trailers, the brake valve is controlled by a hand lever rather than by the driver's foot operating through the brake pedal.

From an examination of the layout shown in Figure 31, it can be seen that each time the brakes are applied there is a quantity of raw air which travels into the engine manifold from the booster cylinder. It can be easily seen why this occurs when we remember that with this system, there is ordinary air pressure on both sides of the booster cylinder piston with the brakes not applied. Pressing the brake pedal opens the brake valve and removes the air from one side of the booster piston and this raw air travels into the engine manifold. With a large booster cylinder the amount of raw air traveling into the engine manifold is considerable and there is quite likely to be detrimental effects upon engine carburetion since the engine is usually at low gas throttle position when the brakes are applied. Therefore, in order to avoid this, we find that large booster cylinders can not be used successfully with the "atmospheric suspended" or "single line" system. Since large booster cylinders cannot be used successfully with this system, we find that the "Atmospheric suspended" system's use is limited to passenger cars, light trucks and in a few cases, light trailers.

VACUUM SUSPENDED (DOUBLE LINE) SYSTEM

Figure 32 shows a layout of the "vacuum suspended" or "double line" vacuum power brake system. This system is called "vacuum suspended" because there is vacuum on both sides of the booster cylinder piston when the brakes are not applied. The brake valve is therefore open to both lines A and B, thus admitting vacuum to both sides of the booster cylinder piston when the brakes are off. When the driver presses on the brake pedal he operates the brake valve which shuts off the vacuum to line B and admits atmospheric pressure to this line. There is now vacuum on one side of the piston and atmospheric pressure on the other side and the piston therefore moves and helps apply the brakes. It will be noted that there is a check valve used between the brake valve and the engine manifold. This seals the system at maximum vacuum and permits at least one power brake application even if the engine should stall. It will also be noted that the vacuum suspended system requires two lines from the brake control valve to booster cylinder, thus giving it the name "double line" system.

With the vacuum suspended system there is also a quantity of air which travels from the booster cylinder to the engine manifold. However, this occurs when the brakes are released with this system instead of when the brakes are applied as with the atmospheric suspended system. When the brakes are released the engine is usually starting to pull with an advanced gas throttle position and the admission of air to the carburetor does not have as much effect as it does under the air suspended system with the engine at low throttle position. Therefore large booster cylinders can be used with the double line system and this system can be used on trucks and trailers where the single line system does not work out as well.

A vacuum booster cylinder can be installed on a trailer and the two lines coming from the trailer are hooked on to a tee connection in line A and to a tee connection in line B on the trailer. In this case the trailer brakes would be controlled by the same brake valve which controlled the tractor brakes. In many cases however, the trailer brakes are controlled by a hand control valve mounted in the tractor cab. Many state laws require that the trailer brake system be capable of applying the trailer brakes in case of a trailer breakaway. This can best be accomplished by using a vacuum reservoir tank and a trailer emergency valve which is merely a separate check valve for the trailer. Thus, if the trailer should break away from the tractor the emergency valve seals the vacuum in the one line and the atmospheric pressure entering the other line causes the booster to apply the trailer brakes.

In addition to the foot control valve, hand control valve, check valve and emergency check valve mentioned above, there are a number of other valves used in vacuum brake work.

A relay valve is used on a trailer brake system to speed up the application of the trailer brakes. Without a relay valve the air to apply the trailer brakes would have to travel all the way from the control valve to the power cylinder on the trailer before the trailer brakes would begin to apply. Since the control valve, either foot type or hand type is mounted near the driver and the power cylinder may be near the trailer rear wheels, this represents considerable distance and lost time in the case of a long tractor-trailer com-

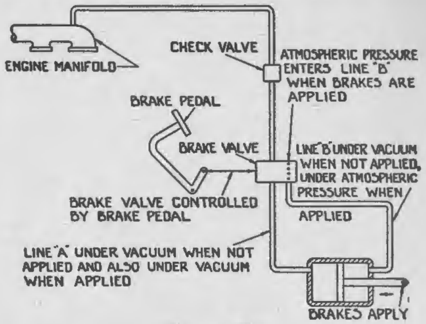

Figure 32

Layout of Vacuum Suspended Vacuum Brake System (Double Line)

bination. The relay valve is mounted near the trailer power cylinder and there is little time lost since the air only has to travel from the relay to the power cylinder in order to apply the trailer brakes.

A regulating valve may be installed on the dash, so that the driver may control the amount of vacuum in the system.

A pneumatic relay valve is used when it is desired to operate a trailer equipped with vacuum brakes in conjunction with a tractor equipped with air brakes.

A conversion relay valve is used when it is desired to operate a trailer equipped with an atmospheric suspended vacuum brake system in conjunction with a tractor equipped with a vacuum suspended power brake system.

A synchronizer valve is occasionally used to obtain the proper relative amounts of braking between tractor and trailer on tractor-trailer combinations.

In some cases a vacuum chamber and diaphragm are used instead of a vacuum cylinder and piston but the operation of the power system is the same in eithe case.

The power cylinder in a vacuum brake system may be mounted so that the piston exerts a "pulling" action in applying the brakes, as shown in Figure 31 and 32, or it may be mounted so that the piston exerts a "pushing" action in applying the brakes. In most hydraulic systems it is built integral with a hydraulic cylinder.

SERVICE HELPS

In order to check a vacuum power brake system for leaks, it is necessary to have a vacuum gauge, hose and fittings. The vacuum gauge is graduated from 0 to 30 inches of mercury. Atmospheric pressure is normally equal to about 15 pounds per square inch and this pressure will support a column of mercury 30" high. Therefore a perfect vacuum would show a reading of 30" mercury on the vacuum gauge. However, the vacuum in automotive engines is never perfect but in engines in good condition it should range between 20" and 26" of mercury. For satisfactory brake operation a vacuum booster system should show a reading of 16" on the test gauge. On a truck or bus installation the vacuum leakage when tested should not exceed 3" per minute. In the case of a tractor-trailer combination which must conform to trailer breakaway laws the leakage should not exceed ⅓" per minute. (1" in 3 minutes.)

Vacuum power units of the piston-cylinder type should be lubricated with about 2 ounces of vacuum cylinder oil for every 5,000 miles of operation.

Vacuum power units of the diaphragm-chamber type require no lubrication but the diaphragm and seal should be inspected regularly and replaced if necessary.

In cold weather, there is always danger of moisture condensing and freezing in the lines and other parts of a vacuum power brake system. In order to prevent freezing, we recommend placing a small amount of permanent type anti-freeze in the lines and a small amount in the power unit. In diaphragm-chamber type units about ½ ounce of anti-freeze is sufficient, while in the piston-cylinder type units, it is best to place about 2 ounces on each side of the piston.

The air cleaners used at different points on a vacuum power system should be cleaned regularly to insure efficient operation of the brakes.

AIR BRAKE EQUIPMENT

The layout of a typical air brake system is shown in Figure 33. This layout shows what is commonly called a "straight air" system. It will be noted that a power unit is used at each wheel brake and that these power units may be either the diaphragm—chamber type—or the piston-cylinder type. The power units in this straight air system are attached to levers which operate the brake cams of mechanical brakes. These levers are usually referred to as "slack adjusters" since the brake adjusting mechanism is built into these levers.

Some air brake systems operating mechanical brakes have a hydraulic cam brake actuator in place of the slack adjuster. The air from the compressor is used to operate an air piston which in turn operates a hydraulic master cylinder. The pressure from the hydraulic master cylinder is then transmitted through the hydraulic fluid lines to the hydraulic cam brake actuators at each wheel brake. The hydraulic cam brake actuators then turn the cams of the mechanical brakes. Thus, it can be seen that this system is a combination air-hydraulic-mechanical brake system. However, it is generally referred to as an "air-hydraulic" system for mechanical brakes.

There is another air brake system which uses the air from the compressor to operate an air piston which in turn operates a hydraulic master cylinder. However, in this case the pressure from the master cylinder is transmitted through

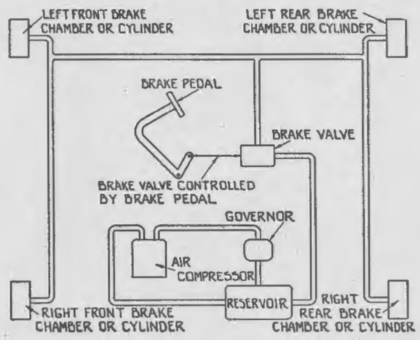

Figure 33

Layout of Typical Automotive Air Brake System

the hydraulic fluid lines to ordinary hydraulic brake wheel cylinders in standard type hydraulic brake assemblies. Thus, it can be seen that this system is merely a regular hydraulic brake system operated by compressed air pressure. It is generally referred to as simply an "air-hydraulic" system for hydraulic brakes.

There are a number of valves used in air brake work and it is well for the mechanic to understand the function of each.

Air brake application valves are divided into two general types, that is, foot-operated brake valves and hand-operated brake valves. The hand-operated brake valve is usually used in tractor-trailer operation.

A two-way valve, or double check valve, is used in tractor-trailer operation so that the hand control valve may be used to control only the trailer brakes while the foot control brake valve will apply both the tractor and trailer brakes. This type of installation gives added safety, for, in normal driving the foot pedal will apply both tractor and trailer brakes and on slippery pavements or in mountain driving, the driver can apply the trailer brakes alone through use of the hand control valve.

In some cases a pressure distributing valve is used on tractor-trailer combinations in order to provide for application of the trailer brakes before the application of the tractor brakes.

A quick release valve is used to provide faster release of the brakes. One or more quick release valves are used and they are mounted near the brake assemblies on which the quick release is desired. Without the quick release valve the exhaust air must travel from the brake assembly to the brake application valve before the brake releases. Using the quick release valve, the exhaust air must travel only from the brake assembly to the quick release valve before the brake release.

A relay valve is used to speed up the application of brakes which are a long distance from the brake application valve such as the rear brakes of long wheelbase vehicles.

A relay emergency valve is used in trailer operation to speed up the application of the trailer brakes and at the same time it provides a method of automatically applying the trailer brakes in case of a break-away. Of course, it is necessary to have an air reservoir tank mounted on the trailer and connected to the relay emergency valve in order to provide the air power for the automatic application of the trailer brakes.

There is also a special relay emergency valve which can be mounted on trucks to provide for automatic application of the rear brakes in case any hose or tubing of the air brake system should become broken. Here, too, it is necessary to have a special air reservoir tank to supply air for the automatic application of the

brakes. This system is only used on heavy duty equipment operated in special types of service.

A relay-quick-release-emergency valve is used in trailer operation to speed up application of the trailer brakes and provide for quick release of the trailer brakes and at the same time provide for automatic application of the trailer brakes in case of a trailer breakaway. Here, too, it is necessary to have an air reservoir tank mounted on the trailer and connected to the relay-quick-release-emergency valve to provide for the automatic application of the brakes.

A safety valve is mounted at the air reservoir connection to prevent the building up of too great a pressure in the system. The safety valve is usually set to release any air pressure above 150 pounds per square inch.

In some cases a pressure regulator valve is used to govern the air pressure in an air brake system and to prevent loss of air due to too much use of other air operated devices, such as horns, windshield wipers, door openers, etc. The pressure regulator valve is also used in brake systems requiring a rapid build up in air pressure in order to provide brake power in the case of stops made a few minutes after starting. This condition is particularly prevalent in fire engine operation.

A limiting valve is frequently mounted on the instrument panel so that the driver may control the amount of brake pressure and thus reduce the brake power when driving on wet or ice-covered roads.

On some vehicles an air supply valve is installed in the system to provide air pressure for emergency tire inflation or other uses.

SERVICE HELPS

Although the safety valve is usually set for 150 pounds per square inch, it is recommended as a general rule, to keep the line pressure below 105 pounds per square inch on air brake systems.

The air cleaners used throughout the system should be cleaned regularly.

In the case of self-lubricated air compressors the oil should be checked daily and drained at the proper intervals.

In the case of engine lubricated air compressors, the oil line feeding the compressor should be checked regularly.

In average service the diaphragms in brake chambers should be replaced at least once a year. In severe service the diaphragms should be replaced more often.

Power units of the piston-cylinder type should be inspected regularly and in extreme heat or dust or in winter operation two ounces of S.A.E. 10 oil should be put into the atmospheric end of the power cylinder.

If an air brake system is not operating properly, it is advisable to first check the entire system for leaks and attempt to determine which unit is causing the trouble. Ordinary soap suds are generally used for locating leaks in an air brake system.

All air brake reservoir tanks should be drained daily in order to eliminate any condensation from the system.

STOPPING DISTANCE CHART

With brakes in perfect operating condition, the stopping distance depends upon the friction between the tire and road surface. It can be readily understood that even with perfect brakes a vehicle cannot make a very rapid stop on a slippery pavement. The stopping distances from various speeds for a vehicle with perfect brake equipment and tire treads operating on the average dry, concrete, brick or cold asphalt road surface would be as shown below. Incidentally, a vehicle with perfect brake equipment must have a sufficiently powerful brake on each wheel so that all wheels may be brought up to the locking point. The vehicle is stopping at the fastest rate just as skidding is impending at all four wheels.

In order to find the actual total stopping distances from the various speeds it is necessary to add from 20 to 80 feet, depending on the car speed, to take care of the distance the car travels during the time interval between the instant the driver decides to stop and the instant his foot actually applies the brake. The stopping distances after the brakes are applied and the total stopping distances which take into account the average driver reaction time of ¾ second are as follows:

Speed of Car	Reaction Distance	Braking Distance	Total Stopping Distance
20 M.P.H.	22 ft.	18 ft.	40 ft.
30 M.P.H.	33 ft.	40 ft.	73 ft.
40 M.P.H.	44 ft.	70 ft.	114 ft.
50 M.P.H.	55 ft.	110 ft.	165 ft.
60 M.P.H.	66 ft.	160 ft.	226 ft.
70 M.P.H.	77 ft.	220 ft.	297 ft.

It should be remembered that the above figures are for a vehicle with perfect brakes and tire treads operating on a dry brick, concrete or cold asphalt road. Under less favorable conditions, the vehicle could not be stopped in as short a distance as shown here.

INDEX OF BRAKES USED ON VARIOUS PASSENGER CARS

Make	Year	Model	Type of Brakes	Page
Buick	1947-36	All	Bendix Hydraulic	16
Cadillac	1947-36	All	Bendix Hydraulic	16
Chevrolet	1947-36	All	Huck Hydraulic	26
Chevrolet	1935-30	All	Huck Mechanical	25
Chrysler	1947-30	All	Lockheed Hydraulic	7
De Soto	1947-30	All	Lockheed Hydraulic	7
Dodge	1947-30	All	Lockheed Hydraulic	7
Ford	1947-39	All	Ford Hydraulic	11
Ford	1938-28	All	Ford Mechanical	21,22,23
Frazer	1947	All	Bendix Hydraulic	16
Graham	1940-30	All	Lockheed Hydraulic	7
Hudson	1947-36	All	Bendix Hydraulic	16
Hudson	1935-30	All	Bendix Mechanical	18 & 19
Hupmobile	1939-36	All	Lockheed Hydraulic	7
Kaiser	1947	All	Bendix Hydraulic	16
LaSalle	1940-36	All	Bendix Hydraulic	16
LaSalle	1935-34	All	Bendix Mechanical	18 & 19
Lincoln	1947-39	All	Bendix Hydraulic	16
Lincoln	1938-36	Zephyr	Bendix Mechanical	18 & 19
Nash	1947-40	All	Bendix Hydraulic	16
Nash	1939-37	Some	Bendix Hydraulic	16
Nash	1939-37	Some	Lockheed Hydraulic	7
Nash	1936-34	All	Bendix Mechanical	18 & 19
Oldsmobile	1947-34	All	Bendix Hydraulic	16
Oldsmobile	1933-30	All	Bendix Mechanical	18 &19
Packard	1947-37	All	Bendix Hydraulic	16
Packard	1936-30	All	Bendix Mechanical	18 & 19
Plymouth	1947-30	All	Lockheed Hydraulic	7
Pontiac	1947-35	All	Bendix Hydraulic	16
Pontiac	1934-32	All	Bendix Mechanical	18 & 19
Reo	1936-30	All	Lockheed Hydraulic	7
Studebaker	1947-35	All	Lockheed Hydraulic	7 & 12
Studebaker	1934	Some	Bendix Mechanical	18 & 19
Willys	1946-41	Some	Lockheed Hydraulic	7
Willys	1947-41	Some	Bendix Hydraulic	16
Willys	1939-30	All	Bendix Mechanical	18 & 19