THE BRAKE RE-LINER'S MANUAL

Fourth Edition

JOHNS-MANVILLE PRODUCTS

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THE BRAKE RE-LINER'S MANUAL

Fourth Edition



This book is dedicated to you who are responsible for the efficient operation of motor vehicles. It is hoped that you will find it helpful in that important part of your work—the servicing of the brakes—upon which so largely depends the safety and security of human lives and property.

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FOREWORD

The demands of the public for greater perfection in the performance of motor car brakes, the greater demands from the brakes themselves due to changes in traffic conditions and the notable improvement in design, have brought the maintenance and repair of brakes into a specialized class of service.

This, together with the fact that the success of brake work depends to a great extent upon the proper selection and application of the friction material and the suitable adjustment of the brakes, makes it necessary for the mechanic to have complete and accurate information on the various friction materials, mechanical details of brake design, adjustment and proper servicing.

The present edition of the Brake Reliner's Manual is intended to supply this information. It has been revised and enlarged to include instructions for the complete servicing of all popular types of brakes, as well as considerable other information which a study of conditions indicates will be of value to the Service Station.

In presenting information on this subject, we have endeavored to refrain as much as possible from technical terms and have worded the information in suitable phraseology which, it is believed, will be readily understood generally.

JOHNS-MANVILLE

H. COPLESTON, *Staff Engineer*

We acknowledge our indebtedness to the following concerns for many of the illustrations used in this book: American Cable Co., Barnes & Fisher Mfg. Co., John Bean Mfg. Co., Bendix Brake Co., Bendix-Cowdrey Brake Tester, Inc., Bendix-Westinghouse Automotive Air Brake Co., The Black & Decker Mfg. Co., Bragg-Kliesrath Corp., Buick Motor Car Co., Chilton Class Journal Co., The Greb Co., Hutchinson Mfg. Co., Inc., Kent-Moore Organization, The Midland Steel Products Co., The Norwalk Auto Parts Co., Reiff & Nestor Co., The Riess Mfg. Co., Star Tool Co., Stiles-Herman Mfg. Co., The Timken-Detroit Axle Co., Vacuum Oil Co., Wadell Engineering Co., Wagner Electric Corp., Walker Mfg. Co.

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AUTOMOBILE BRAKES OF VARIOUS DESIGNS

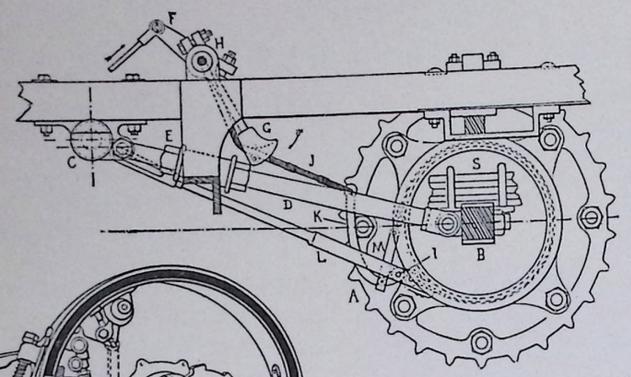


Fig. 1—Hub Brake and Operating Levers used on Panhard Carriages. Cable J, pulling on lever K pivoted at 1, pulls the band, shown by dotted lines, around drum. End of band is prevented from rotating by rod L

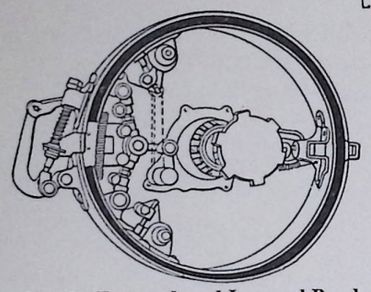


Fig. 2—External and Internal Band Brake on Same Drum

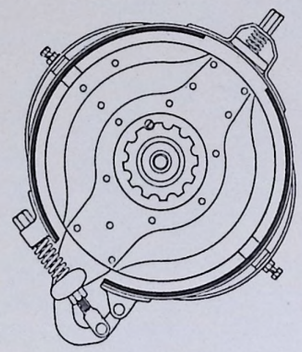


Fig. 3—External Band Brake

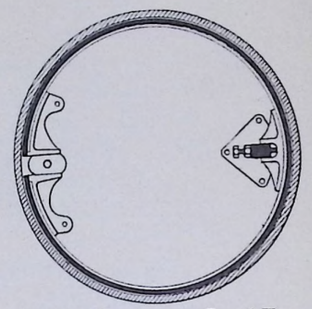


Fig. 4—Continuous Band Type of Internal Brake

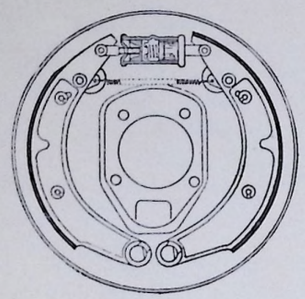


Fig. 5—Internal Shoe Brake—Lockheed Hydraulic

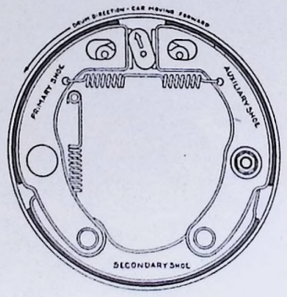


Fig. 6—Bendix 3-Shoe Internal Brake

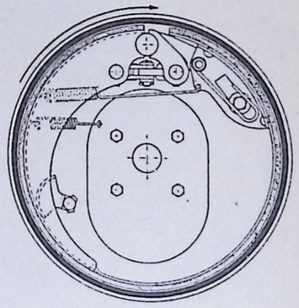


Fig. 7—Combination Band and Shoe Internal Brake—Steeldraulic

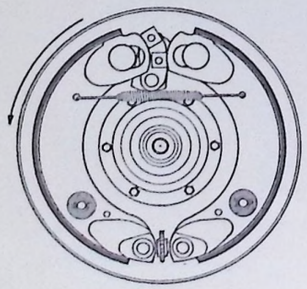


Fig. 8—Bendix 2-Shoe Internal Brake

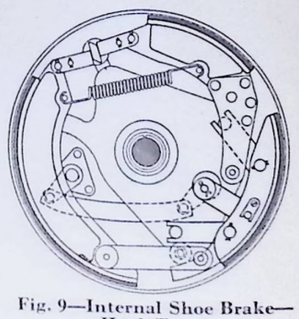


Fig. 9—Internal Shoe Brake—Huck Type

FUNDAMENTALS OF BRAKE ADJUSTMENT

THE present day trend of specialization has divorced the maintenance of motor vehicle brakes from the general repair shop to the more modern Brake Service Station. This has been brought about through higher speeds and greater demand of the public for better performance.

The successful Brake Service Station must be thoroughly familiar with the various designs and proper adjustment of brakes to quickly determine and correct such minor faults as are brought to its attention.

Brake

In a broad sense, the term brake refers both to the entire retarding mechanism from the foot pedal to the brake drum, and to the individual wheel mechanism which includes the brake band or shoe, the brake lining and the brake drum. Briefly, the brake is the very important but often sadly neglected part of an automotive vehicle which retards, stops or prevents the vehicle from rolling away.

It is a highly sensitive mechanism and its adjustment not as simple as might be expected. Brake problems are often mystifying, but can be solved easily when the fundamental principles involved are understood.

Types of Brakes

Motor vehicle brakes are all of the friction type and are operated by forcing a stationary member against a moving one by pressure of the foot on a convenient pedal. One of the earliest types of practical motor vehicle brake is shown in Fig. 1.

Various other, but more modern types, are shown in Figs. 2 to 9 and these and their adjustment will be described in detail later.

Nomenclature

Motor vehicle brakes are commonly referred to as External Band Brake; Internal Band Brake; External Shoe Brake; Internal Shoe Brake, with further reference to their location, as Internal Front Shoe Brake, etc. Other descriptive terms applied to brakes are Jackshaft, Propeller Shaft, Transmission or Parking Brake, etc.

Jackshaft Brake

This term refers generally to a brake mounted on a jack or cross shaft from the transmission on a chain driven car, and is still used on chain driven trucks. Adjustments are usually simple.

Jackshaft Brakes catch grease thrown from the supporting bearing or chain and will sometimes glaze. (See Grease, Glazing, pages 98 and 99.)

Propeller Shaft, Transmission or Parking Brake

These terms are generally applied to brakes which are mounted on the rear of the transmission case and retard the motion of the drive shaft which connects the transmission with the rear axle. They are generally of the external type and easily adjusted. Since a transmission or propellor shaft brake is usually small, it is intended to be used in an emergency or to hold the vehicle once it has been stopped, rather than as a service brake. The term parking brake is widely used to describe this type of brake on passenger cars.

The parking brake lever, however, is sometimes connected with the service brake linkage and operates either the rear service brakes or the service brakes on all four wheels. This design is found on many of the newer cars.

Energizing Effect

Since the pressure of the foot is limited, especially with women drivers, it becomes necessary to employ some means to increase the pressure on the brake lining considerably above that applied by the foot.

While some leverage can be obtained in the design of the brake operating linkage, it is usually insufficient and the momentum or the movement of the vehicle must be employed to increase the pressure and retarding action of the brake.

Practically all of the brakes shown have what is known as a self energizing effect and two have what is known as a servo action. (See Boosters, page 41.)

The self energizing effect is caused by the tendency of the band or shoe to grip the drum, due to the rotation of the wheel. This action in the case of the external band brake is clearly shown in Fig. 9-A, page 6.

The anchor point in the average external band brake is at or near the back of the band, generally one half of its length. This is so as to have the brake hold well in either direction, as a full wrapping brake or one where the anchor is at the end of

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the band does not hold well in the reverse direction. (See Fig. 1.) The average band brake gives about 2.13 times greater retarding force with the same pressure acting at the ends of the band, than a brake which has no wrapping influence.

In the internal shoe type, the forward shoe tends to wedge due to its being moved by the rotation of the brake drum, which increases the pressure between the brake drum and the shoe above that applied by the foot.

In the case of the servo action, it will be noted in Fig. 6 that the primary shoe is fastened to the secondary shoe and when in contact with the revolving drum will force the secondary shoe against the drum with greater pressure.

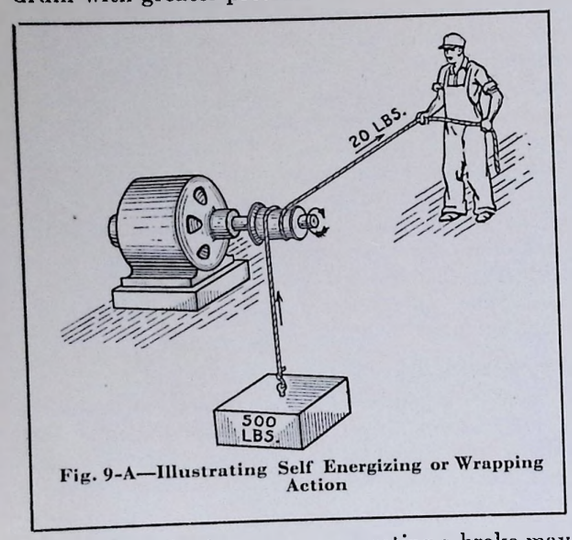
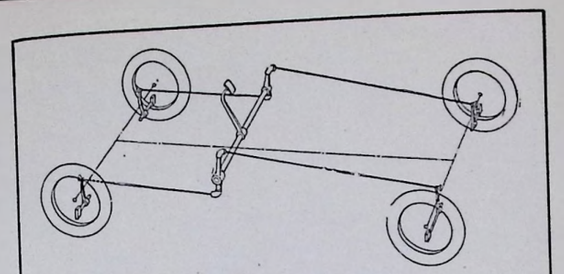


Fig. 9-A—Illustrating Self Energizing or Wrapping Action

Thus, while the pressure operating a brake may be light, it is possible to have the brake itself build up additional pressure either by the wrap effect or by servo action, according to the design of the brake. The additonal pressure obtained, however, will be proportional to the operating or applied foot pressure.

Pressure Applying Systems

All vehicle service brakes in the wheels are operated by pressure on a foot pedal, various means of transmitting this pressure being employed. Systems consisting of a series of levers and rods or cables are known as Mechanical Brakes. A simple form of mechanical brake is shown in Fig. 10. Others are a series of pipes and cylinders in which a liquid is confined. This type, known as a Hydraulic Brake, is shown in Fig. 11. (See Lockheed Brake, page 64.)


Fig. 10—A Mechanical Brake System

Pressure Increasing Means

In some cases, suitable pressure cannot be obtained to properly operate the brakes and it becomes necessary to employ other means to increase the pressure at the brakes themselves.

There are several methods which are employed to increase brake pressure. These are commonly known as self energizing, servo action, air pressure and Boosters. (See Booster Brakes, page 41.)

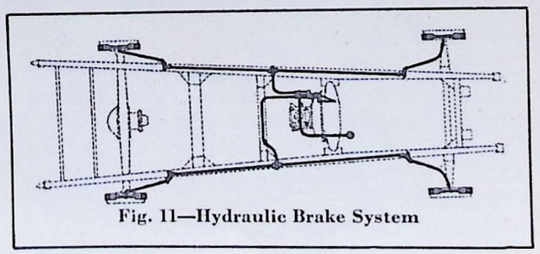
Any device, either separate or part of a brake mechanism, which mechanically increases the pressure, is generally known as a Servo mechanism. A Servo mechanism is shown in Fig. 12.

The device which applies this pressure is shown in Fig. 13.

The movement of the car drives the disc clutch F. When lever H is pulled, the worm I actuates the clutch, causing levers K to pull on the front and rear brake rods, thus applying the brakes.

The Westinghouse Air Brake system as commonly employed on railroad cars has been adapted for use on the heavy types of buses and trucks. In this system, air under pressure is released by the foot and actuates the brake levers on the axle by means of small cylinders. See page 86.

A Booster is an auxiliary device which is introduced in the brake linkage to increase the brake pressure and is generally operated by air pressure obtained from the inlet manifold of the engine.


Fig. 11—Hydraulic Brake System

The inlet manifold is under a vacuum when the engine is running and causes an unbalanced air pressure condition from which the energy is obtained.

In consequence, while the word Booster refers to any means of increasing the brake pressure, in the Automotive Industry it is confined to the device which operates by a connection to the inlet manifold.

There are two Boosters which will be found in the field, namely, Westinghouse and B-K (Bragg-Kliesrath.) Westinghouse Booster is no longer manufactured. B-K Booster is available in various types for single vehicles or vehicles with trailers, and information can be secured by writing the Bragg-Kliesrath Corporation, South Bend, Ind. (See Booster Brakes, page 41.)

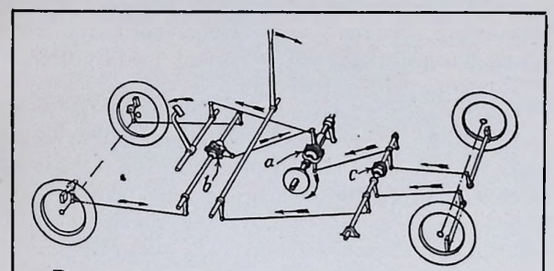


Fig. 12—Brake Linkage with Servo Mechanism

Lubrication

Since a series of levers as used in a mechanical brake system has several moving joints and since the required pedal pressure should not be too high, it is necessary to reduce the friction at the various joints as much as possible. It is essential, therefore, that these joints be properly lubricated so as to obtain as much pressure as possible at each of the four wheels. The hydraulic system requires lubrication only at the pedal and shoe anchors.

Equalization

When the foot pressure is applied to the brake pedal it is necessary to divide this pressure equally to each wheel brake. Various means are employed to do this. In early cars a wire cable was used which would adjust itself by slipping where necessary to equalize the pressure on each brake, as shown in Fig. 1 at G. (Page 4.)

Modern equalizers employed in mechanical brake systems are of various designs, but the simplest form is shown in Fig 14. To obtain proper action, the joints must be kept lubricated and the angles A & B must be 90°, or a right angle, when in proper pulling position. Any other angle will defeat the purpose of the device.

The popularity of the hydraulic system is due to the insured equal pressure at the brakes. This results from the use of a liquid, as a liquid under

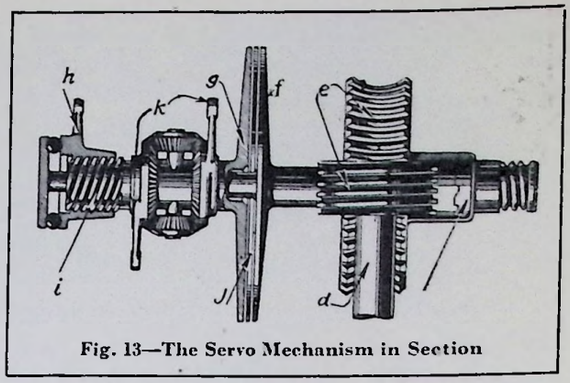


Fig. 13—The Servo Mechanism in Section

pressure will exert the same force or pressure at any point in the system. (See Lockheed Brake, page 64.)

While equalizers in a mechanical brake system or the hydraulic system will ensure of equal pressure being delivered to each wheel brake, it is quite possible to have an unequalized brake condition, that is, where one wheel brake holds more than the others.

The individual brakes are capable of being adjusted with varying results even though the pressure delivered is the same at each brake. When all brakes hold alike, the brake is said to be equalized.

Since brake linings may vary in their friction, it is necessary to place the same material on each pair of brakes, that is, both front or both rear. The same lining can be placed on all four brakes or one type of lining on the front set and one type on the rear. If this is not done it will be difficult, if not impossible, to equalize all brakes. An unequalized brake will, when a quick stop is made by locking

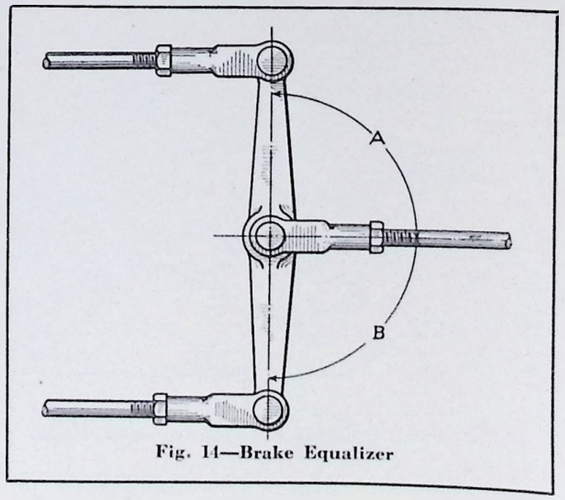


Fig. 14—Brake Equalizer



Fig. 15—When Brakes are unequalized, Marks are unequal



Fig. 16—When equalized, all Marks are alike

the wheels on asphalt paving, show unequal marks on the pavement. When equalized, all marks will be alike. (See Figs. 15 and 16.)

If the brakes are unequalized, the car will tend to go to the tight side when the brakes are applied.

It has been customary in the past in four wheel mechanical brakes to arrange the linkage so that 40% of the available pressure is distributed to the front brakes and 60% to the rear. This was done as a precaution against possible locking of the front wheels, which would disturb the steering of the car. If the front wheels lock, the car cannot be steered.

Weight Transfer

Improvements of brakes to prevent grabbing and the transfer of weight from the rear to the front

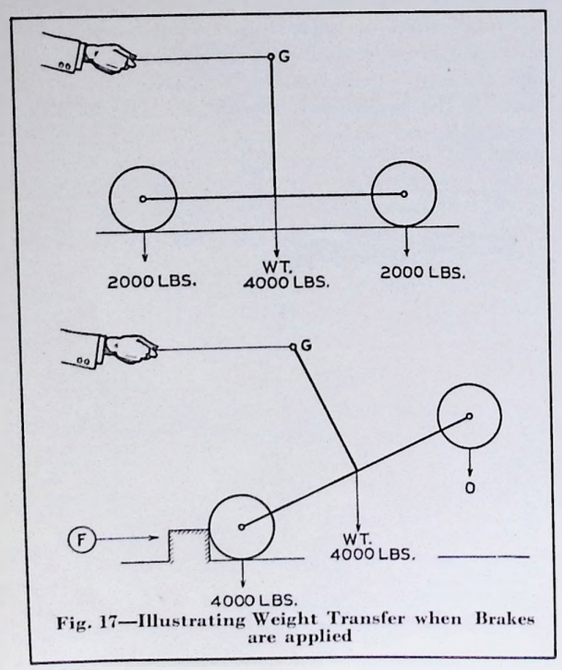


Fig. 17—Illustrating Weight Transfer when Brakes are applied

axle due to stopping the vehicle has developed that equal retardation can be obtained from each wheel with safety. In fact, some mechanical brakes are changed so as to take 60% of pressure on front and 40% on rear with satisfaction.

The reason for transfer of weight from the rear to the front is shown in the exaggerated diagrammatic sketch, Fig. 17, and is due to the retarding force F, representing the brake force, not acting in line with the center of gravity G, which tends to trip up, or rotate the entire vehicle about the front axle as shown. The entire weight, however, does not transfer to the front axle in practice.

Levers

Since there are many levers employed in a mechanically operated brake, it is necessary that they be properly adjusted so as to obtain greatest mechanical advantage. Figs. 18-19-20 show levers in proper and improper position. Should there be two or more levers of similar design, one on the left side of car and one on the right, they should be in similar positions. Not one like Fig. 18 and one like Fig. 19. Both should be like Fig. 18.

In all cases where a rod and lever is employed, the effective radius of turning effort to the shaft to which the lever is attached is always through a line which is 90° or a right angle to the rod which is fastened to the lever, as indicated in Fig. 20.

It will be readily noted that the effective radius in Fig. 20 is much less than in Fig 18, and in consequence the same pull on the rod in Fig. 20 will tend to twist or rotate the lever shaft with much less effort than in Fig. 18.

The same is true of the levers on the respective wheel brakes. All should be in similar relation in order to obtain equal operating conditions. One brake lever should not be as shown in Fig. 21 and another like Fig. 22. Both should be as shown in Fig 23.

The hydraulic system of brake operation was developed to insure equalization of pressure applied

to the brakes and to eliminate the various levers and equalizers. Its principle is based on the law of equalization of pressure of a liquid or gas in an enclosed chamber. A complete description of this system will be found on page 64.

Mechanical brake systems are generally correctly adjusted at the factory when the car is assembled, and usually require no other adjustment except where the rods are attached to the wheel brakes, but it must not be assumed that they are correct when a car is to be adjusted after a relining of the brakes. The system should always be inspected, especially if suitable adjustment cannot be readily obtained at the wheels.

Rods

Brake rods should be examined at the threads of the adjustable yoke. Sometimes the jamming of the lock nut against the yoke will crack the rod, which has been weakened by cutting the thread.

The cracks appear at the bottom of the thread between the nut and the yoke.

If the rod vibrates, it is liable to develop cracks just outside of the nut.

Clevis Pins

Brake rods and levers are usually joined by a headed pin with a cotter pin hole in the end. These pins should be oiled and kept free to reduce friction in the mechanism. This permits greater pressure to be exerted on the brake lining which will assist in overcoming the effect of water on the brakes. (See Slipping, page 99.)

Cotter Pins

Cotter pins are very important and should be replaced whenever missing. If a cotter should become lost and the clevis pin drop out, all wheel brakes, in many cases, are affected because of the equalizer.

In consequence, when relining or adjusting brakes, be sure to examine the entire brake mechanism for missing cotter pins.

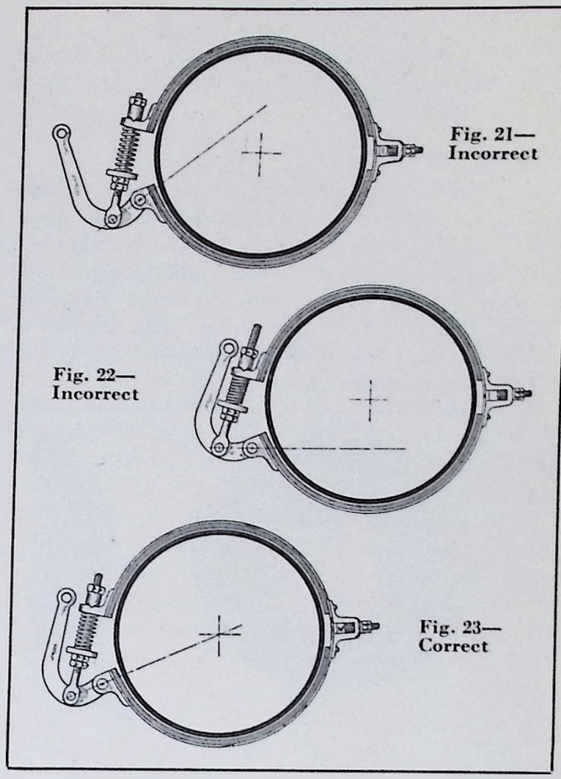


Fig. 21—Incorrect

Fig. 22—Incorrect

Fig. 23—Correct

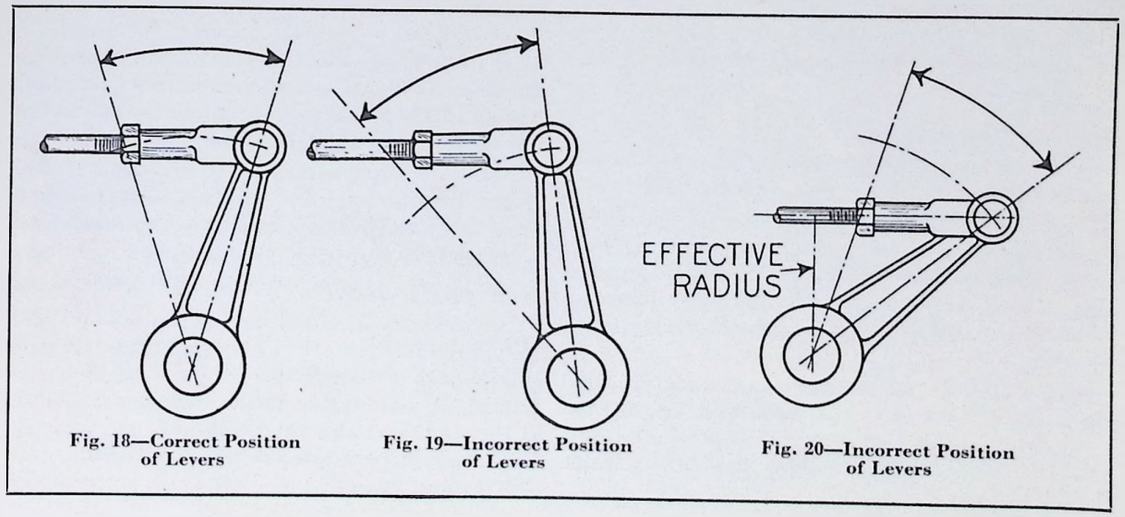


Fig. 18—Correct Position of Levers

Fig. 19—Incorrect Position of Levers

Fig. 20—Incorrect Position of Levers

Pedals

General inspection and lubrication of the brake system should include all levers and rods and even the brake pedals.

Return Springs

It is quite essential to replace the brake springs used to return the shoes or bands to the "off" position. If this is not done, the brakes are likely to drag, causing heat and wear as well as considerable noise due to rattling. Fig. 24 shows how the springs can be easily assembled with the aid of special tongs made for this purpose. (See also Spring Tongs, page 111.)

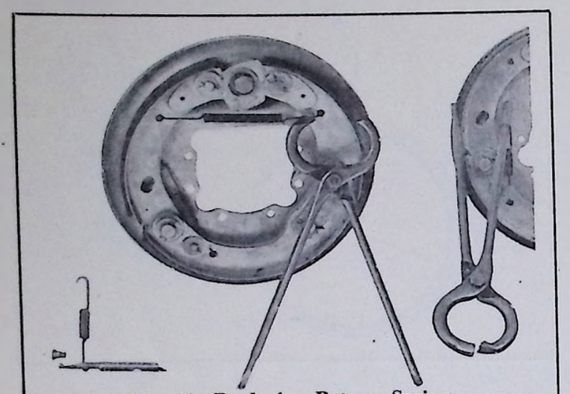


Fig. 24—Replacing Return Springs

In replacing the springs, especially those separating the bands on external brakes, care should be taken to see that they are of the same size and tension, or springiness, as those orginally used. This can be done readily by hooking the old and new spring together and then pulling the free ends. If both springs stretch an equal amount their tension is the same.

Spring Shackles

The car supporting springs are fastened to the frame at one end by a spring shackle, which is a link to compensate for change in spring length due to flexing.

In mechanically operated brakes, especially those which do not employ flexible wheel connections, movement of the axle will affect the brake action.

Spring shackles should be examined and if badly worn should be renewed or rebushed. Examination of the shackles will often indicate whether the axle is in proper alignment as the angle of the shackles should be alike.

Some shackles or spring connections are made of rubber and when worn will permit of axle movement.

These should be replaced after about 20,000 miles of service, especially taxicab service or where frequent stops are customary.

Hotchkiss Drive

Since there are heavy forces or shocks acting on the vehicle when brakes are applied to stop it rapidly, and since these forces are liable to damage the parts of the vehicle unless very heavy construction is employed, a method of cushioning the shocks is often found in motor vehicle design. This method is commonly known as the Hotchkiss drive.

The Hotchkiss drive utilizes the vehicle spring to soften the acceleration and retardation forces by permitting the axle to twist the springs slightly. Careful brake adjustment is necessary where this design is employed, to prevent chatter and grab, especially where the brake rods extend from the frame to the axle.

Wheel Bearings

It is absolutely essential that wheel bearings, both front and rear, be tightened before any brake adjustments are made. If bearings are loose, brakes cannot be satisfactorily adjusted.

Anchorage

Brake bands and shoes are rigidly supported from a stationary part of the axle by brackets or pins.

This support is known as the anchorage.

The band on an external brake is usually supplied with an adjustment at the anchorage. It is quite essential that this adjustment be carefully made.

In most cases, internal brake shoe anchorages are also adjustable and the action of the brake is widely affected by slight change in the position of the supporting pin, or anchor.

Brake anchorages frequently become rusted or frozen through neglect. It is quite necessary to have this joint free before satisfactory results can be expected from the brakes.

Concentric Bands

Brake bands should always be cleaned and carefully examined to see if the anchorage or other metal parts are firmly riveted in place, and more important, that the bands are true or concentric. If they are twisted or have kinks in them, these defects must be removed or very unsatisfactory results will be experienced. Bands can be trued by

fitting them around a brake drum, fly wheel, or other suitable true piece. The diameter of the piece should be the same as the diameter of the brake drum of the car from which the band has been removed, plus twice the thickness of the lining to be used. By carefully striking with a hammer, the bands can be straightened so that they will be again as true as when new. (See Bench Anvil, page 111.)

After the bands are true, care should be taken to keep them so. Avoid opening the ends, etc., to make riveting easy. If the bands are on the car and found to be distorted, the kinks can be removed by inserting two parallel flat pieces of steel between the band and the drum, and then hammering the band at a point between the steel strips, changing the location of the strip until the band fits properly. It is a tedious job, but must be done before satisfactory brake adjustment can be made.

Brake Shoes

Brake shoes should always be cleaned and carefully examined for cracks in the cast aluminum type and for bends or other distortion in the stamped metal type. Where bushings are used in the anchor holes they should be checked for wear and if very loose should be replaced.

Worn bushings are liable to cause squeaks and unless return springs are very strong the shoes may rattle on rough roads. Where moulded lining is used it is very essential that the surface on which the lining is riveted be true and flat as any irregularities are likely to cause the brake to squeak. (See Fig. 25.)

Brake Drums

Brake drums are generally made from a sheet of flat steel which must necessarily be soft to withstand the forming operation, which operation will to a certain degree harden them as they are usually formed cold.

Some drums are quite soft, in fact so soft that the brake lining will pick up metal from the surface. If a highly resistant lining is used on these drums severe cutting will result. (See Cutting, page 97.)

Drums should be true and if badly worn should be turned off in a lathe or ground until a uniform surface is obtained. Care must be exercised, however, that the drums do not become too thin, as the pressure of the band or shoe may distort them or cause a severe squeak. (See Squeaks, page 100.)

Average practice indicates that a brake drum should be replaced if the thickness is reduced by turning below the minimum indicated in the following table:

11″ drum	0.120″ thick
12″ drum	0.135″ thick
13″ drum	0.150″ thick
14″ drum	0.165″ thick
15″ drum	0.180″ thick
16″ drum	0.195″ thick

A brake tester of the dynamic type will detect out of round drums. (See Brake Testers, page 107.) If drum truing equipment is a part of the shop and no dynamic tester is available, the error of the drums can best be detected with a dial tester reading in thousandths, which comes equipped with a magnet to hold it in any convenient position. Drums which are out of round more than .005″ should be turned.

When relining, the bolts holding the brake drums should be checked for tightness. Loose bolts are a common cause of squeaks on cars which are equipped with wood wheels.

New Drums

Some brake drums supplied by the parts jobbers are painted by dipping, which completely covers the entire surface with a black paint or enamel. This serves as a rust protection and eliminates the necessity of painting by the repair man.

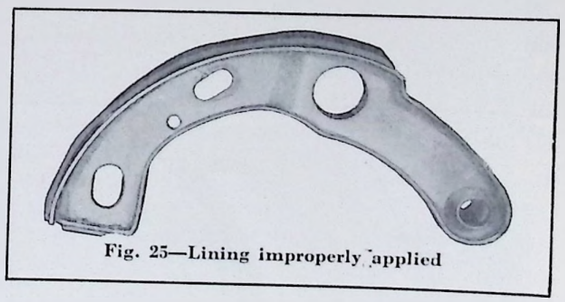


Fig. 25—Lining improperly applied

It is highly important, however, to thoroughly remove this coating from the surface in contact with the brake lining. Unless this is done, the paint will adhere to the lining after a few applications of the brakes, causing them to grab or chatter.

Drum Expansion

Frictional heat will expand the drum to a greater diameter, causing a decrease in the lining to drum clearance on external brakes. Unless sufficient

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clearance is provided to allow for this expansion when adjusting, the brakes are likely to drag when hot. (See Dragging, page 98.)

It is for this reason that front wheel brakes are generally of the internal type, as any expansion of the drum will tend to release the brake and avoid a possible locking of the wheel.

The external band brake, due to its exposure to mud and water, has lost popularity but is still found in some four wheel brake assemblies on the rear wheels, the front brakes being of the internal type.

Importance of Adjustment

The retarding effect of the various brakes is dependent upon the relation of the parts to one another and also of the parts to the drum.

This relationship is very important and constitutes the adjustment of the brake. It is quite necessary to have the entire friction surface in contact with the drum and sufficient pressure applied to the shoes or bands to give the necessary retarding force.

When moulded lining is applied to the brakes the curvature of the shoe is fixed and the thickness of the lining fixed. The resulting curvature of the shoe and lining may be perfect and to specification, but due to wear on the drum it may not correspond to that of the brake drum.

In consequence, there is only one curvature which will fit the brake drums and it often happens that the linings either touch at center or ends as shown (greatly exaggerated) in Fig. 27. While it is only slightly different, the nature of the moulded material will not permit of it compressing and the high spots must be removed. Some mechanics do this by "burning-in" but the resistance to wear of moulded lining and the heavy pressure necessary may cause the drums to heat or possibly cut, due to high unit pressure. (See Cutting, page 97.)

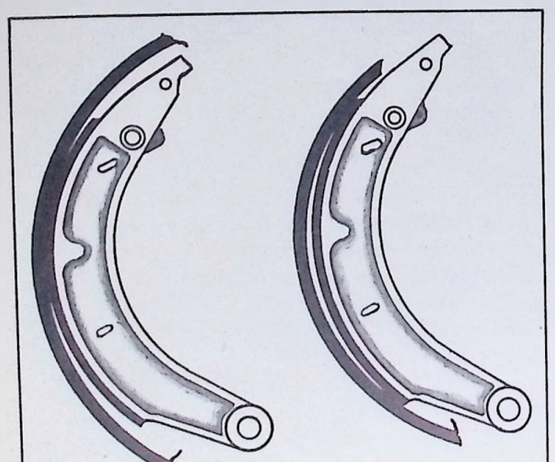


Fig. 27—Brake Lining Contact

The relined shoes can best be fitted to the drum curvature by means of a brake lining grinder. (See Brake Lining Grinders, page 108.)

When moulded linings are properly fitted to the drums, which is indicated by the entire surface of the friction material showing contact with the drums, a smooth operating, quiet and efficient brake is to be expected.

The importance of adjustment should be carefully noted as unsatisfactory results obtained from the brake are too often thought to be due to the friction material with which the brake is lined.

Clearance

The clearance necessary between the lining and drum on external brakes depends on the maximum temperature at which the brake operates and also on the diameter of the brake drum. The larger the diameter and hotter the brake, the greater the clearance must be.

On internal brakes, except the Steeldraulic Brake, (See page 77) the clearance can be set as close as possible without dragging, as the drum expands when heated and the clearance becomes greater. The brakes, however, must be cold when adjustment is made as hot drums will contract when cold and are liable to bind on the brake shoes, heating the drums to a high temperature or destroying the linings.

For correct clearances of the various brakes, see Cars and Brake Adjustments Section, also Brake Clearance, page 101.

Burning-In

Mechanics, realizing the necessity for suitable contact of the brake lining and drum, will sometimes resort to the practice of burning-in the brakes, which consists of driving the car and applying the brakes with the power applied.

This practice heats the brakes and is at the same time supposed to wear off high spots in contact with the brake drum, and make the lining fit the drum.

Where moulded linings are used and the brake drums only slightly grooved, "burning-in" is likely to cause the lining to pick up metal from the drum and cause future trouble. (See Cutting, page 97.)

There is no objection to making several brake applications on the road while adjusting, but the temperature of the bands should not be raised to a higher temperature than the hand can comfortably withstand.

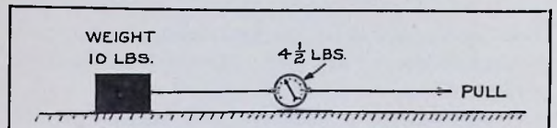


Fig. 28—Determination of Co-efficient of Friction

Co-efficient of Friction

When two surfaces are brought into rubbing contact, friction is developed and the amount of resistance to further motion will be dependent on whether the friction is high or low. However, instead of simply stating high or low, a numerical value is placed on the friction. This value is known as the Co-efficient of Friction, and may be explained as follows: If we take a block of a certain weight and place it on a board, the surface of which is horizontal, true and uniform, and then determine the number of pounds required to draw the block horizontally over the surface at a uniform speed, the ratio of the force required to draw the block to the weight of the block will be the co-efficient of friction. In other words, if it takes four and a half pounds to draw it along, and the block weighs ten pounds, the co-efficient of friction is .45, which is the force of 4.5 pounds required to move the block, divided by 10, the weight of the block. (See Fig. 28.)

Therefore, if we have a pressure of 150 pounds on a brake pedal and the ratio of the linkage is 6 to 1, there will be a pressure of 900 pounds on the brake. If the co-efficient of friction is .4 there will be a retarding force of 360 pounds on the drum.

The above is a brief explanation of the use of the co-efficient of friction and does not include reference to many factors which must be taken into consideration in an accurate brake calculation.

The co-efficient of friction is of interest to the designing engineer only as it is used in mathematical calculations, in which the brake specialist is not interested.

The specialist, however, can refer to a high or low friction which, if brake adjustment is the same, will be proportional to the pedal pressure, i.e., high pedal pressure. low friction and low pedal pressure, high friction.

Brake adjustment, if poor, might indicate a low friction on the lining, due to poor adjustment, whereas it is actually high.

Since friction, or the resistance to sliding of two surfaces, is dependent upon the nature of those surfaces, it is obvious that the friction will vary as the conditions change. Dust, water, oil, variable temperature and combinations thereof will make the friction vary, but for all practical conditions this variation is compensated for by increasing or decreasing the pedal pressure.

Stopping

It is obvious that the proper application of the lining and the use of brakes in service on the road have a great deal to do with the life of the brake mechanism as well as the life of many of the mechanical parts of the car, such as the differential gears, wheels, wheel keys, universal joints and transmission gearing. Sudden and vicious brake application when the car is moving rapidly causes unnecessary and severe stresses in these parts, and if continued, may result in broken springs, decreased tire life, loose wheel spokes, and rapid wearing out of differential gears, universal joints and the keys which hold these parts to their shafts. (Loose rear wheel keys can be detected by a peculiar clicking of the wheel upon engaging the clutch when starting from rest after reversing.) It may even result in the failure of the brake mechanism itself at a time when such failure would cause a serious accident.

Drivers very frequently use brakes unnecessarily and thereby decrease the life of the linings. Under average driving conditions the speed of a car can be controlled to considerable extent by using the engine as a brake. When making a stop on approximately level road, leave the clutch engaged until the car slows down—idling almost to a stop—then declutch and apply the brakes. When the car is traveling at a rapid rate and the foot is removed from the accelerator pedal, or the throttle is closed to an idling position, the engine has a tendency to slow down more rapidly than the car, and consequently acts as a brake in so doing.

Before going down dangerous hills, it is advisable to keep the throttle closed, and if the car is equipped with Free Wheeling to lock it out of service and shift gears into intermediate or low, depending on the steepness of the hill. The engine will then act as a brake, because it is "geared up" to the axle, and will hold the car so that a very moderate application of the brake will serve to control the speed.

When making an emergency stop, disengage the clutch and apply the foot brake as hard as necessary, without actually causing the wheels to slide.

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This kind of stopping test is no longer seen

Testing Brakes

There is much difference of opinion as to the proper method of testing brakes and at the present time there is no standard which is accepted. In many cities a method was used which consists in marking a convenient street pavement with white and red lines and driving the car at a predetermined speed of approximately 20 miles per hour and applying brakes at a marked point. If the vehicle did not stop within a specified distance it was declared defective.

It was soon found that the stopping distance varied considerably with various makes of cars and the tendency was to accept the maximum stopping distance as a standard. You will appreciate that this is not a good practice. However, these tests brought out the fact that a great percentage of the cars in operation had defective brakes.

The modern method for testing automobile brakes requires a simple but effective machine which may be classed as a dynamometer. (See Brake Testers, page 107.) Essentially, it consists of rollers on which the wheels of the car rest. The rollers are rotated by electricity and application of the brake of the vehicle tends to retard the roller rotation. Visible dials indicate the resistance to rotation of each roller, which naturally is dependent upon the resistance offered by each brake.

If the brakes are in proper adjustment the front rollers will indicate similar and suitable figures and those on the rear other similar and suitable figures, depending upon the percentage of total braking permitted on the front.

Brakes can be readily checked for defects and can be adjusted while on the testing machine. There are several types of testers on the market. Write us for further information regarding approved equipment.

Various other more simple brake testers are appearing on the market, all of which have some means of indicating the resistance to rotation of the wheels when the brake is applied, and all of which are more dependable and speedy than the old method of cut and try.



A modern stopping test



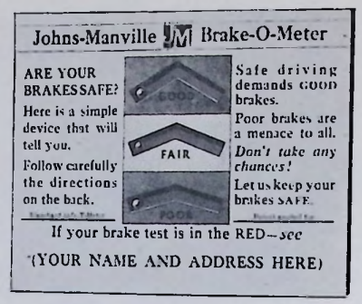
One of the first automobile stopping tests—made in 1902

Brake testers which are attached to the vehicle are known as decelerometers. These are available in various types, some of which register the stopping distance at 20 miles per hour, while others give the rate of stopping in feet per second for each second of time.

A decelerometer in the form of an advertising novelty is shown on page 15. This device is intended to be distributed to car-owners, its purpose being to encourage more frequent attention to the brakes. It is simple, but surprisingly accurate.

Stopping Distances

Many attempts have been made to fix a distance in which an automobile should be stopped from known speeds, but the controlling factors are so many and varied that only an approximation of the stopping distance can be given.



Decelerometer in the form of an advertising novelty

Factors which govern the stopping distance:—

Speed—Speedometer variations.

Wind—May or may not assist.

Tires—Their tread and inflation.

Weight Transfer—The weight transfer from rear to front is dependent upon height of the center of gravity of the car from the road; the greater it is and the quicker the stop, the greater the transfer. This factor can be neglected for four wheel brakes, however. (See Weight Transfer, page 8.)

Road Grade—The grade will affect the stopping distance, increasing when stopping on downward grade and decreasing on the upward.

Road Surface—The condition of the surface will change the friction between the tires and the road. High friction (dry roads) shorter stop.

Popular impression is that the weight of the car is a great factor, but the maximum retardation is independent of the car weight.

The stopping of a moving vehicle with locked wheels or with maximum pressure applied is due to its contact with the stationary road surface. The retarding force is the result of the weight of the vehicle and the friction of the tire on the road.

The friction is the same with both heavy and light vehicles, but as the energy of the heavy vehicle is greater, a greater force will be required to stop it than will be required to stop a light vehicle traveling at the same speed.

The greater force necessary is obtained by the greater weight, as the retarding force is a product of the friction co-efficient and the weight. (See Co-efficient of Friction, page 13.)

Shown below is a comparative table of stopping performances at 20 miles per hour for various types of road surfaces, the distances being graded for both four and two wheel brakes in the column at the left. The road surfaces are assumed to be dry, smooth, level, clean and free from loose material. Variations of the distances given will be dependent on one or more of the above factors.

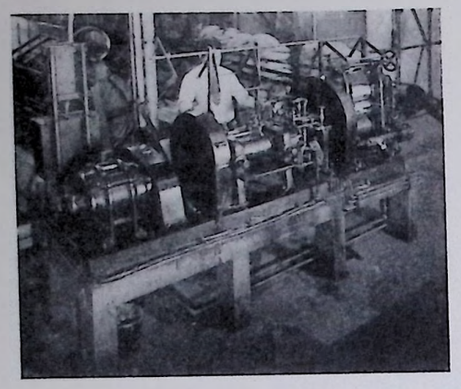
The table will be found satisfactory for use in conducting public safety campaigns in your territory. Write us for complete instructions on how to conduct such a campaign and information of literature available.

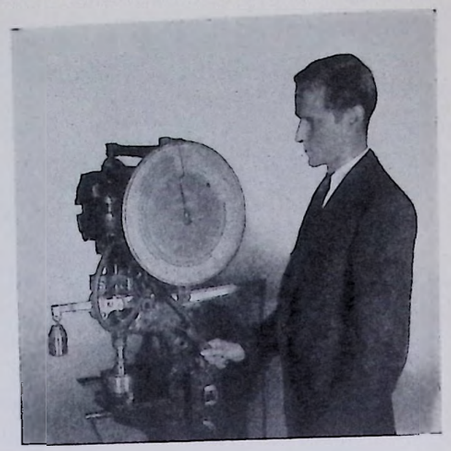
DEFINITION OF PERFORMANCE	60% CO-EFFICIENT OF FRICTION TIRE AND ROAD Warm, Sticky Asphalt	70% CO-EFFICIENT OF FRICTION TIRE AND ROAD Cool Asphalt	75% CO-EFFICIENT OF FRICTION TIRE AND ROAD Cold Asphalt Average Concrete Good Brick	80% CO-EFFICIENT OF FRICTION TIRE AND ROAD Rough Finish Concrete
Four Wheel Brakes	*Four Wheel Brakes*	*Four Wheel Brakes*	*Four Wheel Brakes*	*Four Wheel Brakes*
Perfect for 4-wheel brakes	18.7 ft. to 20 ft.	16.1 ft. to 17.1 ft.	15 ft. to 16 ft.	14 ft. to 15 ft.
Excellent for 4-wheel brakes	20 " " 22.5 "	17.1 " " 19.3 "	16 " " 18 "	15 " " 16.9 "
Good for 4-wheel brakes	22.5 " " 25 "	19.3 " " 21.4 "	18 " " 20 "	16.9 " " 18.7 "
Fair for 4-wheel brakes	25 " " 31.3 "	21.4 " " 26.8 "	20 " " 25 "	18.7 " " 23.4 "
Poor for 4-wheel brakes	31.3 " " 37.6 "	26.8 " " 32.1 "	25 " " 30 "	23.4 " " 28.1 "
It's no longer a 4-wheel brake car	Over 37.6 "	Over 32.1 "	Over 30 "	Over 28.1 "
Two Wheel Brakes	*Two Wheel Brakes*	*Two Wheel Brakes*	*Two Wheel Brakes*	*Two Wheel Brakes*
Perfect for 2-wheel brakes	37.6 ft. to 40 ft.	32.1 ft. to 34.3 ft.	30 ft. to 32 ft.	28.1 ft. to 30 ft.
Excellent for 2-wheel brakes	40 " " 43.8 "	34.3 " " 37.5 "	32 " " 35 "	30 " " 32.8 "
Good for 2-wheel brakes	43.8 " " 50 "	37.5 " " 42.8 "	35 " " 40 "	32.8 " " 37.5 "
Fair for 2-wheel brakes	50 " " 56.4 "	42.8 " " 48.2 "	40 " " 45 "	37.5 " " 42.2 "
Poor—brakes need attention	56.4 " " 62.5 "	48.2 " " 53.5 "	45 " " 50 "	42.2 " " 47 "
Vehicle unsafe on highways	Over 62.5 "	Over 53.5 "	Over 50 "	Over 47 "

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Where the search for better Brake Lining begins—

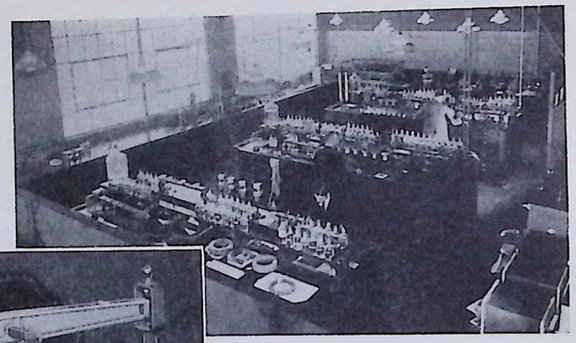
A few of the many testing operations carried on in the Johns-Manville Research Laboratories at Manville, N. J., in connection with the manufacture of J-M Brake Lining.





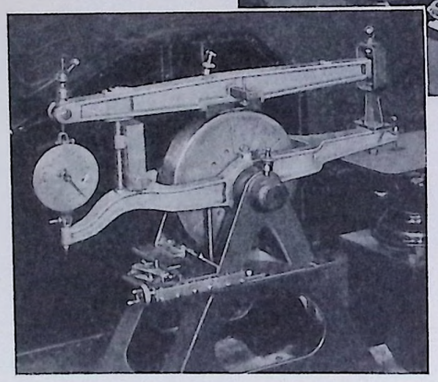
Right—Testing friction values.

Left—This machine is used to prepare new materials for experiment and test.



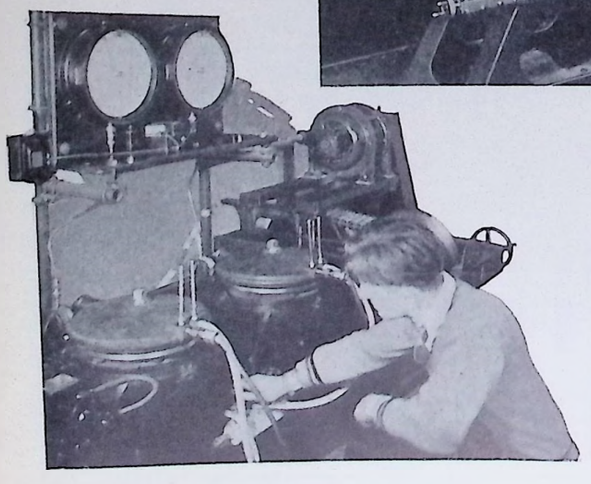
Above—The chemical laboratory.

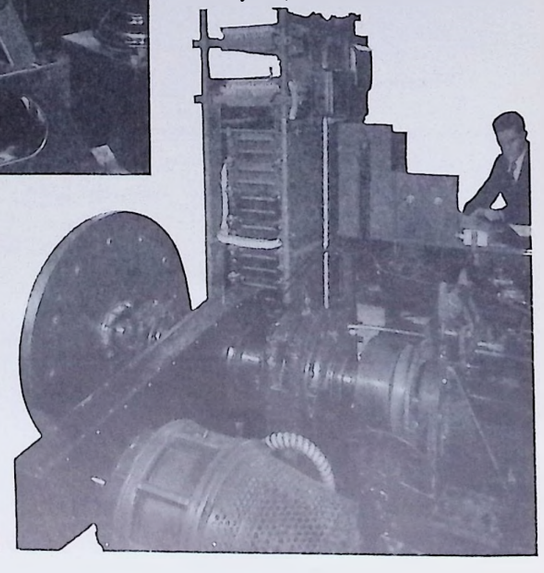
Below—The Inertia Machine, which duplicates the brake action of any car, bus or truck.



Right—Close-up of machine on which materials are tested for resistance to heat.

Below—Wear resistance is one of the tests made on this machine.





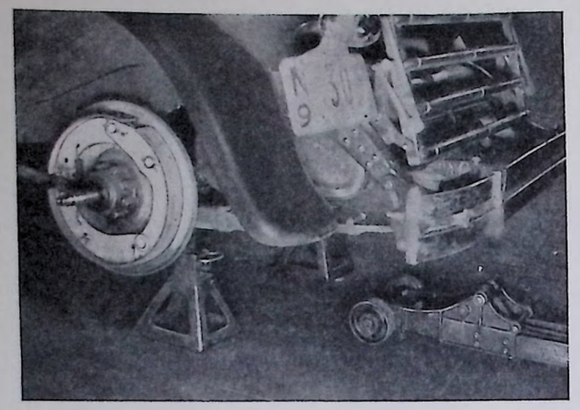
RELINING BRAKES

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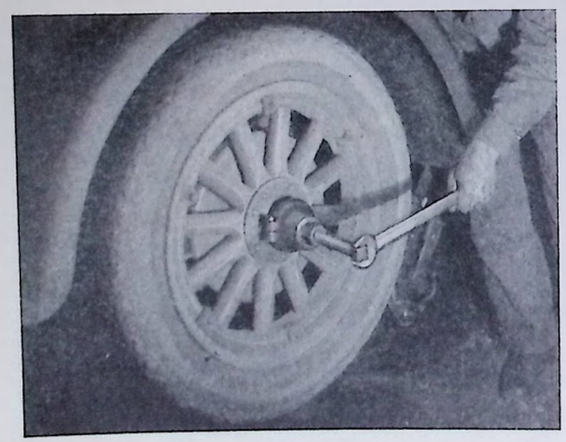
OPERATIONS NECESSARY FOR COMPLETE BRAKE RELINE

THE general procedure in relining and adjusting brakes is as follows:



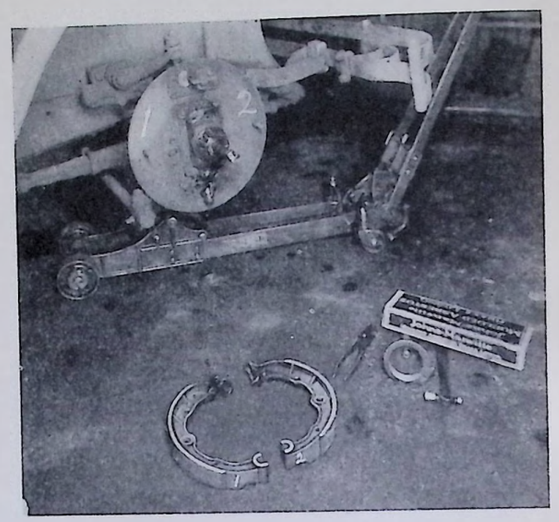
1—Jacking

Jack all wheels containing brakes. This should be carefully done, otherwise the vehicle might slip off the jacks and either damage itself or seriously injure the mechanic. (See Jacks, page 104.)



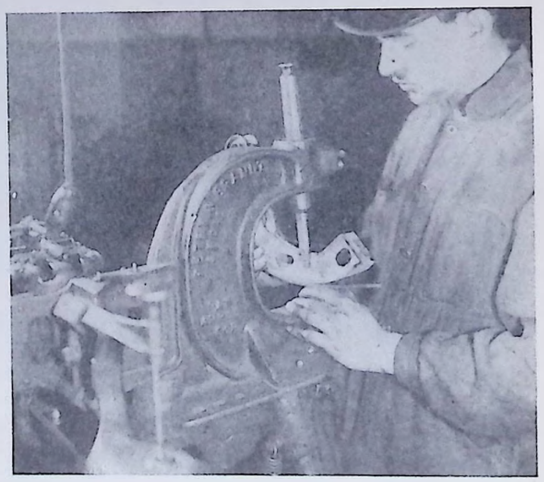
2—Remove the Wheels

Proper wheel pullers for the rear or driving wheels will be required in most cases. (See Wheel Pullers, page 105.) If grease is leaking from the axle and gets on the lining it is necessary to correct this by new washers. If bearings are loose they must be tightened also. Scored or eccentric drums should be turned or replaced. (See Brake Drums, page 11.)



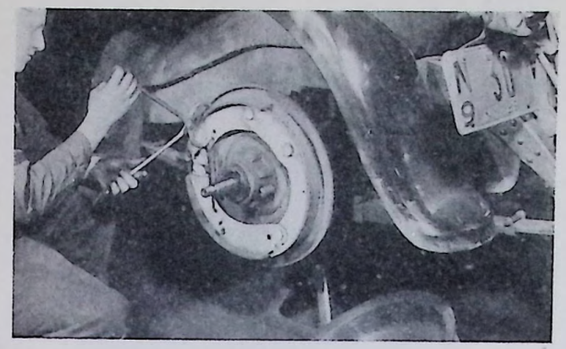
3—Remove Shoes or Bands

These should be kept in sets and replaced in the same position from which they were removed. Shoes should be carefully cleaned and relined.



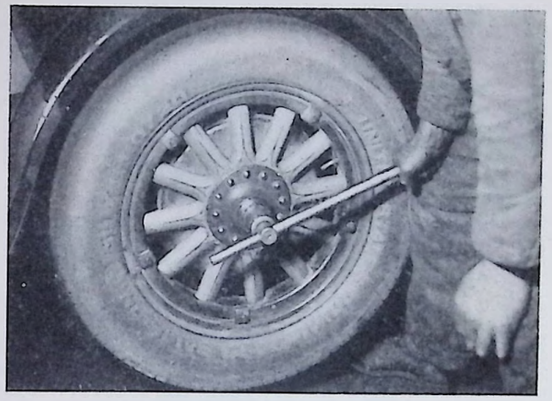
4—Reline Shoes or Bands

The axle work, cleaning and checking up of the linkage for lost pins, necessary adjustments and lubrication can be done while the shoes are being relined by an assistant.



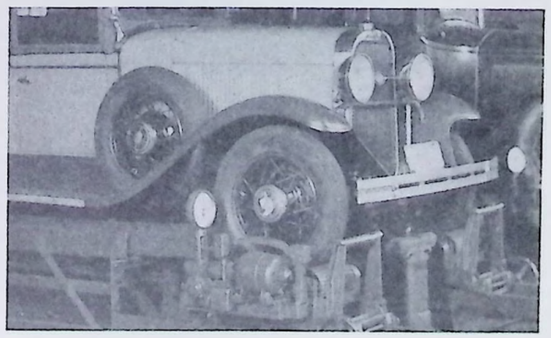
5—Replace Shoes or Bands

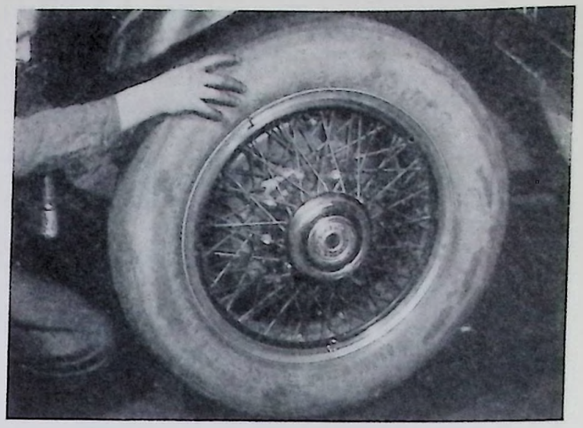
As fast as relined shoes or bands are received they can be replaced and adjusted as near to correct position as possible. All cotters and springs should be carefully replaced and all nuts tightened, except those to be finally adjusted.



6—Replace Wheels

The driving wheels should be tightened securely to the shafts, the front wheel bearings carefully adjusted so as to be free but with no looseness. Cotters and hub caps should be replaced.





7—Adjustment

This should be carefully done until the foot pedal is in the proper position and all wheels free when brake is released. Unless special testers are available (See Brake Testers, page 107), the brakes should be checked until they hold alike on each wheel and the pedal pressure necessary to stop the vehicle is comfortable.

The design of the brakes varies and the method of proper adjustment often differs with each design and it is very important that a thorough knowledge of the various brake adjustments be acquired. (See Cars and Brake Adjustments Section).



8—Testing

Since it is customary to test the brakes by a road test it is quite essential to keep the upholstery clean and it is advisable to protect it with suitable material while the mechanic drives.

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RELINING BRAKES

THE days when brakes were satisfactorily relined with the use of split rivets and the common copper belt rivet are past.

The present day brakes are expected to be quiet, smooth in action, efficient, and require little attention. The use of the popular flat rate system of service charge (See Service Charges, page 113) and the necessity of accurate and prompt repairs make it imperative to employ the most up-to-date types of equipment.

Equipment

The minimum equipment necessary for handling brake work consists of a jack, wheel-puller, drilling and counterboring machine and rivet press.

Other equipment, such as an air compressor, grinder or lathe for brake drums, and a dynamic or other brake tester, can be added as desired. Obviously, the more equipment a station has, the better the service given to the customer, and the greater the volume of business which can be handled.

(See Service Station Equipment Section.)

Friction Materials

The diverse conditions under which cars are operated and the variation in design of brakes make it necessary to have different types of friction materials.

Some brakes are quite small for the service intended and require a high heat resisting type of brake lining, whereas others are limited in possible pressure and require high friction in order to make a satisfactory brake. Since there is also no standard of drum composition or uniformity of area of lining, speed or weight of vehicle, it is necessary to have a knowledge of the best type of lining to use for special conditions.

There are two general types of friction materials used in the automotive field—fabric and moulded. The fabric materials include woven, heavy duty and folded and compressed linings; the moulded materials include moulded lining, die formed lining and brake blocks.

Fabric Materials

Woven Lining

Woven lining is, as the name implies, a woven to size tape of asbestos and wire which is saturated, or impregnated, with a compound which prevents absorption of water and oil and controls the naturally high friction of the asbestos. After impregnation the tape is compressed and heat treated. (See Fig. 1.)

Johns-Manville Standard Woven is an all purpose lining for light service. It has moderate mechanical strength, high heat resistance, high friction and flexibility with moderate density and is suitable for all qualities of brake drums. Woven lining is best for external brakes on light passenger or delivery cars and trucks but should not be used for brakes with air or booster attachments. (See Chart, page 23.)

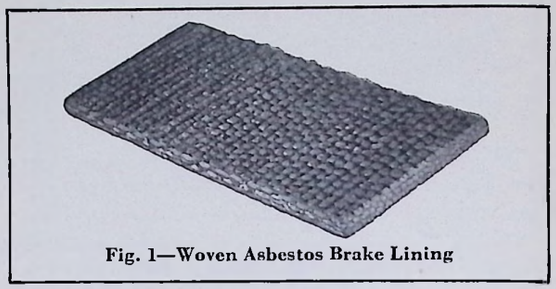


Fig. 1—Woven Asbestos Brake Lining

Heavy Duty Lining

Johns-Manville Heavy Duty Brake Lining is of the woven type and has high strength, high heat resistance, moderate friction and gives long life in service where braking is severe and sudden.

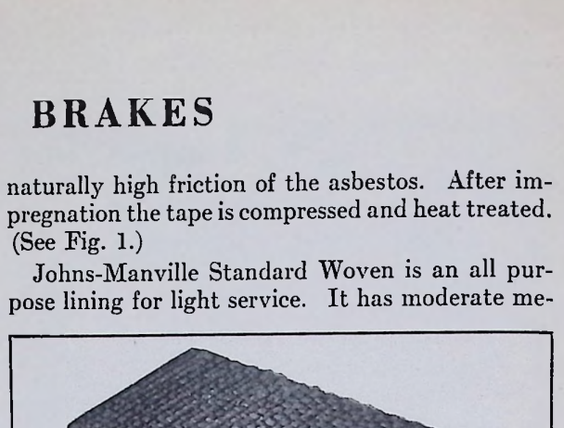


Fig. 2—Heavy Duty Woven Lining

While the material is dense and quite stiff it is flexible enough to readily conform to the various diameters encountered.

This material is for use on heavy vehicles at high and low speeds, either internal or external

brakes, with or without air or booster attachments.

Where service is very severe and the temperature is high the brake drums should be of good quality. (See Chart, page 23.)

Heavy Duty is for Heavy Service

There is an impression in the field that if heavy duty lining is applied to a light car, brake troubles are over and the material will last forever. This is not true. While better life can be expected, it does not hold true that life of the brake may be prolonged indefinitely because the service is light and a lining which is capable of severe service is used.

Light cars do not necessarily require a hard brake drum and standard linings will give good service and not abrade or cut the drum, whereas heavy duty linings might in this case. (See Drums, page 11.) Heavy service brakes are generally provided with hard drums which permit the use of hard or high strength linings.

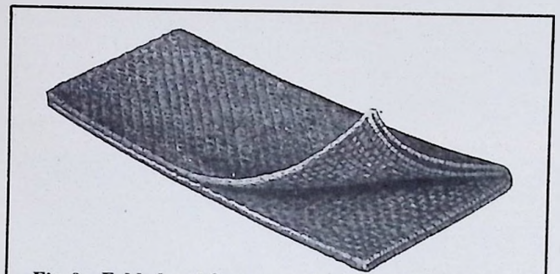


Fig. 3—Folded and Compressed Asbestos Brake Lining

Folded and Compressed Lining

The folded type is a woven cloth of asbestos and wire which is coated with a compound and then folded upon itself a sufficient number of times to make the desired thickness. It is then placed in a hydraulic press and cured by heat while under pressure of several hundred pounds. In some linings of this type, rows of stitching are used. The only value of this stitching is that is serves to hold the folded cloth in position during the process of manufacture until it has been cured. (See Fig. 3.)

Johns-Manville Folded and Compressed is a lining of high density, has high mechanical strength at moderate temperature, good rivet holding, high friction and when used on poor drums will give excellent service on medium and heavy vehicles at low speeds. (See Chart, page 23.)

Moulded Materials

Friction materials which are hard, dense and homogeneous in structure come under this classification. They are generally produced in metal dies. Johns-Manville makes three materials of this type: Moulded Lining, Die Formed Lining and Brake Blocks.

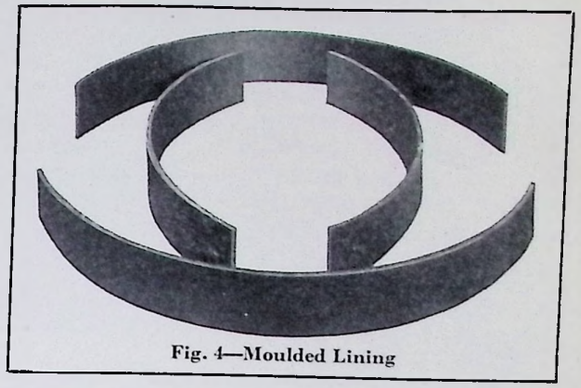


Fig. 4—Moulded Lining

Moulded Lining

Johns-Manville Moulded Lining is supplied in cartons or boxes with limited flexibility and is cut to size to fit the various cars for which it is suited. (See Fig. 4.) Write for list of vehicles for which sets are available.

It is also supplied in coil form curved to various brake drum diameters to take care of small service stations in outlying villages where adequate stock of box sets involves too great an investment.

Johns-Manville Moulded Lining has very high mechanical strength, uniform moderate friction, can be readily cleaned of grease and is remarkably free from tendency to squeak.

It is suitable for internal brakes of light vehicles at all speeds and heavy vehicles at low speeds. (See Chart, page 23.)

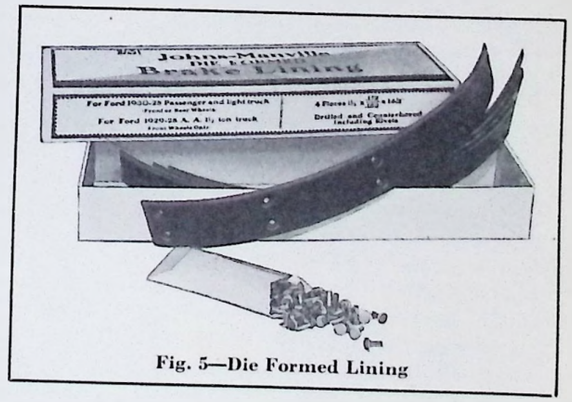


Fig. 5—Die Formed Lining

Die Formed Lining

This material is very dense in structure, yet flexible, and consists of a rubber base compound reinforced with strands of asbestos and brass wire.

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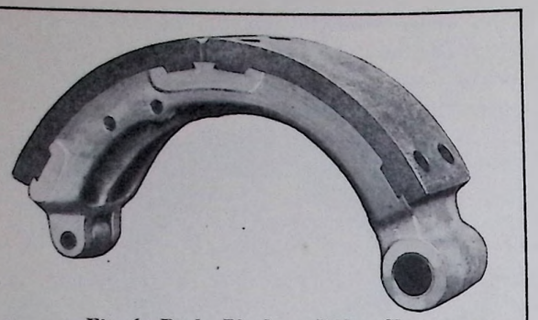


Fig. 6—Brake Block applied to Shoe

It is formed in a steel die and is provided with holes and recesses for the rivets used in its attachment to the shoes. (See Fig. 5.)

Johns-Manville Die Formed Lining is specially designed for a limited group of cars. See J-M Catalog Section, page 119.

Brake Blocks

This material is moulded or formed to exact size, often in small blocks or segments, several segments being used on each brake shoe instead of one piece. Single pieces are also supplied, in which case they are known as full coverage blocks. (See Fastening Brake Blocks, page 25.)

Brake blocks are hard and rigid and are used on bus and truck brakes which generally are air or booster operated. (See Booster Brakes, page 41.) They are also used in some cases where manually-operated brakes are so designed as to obtain a high pedal ratio.

Bus and truck brakes, especially those using air or booster attachments, require a friction material of high mechanical strength and high heat resistance, which is obtainable only in a moulded type of material.

Brake blocks, being uniform in structure, provide a uniform, smooth stop and overcome the objectionable variation in retardation rate which is quite common with the use of metal linings. Their smooth action reflects itself in the absence of squeak which is particularly objectionable in passenger-carrying vehicles and their use has resulted in savings due to the reduction of accidents classified as collisions and those resulting from grabbing or rough brake action.

A list of Johns-Manville blocks for the various vehicles will be supplied on request.

Brake Blocks (Sheet Form)

In addition to being supplied in drilled cut to fit sets, brake blocks are also furnished as large sheets curved to fixed drum diameters. These can be cut into small blocks or segments with a suitable saw, (See Brake Block Cutter, page 110) making it possible to service most any brake with a limited stock of sheets. Further information regarding Johns-Manville Brake Blocks in sheet form will be supplied on request.

See J-M Automotive Catalog Section.

Recommendations

While in most cases the different types of lining are recommended for specific service, other types of friction materials can be used in order to meet a special condition. For instance, while a moulded lining on an internal brake will give excellent service on paved roads, even though the brake is open at the back so as to admit dust and water, it will not give as good service as a woven or more flexible type of lining if the car is operated on muddy roads.

This is due to the grit which grinds the moulded lining away faster than the softer type of lining. While such conditions are not desirable for any brake, they must be met in the best possible way.

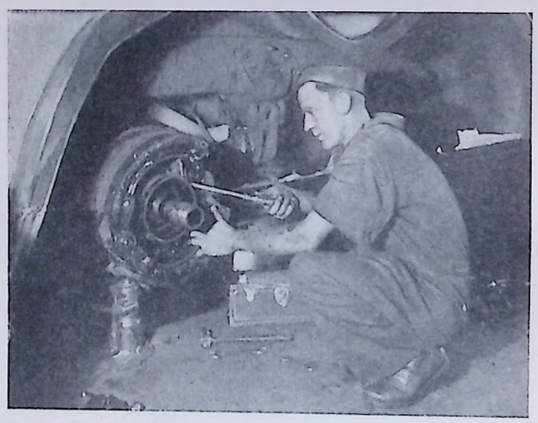


Fig. 7—Making first adjustment on a bus equipped with J-M Brake Blocks after 30,000 miles of service

The service from standard material might generally give satisfaction, but due to locality or other conditions a high heat resisting material may be required, or perhaps smooth operation is of more importance, and a change of material will more closely meet the requirements.

To simplify the selection of suitable friction material, the following chart has been prepared, giving the type of friction material, its characteristics and recommendations:

JOHNS-MANVILLE ASBESTOS BRAKE LINING

CHARACTERISTICS		RECOMMENDATIONS
A general all-purpose lining for light service. Has moderate density and mechanical strength. High heat resistance. High friction. Gives excellent service on all qualities of drums.	**STANDARD WOVEN**	For light passenger cars and delivery trucks. External brakes. Internal hand brakes. Transmission or parking brakes. Not to be used on air or booster brakes.
A heavy duty lining for hard service. Moderate friction. High heat resistance. Has the high mechanical strength and great density necessary where heavy loads are carried and braking is severe and sudden. Gives long life under above conditions.	**HEAVY DUTY WOVEN**	For heavy weight vehicles operating at both high and low speeds. External brakes. Internal brakes. Can be used on air or booster brakes. For high temperature or heavy service; brake drums should be of good quality.
Folded and compressed to high density. Has great mechanical strength at moderate temperatures. Good rivet holding. High friction. Provides excellent service on medium quality drums.	**FOLDED & COMPRESSED**	For medium weight vehicles at all speeds and heavy trucks at low speeds. Internal brakes. Parking brakes. Internal truck brakes where temperature is not high. Air or booster brakes at low temperature.
Moulded to exact size and curvature, in a semi-flexible state. Uniform moderate friction provides smooth retardation. Minimizes possibility of squeaks. Withstands reasonable temperatures. Held to close tolerances to meet small clearance conditions.	**MOULDED**	For light weight vehicles at all speeds and heavy weight vehicles at low speeds. For all internal and some external brakes. Drums should be of good quality. Recommended for conditions where lining tends to creep or rivets tear through.
Moulded to exact size and curvature in a rigid state. See special J-M list. Has uniform moderate friction; gives smooth retardation. Withstands high temperatures. Gives exceptionally long service. Less tendency to squeak than other linings. Molds and exact dimensions necessary for production.	**J-M BRAKE BLOCKS**	For heavy vehicles at high and low speeds. See special J-M list. Drums must be of good quality. Air or booster brakes, or where pedal ratio is high. Replaces metal linings to obtain smooth retardation. Internal brakes and some protected external brakes.

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Fastening the Lining to the Band or Shoe

In the past the method of attachment of brake lining to the bands was not considered very important. The rivets available at the time were belting rivets, usually made of copper with large flat heads. These were forced into the material and no effort was made to prevent their contact with the brake drum.

With the development of more modern brake constructions, it became necessary to attach brake lining by more up-to-date methods.

Considerable investigation has developed the fact that the most satisfactory method of attaching brake lining is by using brass tubular rivets, the heads of which are countersunk beneath the brake lining surface.

In order to insure proper attachment of Johns-Manville brake linings, rivets are supplied to the trade in both brass and aluminum.

Johns-Manville rivets are the result of careful investigation to determine first, the most satisfactory type, second, the proper relative proportion and third, the most satisfactory material, composition, hardness, ductility and strength, for the service intended. (See J-M Automotive Catalog Section.)

When copper rivets were used on the modern constructions they tended to cut the drums or roughen them so that the brake lining was quickly worn out. These rivets also helped to create the squeaks which seem so common today. They are not the direct cause of squeaking but do contribute to this annoying complaint. (See Squeaks, page 100.)

Brass rivets, however, when they do come in contact with the drum, have less tendency to cut the drum surface than does copper. While it is true that brass consists of approximately 80% copper and 20% zinc, the tendency to cut is reduced because of the lubricating effect of the zinc in the metal to metal contact.

Brass rivets may cut if the percentage of area in contact is sufficiently high so that the brake band lining rides, so to speak, on the rivet material. This is the result of the heavy pressure applied, due to lowered friction, to stop the vehicle. The combination of the brass rivet and the excess pressure required tends to cut the drum.

Split rivets, if carefully selected and of brass, have proven satisfactory in some cases for use with flexible linings, but the tendency is to select a long rivet to insure proper holding of the frictional material. Then the prongs which project through the material and bend over, expose considerable metal area to the brake drum surface. When the prongs make contact with the drum, they either cut or are soon worn away and the lining is then practically unfastened. There is then the possibility of the material tearing free from the rivet. Copper plated steel split rivets are exceptionally severe in cutting when in contact with the drum and should be avoided.

Cup headed rivets, while tubular and of brass, are designed for automatic riveting machine use and are not as satisfactory as the flat head type. There is greater possibility of the rivet contacting the drum.

From the foregoing it can readily be seen that it is not desirable to allow contact of the rivet with the drum; for this reason the bifurcated or split rivet is not satisfactory except on Ford Transmission Linings which operate in oil and which cannot readily cut because of the ever present lubrication.

Not all aluminum rivets are satisfactory as some are quite hard and will tend to cut the brake drums if permitted to come in contact with them.

The most satisfactory rivet for attaching friction lining is a flat head, brass, tubular rivet as shown in Fig. 12.

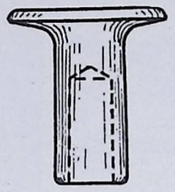


Fig. 12—Tubular Rivet

The lining should be drilled and counterbored to receive the rivet head with the use of special equipment available for this purpose. (See Service Station Equipment Section.)

Tubular rivets are divided into two types, full tubular and semi-tubular.

Full Tubular Rivet

Full tubular rivet means that the entire shank is drilled to the head. Generally speaking, full tubular rivets are used only for clutch facings because the riveting is done on the facing itself, and this requires a much larger bearing surface than would be needed for a clinch on metal. For this reason longer rivets are used than where the clinch is on metal, and the additional length is used for a larger clinch on the facing.

Some garages and service stations are using the full tubular rivets for brake band work, but we believe the semi-tubular to be better for reasons that will be pointed out below.

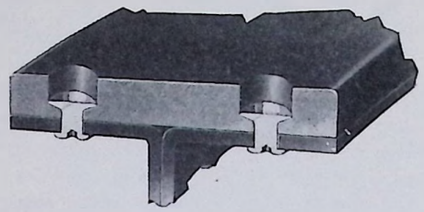


Fig. 13—Correct Riveting of Lining

Semi-Tubular Rivet

These rivets are to be inserted with the head on the lining side and the upsetting or clinching done on the brake band, or shoe. Semi-tubular rivets are better for brake relining work as they are considerably stronger than the full tubular rivets. The semi-tubular rivet has the advantages of the solid rivet for brake relining work. It is stronger, and provides a more satisfactory job than the full tubular rivet. The semi-tubular rivet, however, should be reasonably correct as to length.

Lengths Recommended

To arrive at the correct length of rivet, take the combined thickness of the brake lining and brake band or shoe and to this add the diameter of the rivet body. (Only the net thickness of the lining after counterboring is considered.) This is the minimum length to be used and it is also possible to use the next longer length.

Example

A lining with thickness of 1/8″ after counterboring, and with a brake band 3/32″ thick, using a rivet 9/64″ diameter would require a rivet 3/8″ long. In other words, 6/16″ is the shortest or the minimum length which should be used, and 7/16″ could be used if desired.

Size of Rivet Heads

For flexible linings, rivets up to 7/16″ long with 3/8″ heads are satisfactory. On rivets 8/16″ or longer, we recommend the 7/16″ or 1/2″ heads.

Moulded lining, being dense and mechanically strong, does not require rivets with large heads to properly hold it in position.

Depths of Countersinking

On lining up to and including 3/16″ in thickness, the lining should be countersunk one-half of the total thickness; on lining thicker than 3/16″ and on moulded lining, the lining can be countersunk two-thirds of the lining thickness, leaving one-third for the holding. We have found this to work out satisfactorily in general practice.

Rivet Sizes

While the Society of Automotive Engineers has established a standard of rivet sizes it has not fixed the designation of each rivet by letter or number.

Rivet manufacturers often have their own standard, generally a number, such as number 40, which will represent a certain style and size of rivet.

The length of a rivet is measured from the underside of the head to the end of the shank or body in sixteenths of an inch, as 8/16, 4/16, etc. Order rivets by number or as follows: Example: flat-head, brass tubular brake lining rivets, 9/64 body, 3/8 head, 8/16 long. (See J-M Automotive Catalog Section.)

Fastening Brake Blocks

While it is customary to use rivets for fastening most brake linings, the thicker, more rigid brake blocks are often held in place with bolts. Special designs for holding brake blocks are also employed on buses and trucks, using clamps held in place by bolts. This construction is designed to permit of replacing the blocks without removal of wheels.

This structure is shown in Fig. 14. Removal of the bolts permits of the clip and block being readily withdrawn from the space between the shoe and the drum. (See Brake Blocks, page 22.) Since the area of the block will affect the life or service obtained, i.e., more area greater life, brakes with this shoe structure are often lined as shown in Figs. 15, 16 and 17, page 26. A considerably greater area of friction material is obtained in this manner.

Since steel bolts are more likely to cut the brake

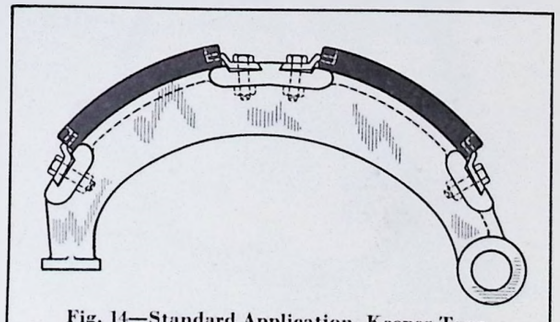
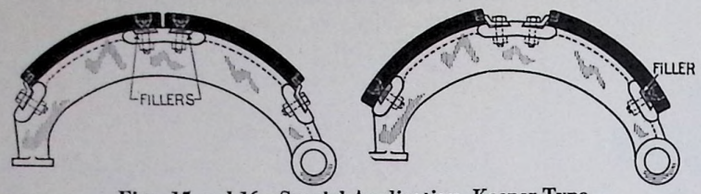


Fig. 14—Standard Application, Keeper Type

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Figs. 15 and 16—Special Application, Keeper Type

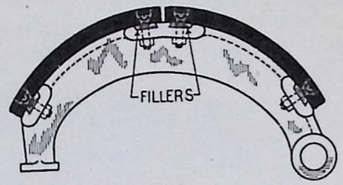


Fig. 17—Full Coverage Application

drums (See Cutting page 97), blocks fastened as shown are best secured with brass or bronze bolts. While special bolts are sometimes used, the most popular are standard flat head brass machine screws $\frac{3}{8}''$ in diameter. These are inexpensive and readily obtainable.

The gaps for the clips are generally filled with metal, which makes the surface of the metal shoe smooth and provides a solid backing for the block or friction material. (See Figs. 15, 16 and 17.)

In some cases brake blocks are provided with lugs on the back to fill the spaces occupied by the keeper, thus avoiding the necessity of filling in the gaps.

How to Reline External Brakes—Flexible Lining

Cut the lining to the correct length required for the particular band to be relined, which should be from $\frac{3}{8}''$ to $\frac{1}{2}''$ longer than the band, because when this is done the lining will fit snugly.

Place lining in position on inside of band, locate and drill and counterbore rivet holes on one end of lining, locating position from holes in band.

Insert brass tubular or aluminum rivets and head over on outside of the band.

Bring lining to position within band, then draw out center portion of lining from band, so that unriveted end of lining will slide along band until it is just possible to force the lining back against the band. (See Fig. 18.) Having found this position experimentally, locate other end rivet holes from holes in band.

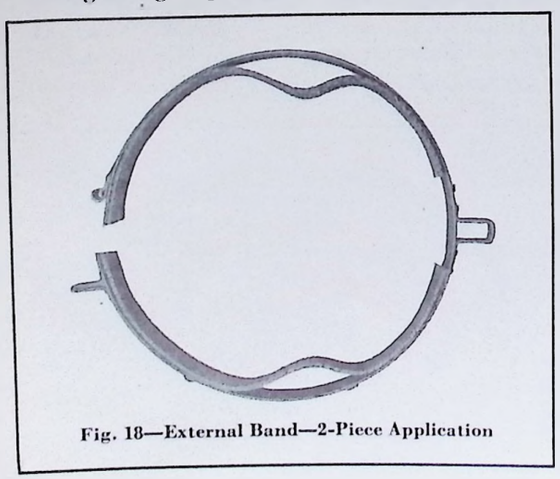


Fig. 18—External Band—2-Piece Application

Insert rivets and head over on outside of band.

Force lining into position against band, making sure that it presses firmly against the band.

Locate remaining rivet holes, from holes in the band.

Insert remainder of rivets and head over on outside of band. NOTE: Make sure that the rivet heads on the inner surface of the lining are embedded deeply enough so that they set below the surface of the lining an amount equal to about one-half the thickness of the lining.

This method obviously cannot be used for moulded lining as the material is not sufficiently flexible. In case of moulded lining, the end of the lining is fastened first, and working toward the opposite end, each rivet is progressively inserted, the drilling, counterboring and fastening being done before proceeding with the next.

Care should be exercised in applying moulded lining to external bands, as this lining lacks resiliency and if the adjustment is too close the brake drum may expand and lock the brake or destroy the lining. (See Drums, page 11.)

How to Reline Internal Brakes

Cut the lining to proper length, drill and counterbore for the center rivets and then rivet lining in place. A brake lining clamp will be found convenient for holding the lining to the shoe while this is being done. (See Service Station Equipment Section.)

If no clamp is used, pull the lining tightly around the shoe or band and drill and counterbore the remaining holes and insert rivets, working from the center of the lining toward the end in each case. (See Fig. 19.) This insures the lining fitting the band or shoe snugly and prevents the possibility of space being left between the lining and the shoe

as shown in Fig. 20. This method is satisfactory for both flexible and moulded types of lining.

How to Apply Moulded Lining

In attaching moulded lining to an internal brake shoe, clamp or hold the lining firmly to the shoe and prepare the center holes first, spotting the holes from the holes in the shoe. (See Fig. 19.)

The counterbore can be set a little deeper since this material has high mechanical strength and good rivet-holding characteristics. The head of the rivet should be below the surface at least one-half the thickness of the material. Johns-Manville brass or aluminum rivets are satisfactory, provided the underside of the head fits the bottom of the counterbore.

Two rivets, placed at the center, will hold the material in proper position. The remainder of the holes and rivets can then be placed. Be careful to have the material fit closely to the shoe. This can be done by working toward each end from the center rivets.

Burrs caused by dull counterbore can be readily removed with a rough file, a flat piece of medium sand paper or a special brake lining sander. Take care that all sand-dust is removed.

Some of the Bendix shoes have a ramp or sudden change in the contour of the surface at the ends. Unless the ramp is removed, it will be difficult to draw the lining down so that it fits closely to the shoe at this point. These shoes may be reshaped by setting up a brake drum in an anvil and striking the shoe with a hammer while it is held in place against the drum.

When applied as directed above, Johns-Manville Moulded Lining is as free from squeak, grabbing and other brake troubles as any lining yet produced, but in order to secure these results it is necessary to have the lining fit the shoe snugly and *not* show a space between the lining and shoe, as in Fig. 20.

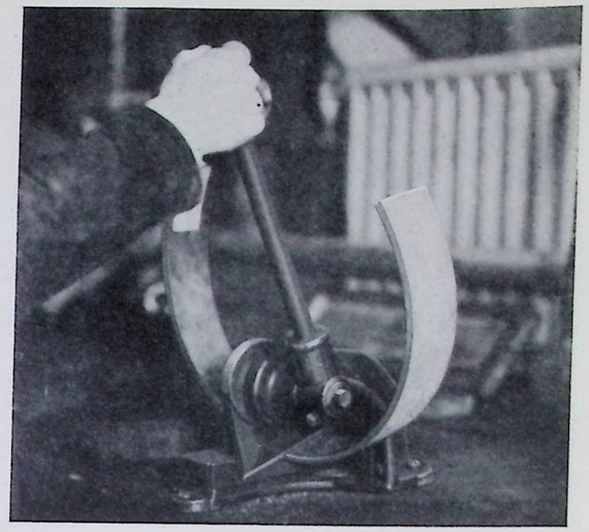


Fig. 21—Cutting Moulded Lining

Johns-Manville Moulded Lining is also easily handled and can be readily drilled and cut with standard tools. (See Fig. 21.)

How to Apply Johns-Manville Brake Blocks

Before attaching Johns-Manville Brake Blocks, the shoes should be carefully cleaned and inspected. If the anchor bushings are worn they should be replaced. The surface on which the blocks are applied should be flat and free from accumulations of grease or rust. If the shoes are of the keeper type, the gaps or spaces for the keeper clips should be properly filled in so as to obtain a smooth, flat surface.

When the blocks are supplied drilled and counterbored, it is only necessary to insert the bolts and apply the nuts. Lock washers should be placed under the nuts and each nut taken up slightly until all are tight.



Fig. 19—Apply Center Rivets First

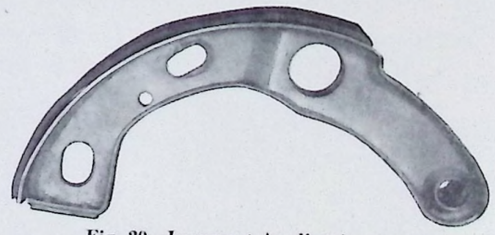


Fig. 20—Incorrect Application

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Brake Blocks are hard and rigid in structure and should be of proper curvature to fit the shoe. Being quite tough, they can be adapted to slight variations in curvature but are likely to crack if an attempt is made to distort them too much.

Where the blocks are not already drilled and counterbored, the drilling can be done in the usual way, no special tools or equipment being required. Due to their greater strength, however, brake blocks can be counterbored to a greater depth than flexible materials. A good rule to follow is to allow the top of the fastening to come about 2/3 of the thickness of the block below the surface.

While the size of the fastenings used depends somewhat on the drilling of the shoes to which the material is to be attached, blocks 3/4" and over in thickness should be applied with standard flat head brass machine screws about 3/8" in diameter. Blocks up to 1/2" in thickness may be fastened with 1/4" brass tubular or solid aluminum rivets. In either case, make sure that the bottom of the counterbore fits the under side of the head of the fastening used.

Where the blocks are put on the shoe in two or more pieces, the surface at the joints should be ground smooth if there is any noticeable difference in alignment. In applying full coverage blocks to shoes which are designed for keeper type blocks, it is necessary to fill the space provided for the keeper clips so that the bolts will pull the block down to a solid support, otherwise the bolt may pull out the back of the block or crack it.

ALWAYS DRILL AND COUNTERBORE

CARS AND BRAKE ADJUSTMENTS

In the following pages will appear a description of the adjustments necessary to insure proper functioning of brakes of various types. These will be listed alphabetically either under the name of the car, the brake, or the type of brake, such as Buick; Lockheed Hydraulic Brake; External Contracting Band Brake; etc.

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CARS AND BRAKE ADJUSTMENTS

(For vehicles not listed in this section see index, pages 29 to 31.)

EXPERIENCE indicates that most of the difficulties with brakes are caused by improper adjustment, and not by the brake lining itself. A lever in incorrect position, or a single rivet touching the drum, will make it difficult, if not impossible, to properly adjust or equalize the brake.

In making adjustments, therefore, do not consider the lining at fault until you are sure that no one operation has been overlooked. By following directions in proper order, a satisfactory adjustment should be obtained with a minimum of time and labor.

A. C. F. BUS

The service brakes are operated by the Westinghouse air system and the adjustment is accomplished by setting the stroke of the air cylinders as outlined under Westinghouse Air Brake, page 86.

The cam levers are adjustable by means of a worm and worm wheel. (See Timken Duplex Brake, page 84.) When the lining is worn so that the cam is in or near the extreme position, new cams or shims are introduced which permits of returning the cam and lever to its original relationship.

The Tru-Stop Brake is used for the hand brake. (See Tru-Stop Brake, page 86.)

AUBURN, MODELS 76, 88, 115

(See Lockheed Brake, page 64.)

AUBURN, MODELS 6-66, 8-77, 8-88

(As follows)

With the car on jacks remove front pull rods 1, Fig. 1. Tighten adjusting nut 2, until both front wheels drag an equal amount, then loosen 12 to 14 notches, or clicks. After backing off, tap the nut lightly until it is against the anchor bracket. If wheel still drags, loosen anchor bracket bolts on outside of splash plate and tap bracket to locate or centralize shoes. Rear brakes should be adjusted next. With lever 4 against the stop, adjust anchor 5, allowing .020" clearance between band and drum. Adjust top band by nut 6 and bottom by nut 7. The band should now have .020" clearance all around.

With foot pedal against under side of toe board adjust rod 8 so that pin 9 is in center of hole. Adjust rod 1 so that it just slips into lever 10 when 10 is in position as indicated.

Lever 10 is adjusted by changing length of rod 11. When pin 9 is in center of hole, lever 4 should be against stop. If not, adjust rod 12.

With new linings it is advisable to apply brake several times and readjust rods 8 and 11, keeping pin 9 in center of hole and levers 4 against the stops.

Rod 8 can be placed in lower hole to increase leverage and give lighter pedal pressure, but wear will more readily affect the pedal and more frequent adjustment will be necessary.

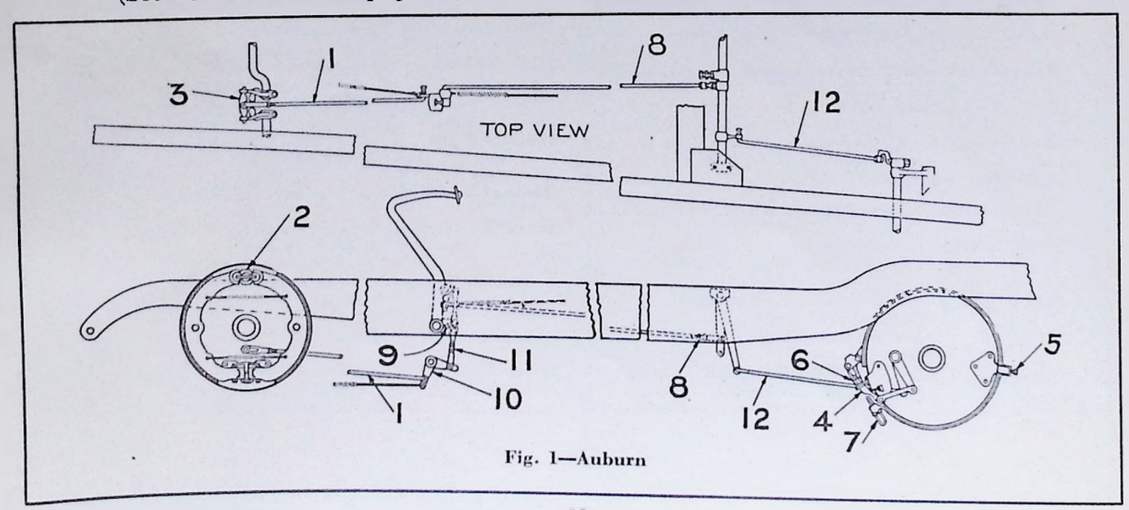


Fig. 1—Auburn

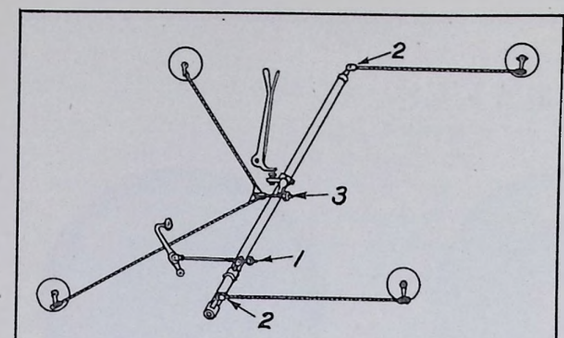


Fig. 2—American Austin

AMERICAN AUSTIN

The adjustment of the brakes on the American Austin is very simple, no adjustments being made at the wheels.

Adjustment for wear is made by tightening nut 1, Fig. 2.

The brakes are equalized by applying the hand brake about 1/3 of its maximum travel, at which point the brakes should hold alike.

Adjust rear cables at 2 until both rear brakes hold alike, then adjust front brakes at 3 until all four brakes are alike. The front cable, if free, will equalize both front brakes.

BENDIX BRAKES

Bendix Brakes are supplied in various designs and methods of operating the cams controlling the brake pressure, as indicated on page 34.

All are internal brakes and have servo action whereby the movement of the vehicle assists in supplying additional pressure to the friction linings. While the design may vary, the principle of the brake is not departed from and all types will be found similar in method of adjustment.

Some Bendix Brakes have three shoes and others two. In either case, however, the movement of the car tends to force one shoe against the other, thus increasing the pressure on the second shoe.

The three shoe type consists of a primary, a secondary and an auxiliary shoe as shown in Fig. 3.

The friction between the rotating drum and primary shoe tends to carry the primary shoe around with the drum. The primary shoe being attached to the secondary at 1, Fig. 3, is prevented from rotating but not from forcing the secondary shoe against the brake drum with considerable pressure. The auxiliary shoe is forced against the drum by the cam.



Fig. 3—Bendix Three Shoe Brake

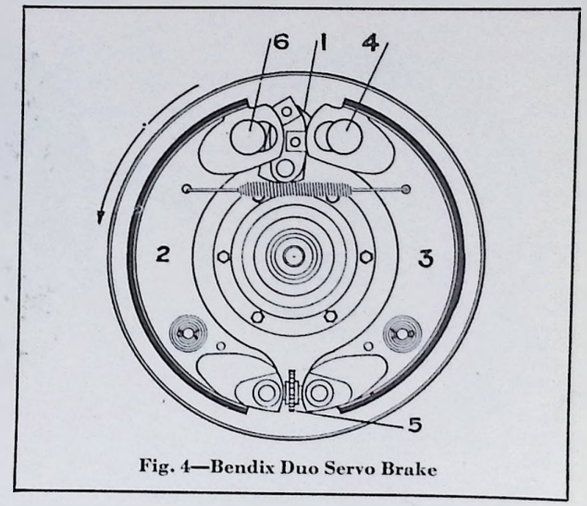


Fig. 4—Bendix Duo Servo Brake

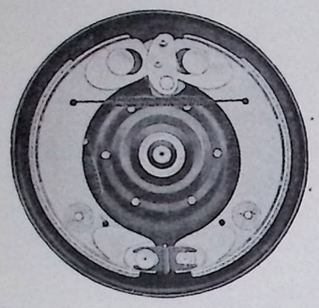
The two shoe Bendix Brake retains the same servo principle. Its action is as follows:

When the brake drum is revolving in the direction of the arrow, Fig. 4, and the cam 1 expands the ends of the shoes, shoe 2 tends to revolve with the drum and forces shoe 3 against the anchor pin 4 and also against the brake drum with considerable force, but proportional to the pressure applied on the pedal. The opposite direction of rotation reverses the action, making shoe 3 the pressure applying shoe.

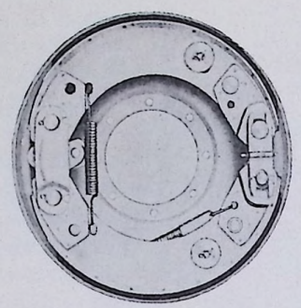
Bendix Brakes are extensively used and will give excellent performance when properly adjusted. The instructions given on the following pages should be closely followed.

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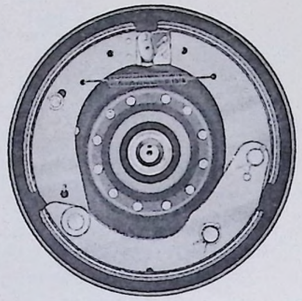
BENDIX BRAKES



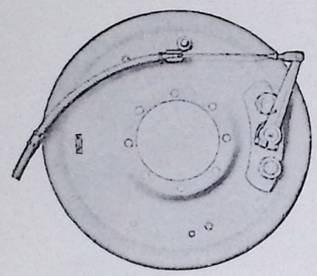
Bendix Duo Servo Brake



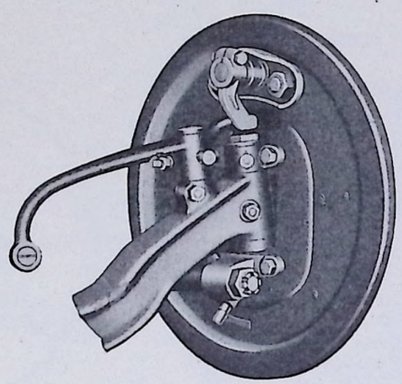
Bendix Duo Servo Brake for Trucks and Coaches



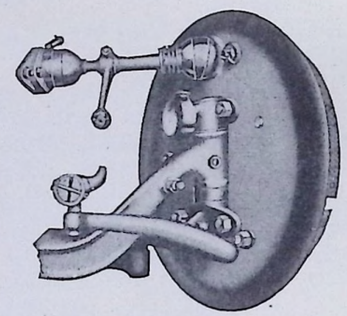
Bendix 3-Shoe Type Brake



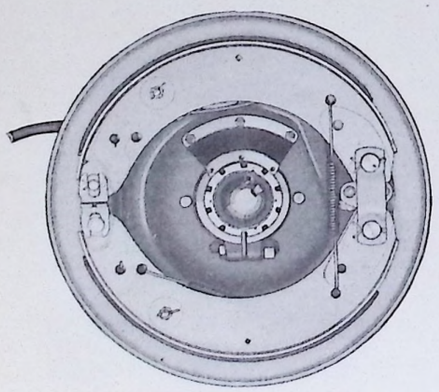
Bendix Cable and Conduit Type Control



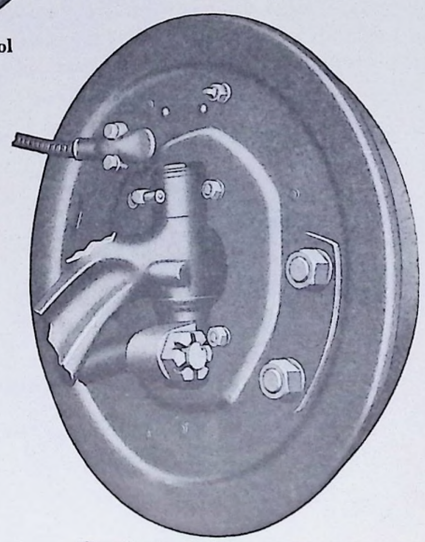
Bendix Lever Type Control



Bendix Perrot Type Control



Inside View of Bendix Duo Servo Brake with Inside Type Cable and Conduit Control



Bendix Inside Type Cable and Conduit Control

BENDIX PERROT OR SHAFT TYPE

Minor or Service Adjustment

Before making an adjustment lubricate all moving connections such as rods or lever pins, etc.

Beginning with each front wheel, tighten nut 2, Fig. 1, until brake drags, then back off until free.

Check equalization of front wheels by slightly depressing foot pedal, and noting resistance to rotation of front wheels when in straight ahead position. Repeat operation on rear wheels.

Major Adjustment

Should levers 3, Figs. 1, 2, 3, 4, become vertical when brake is in released position, it is necessary to readjust them.

When in proper adjustment and with brake in released position, the levers should be forward on the front and rearward on the rear, forming an angle of 60° to 70°, as indicated in Figs. 2 and 3.

Assuming levers to be incorrect, proceed as follows: With wheels jacked loosen lock-nut 4, Figs. 1 and 2, and back off screw 5.

Loosen screws 6 and 7, Figs. 1 and 2, leaving them finger tight.

Rotate 5, until wheel just binds. Then release by backing off slightly. Then tighten nut 4.

Rotating wheel in forward direction by hand or by means of tester, apply brake pedal hard to force shoes into position. Keeping a light pressure on the pedal to hold shoes in position, tighten nuts 6 and 7. These nuts must be set up very hard. Use at least a 16″ wrench.

Revolve wheel forward and turn screw 5, Figs. 1 and 2, in same direction until brake drags, then release for clearance, tightening nut 4, Figs. 1 and 2 (Fig. 5 shows construction of brake at point of location of screw 5 and nut 4.)

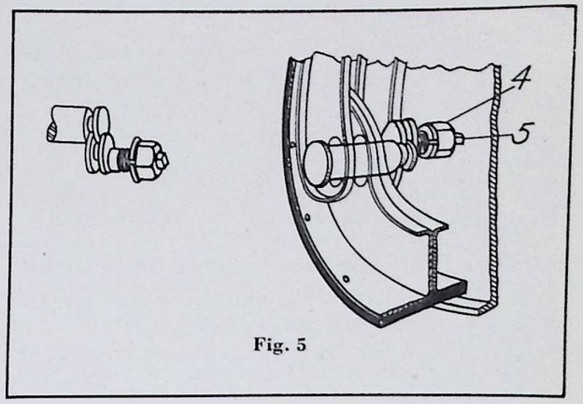


Fig. 5

Repeat for each wheel.

Check each wheel for dragging.

Remove front pull-rods 8, Figs. 1, 2, 3, from levers 3.

Mark position of lever on shaft as indicated in Fig. 4 and loosen lever 3, Figs. 1, 2, 3, 4.

Note—It will be necessary to remove shoes on some cars and on those with flanged shoe operating cam it is necessary to remove bracket 9, Fig. 6.

Replace front lever 3 about 3 knurlings forward of the old position as noted by marks previously placed. Set left and right levers at same angle and connect rods 8, Figs. 1, 2, and 3.

Equalize brakes as outlined under Minor or Service Adjustment.

If the rear wheels are equipped with Bendix Shoes remove both operating levers 3, Fig. 2, mark-

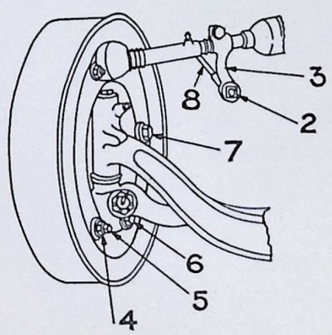


Fig. 1

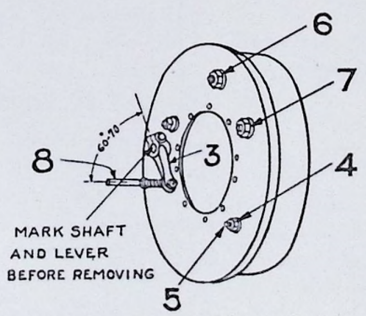


Fig. 2

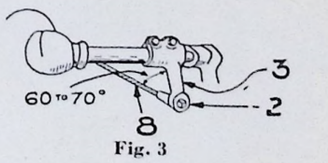


Fig. 3

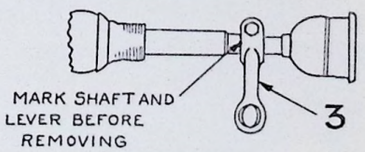


Fig. 4

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ing position of lever on shaft before removing. Relocate lever 3 about three knurlings rearward from the original position.

Left and right levers should stand at the same angle.

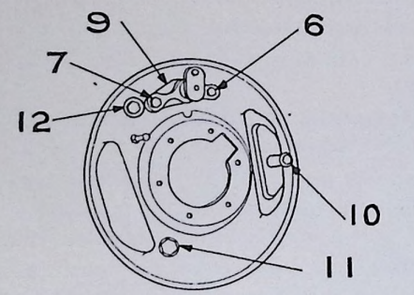
Connect operating rods 8, Fig. 2, and adjust brakes as outlined under Minor or Service Adjustment.

NOTE—The cam supporting bracket which is bolted to the backing plate is designed so as to be movable when struck with a light hammer. This allows the cam bracket to center itself.

Anchor Pin Adjustment—11 Inch Brake

On this size brake there is only one adjustable anchor pin. Adjust as follows:

Loosen nut one turn on the secondary anchor pin 10, Fig. 6, and turn eccentric 11, opposite to



11 INCH TYPE
Fig. 6

the direction wheel turns when car is moving forward, until wheel is very free.

Apply brake with force while wheel is spinning forward.

Leaving brake still applied, jar pin 10 outward with a hammer so that it will readily move in position.

Then tighten nut tightly and adjust eccentric 11.

The cam brake adjustable stop screw is shown at 12, Fig. 6.

BENDIX LEVER TYPE

This type differs in the method of operating the front brake. Instead of a horizontal universal jointed shaft mounted between the car frame and axle a lever mounted directly on the axle is used.

Minor or Service Adjustment

With car jacked up front and rear, loosen lock

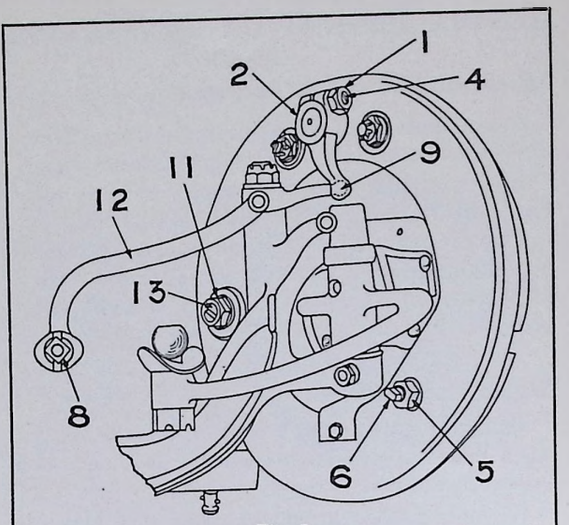


Fig. 7

nut 1, Figs. 7, 9, 10, Fig. 9 being an enlarged cutaway view of lever 2, Fig. 7.

By means of a screw driver in slot 3, Figs. 9 and 10, turn screw 4, Figs. 7, 9 and 10, to the right until shoes are just free from the drum.

NOTE—Some brakes are equipped with a lever as shown in Fig. 8. On this type, release lock nut 1 and then make above adjustment by inserting a screwdriver in slotted end of screw 3.

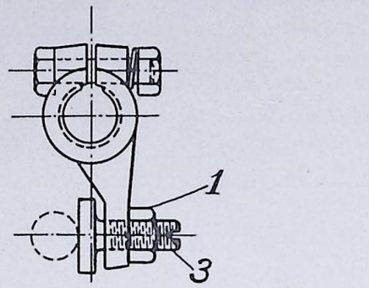


Fig. 8

Without tightening lock nut 1, loosen lock nut 5, Fig. 7, and turn screw 6, Fig. 7, in the same direction as wheels revolve when moving forward until wheel binds. Then just release screw 6 until wheel is free. Then tighten lock nut 5.

Repeat on opposite front wheel.

Release ball nuts 7, Fig. 11, on each rear wheel and proceed as with the front, loosening nut 5 and adjusting screw 6, Fig. 7.

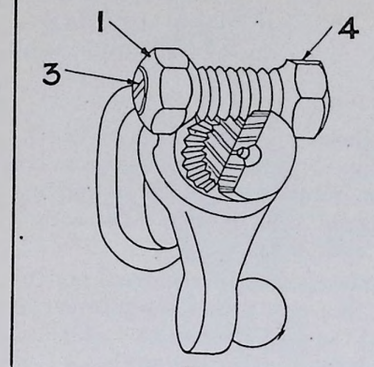


Fig. 9

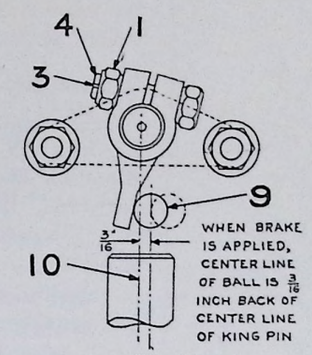


Fig. 10

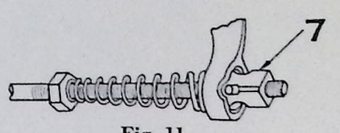


Fig. 11

With brake released, adjust front ball nut 8, Fig. 7, until the center line of ball 9, Figs. 7 and 10, is from ¼" to 5/16" back of the center line of the knuckle pin 10, Fig. 10.

Repeat for opposite front wheel.

With screw driver adjust screw 4, Figs. 7 and 9, by turning left until wheel binds, then just release wheel. Screw 4 may now be locked by tightening nut 1.

Balance or equalize all of the brakes by adjusting ball nuts 8 on the front and 7 on the rear.

When the front brakes are applied and in proper adjustment the center line of the ball 9, Figs. 7 and 10 should be 3/16" back of the center line of the knuckle pin 10, as shown in Fig. 10.

The final check for equalization can now be made on a dynamic brake tester or by lightly applying brake pedal until one wheel slightly binds and then adjusting ball nuts 7 and 8 so that all wheels bind alike.

Major Adjustment

If adjustments as outlined above fail to give satisfactory results or new linings have been installed, it is advisable to check over the rods and levers as outlined under Major Adjustment for Bendix Shaft Type Brakes. Make sure the angle of the rod and levers on the rear brakes is between 60° and 70°. Reset levers if necessary.

The shoes are relocated by loosening nut 5, Fig. 7, and turning screw 6, Fig. 7, in opposite direction of wheel rotation when moving forward.

Loosen nut 11, Fig. 7, leaving it finger tight. Apply brake by pulling on lever 12, Fig. 7, or the rear lever, similar to 2, Fig. 7, for the front. While so applied jar the pin 13, Fig. 7, then tighten nut 11. Adjust 6 and tighten 5 as outlined under Service Adjustment. Repeat for each wheel.

Examination of the cams will disclose an arrow as shown in Fig. 3, page 33. It is important that this cam be assembled in proper position. For front brakes the arrow should point upward and for rear brakes it should point downward.

BENDIX DUO SERVO

(Double Anchor Types)

This type of Bendix Brake is of the two shoe construction. The design varies somewhat, the most common form being the double anchor type having two adjustable anchors, one on either side of the cam operating shaft, as shown in Fig. 12.

The lower ends of the shoes are adjustable by means of a threaded shaft containing a left hand thread on one end and a right hand thread on the other so that by turning the notched wheel 5, the

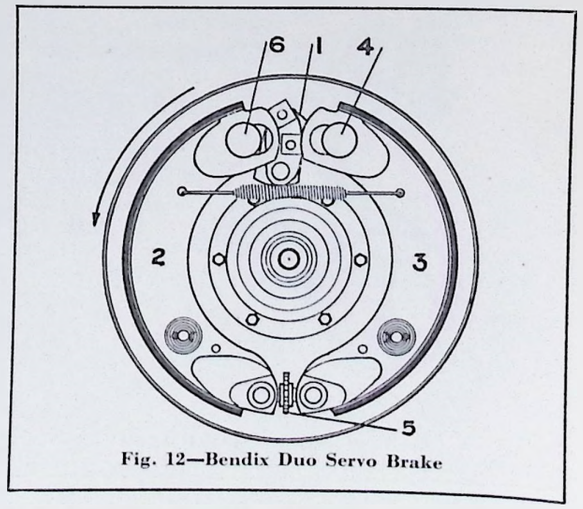


Fig. 12—Bendix Duo Servo Brake

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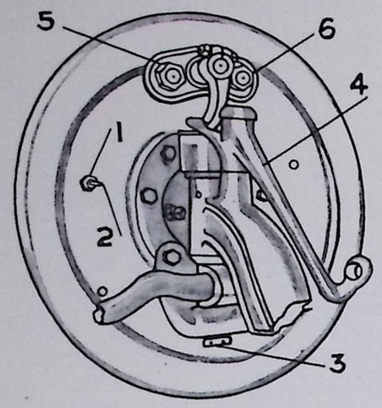


Fig. 13—Front Brake (looking outward)

shoe ends are separated or brought together as desired.

When the brakes are properly adjusted the center of the ball on the front control lever 4, Fig. 13, should be from ¼" to 5/16" back of center line of knuckle pin as indicated in Fig. 14 when in released position.

The ball should also have slight clearance as indicated in Fig. 16 and the same amount of clearance should be found on the rear control levers. If this is not found and the brakes have been adjusted as noted below, the clearance can be adjusted at the pull rods. Be sure, however, the adjustment has been properly made at the brakes before attempting any disturbance of the rods.

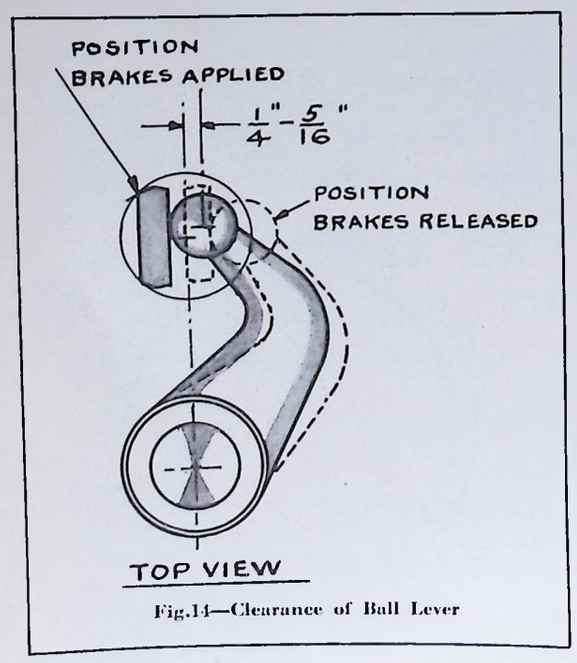
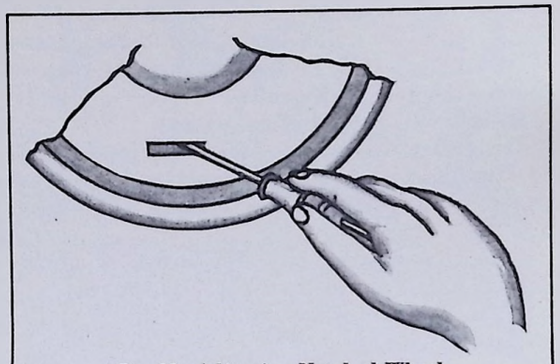


Fig. 14—Clearance of Ball Lever

Minor Adjustment

1. With car on jacks, centralize shoes by loosening lock nut 1, Fig. 13, and turning cam 2 in the direction of wheel rotation when car is moving forward. When light drag is felt, tighten lock nut. Repeat for each wheel.

2. With cover plate 3, Fig. 13, removed, pry the notched wheel 5, Fig. 12, with a screw driver as indicated in Fig. 15 toward the rim of back plate, until shoes drag heavily. Do this with all four wheels, keeping drag equal as much as possible in all wheels.


Fig. 15—Adjusting Notched Wheel

3. Release the shoes for clearance by turning notched wheel 5, Fig. 12, back until only slight drag remains. Repeat for each wheel.

4. Release lock nut 1, Fig. 13, and turn cam 2 in opposite direction as noted in paragraph 1 until wheel is just free of drag. Tighten lock nut. Repeat for each wheel.

5. Apply pedal by means of pedal depressor or jack until two inches of travel is obtained. Then try turning the front wheels. They should be alike in resistance to turning. If not, loosen the notched wheel 5, Fig. 12, on the tight brake until both are alike. Repeat for the rear wheels, making both alike.

Be sure to replace cover plates 3, Fig. 13.

Major Adjustment (Under 17" diameter)

Anchor pins are not adjusted except when the shoes have been relined or the nuts 5 and 6, Fig. 13, are found loose.

1. Follow instruction as outlined in paragraph 1 under Minor Adjustment.

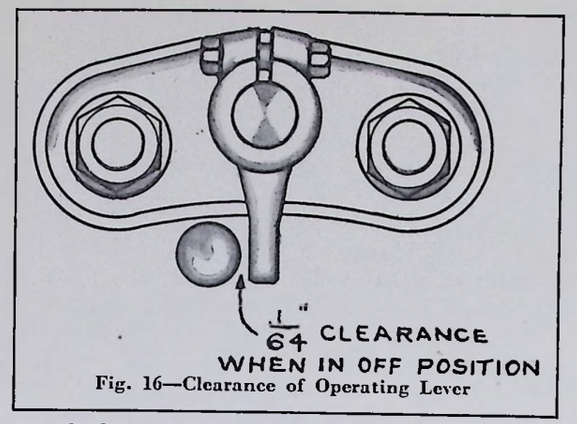


Fig. 16—Clearance of Operating Lever

2. Release the two anchor pin nuts 5 and 6, Fig. 13, so that they are free.

3. Follow instructions in paragraph 2 under Minor Adjustment, then tighten nuts 5 and 6 as tight as possible.

4. Follow instruction in paragraphs 3, 4 and 5 under Minor Adjustment.

When shoes are adjusted by the above method the clearance between the shoe and brake drum will be about twice as much at the notched wheel adjustment end of the shoes as at the anchor end.

When inspection plates are provided in the drums the clearance will show about .008" at the anchor end and .014" at the adjustable end of the shoes.

Major Adjustment (17" diameter and above)

In making the Minor or Service Adjustment on the above sizes of the Duo Servo Brake, follow the instructions given on page 38.

The Major, or Anchor Pin Adjustment differs from that of the smaller diameter brakes, the larger brakes being fitted with eccentric anchor pins, which are not used on the smaller sizes.

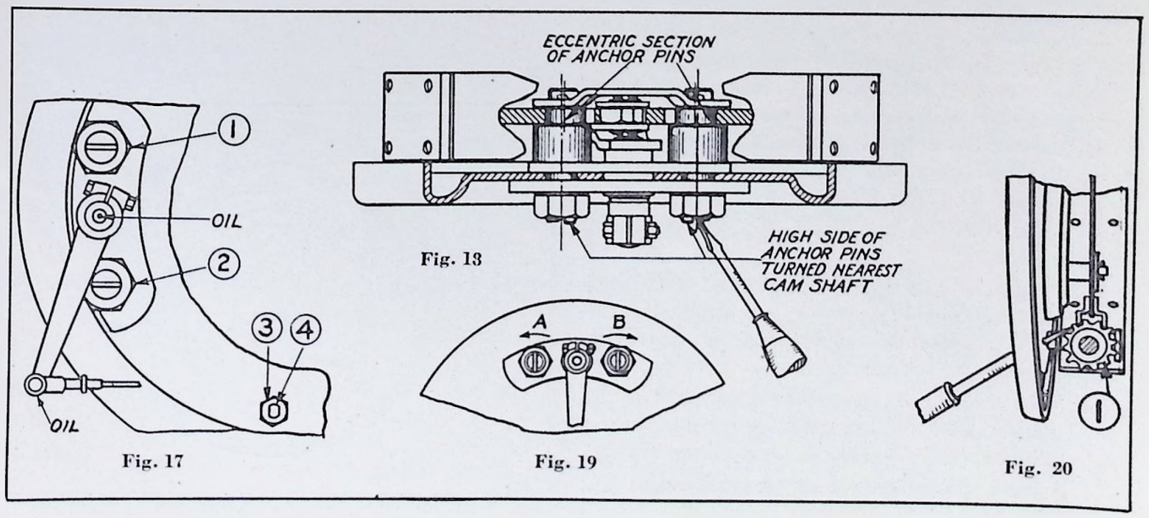
1. Loosen anchor nuts 1 and 2, Fig. 17, and turn pins so they are in position shown in Fig. 18. (That is, turn each pin so the high side of the slot is nearest the cam shaft.)

2. Release lock nut 3, Fig. 17, on eccentric adjustment. Turn eccentric 4 in same direction as wheels revolve when car is moving forward until a very slight drag can be felt when wheel is rotated by hand. Then turn eccentric in opposite direction until wheel is just free of drag. Tighten lock nut 3. Repeat for each wheel.

3. With cover plate removed, turn notched wheel 1, Fig. 20, toward the rim of back plate until wheel drags slightly when revolved by hand. Then turn notched wheel in opposite direction until wheel is just free of drag.

4. Turn anchor pin A, Fig. 19, counter-clockwise as indicated until wheel drags slightly when turned by hand. Then turn pin in reverse direction until wheel is just free. Lock pin in this position. Repeat for pin B, turning in direction indicated until wheel drags. Then turn pin B in reverse direction, locking it in position when wheel is free of drag.

5. Depress brake pedal by means of pedal depressor from two to three inches. Then try revolving front wheels. They should be alike in resistance. If not, loosen notched wheel 1, Fig. 20, on tight wheel until both wheels are alike. Repeat for rear wheels.



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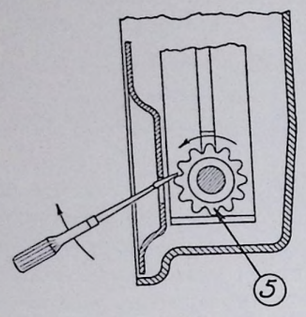


Fig. 21

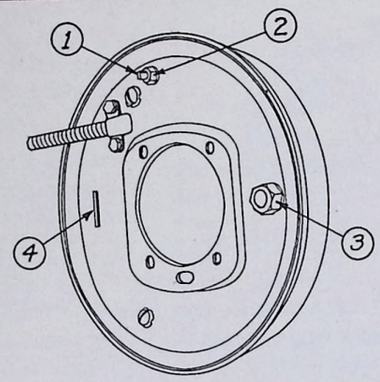


Fig. 22

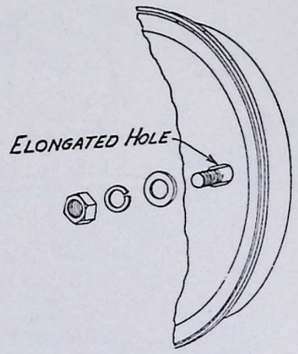


Fig. 23

BENDIX DUO SERVO

(*Single Anchor Types*)

In addition to the double anchor type, Bendix Duo Servo Brakes are also supplied with a single anchor which may or may not be adjustable.

The *adjustable* single anchor type is easily recognized by the fact that the anchor pin passes through an elongated hole in the backing plate. (See Fig. 23.)

In the *non-adjustable* single anchor type, the hole for the anchor pin is round.

Minor or Service Adjustment

In making the Minor or Service Adjustment on either the adjustable or non-adjustable single anchor type of Bendix Duo Servo Brake, proceed as outlined under Minor or Service Adjustment for the double anchor type (page 38.)

Major Adjustment (*Adjustable anchor*)

1. With car on jacks and all four cables disconnected at cross shaft levers, turn eccentric adjusting screw 1, Fig. 22, in the direction wheel revolves when car moves forward until a slight drag is felt when turning wheel over by hand. Then turn eccentric in opposite direction until wheel is free of drag. Tighten lock nut 2.

2. Loosen anchor pin nut 3, Fig. 22, until lock washer is free.

3. Expand shoes against drum by removing cover plate 4, Fig. 22, and turning notched wheel 5, Fig. 21, as indicated until wheel can barely be turned over with both hands.

4. With a soft hammer, tap end of anchor pin until anchor shifts and then tighten anchor pin nut 3, Fig. 22, as tightly as possible with a large wrench.

5. Repeat above procedure at each brake and then readjust all four cable lengths so as to remove any backlash existing between operating lever and anchor ends of brake shoes.

6. Back off notched wheel 5, Fig. 21, until wheels are just free of drag and recenter shoes at each brake by repeating procedure outlined under paragraph 1.

7. With pedal depressed from two to three inches, test brake holding effect at each wheel. If all wheels are not alike in resistance to turning, loosen the notched wheel 5, Fig. 21, on the tight wheels until drag is equal.

Major Adjustment (*Non-Adjustable anchor*)

1. With all wheels removed, check position of brake shoes at the anchor pin 4, Fig. 24. They should rest against the anchor pin when the brakes are fully released.

2. Adjust cable or pull rod length so as to remove any backlash which may be found between the lever 5, Fig. 24, and the anchor ends of the

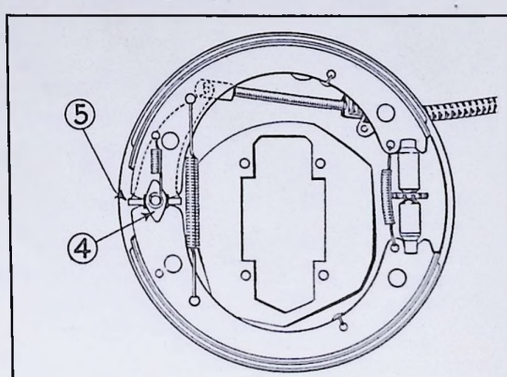


Fig. 24

brake shoes. (In doing this, make sure that brakes are fully released and that cables and rods are not shortened so that operating lever holds shoe ends away from anchor pin.)

3. With wheels in place, loosen nut on anchor pin and adjust notched wheel 5, Fig. 21, forcing shoes against drums. With brake in released position it should be just possible to turn the wheels. Jar the anchor pin to make sure it moves into a central position. Then tighten anchor pin nut with a large wrench. Release notched wheel until car wheel is free and then adjust eccentric adjusting screw 1 as for Minor or Service Adjustment on double anchor brakes. (See page 38.)

Repeat for each wheel.

Lubrication and Adjustment of Cables and Conduits

On Bendix Brakes equipped with cable and conduit control it is important that the cables be kept properly lubricated. On some types, a lubricator fitting is mounted in the center of the conduit so that greasing can be done by means of an alemite gun. Where this fitting is not provided, proceed as follows:

1. Clean uncovered portion of cables at 2, Fig. 25.

2. Disconnect each conduit at its support bracket 3, moving the conduits 4 toward the brake cross shaft until the portion of the cable normally covered by the conduit is completely exposed.

3. Apply a liberal amount of graphite grease to the cable, slip the conduit back into place and fasten again at the supports 3.

4. After greasing, check cables to be sure that no lost motion is present. If an adjustment is necessary disconnect cables by removing clevis pins 5, Fig. 25. Then with the cross shaft and brake mechanism in full released position, pull on each cable until the operating mechanism can just be felt against the shoes in the brake assembly. Then adjust cable connections so they fit cross shaft properly.

Points 6, where the cable is in contact with the backing plate inside the brake assembly, should be lubricated when the brakes are adjusted.

BOOSTER BRAKES

Booster Brakes are those which have an auxiliary independent means of applying additional pressure to the brake system. This pressure will be proportional to that applied to the foot pedal, and is generally secured by a device which is attached to the inlet manifold of the engine.

There are two Boosters which will be found in the field: The B-K (Bragg-Kliesrath) and Westinghouse. The Westinghouse Booster is no longer manufactured. Although both types are air operated, these devices should not be confused with air brakes. (See Westinghouse Air Brake, page 86.)

The latest Cadillac car is equipped with a device which operates on the same principle as the Booster but is referred to as an "assister." (See page 52.)

B-K BOOSTER

The B-K Booster is available in various types for single vehicle and trailer attachment, and can be secured from the Bragg-Kliesrath Corporation, South Bend, Ind.

The device is readily attached to almost any type of motor vehicle operated by an internal combustion engine.

Boosters are designed primarily to increase the pressure on the existing brakes of heavy vehicles such as buses or trucks by utilizing the vacuum or suction present in the inlet manifold.

Fig. 1, page 42 illustrates the manner in which the device is attached and functions.

The downward stroke of the piston of an automobile engine causes a vacuum to be formed in the inlet manifold during one part of its cycle, es-

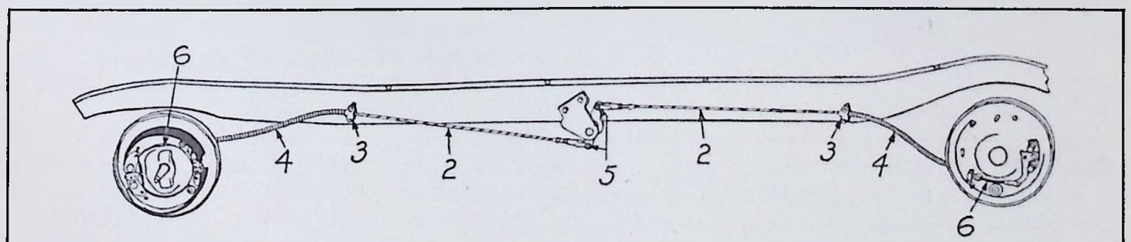


Fig. 25—Bendix Cable and Conduit Control

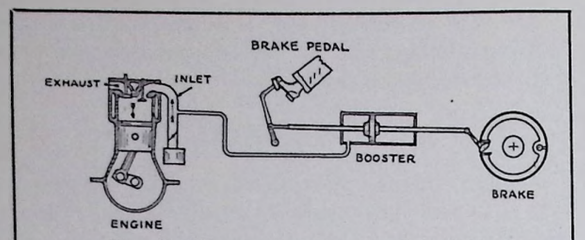


Fig. 1—Illustrating Booster Principle

pecially if the throttle is closed, which it generally is, when a brake is applied.

From the inlet manifold a pipe is carried to the Booster which is connected as a part of the brake rod joining the brake pedal to the brake mechanism. It will be readily seen that the brake can be operated the same as if the device had not been connected. This is so that the brake will still function if the engine should stop or vacuum fail, in which case the conditions are the same as before the Booster was attached.

The Booster itself is also shown in enlarged section with all valves in normal position in Fig. 2. If the parts are traced it will be found that each side of the piston is under reduced pressure or a vacuum, and there is no tendency for movement, due to balanced pressures on the piston. When the foot pedal is depressed it moves the valve A, Fig. 3, from its seat, compressing spring B, and also closes valve C. Opening valve A, and closing C allows air to pass into an air cleaner D, through the center of the shaft and into right side of piston as indicated by arrows, Fig. 3, and thus kills the vacuum. The unequal pressures in the cylinder, the left lower than the right, cause the piston to move to the left and assist or follow up the movement of the brake pedal, but with considerable force.

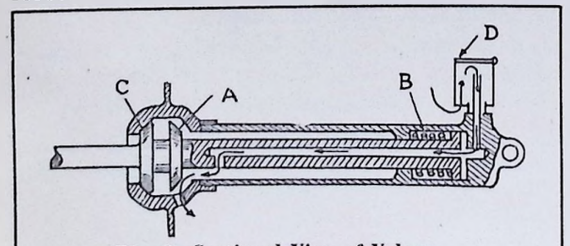


Fig. 3—Sectional View of Valves

When the brake pedal is released, spring B returns valves A and C to their normal positions and the air which was admitted to the right hand side of the piston follows through the piston as shown by arrow E, Fig. 2, passing out through the engine.

The pressures on each side of the piston having again been balanced, there is no further force exerted and the brake return springs return the piston once again to normal position and release the brake.

Spring B requires about 125 pounds pedal pressure to compress it to its maximum and gives "feel" to the brake pedal so that the driver does not experience a great difference when operating the vehicle equipped with a Booster.

The device is easily attached to the vehicle, and in no way interferes with the adjustments, which are the same as if it had not been attached.

If difficulty has been experienced in stopping heavy trucks and the use of Johns-Manville lining and proper adjustment has not given satisfaction, the use of a device such as a Booster is necessary.

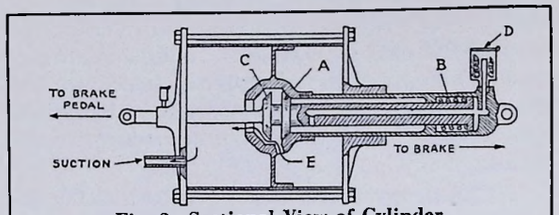


Fig. 2—Sectional View of Cylinder

Instruction and Maintenance

Fig. 5 shows the essential parts and connections.

In order to control the pressure applied to the wheel in wet or dry weather and to keep the operation of the car by the driver normal at all times, a convenient control valve is often mounted on the instrument board. (See Fig. 4.)

This valve is carefully adjusted before shipment and should not be tampered with except for tests for leakage as instructed.

Test to Determine if Trouble is with Booster or Brakes

An emergency road test may easily be made to determine whether the trouble is in the Booster or in the brakes and brake system as follows:

1. Stop engine.
2. Make a very light brake application with the left foot, approximately one inch on the pedal.
3. Turn on ignition switch.
4. Start engine, taking care to keep left foot on pedal in above mentioned position. If the Booster is working the pedal will go down of its own accord and the brake trouble lies in the brake system. If there is no change of pedal position after starting motor there is something wrong with the Booster.

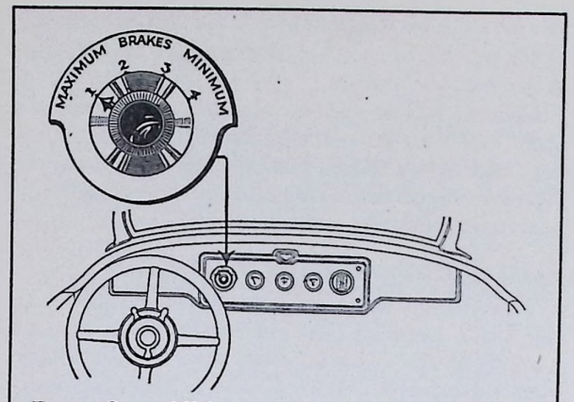


Fig. 4—Control Valve mounted on Instrument Board

Never change the adjustment of the rod between the foot pedal and the valve. This is set in the proper position when vacuum brake is installed, and any change will affect the opening of the valve, and the proper working of the booster cylinder.

If both the cylinder and the valve test out to be O. K., examine brake mechanism and adjust.

In case of emergency where the brakes fail to release and the cause is not known, disconnect the nipple on the vacuum line at the intake manifold and insert a plug. This will remove the power application of the brakes and they can be operated physically until a service station can be reached.

If, after disconnecting the line as above stated, the brakes still do not release, the trouble will then be found in the braking system itself and not in the Booster.

Testing Air Suspended Type Cylinder for Leaks

1. Remove hose, disconnect rod from cylinder and then depress piston all the way to the rear.

2. Place cork in orifice or place finger firmly over nipple end. If piston remains in position there are no leaks and booster cylinder is O. K. If piston moves to the front, it indicates that air is passing by the piston cup. If latter condition exists, put about two ounces of medium engine oil mixed with a light penetrating oil into cylinder through nipple. Turn piston around one-half turn and work back and forth. Test again and if leak remains, send cylinder to B-K station or to the factory for service.

Testing Vacuum Valve

To test the valve used with the air suspended cylinder, proceed as follows:

1. Start engine. Place vacuum gauge in end of the disconnected hose so it is connected to connection "X" of valve.

2. With pedal in off position, gauge should show zero inches of vacuum. When the brake pedal is depressed, gauge should show 18 to 20 inches of vacuum. If this amount is not shown, it indicates a leak in valve or seat, and assembly should be sent to B-K official station or to the factory for service.

Testing Vacuum Suspended Type Cylinders

1. Remove the pipe plug on the rear end plate of cylinder. Insert a hose connection with vacuum gauge into pipe plug hole in end plate.

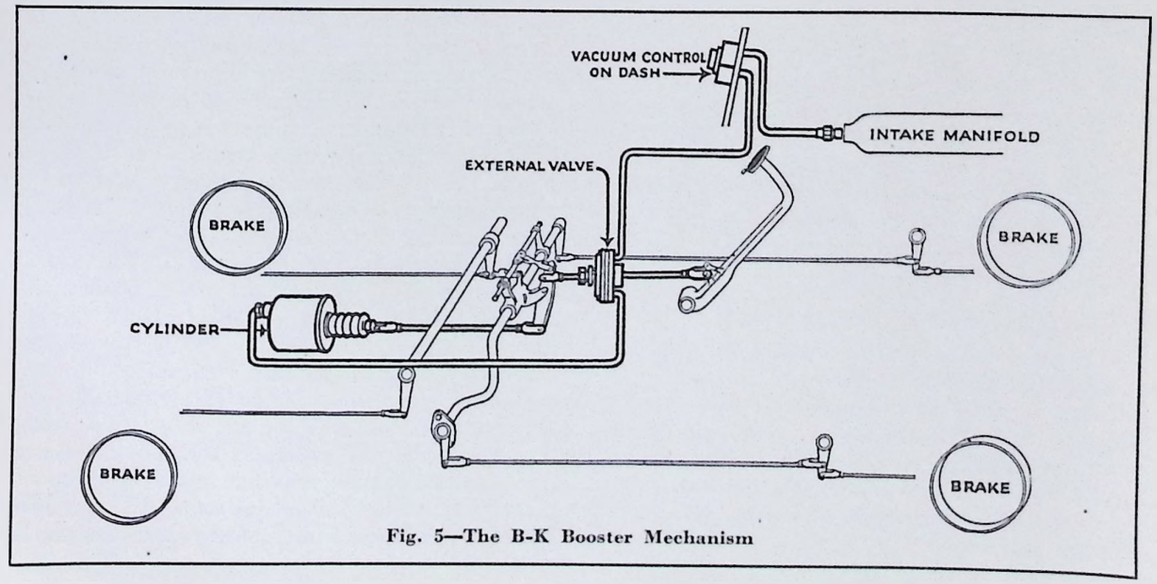


Fig. 5—The B-K Booster Mechanism

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2. Start engine and note reading on gauge. It should show a vacuum of 17 to 20 inches. Now stop engine and note if vacuum is retained for a reasonable length of time. If gauge shows rapid falling off, it indicates a leak which may be in the cylinder or in the inlet manifold connections. To test the line to inlet manifold, disconnect it from the front of the cylinder, connect gauge to the line, then start engine and note reading on the gauge. Now stop engine and note if vacuum is retained for a reasonable length of time. If vacuum falls off rapidly, it indicates a leak in the line or in the check valve at the inlet manifold connection.

Test for leaks in cylinder or lines may be made without a vacuum gauge. This test, which is based on the fact that air leaks cause abnormally fast idling is made as follows:

1. With the engine idling, hold the finger over the air inlet stand pipe, after the lid of the air cleaner has been lifted. If a suction is felt on the finger tip, or if there is a drop in the engine idling speed, there is a leak in the cylinder valves.

2. If in the above test no change is noted in the speed of the engine, remove the pipe at the inlet manifold and close the manifold orifice with a finger. If the engine runs slower it indicates a leak in the hose or in the connection between the manifold and cylinder end plate. However, if the engine speed does not change, but continues to idle faster than normal, there is probably a leak in the inlet manifold or gaskets, or the throttle stop screw is improperly adjusted.

Lubrication

About every sixty days two ounces of light engine oil should be placed in the booster cylinder as follows: Remove ⅛ pipe plug located in end plates and inject oil. Remove rear clevis pin and turn piston over several times. Do not pour oil in the atmospheric inlet as this tends to retard the air entering and also drips on the rubber piston rod guard, eventually destroying it. The external valve requires no lubrication.

Cleaning Air Cleaner—Internal Valve

The air cleaner on the internal valve vacuum suspended cylinder should be examined and cleaned at least twice yearly. This is done by lifting the cover on the cleaner, removing the hair, washing thoroughly in gasoline, drying and then saturating with light machine oil. Clean off dirt from holes in the bottom of cleaner and replace hair in the shell.

Cleaning Air Cleaner—External Valve

The air cleaner should be examined and cleaned at least twice yearly.

Remove rubber piston rod guard and air cleaner shell. Remove hair, wash thoroughly in gasoline, dry and then saturate with light machine oil. Clean off dirt from holes in end plate, replace hair in cleaner shell and reassemble.

Testing External Valve

To test the valve, engine must be shut off. With the brake pedal in the released position, remove hose at V, Fig. 6, and close orifice with finger. Suck through connection C, and if valve 2 is seating properly, no air can be drawn through. If air can be drawn through in this test it indicates an improperly seating valve and the assembly should be taken to an official B-K service station.

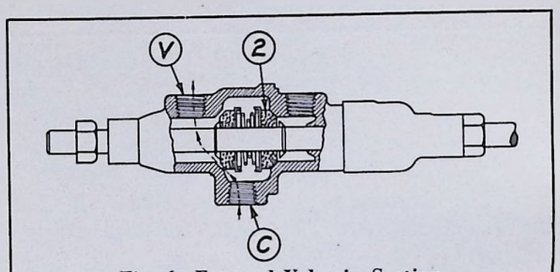


Fig. 6—External Valve in Section

Checking Pedal Rod

In order to get standard stopping performance (See Stopping Distances, page 14), it is necessary that the pedal have full travel. Less than full travel is the result of tampering with the pedal rod. To check for pedal travel proceed as follows:

Disconnect the rod connecting the pedal to forward end of Booster, then operate pedal and see if it moves through its entire throw, that is, all the way to board (or stop, if so provided) and all the way back to stop or underside of board. If pedal stops too soon, determine cause and correct.

If the above test shows pedal has full normal travel, reconnect the pedal rod and disconnect the rod that attaches to the rear end of booster cylinder. Now operate the pedal. If pedal stops before traveling same distance as with front rod disconnected, it indicates piston is striking end of cylinder, due to pedal rod being too short. To adjust length of pedal rod disconnect it at one end, then move piston against rear end plate of cylinder, place pedal in the full off position with arm just clearing underside of floorboards, then turn clevis until rod can be reconnected without tension. After pedal rod has been adjusted, it will probably be necessary to shorten the rod attached to the cylinder rear end plate. This rod should be shortened only enough to remove slack from system without moving levers away from their stops.

If both the cylinder and valve test O. K., examine brake mechanism and adjust.

BUICK 1926-27 EXTERNAL BRAKE

Major Adjustment

1. Release both front and rear brakes on right side only, by turning nuts 1 and 2, Fig. 1.

2. Adjust screw 3 so that the lining will clear the brake drum about 1/64″ when the wheel is revolved. Also adjust band guides 4 on the lower side of front brakes and the upper side of rear brakes so the band clearance will be 1/32″. If bands are not true, they should be rounded to obtain uniform clearance.

3. Adjust nuts 1 and 2 on left side so that equalizer is squared and a pedal travel of 5″ is obtained.

4. Adjust the opposite side brakes in the same manner as mentioned above so that right and left brakes in each set hold alike, and the band clearance is the same at any point on each brake.

All lock nuts should then be set.

If proper clearance is not obtained by these adjustments, the rods, levers and cables should be checked and minor adjustments made.

Minor Adjustment

1. Lever 5 must be against its stop when the brakes are released.

2. The brake pedal should clear the underside of the toe board 3/16″ and may be adjusted by the screw 6 when the yoke pin has been removed at the rear end of the rod.

3. Levers 7 and 8 must be parallel to each other, but if not, remove pins from adjusting yokes at levers 9 and 10 and with levers 5 and 11 against the stop, adjust yoke ends so they will be in alignment with their levers. This will make the equalizer parallel to the cross shaft above.

4. The brake pedal rod should be of suitable length to take up all looseness between the equalizer and levers 7 and 8. If not, adjust by turning yoke so that holes in yoke and equalizer are in alignment when lever 5 is against stop, and lever 7 is hanging straight downwards and equalizer is parallel to shaft above.

5. When the center of the upper pin in lever 12 is one inch ahead of a vertical line through the center of supporting bolt (See Fig. 2 in Fig. 1) and lever 5 is against stop, lever 12 should be in proper position. If not, adjust yoke on rod attached to it.

6. With lever 12 in proper position, to check cables, turn wheels to extreme right and adjust right cable so pin 13 can be easily inserted when the brakes are released and lever 5 and the front brakes are against their stops. Adjust left cables in similar manner with wheels turned to left.

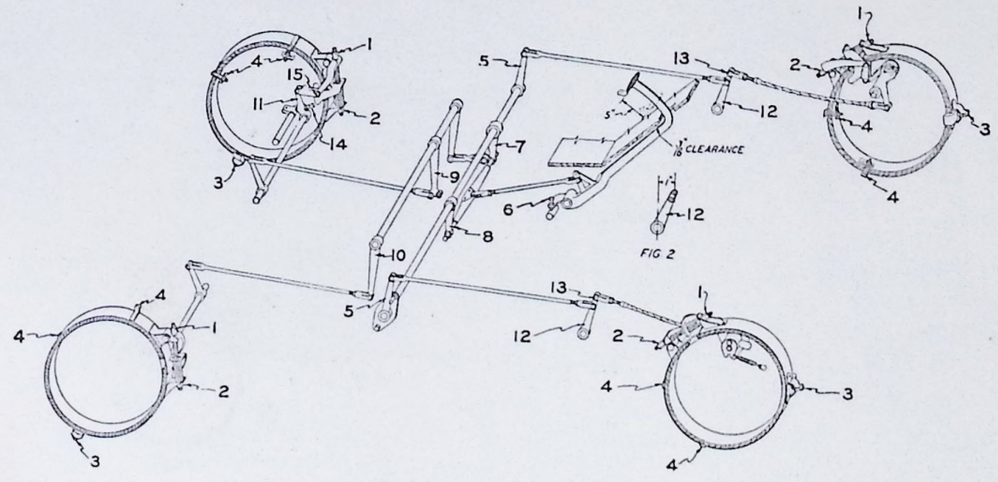


Fig. 1—Buick 1926-27 External Brake

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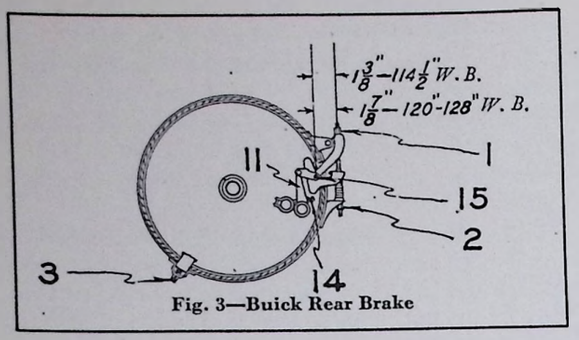


Fig. 3—Buick Rear Brake

7. Rear lever stop screw 14 should be adjusted so pin 15 will be in the position as indicated in Fig. 3 for the respective wheel base.

8. All working parts of the braking system should be properly lubricated, but care should be exercised to protect the lining from the lubricant.

BUICK 1928-29 EXTERNAL BRAKE

These brakes are similar to those used on the 1926-27 Buick models and their adjustment is the same. The linkage hookup, however, is slightly different, the cross shaft being inverted, as shown in Fig. 4.

Follow the instructions given on page 45 for 1926-27 Buick cars in making both minor and major adjustments.

BUICK 1930 INTERNAL BRAKE

Foot Brake Adjustments

Follow instructions in order listed below. Do not adjust when brakes are warm or they will drag when cold. Brake drums must be at room temperature. Brakes must be adjusted when pedal travels to within 2″ of toe board.

1. Lubricate all moving connections.

2. Levers 4, 8 and 8A, Fig. 5, should be against stops 9 and 18 in released position.

NOTE—Adjusting screw 3 is used at factory to set equalizer 5 parallel to cross shaft, and it should not be necessary to disturb it.

3. Remove all slack in pedal movement, as follows:

(A) Pedal should be set 3/16″ from underside of toe board by adjusting screw 23 with rod 7 disconnected.

(B) Set front wheels straight and adjust rods 10 so that levers 19 set approximately 1¼″ forward of a perpendicular center line as shown.

(C) Adjust cables 11, removing all slack.

(D) Adjust Rods 12.

(E) Adjust Rod 7.

NOTE—When adjusting rods 7, 10 and 12 and cables 11, care should be taken not to pull levers from their stops.

4. Jack all four wheels.

5. Loosen nuts 2 until lock washers are free—to allow centralizer to center cam.

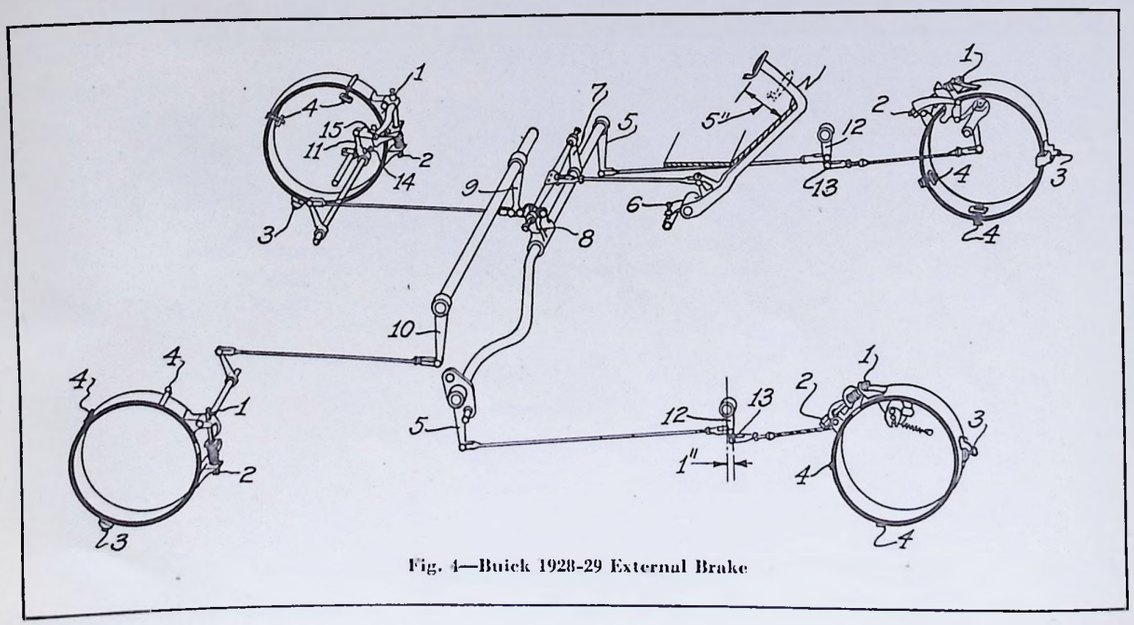


Fig. 4—Buick 1928-29 External Brake

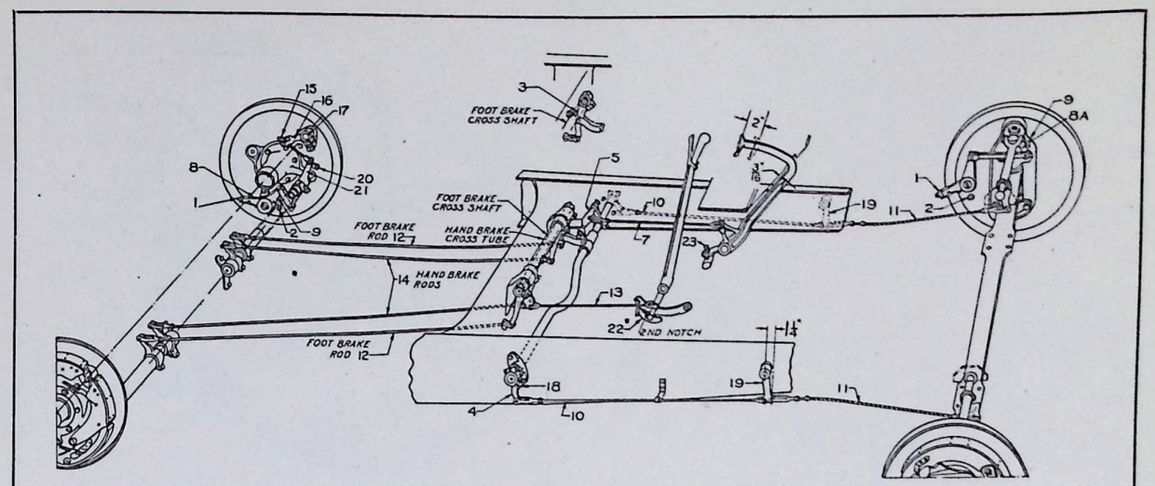


Fig. 5—Buick 1930 Internal Brake

6. Take up nuts 1 until wheels drag hard, or until it is just possible to rotate wheels a complete revolution by hand.

7. Tighten nuts 2— to lock centralizer in correct position.

8. Back off nuts 1 fourteen flats (this should give sufficient clearance to free the wheel, and is equivalent to approximately 2″ pedal travel). After backing off nuts 1, it will be necessary to apply brakes firmly to properly seat nuts 1 against the levers 8.

NOTE—Check spring lock to make sure it will hold nut 1 securely.

9. Before removing jacks, apply brakes lightly with pedal jack to determine whether right and left wheels have same drag. If not, slack off adjusting nut 1 on tight wheel to balance.

IMPORTANT NOTE—The brake linkage is arranged to give proper distribution of braking effort between front and rear wheels. This relation cannot be changed by varying adjustments of nuts 1.

Hand Brake Adjustments

1. Check levers 21, making sure they set against stops 20, and there is no slack in rods 13 and 14.

NOTE—Rod 13 is set in lower hole of cross shaft lever to give maximum ease of operation.

2. Set hand brake lever pawl 22 in second notch of ratchet with rear wheels off ground—which is equivalent to fourth notch when brakes are applied with car moving.

3. Adjust nuts 15 until both rear wheels have a heavy drag.

NOTE—If there is not enough thread to do this, move lever 16 one or two notches forward on serrated shaft.

4. Release hand brake—(wheels should be free from drag.)

BUICK 1931 INTERNAL BRAKES

Series 8-50

(*See Bendix Duo Servo Brake, page 37.*)

Series 8-60, 8-80, 8-90

(*As follows*)

The above models are equipped with a brake which is similar in design to that used on the 1930 Buick cars, the adjustments at the wheels being the same. On the 1931 cars, however, the hook-up is considerably simplified and the hand lever now operates the brakes on all four wheels, instead of the rear wheels only, as formerly.

Major Adjustment

Major or Linkage adjustments (necessary when pedal travels to within 2″ of toe board with brakes applied) are as follows:

1. Lubricate all moving connections and see that cross shaft 1, Fig. 6, page 48, returns freely to stop 2 when brakes are released.

2. Set pedal approximately 3/16″ from under side of toe board by adjusting screw 3.

3. Adjust pedal rod 4 to remove slack. (This rod should normally be in lower hole in pedal, but may be connected to upper hole if a harder pedal pressure is desired.

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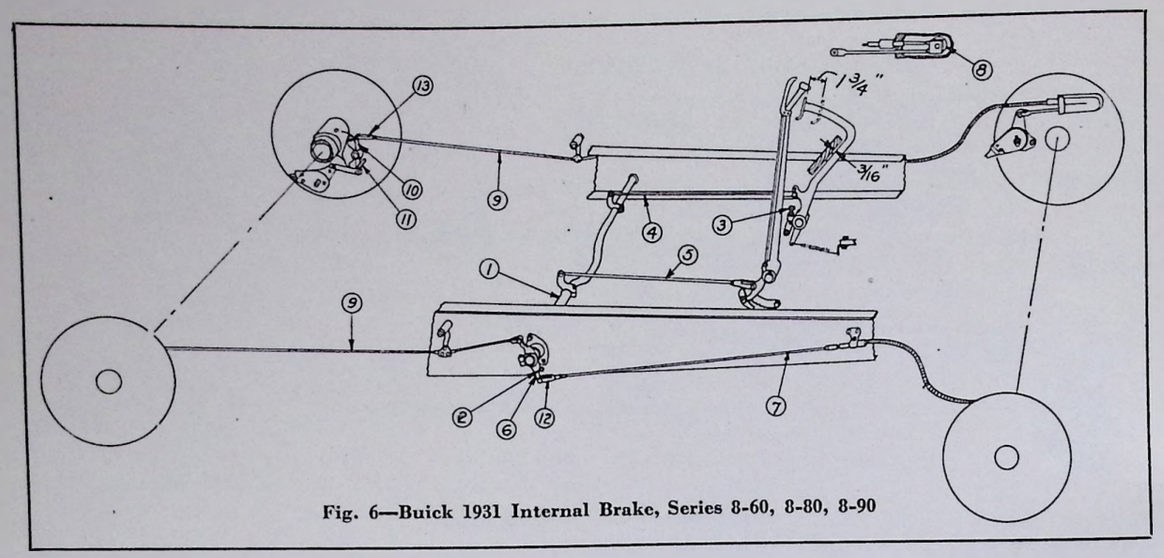


Fig. 6—Buick 1931 Internal Brake, Series 8-60, 8-80, 8-90

4. Remove slack from hand brake lever rod 5, with lever fully released. Cross shaft lever 6 should then rest against stop 2.

5. With wheels set straight ahead, disconnect rods 7 at levers 6 and then pull on rods 7 to see that front brakes release freely to stops 8. Disconnect rods 9 at levers 10 and pull on these levers to see that rear brakes release freely to stops 11.

6. Reassemble rods 7 and 9, removing all slack at adjustable yokes 12 and 13.

CADILLAC, TYPE V-63 AND 314

Minor or Service Adjustment

Rear Wheels

With car on jacks release lock nuts 1, Fig. 1, page 49, on rear brake, then back off screws 2.

Adjust anchor screw 3, until clearance of lining and drum is .035″.

Loosen lock nut 4, and adjust nut 5 and nearest screw 2 until clearance is .035″.

Adjust nut 6, and the upper band screws 2, until clearance is .035″.

Repeat for opposite rear wheel.

When in proper adjustment the upper ends of levers 7, should travel not less than 7/8″ when brake is applied. If this is not obtained repeat above adjustments. Do not disturb any other points than above.

Front Wheels

With car on jacks and wheels straight ahead, remove inspection plate 8, Fig. 2, and check clearance between lining and drum at points 9 and 10. Proper clearance is .025″, but should it be .010″ more or less than this the wheel must be removed.

Adjust the anchor 11, Fig. 2, by adding or removing the shims 12, so that when screw 13 is tight, the clearance between lining and drum will be .025″ at points 9 and 10. The wheel will have to be replaced to do this. Adjust remainder of band by loosening lock nuts 14 and adjusting screws 15. Also release lock nuts 16, and adjust 17 until clearance is .025″ all around the band.

Tighten all lock nuts.

Check equalization of front wheels either on a dynamic brake tester or by driving the car in a straight ahead direction.

Make corrections if necessary by adjusting 17, releasing 17 on tight wheel and taking up on loose one. It may be necessary to adjust screw 15 to obtain results.

Turn steering wheel first to right and then left and note if when in extreme position the outer wheel is released when brake pedal is depressed. The inner wheel should then have a slight braking effect. Correct by adjusting 17, Fig. 2, releasing one and tightening opposite a similar amount.

Major or Linkage Adjustment

It is generally not necessary to disturb the linkage, but in case it has been tampered with by an inexperienced person, proceed as follows:

Disconnect rods 18 and 19, Fig. 3, page 49.

Adjust stop screw 20, Figs. 1 and 3, on both rear brakes so that distance between surface of brake drum and pins is 1/2″ to 3/4″ as shown.

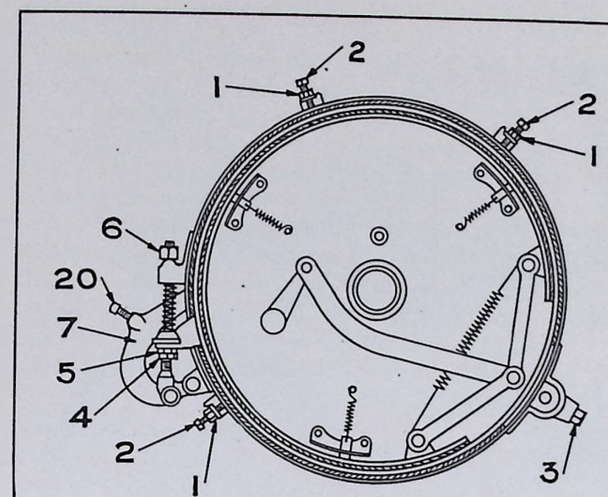


Fig. 1—Cadillac V-63 and 314, Rear Brake

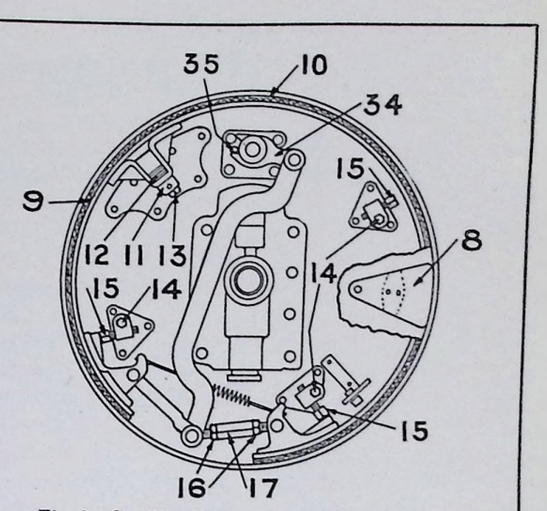


Fig. 2—Cadillac V-63 and 314, Front Brake

Adjust pull rods 21, Fig. 3, so that the equalizer 22 is parallel to frame cross member 23, and the center line of pin 24 is 1 and 11/16″ to 1 and 13/16″ back of the front face of cross member as shown.

Link 25 is provided with three holes, but the center one is standard. Lower hole provides more braking on front and less on rear; top hole, more on rear and less on front.

Adjust stop screw 26, Fig. 3, so that pedal 29 clears toe board as shown when released. Connect rod 19, so that the centers of pins 27 are 2 3/4″ to 2 7/8″ ahead of the front face of cross member 28, as shown.

Connect rod 18, Fig. 3, and adjust so that when pedal pad 29 is from 1″ to 1½″ from toe board the pin 30 just begins to pull on rod 18.

Tighten all lock nuts and replace cotters.

With front axle on jack adjust front cables 31, Fig. 3, by loosening lock nuts 32, and turning 33 until slack in cables is removed and levers 34, Fig. 2, are both against stop 35.

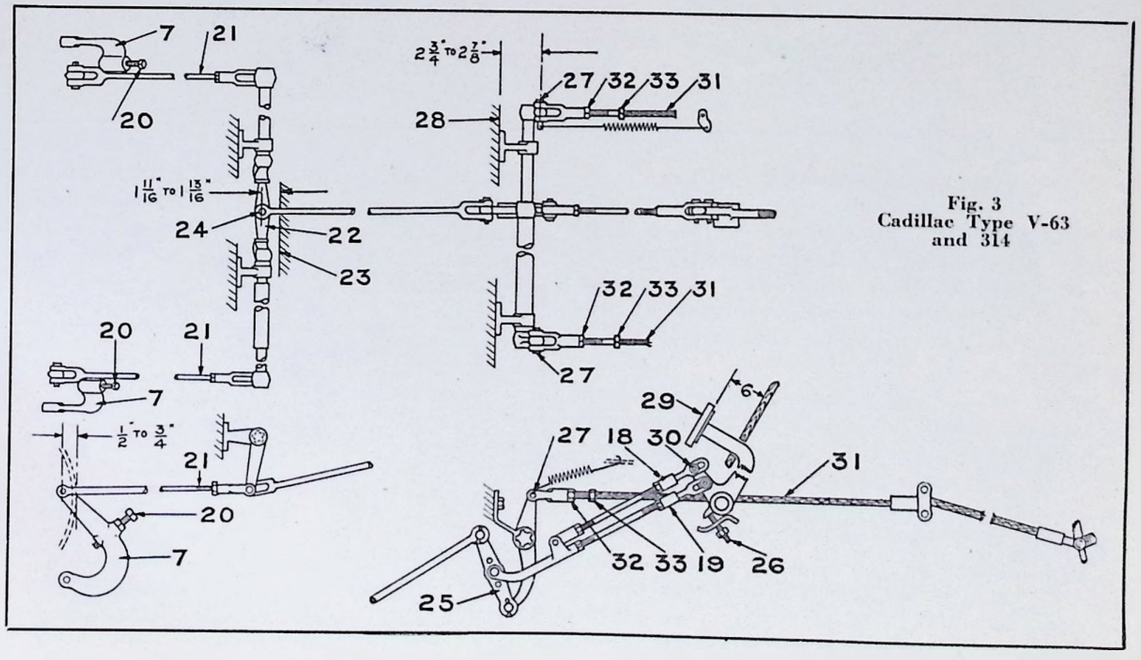


Fig. 3
Cadillac Type V-63
and 314

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CADILLAC MODEL 341-A

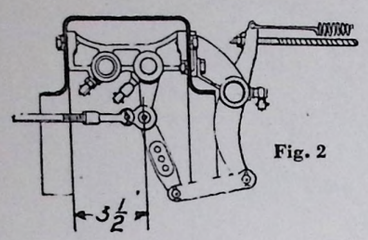


Fig. 2

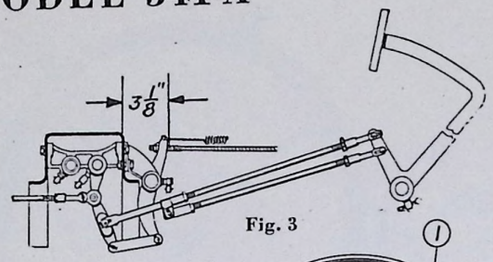


Fig. 3

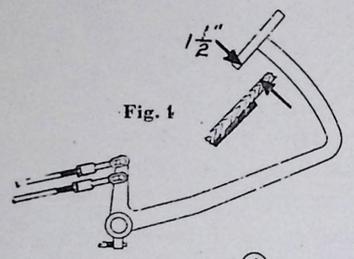


Fig. 4

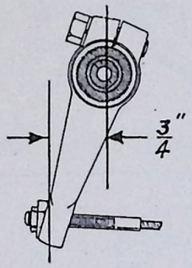


Fig. 5

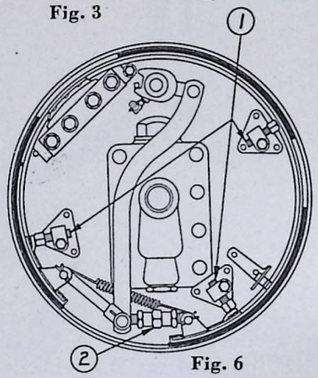


Fig. 6

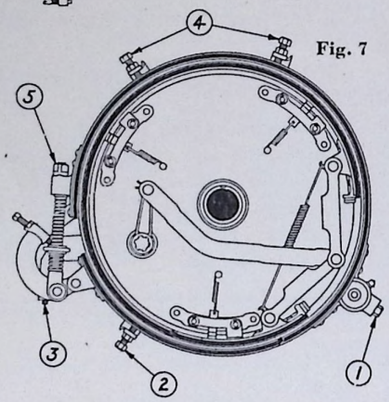


Fig. 7

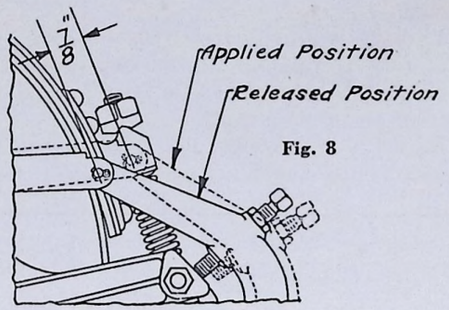


Fig. 8

CADILLAC, MODEL 341-A

Minor adjustment for wear is cared for by tightening nuts on forward pull cables and the rear by average external brake adjustment. In relining, however, or where results are not satisfactory, it is necessary to make complete adjustments as follows:

With car on jacks release cable nuts at front brakes and remove brake pedal rod and yoke. Adjust brake pedal to clear underside of toe board ⅜" by stop screw at the bottom of pedal near hub. Adjust rear axle rocker shaft lever so as to obtain band operating lever position as shown in Fig. 1.

Adjust rear rods so as to position rear cross shaft levers as shown in Fig. 2, and connect rear end of pedal rod.

Adjust lower pedal rod to obtain position of levers on forward cross shaft as indicated in Fig. 3, and adjust upper rod so that when pedal is depressed 1½" the pin engages the front brake pedal as shown in Fig. 4.

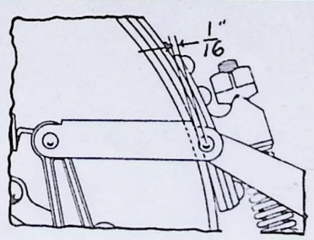


Fig. 1—Rear Axle Rocker Shaft Adjustment

Front Brake

Set the front brake operating levers so that when all slack is out of cables the lever will be in position shown in Fig. 5, page 50.

Adjust band anchor so as to obtain .015" clearance. This is accomplished either by shims or by loosening the four anchor bolts holding the band anchor bracket, depending on the construction. Bolt construction is shown in Fig. 6, and consists of four bolts passing through enlarged holes which permit a slight adjustment to the band anchor.

Adjust the remainder of the band to .015" by means of the screws 1, Fig. 6. To obtain this clearance, it may be necessary to adjust turnbuckle 2.

Rear Brake

Adjust rear anchor 1, Fig. 7, for .030" clearance between band and drum, and screws 2 and 3 until .030" clearance is obtained on lower band. Then adjust screws 4 and nut 5 until the clearance is the same all around the band.

The travel of the brake band operating lever from released to applied should measure ⅞", as indicated in Fig. 8.

Hand Brake

The hand brake is an internal band type and is adjusted by shortening the forward pull rod.

CADILLAC, MODEL 341-B

Minor adjustments for wear are taken care of by adjusting the cam shaft lever which, by tightening the nut, will change the relation of the cam shaft and lever. However, if unsatisfactory results are obtained, the complete adjustment is advisable.

Set cross shaft levers against stops, then adjust pedal rod to obtain ⅜" clearance between toeboard and pedal as indicated in Fig. 1 below.

Adjust rear pull rods so that cam lever release springs measure 4½". (See Fig. 2 below.)

Adjust front pull cables so that cam lever release springs measure 4". (See Fig. 3 below.)

Release cam centralizing nut 1, Fig. 4, on all four wheels and apply brakes hard and when applied tighten all nuts 1. This will relocate the cam in a central position between the shoes.

If all brakes hold equal, tighten nuts 2 on all wheels an equal number of turns until the foot pedal travel is about 2¼". If all brakes are not equal, tighten nuts 2 on each wheel until wheels drag, then release until free. Then recheck for equalization, loosening nut 2 on tight wheel.

The construction of the cam shaft lever is shown in Fig. 5 below.

La Salle, Model 328, is very similar in design and the adjustment is the same except that the

CADILLAC MODEL 341-B

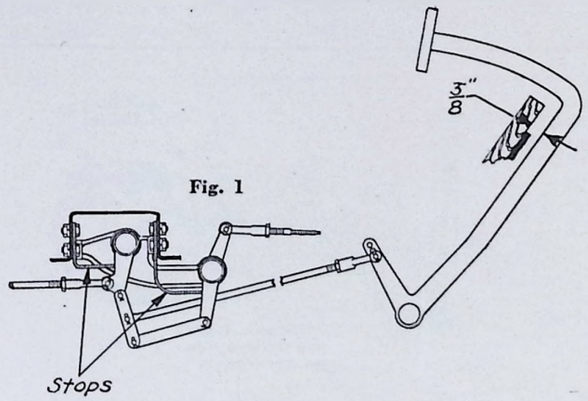


Fig. 1

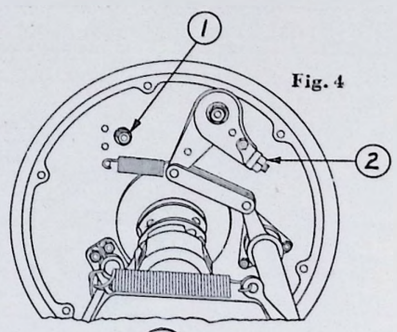


Fig. 4

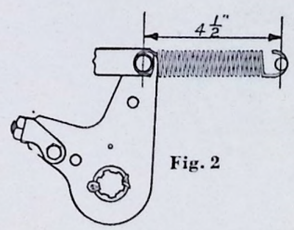


Fig. 2

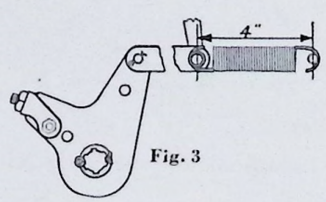


Fig. 3

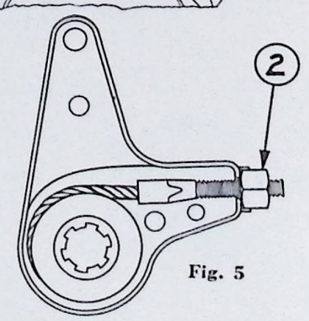


Fig. 5

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cam lever release springs are set to 5½" at the rear and to 4 and 3/16" at the front.

Hand Brake—Cadillac and La Salle

Disconnect pull rod from hand brake lever and adjust rod to give ¾" free movement. Adjust rear rods so that equalizer is parallel with cross member and its center line back of pin in foot brake lever as shown in Fig. 6.

The foot brake lever must be against the stop when setting this dimension. Turn centralizing cam 1, Fig. 7, counter clockwise against the stop and then return to one-half position or midway between the two positions and set lock nut.

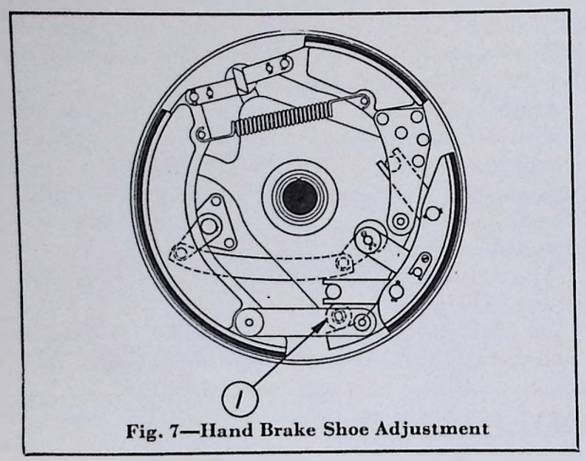


Fig. 7—Hand Brake Shoe Adjustment

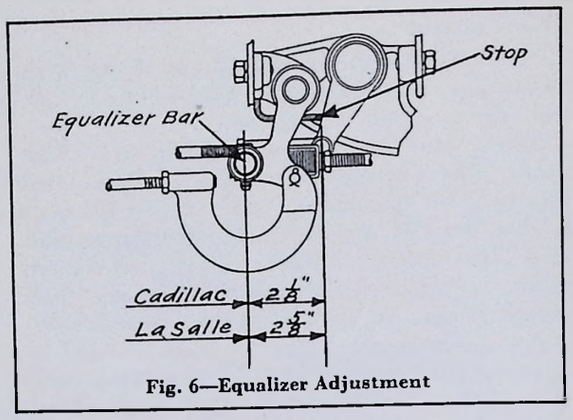


Fig. 6—Equalizer Adjustment

CADILLAC AND LA SALLE 1929 MODELS

The 1929 models have the hand brake connected into the service brake system operating the rear brakes. The adjustments, the same as in the previous models except for the setting of the spring lengths, are shown in Fig. 8.

There is an assister or booster used in the Cadillac V-16 1930, which is connected into the system as shown in Fig. 9, page 53. The brake will function independently of the assister. In principle, the assister is similar to the B-K Booster. (See Booster Brakes, page 41.)

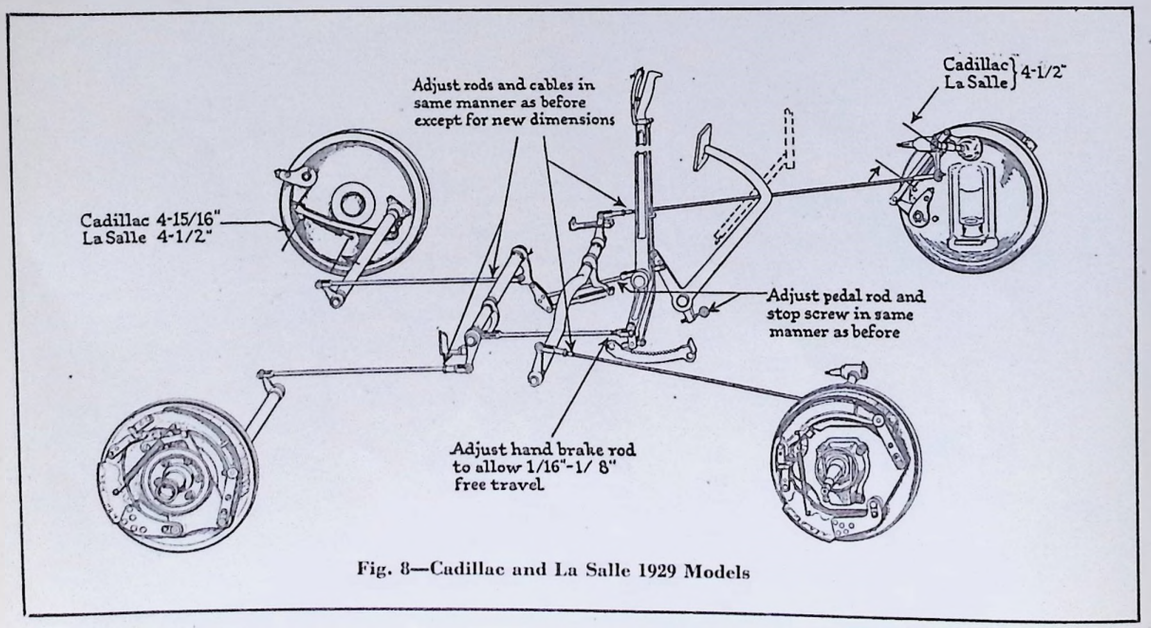


Fig. 8—Cadillac and La Salle 1929 Models

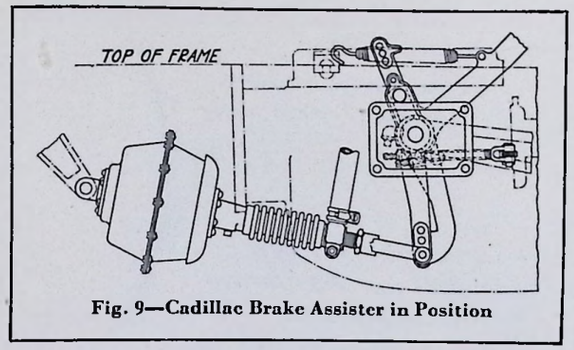


Fig. 9—Cadillac Brake Assister in Position

CHEVROLET AND PONTIAC 1928

Minor Adjustment

With the car on jacks note if front wheel bearings are tight; if not, tighten them. See that all joints are properly lubricated and brake linkage is free.

Release lock nut 1 and adjust, turning left to tighten and right to loosen, until brakes just drag. Then release one-half turn and lock.

Rear brakes are adjusted to 1/32" clearance all around. (See External Brake, page 58) Adjust first 2, then 3 and finally 4, Fig. 1.

The guide pin at 2 is unlocked by pulling the lock plate, which is between the anchor spring and the band, outward. In order to pull the lock plate outward it is first necessary to move it forward against the spring to release the bent-over or hooked edge which normally keeps it in proper place.

Major Adjustment

While it is not generally necessary to disturb the brake linkage, a check is advisable if difficulty is experienced in adjusting the brakes.

When brake pedal is in released position and the individual brake levers are against their stops, the equalizer should be in position shown.

If not, adjust the rods 5, 6 and 7. An adjusting gauge 8 is used by Chevrolet Service Stations to properly position the equalizer, after which rod 7 is adjusted and then rods 5 and 6.

This gauge, which is known as tool 7344, can be purchased from The Kent-Moore Organization, Detroit, Michigan.

If no gauge is at hand, the outer levers on the cross shaft may be set so that the center distance between the eyes is 3⅝". This will set the equalizer in proper position also.

Chevrolet External Bands

The fittings on the Chevrolet brake bands are riveted in such a manner that the heads of the rivets are not flush on the lining side of the band. Unless the brake lining is relieved over the rivet heads the lining cannot be properly attached.

Holes are punched in the lining to clear the rivet heads on the factory-equipped cars. When relining, by using a drill and counterbore, the lining can be counterbored just enough to relieve the rivet heads. This will permit the lining to lay snugly against the band and the rivet will not interfere.

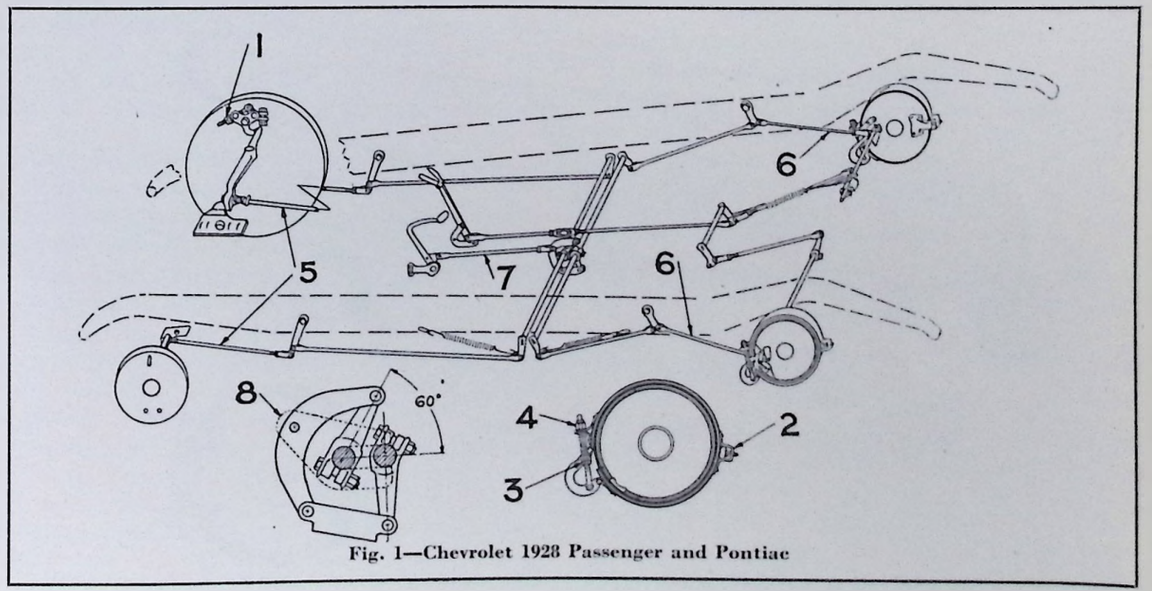


Fig. 1—Chevrolet 1928 Passenger and Pontiac

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Eliminating Squeaks

Unless carefully adjusted, the rear brakes sometimes develop a chatter or squeak. The following method of correcting this trouble has proved effective:

Substitute a Nash anchor screw as used on 1928 Nash external rear brakes and a Buick anchor spring as used on 1928 Buick external rear brakes in place of the corresponding Chevrolet parts. If necessary, grind off the head of the Nash anchor screw slightly to make it fit. (See Fig. 2.)

If this does not eliminate the squeak, it is advisable to check all clevis pins in the hookup, replacing any that are found worn with new ones.

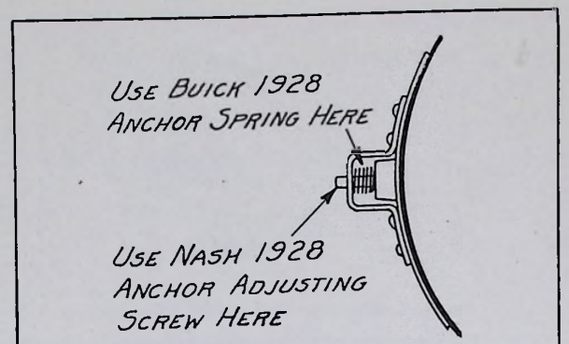


Fig. 2—Chevrolet 1928

CHEVROLET 1929, SERIES AC

Minor Adjustment

With car on jacks, note if wheel bearings are tight and linkage properly lubricated and free.

Release lock nut 1, Fig. 3, and tighten adjusting nut until brake drags. Then release one-half turn.

Repeat for opposite wheel.

Rear brakes are adjusted at 2, 3 and 4. After loosening check nuts, tighten or loosen adjusting nuts 2 for 1/32″ clearance between lining and drum. Then, if clearance is not uniform all around the drum, disconnect clevis pin 4 and turn brake band connecting rod 3 to right or left until same clearance is obtained at the front ends of bands as at anchor ends. The wheels must be removed to do this properly.

Major Adjustment

Disconnect rods, 5, 6 and 7 and place equalizer in position shown at A. (A special gauge for holding the equalizer in proper position may be obtained from the Kent-Moore Organization, Detroit, Michigan.)

With equalizer in proper position, adjust rod 7 to obtain correct setting of foot pedal. Then adjust rods 5 and 6 so they can just be connected when levers are against their stops.

Proceed as for Minor Adjustment.

Hand Brake

The hand brake is adjusted by means of turnbuckle 8.

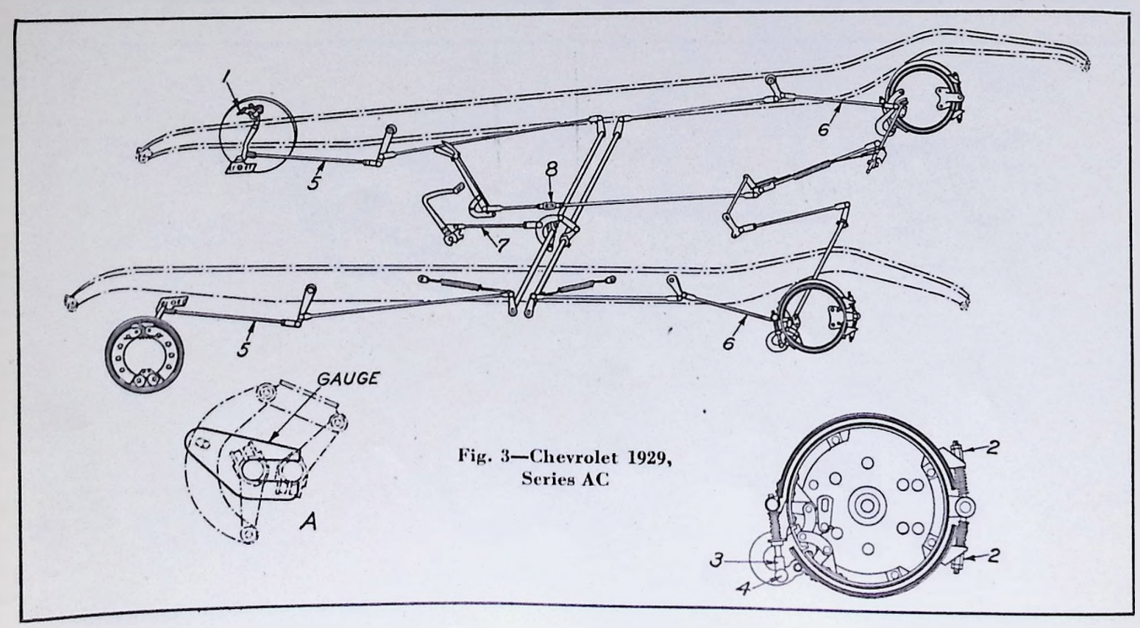


Fig. 3—Chevrolet 1929, Series AC

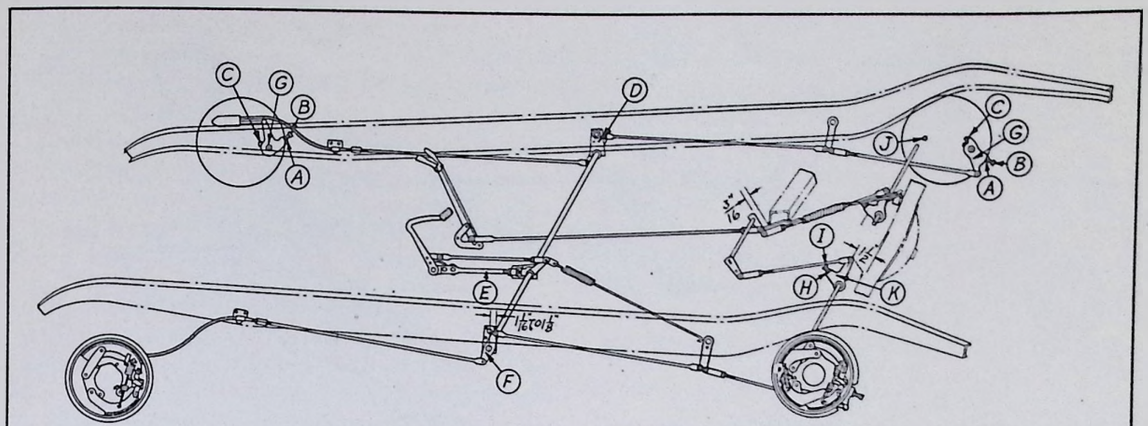


Fig. 4—Chevrolet 1930, Series AD

CHEVROLET 1930, SERIES AD

Minor Adjustment—Service Brake

Jack all wheels and loosen lock nuts A, Fig. 4, and tighten screw B until brake drags slightly, then tighten lock nuts.

If brakes are not equalized, release the tight side until all are equal.

Centralizing Service Brake Shoes

If minor adjustment does not give satisfactory brake, it is necessary to centralize the shoes. Be sure to remove all looseness in front wheel bearings, then loosen bolts C. The cam levers should now be free to move up and down when struck lightly with a hammer.

Apply the brakes with pedal jack, then tighten bolts C. Then proceed as for minor adjustment.

Major Adjustment

It is not generally necessary to disturb the linkage adjustment, but in case it has been tampered with and requires correction, proceed as follows:

Release pedal return spring, brake pedal rod and front and rear adjustable pull rods.

Release cross shaft bracket bolts and locate bracket D vertically with the frame by adjusting brace E so that the cross shaft will be free and in alignment. Then tighten bracket nuts.

Set the outer levers F at cross shaft so that the eye in the lever is from 1 and 1/16″ to 1⅛″ from the center of the shaft, as indicated. With brake pedal against the stop, adjust pull rod to proper length and connect; also connect return spring. Adjust front pull rods and connect. With levers G against the stops, adjust front cables so there is no slack and the levers do not move from the stops. The rod screws into the cable end.

Minor Adjustment—Hand Brake

Jack rear wheels, loosen lock nut H and tighten screw I until brake drags slightly, then set lock nuts. Check for equalization, slacking the tight side.

Centralizing Hand Brake Shoes

Loosen clamp bolts J until cross shaft is free, then apply brake and while applied tighten bolts J.

Major Adjustment

Disconnect return spring and all rods at one end. Place hand lever in released position and adjust front rod so as to obtain 3/16″ clearance between cross member and cross shaft lever, as shown. Adjust rear rods so that eye of levers K is 1½″ from axle housing, as indicated.

CHEVROLET TRUCKS—4-WHEEL BRAKES

Minor Adjustment

Front Wheels

With truck on jack, adjust front wheel bearings. Bearings should be free but without perceptible shake.

Lubricate all operating levers.

Turn adjusting nut to left to tighten brake and right to loosen. (See Fig. 5, page 56.)

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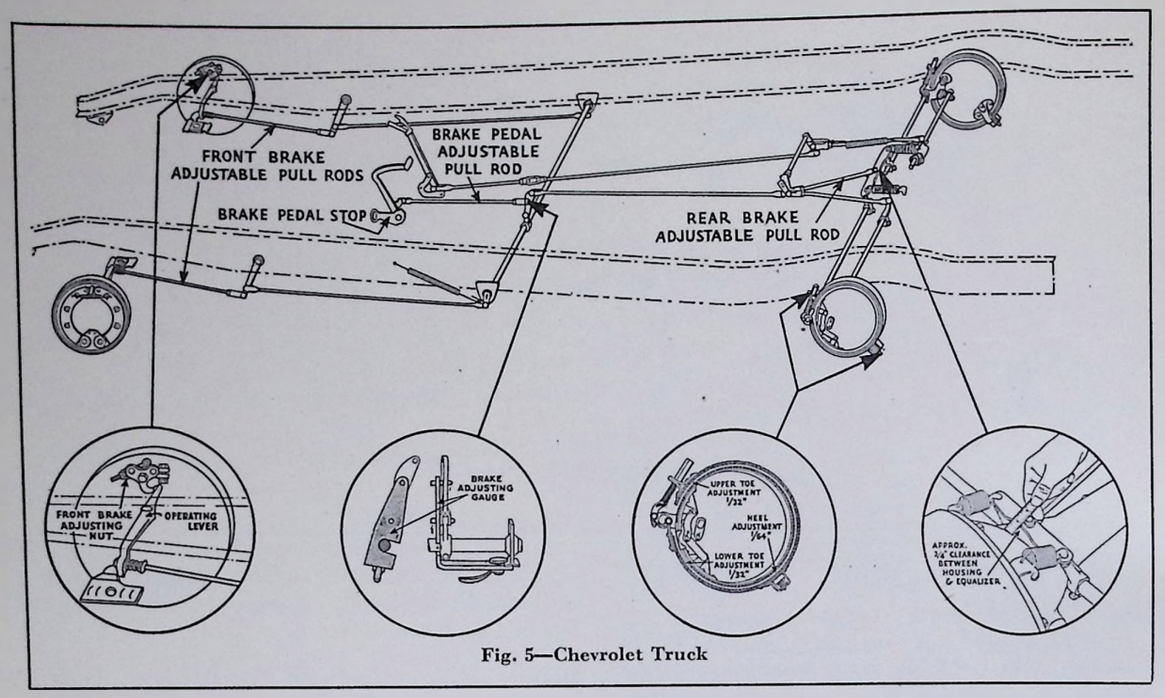


Fig. 5—Chevrolet Truck

Front brakes should be adjusted so as to touch drum and then turn adjusting nut to the right one-half turn and lock with lock nut.

CAUTION: When tightening lock nut be sure the adjustment is not disturbed.

Rear Wheels

With truck on jack, rotate wheel and adjust anchor to 1/64" clearance.

Adjust lower toe to 1/32" clearance and the upper toe to 1/32" clearance as shown in diagram.

NOTE—Lower toe adjustment is obtained by raising or lowering brake operating shaft bracket. This bracket is not rigid and can be moved by tapping with hammer. Upper toe adjustment is obtained by tightening or loosening adjustment nut as in other band brakes.

When the above instructions are followed, the brakes should be readily adjusted and equalized. Should trouble be experienced it is advisable to check linkage as it may have been disturbed.

This is best accomplished by use of a gauge, supplied by Kent-Moore Organization, General Motors Building, Detroit, Michigan, and used by Chevrolet dealers.

Major Adjustment

Disconnect brake pedal pull rod, front adjustable pull rods, rear adjustable pull rod and insert brake adjusting gauge as illustrated in Fig. 5.

Set brake pedal stop so that from the released position the pedal will have 6" effective travel.

Adjust front adjustable brake pull rods so that operating levers are against their stops when rods are connected.

Adjust rear rods so that there is approximately ¾" clearance between axle housing and rear brake equalizer. Connect rod and adjust brakes.

NOTE—It is advisable to check chassis linkage before attempting brake adjustments in all cases, as frequently the rods are found incorrectly adjusted and it avoids repeating the minor adjustment when they are so found.

CHEVROLET, SERIES LR

Minor Adjustment—Service Brake

Front Wheels

Jack all wheels, loosen lock nut A, Fig. 6, page 57, on the front wheels and tighten screw B until brake drags slightly, then tighten lock nuts.

Rear Wheels

Remove wheel discs and adjust anchor clearance to 1/64".

Adjust lower toe to 1/32" clearance and the upper toe to 1/32" clearance, as shown.

Note that lower toe adjustment is obtained by raising or lowering brake operating shaft bracket. This bracket is not rigid and can be moved by tapping with a hammer.

Upper toe adjustment is obtained by tightening or loosening adjustment nut as in other band brakes.

Check brakes for equalization, slacking off on tight side until equal.

Centralizing Front Brake Shoes

If minor adjustment does not give satisfactory brake, it is necessary to centralize the shoes. Be sure to remove all looseness in the front wheel bearings, then loosen bolts C. The cam levers should now be free to move up and down when struck lightly with a hammer. Apply the brakes with a pedal jack, then tighten bolts C. Then proceed as for minor adjustment on front wheels.

Major Adjustment

It is not generally necessary to disturb the linkage adjustment, but in case it has been tampered with and requires correction, proceed as follows:

Release front rod return spring, pedal rod and front and rear adjustable pull rods. Set outer lever D on cross shaft against stop and adjust front pull rods to proper length and connect. There should be no slack in the front cables but the front brake operating levers should be against the stops. The rod screws into the cable ends.

The front return spring is then hooked in place. Insert brake adjusting gauge, and before connecting, adjust rear pull rod until there is about ¾" clearance between axle housing and equalizer bar.

Gauges for setting Chevrolet brake linkage are supplied by the Kent-Moore Organization, General Motors Building, Detroit, Michigan.

Adjust brake pedal pull rod to proper length, remove gauge and connect rod.

Minor Adjustment—Hand Brake

Adjustment for wear is taken up, first, by loosening lock nuts and turning turnbuckle E until brake drags lightly. Then tighten lock nuts.

Major Adjustment—Hand Brake

When the hand brake lever has reached full travel and the car will no longer stop, the linkage is adjusted as follows:

Disconnect return spring and rear rods. Adjust front rod until brake levers on cross shaft point downward and toward the rear.

Adjust rear rods to proper length, connect and replace return spring.

CORD, MODEL L-29

The Cord front drive car is equipped with Lockheed internal brakes which are adjusted through inspection holes in the drums. (See Lockheed Brake, page 64.)

Correct clearance between lining and drum is .012" at the toe, or upper part of the shoe, and .006" at the heel, or portion near the anchor pin.

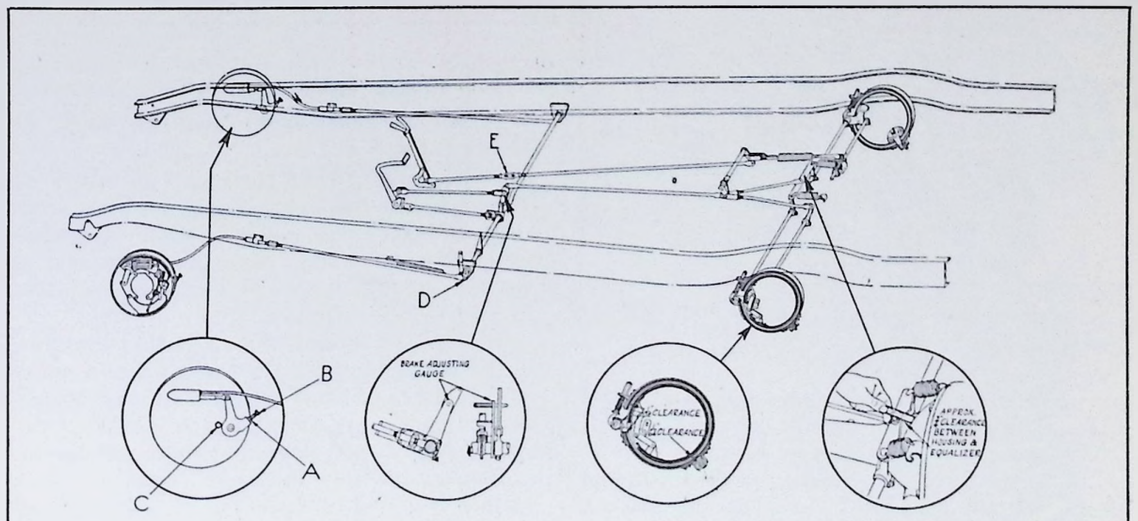


Fig. 6—Chevrolet Series LR

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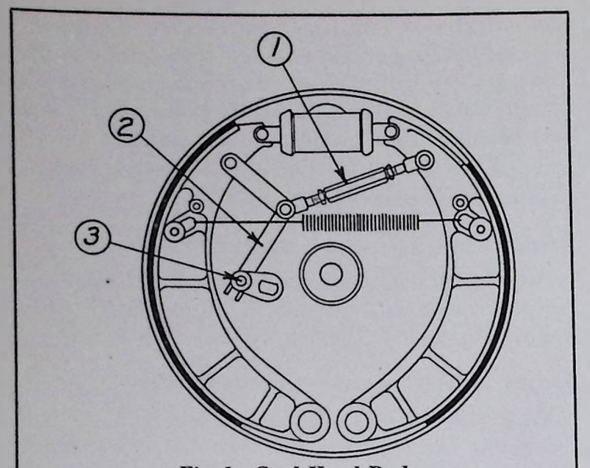


Fig. 1—Cord Hand Brake

Cord Hand Brake

The hand brake, which is mechanically operated, is connected to the service brake shoes on the rear wheels. After the adjustment of the service brakes has been completed, it is necessary to adjust the hand brake. This is done by lengthening the adjusting link 1, Fig. 1, so that yoke 2 just touches pin 3 when hand lever is in released position.

Removal of Front Brake Shoes

In relining, the rear brake shoes are removed in the same manner as the front shoes on other cars. Before removing the front brake shoes, it is necessary to disconnect the driving shafts at the wheels. The procedure is as follows:

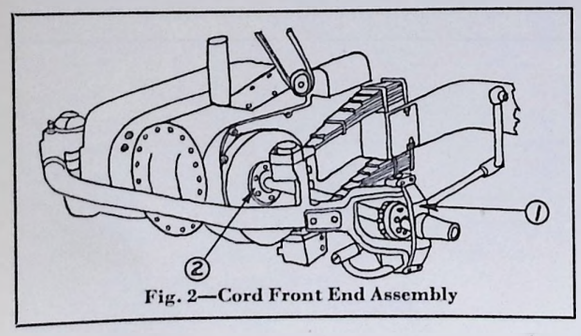


Fig. 2—Cord Front End Assembly

1. Remove front wheels.
2. Take off four cap screws holding front wheel spindle 1, Fig. 2, to the spindle pins.
3. Remove shock absorber bracket.
4. Remove cap screws holding brake drum and grease retaining flange (See 2, Fig. 2) and take out hub and drive shaft. The drum and shoes can then be removed in the usual way.

DODGE STANDARD SIX

This car is equipped with Steeldraulic Brakes which are adjusted in the usual way. (See Steeldraulic Brakes, page 77.)

With the brake pedal in return position and the hand brake lever in "off" position, the pin in the end lever on the cross shaft should be 9/32" ahead of the vertical center line of the cross shaft.

EXTERNAL CONTRACTING BAND BRAKE

External brakes are exposed to dirt and dust and require more frequent cleaning than internal brakes. They are also more likely to be affected by water than are brakes of the internal type.

The clearance between the band and drum on external brakes must be carefully made as the brake drum may expand from frictional heat, causing the brake to drag, unless the adjustment is correct.

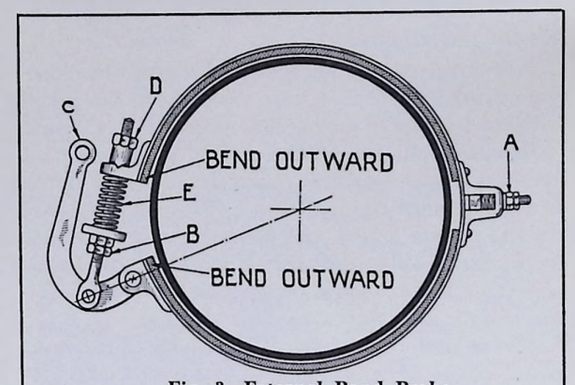


Fig. 3—External Band Brake

A typical mechanically operated external brake is shown in Fig. 3.

It is essential to have the bands concentric or evenly curved to the proper radius, as any kinks or twists will make it impossible to obtain a satisfactory adjustment and may cause brake to squeak or drag. (See Squeaks, page 100; Dragging, page 98.)

Adjustment is as follows:

Adjust anchor screw A, Fig. 3, so that the clearance between lining and the brake drum is about 1/64". The band must be freely but not loosely mounted on the anchor stud at A so that it can move slightly if necessary to compensate for the band movement when the brake is applied.

Adjust B so that the lower band has 1/64" clearance and lever C is close to the band when in "off" position.

Screw down on D so that upper band has 1/64" clearance. The band now should have equal clearance all around the drum except for a short space near the ends of the bands, which are bent slightly away from the drum as shown in figure.

Lever C should be in the same relative position on each brake when the adjustment is completed. (See Levers, page 8.)

The bands should grip the drum evenly all round and at the same instant, or progressively from the anchorage on the upper band, but this will not be possible if the bands are in the least distorted or are not concentric with the brake drum. Slipping or squeaking may then result.

Brakes which are apparently in perfect adjustment may not hold in stopping the forward motion of the car. Try the brake in the reverse and if it is excellent the trouble is that the pressure is too high on the lower band. Bring the upper one down by adjusting nuts B and D and try again. Spring E might be compressed fully and this would also prevent the brake holding in forward direction.

EARLY FORD MODEL A

Early Ford Model A cars are equipped with four internal brakes, which can be operated by either the foot pedal or the hand lever.

Service Adjustment

With car on jacks release hand lever to full release position. Tighten nut 1, Fig. 4, for front and 2 for rear, until brake drags, then back off until wheel is just free, being sure to back off the same amount for each wheel.

If linkage has not been disturbed, the rear brakes should just begin to hold when pedal is down one inch. With one and one-half inch pedal depression, the front brakes should begin to hold and rear almost lock. Two inch depression should lock rear and hold hard on front but not lock.

If suitable adjustment cannot be obtained by wheel adjustment at 1 and 2, Fig. 4, check the linkage.

Major Adjustment

All lever joints should be properly lubricated and wheel bearings tight.

Disconnect rods, 3, 4, 5 and 6 at equalizer shaft.

Levers 7 and 8 should be against stops 9 and the shafts at each side should be in the center of brackets 10. Unless the shafts 11 are bent, the levers 12 should be vertical.

With levers 12 vertical and levers 7 and 8 against stops 9, adjust rods 3, 4, 5 and 6, just taking up free travel of the brake levers 13 and 14.

Adjust brakes as for minor adjustment.

LATER FORD MODEL A

Ford cars produced after the summer of 1928 are equipped with six internal brakes, one on each front wheel and two on each rear. The service brake operates on all four wheels, while the hand

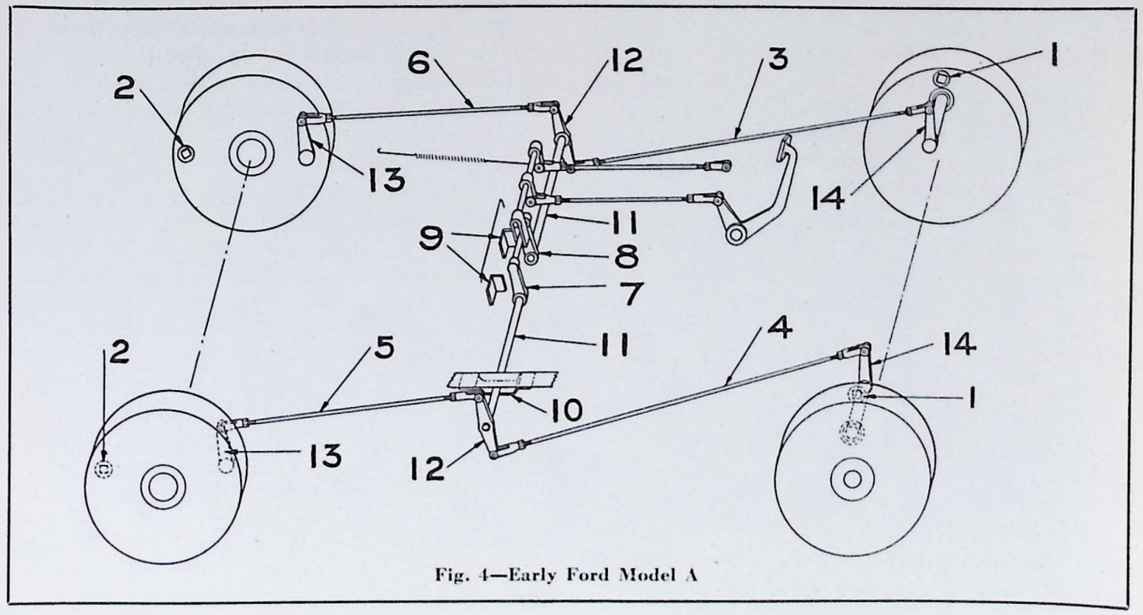


Fig. 4—Early Ford Model A

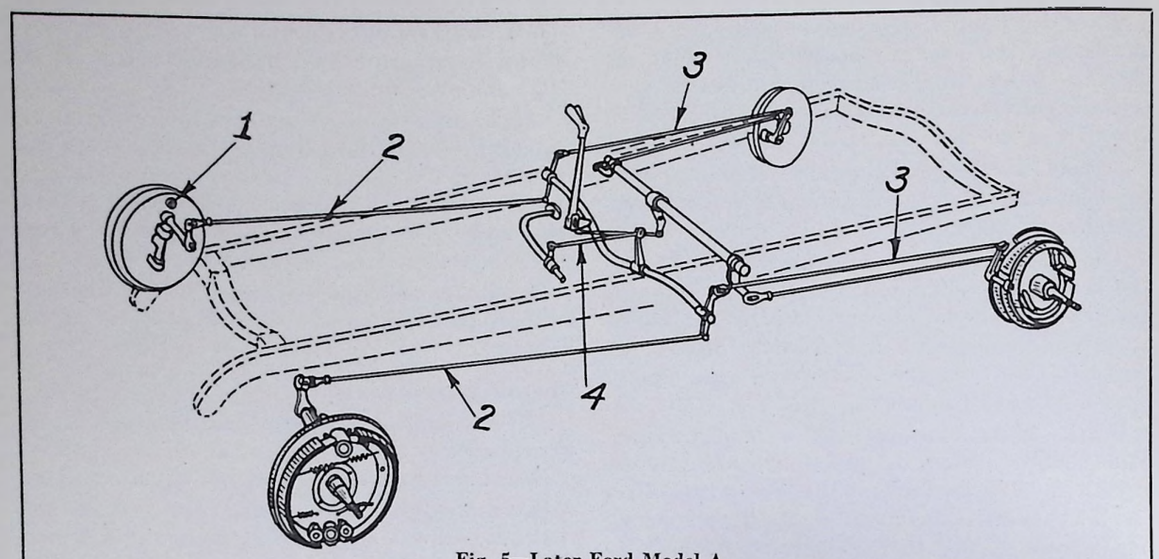


Fig. 5—Later Ford Model A

brake operates independently of the service brake on the rear wheels only.

About the time of adding the separate hand brake, a new type of cross shaft was introduced (See Fig. 6), which, however, is interchangeable with the two-piece shaft used on the earlier cars. The pull rods were also changed, the earlier adjustable rods being replaced by rods which are non-adjustable.

The linkage layout is now as shown in Fig. 5.

The construction and adjustment of the service brakes remains the same as on the earlier models.

Major Adjustment

Make sure that all levers and joints are properly lubricated.

With car on jacks, disconnect front and rear pull rods 2 and 3, Fig. 5 at the wheel ends.

Disconnect pedal rod 4.

If the car is equipped with a *multiple disc clutch*, adjust the length of rod 4 so that when the end of rod touches the cross member of frame, the brake pedal will clear underside of floor board by ½ to ¾ inches. Then connect rod 4.

If the car has a *plate clutch*, pull the brake pedal against its stop and adjust rod 4 until there is 1/16" clearance between rear end of rod and rear flange of the cross member.

Adjust brakes at wheels as for Service Adjustment under Early Ford Model A, page 59.

Adjust pull rods 2 and 3 so that when all free movement is removed the rods can be hooked up without disturbing the position of the levers.

Hand Brake

The hand brake has only one point of adjustment.

If the hand lever F, Fig. 7, travels rearward to the extreme position, which will be due to wear on the linings, the rod A connecting the hand brake lever to the cross shaft center lever should be removed, by first disconnecting rods E.

Replace the rod A by passing it through the hole B in the frame center cross member and connect it to the upper hole C in the cross shaft center lever.

The pull rods E should never be shortened to take up wear, but after changing rod A to a new position it may be necessary to adjust rod E to a new length, leaving rear lever at brakes and cross shaft lever in proper position. Hand lever should be in released position.

If the hand lever still travels to the extreme rear it is necessary to reline the brake. Replace the rod to its former position after relining.

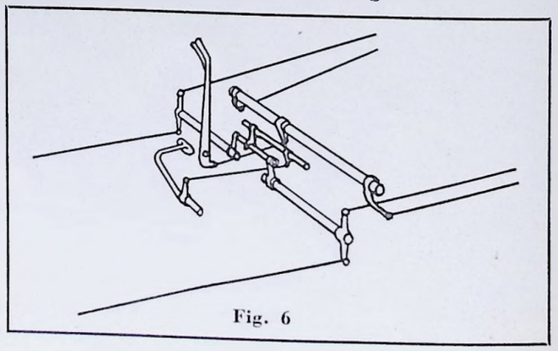


Fig. 6

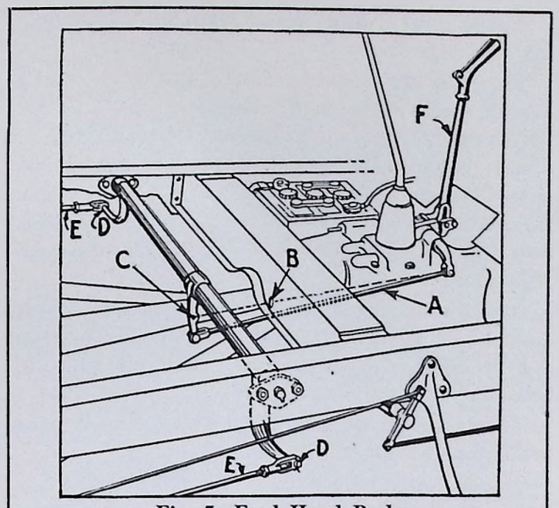


Fig. 7—Ford Hand Brake

INTERNAL BRAKES

Internal brakes are those in which the mechanism is enclosed within the drum.

There are several different designs of internal brakes used today and the adjustment varies with each design. (See Bendix Brakes, page 33; Lockheed Brakes, page 64; Steeldraulic Brakes, page 77.)

Internal brakes as used on trucks and buses are generally simple in design and their adjustment is easily accomplished. (See Timken Duplex Brake, page 84.)

Wear on internal brakes is taken up either by relocating the operating lever on the cam shaft or by installing new cams or shims on the cam faces of the shoes. In some cases the rods are shortened.

Moulded Lining

Moulded lining with internal construction is the latest development of successful brake operation. One of the reasons for the popularity and success of this type brake is the use of moulded lining, which is hard, dense and lacks compression when in service.

Flexible linings, such as woven or folded, will settle quickly at the high spots and will conform to suitable thickness at various points on the shoe of an internal brake after a few applications.

In so doing, however, the density or compactness of the lining is varied and the shoe then is surfaced with a friction material which will have varying density. With squeaky types of brakes it will be difficult to secure proper adjustment.

Fitting Relined Shoes

When moulded linings are properly fitted to the drums, which is indicated by the entire surface of the friction material showing contact with the drums, a smooth operating, quiet and efficient brake is to be expected. It is necessary, however, that the curvature of the drum and the curvature of the shoe be the same, since this lining is incompressible and will not adapt itself to any variation in curvature between the drum and the shoe. (See Importance of Adjustment, page 12.)

Fitting the shoes to the drum is often done by adjusting the shoe anchors or by the use of a brake lining grinder. (See Brake Lining Grinders, page 108.)

Enclosing the shoes makes it difficult to set them to proper clearance and the use of a drum truing gauge will assist greatly. (See page 109.) The latest cars are in many cases being equipped with an inspection hole in the side of the brake drum where a feeler gauge can be inserted to check the shoe clearance.

Use of Brake and Drum Gauge

(See Fig. 8.)

By the use of this gauge the shoes are fitted to the individual brake drum. The gauge indicates the points on the lining of the assembled shoes which require removing, which is accomplished by means of a file or rasp. Fitting the lining to a dummy drum does not necessarily insure a perfect fit as the drums may vary in diameter from one another on the same car, and if all are fitted to

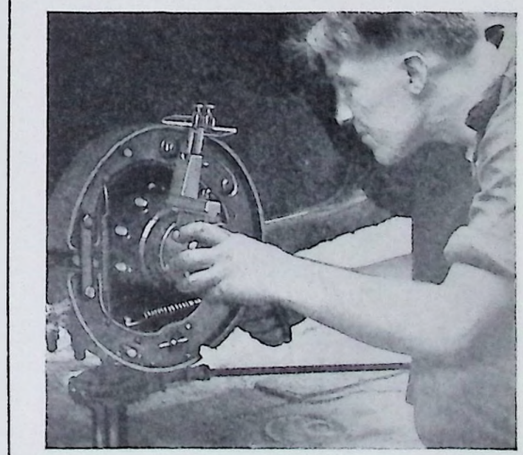


Fig. 8—Adjusting Gauge to Drum Diameter

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the same drum there may be one or two which do not have a perfect fit.

Some cars require very careful adjustment of the brakes for satisfactory operation, much more so than others, and the use of the gauge on these cars is recommended.

The use of the gauge or a precision type grinder eliminates guesswork.

LA SALLE 1927

Minor or Service Adjustment

(See Fig. 1.)

With car on jacks and all linkage properly lubricated adjust 1 so that band has .035″ clearance between drum and lining. Then adjust screws 2 for same clearance and finally 3 and 4. The band should now have uniform clearance all around and lever 5 should travel ¾″ to 15/16″ as shown.

Remove inspection plate on forward drums, and check clearance, which should be .010″. Correct clearance by adjusting nut 6. If results are not satisfactory a complete check is necessary.

Major Adjustment

With car on jacks disconnect rod 7 at 8.

Adjust nut 9 so that distance between lever 5 and bracket is 3″ as shown.

Adjust rod 10 so that center of lever 11 is 2½″ to 2¾″ in front of face of bracket as shown.

Adjust nut 12 so that pedal is ⅜″ from toe board as shown.

Link 13 should be 3½″ long (if 3″ long, it is advisable to replace it with a later type which can be secured from service station and is known as part 82017). Adjust rod 7 so that lever 14 just clears screw bracket.

Adjust rear brakes as outlined under Minor or Service Adjustment.

Back off stop screw 15 and nut 6 on cables. Loosen anchor screws 16. Insert a 1/64″ shim between lining and drum at ends of lining nearest anchor. Apply brake to force band into proper position. Tighten screws 16 and remove shims. Check clearance at ends of band and drum and if necessary slightly move anchor until band is concentric with drum.

Adjust stop screws 15 to .010″ clearance. With cam 18 in vertical position check the clearance near ends of band. If 3/64″ or more it is advisable to install oversize cam.

These can be secured from the service station and are as follows:

Standard ⅝″ thick, part 874,299

Oversize ¾″ thick, part 876,386

Oversize ⅞″ thick, part 876,387

Lever 17 should be about ½″ ahead of vertical as shown; if not, it should be relocated on its shaft.

Adjust nut 6 to give .010″ clearance.

Replace inspection plates.

LA SALLE, MODEL 328

(*See Cadillac, Model 341-B, page 51.*)

LA SALLE, MODEL 303

(*As follows*)

Minor adjustments for wear are obtained by tightening nuts on front pull cables, making the usual external band adjustments for the rear. When relining or where results of adjustment are not satisfactory, it is necessary to make a complete adjustment of the entire system as follows:

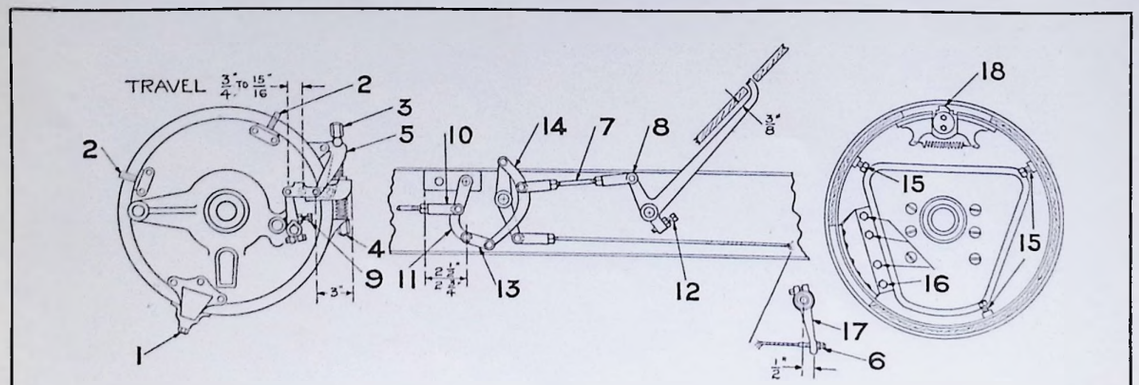


Fig. 1—La Salle 1927

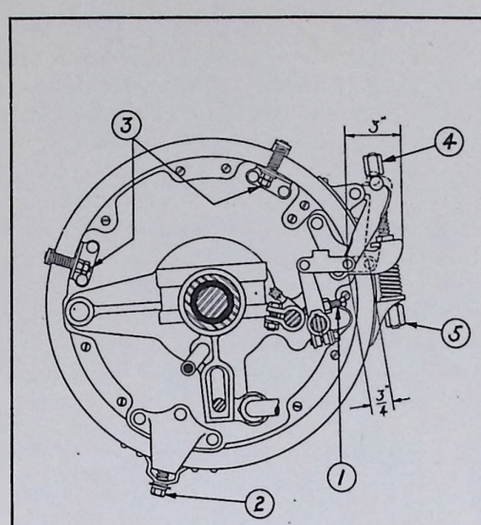


Fig. 2

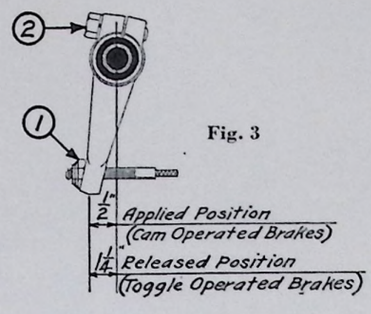


Fig. 3

La Salle
Model 303

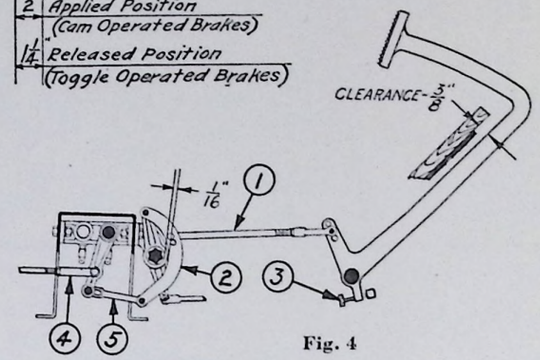


Fig. 4

With car on jacks, release front cable nuts and disconnect pedal pull rod 1 and division bar 2, Fig. 4.

Adjust screw 3 to get ⅜″ clearance between toe board and pedal.

Adjust stop screw 1, Fig. 2, so that lever will give dimension as indicated.

Adjust rods 4, Fig. 4, so that division bar 2 will clear hub of lever 1/16″ when link 5 is connected. Link 5, if it measures 3″ center to center, should be replaced with one measuring 3½″.

Adjust pedal rod 1 and connect. Division bar 2 is generally provided with two holes at center. Use upper hole for 14″ front brakes and the lower for 16″ front brakes. If bar 2 has only one hole, drill another hole ⅜″ center to center above the old one. If brake pedal has three holes, connect rod 1 to the center one.

Screw 3 should just clear pedal.

Should brake pedal have only one hole, drill new one 7/16″ nearer hub.

Adjust front cable nuts, 1, Fig. 3, and take up all slack. The cable lever should be in position shown in Fig. 3. If it is not, by loosening nut 2 the lever may be relocated in proper position except on those cars having 14″ front brakes or where the lever is welded in position.

Rear Brake

Adjust anchor screw 2, Fig. 2, so as to get .030″ clearance between band and drum. Adjust guide nuts 3, then nuts 4 and 5 until .030″ clearance is obtained all around the band. This should give ¾″ travel of lever as shown when brake is applied. If it does not, increase or reduce the clearance between band and drum until the correct travel is obtained.

Front Brake

Adjust screw 1, Fig. 5, for .015″ clearance between band and drum, also turnbuckle 2 and screws 3 and 4 in their order. Anchor bolts 5 may be loosened if necessary to get the proper clearance, .015″ all around the band.

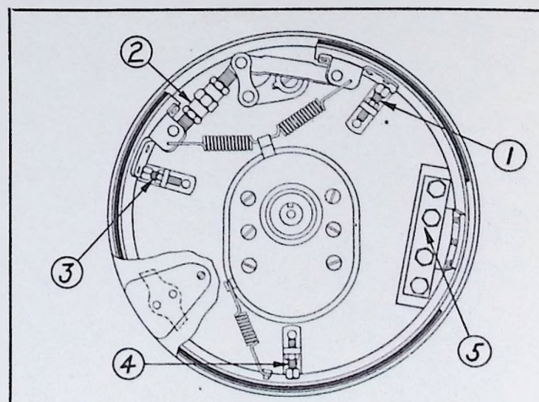


Fig. 5—La Salle Model 303 Front Brake

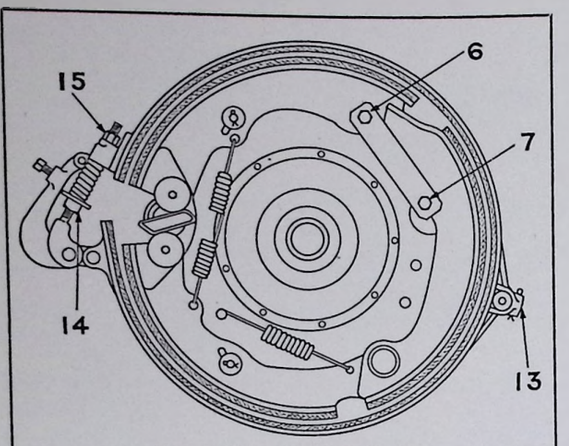


Fig. 1—Lincoln Rear Brake

LINCOLN

(*For Front Wheel Brakes, See Bendix Shaft Type, page 35.*)

Lincoln External Adjustment

Adjust anchor bracket 13, Fig. 1, so that band has a clearance of about .030″. This seems excessive but the service brake is liable to warm the drum, causing it to expand and possibly bind or drag against the external band.

Adjust nut 14, Fig. 1, so that lower band has .030″ clearance allowed. Then adjust 15, Fig. 1, so that this same clearance will obtain at all points.

The band must be true and concentric for satisfactory results.

LOCKHEED HYDRAULIC BRAKES

Operation

As outlined under Fundamentals of Brake Adjustment, a brake consists of the friction element at the wheel and means for transmitting the pressure of the foot to the brake shoes or bands. The Lockheed system of pressure transmission is by a confined liquid, as shown diagrammatically in Fig. 2. Since liquid is incompressible, a pressure applied to the foot pedal will move the piston A, which will force the liquid out of the cylinder through the pipes and into the cylinders B, located at each wheel. As long as the liquid has new space in which to move, it cannot build pressure in any part of the system. Therefore, all of the shoes move until contact with the drum is made. Some shoes move more than others, depending on the adjustment. When all shoes are in contact and no further new space is left into which the liquid might flow, the pressure builds up in the system due to the foot pressure on the brake pedal, and since this pressure must be the same in all parts of the system each piston in the wheels forces the shoes against the drum with equal force.

Air is compressible and if allowed to enter any part of the system, will affect the operation of the brakes, preventing the entire foot pressure from being applied. In such cases, the pedal generally travels to the floor and has a springy feel.

Any loss of liquid in the system will cause it to become inoperative and since there might be slight loss from leakage, a reserve supply of liquid is carried in a reservoir C, which is a part of the system.

Liquid or Fluid

The liquid employed in the system must not be affected by changes in temperature, nor should it affect the packings or metal parts. The liquid is a special mixture and only that supplied by the car or brake manufacturer should be used. Other liquids, such as oil, will affect the piston cups or become electro-chemically active and destroy or pit the pipes or cylinders. Therefore, the system should occasionally be flushed or washed out with alcohol by draining and forcing the alcohol from a tank through the system.

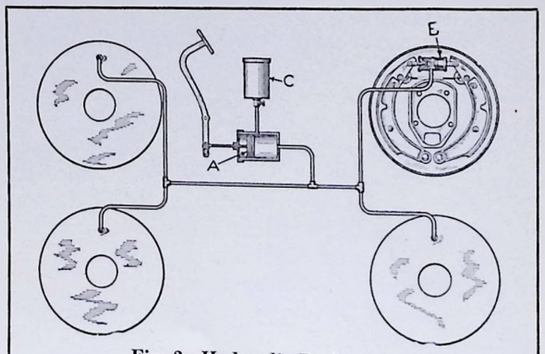


Fig. 2—Hydraulic Brake Principle

Connections are made to the pipe from the underside of the reservoir and the line drained at each wheel. (See Filling the System, Removing Air, or Bleeding, page 65.)

Pressure can be obtained by raising the tank to a high point or a special tank can be made to be filled with compressed air. The tank must be strong or it might explode with disastrous results.

Gasoline should not be used to clean parts such as pistons, cylinders, or cups. Use alcohol as this will dissolve the thickened fluid and not affect the cups.

The basic hydraulic principle is employed in all Lockheed Brakes although various parts, including the master cylinders and the brakes at the wheels, differ in design.

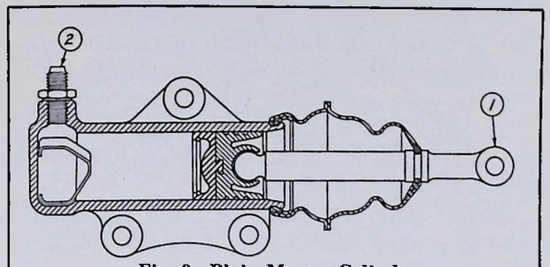


Fig. 3—Plain Master Cylinder

Plain Master Cylinder

This type is used on the early cars, generally in conjunction with external contracting band brakes. It consists of a simple cylinder as shown in Fig. 3. The foot pedal is connected to the link 1, and connection is made to the system at 2.

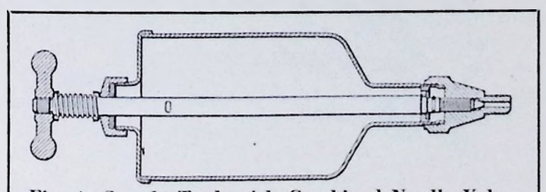
The supply tank, Fig. 4, is also connected to the system, as are the cylinders at each wheel, shown in section in Fig. 5.

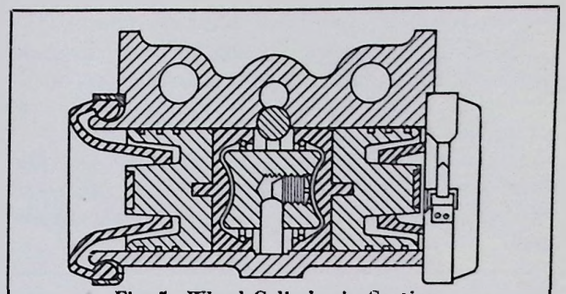
Filling the System, Removing Air or Bleeding External Brake

Fill the supply tank with genuine Lockheed fluid or that supplied by the car manufacturer. This is accomplished by removing the cap and plunger on top of the reservoir.

Remove cap 6, Fig. 7, and attach hose 7, Fig. 6, placing free end into container, preferably glass, containing a small quantity of the fluid, sufficient to cover the end of hose 7. A special hose fitting can be secured from the Wagner Electric Company if desired.

Unscrew connection 8, Fig. 6, about three-quarters of a turn.


Fig. 4—Supply Tank with Combined Needle Valve and Plunger Pump


Fig. 5—Wheel Cylinder in Section

Insert plunger in reservoir and pump slowly.

Liquid will flow from hose 7 into container carrying the entrapped air which will appear as bubbles in the liquid.

When the bubbles no longer appear, tighten screw 8, remove hose and replace cap 6.

Repeat this operation for each wheel, being sure to keep reservoir filled. Should the supply tank become empty during the operation, air will become entrapped in the system when the tank is again filled.

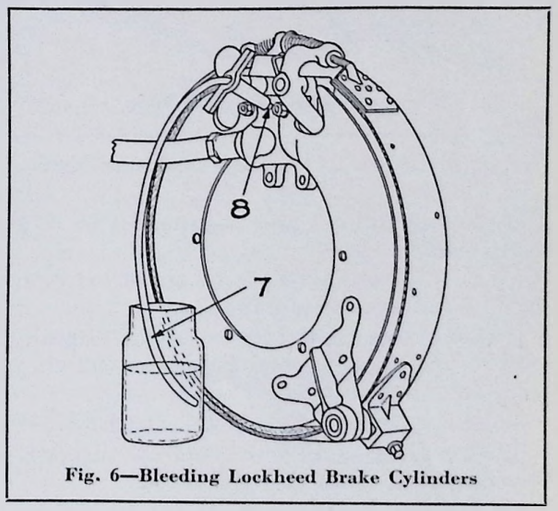


Fig. 6—Bleeding Lockheed Brake Cylinders

To remove air from the master cylinder, force the foot pedal slowly to the floor, being sure the pump plunger in the top of the reservoir or tank is unscrewed. Then fill tank and pump the plunger in the tank until the brake pedal is returned to its normal "off" position, and free play is removed.

Fill the reservoir and screw pump plunger down tightly.

Should the brake pedal still appear resilient or springy, air is still entrapped and the entire process must be repeated until air is eliminated.

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Adjustment—External Brake

Assuming the hydraulic system to be in good condition, adjust the brakes in the following manner:

Remove cotter pin at 1, Fig. 7.

Adjust screw 2 until the band clears the brake drum .015". This can be determined by the use of a feeler gauge or a strip of flat metal of this thickness.

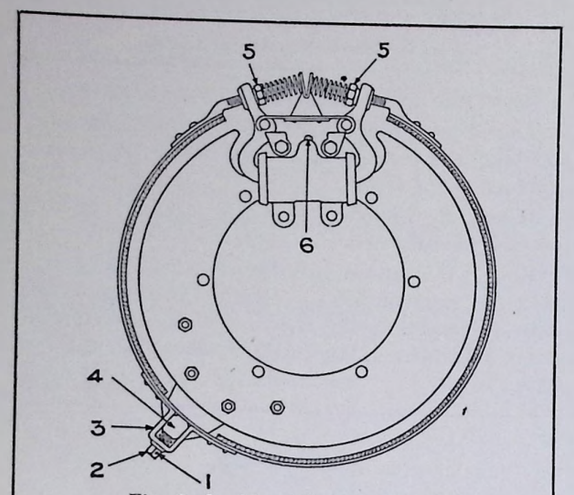


Fig. 7—Lockheed External Brake

The anchor bracket 3 must be free on the anchor post 4.

Replace cotter pin 1 after adjustments are completed.

Adjust nuts 5 until the band clears the drum .015" at all points around the band.

If the band is not true or concentric, difficulty will be experienced in obtaining proper clearance. In this case the bands must be made true.

Proceed in the same manner with all wheels.

Should the hydraulic system not function properly examine for leaks or frozen pistons.

If the system has been disturbed or disconnected or the pedals have no "feel," air has likely become entrapped in the system and must be removed.

Dragging

The external brake with the remote reservoir and simple master cylinder system will sometimes drag in summer, especially when the brakes are heated and the mechanism of the car is warm from hard driving. (See Dragging, page 98.) This is due to a close adjustment of the bands and the expansion of the brake drums and liquid in the system.

When this occurs it is necessary to release the valve in the reservoir for a minute, thus permitting the expanded liquid to flow into the reservoir and release the brake bands. Be sure to tighten the valve again. If this does not correct the difficulty, the bands are too tight and must be released. This is done by releasing nuts 5, Fig. 7.

Compensating Master Cylinder

Improvements in the master cylinder to avoid fluid expansion difficulties and to reduce necessary attention to the system are indicated in Fig. 8.

The reservoir and master cylinder are combined.

The cylinder is surrounded or submerged in the fluid at all times and must be kept so in order to exclude air.

The foot pedal is shown at A. When pressed it forces the piston against the spring and displaces the liquid in the cylinder.

When the piston is in the returned position or as shown, the small hole or port B, Fig. 8, permits the excess fluid to return to the reservoir, air to escape or liquid to fill the cylinder as the case may be.

As long as port B is open, the system can release the expanded fluid in case it is heated or take in additional quantity in case of necessity.

The instant the piston travels to close the port, the system is closed and functions the same as the simple cylinder type with the remote tank.

Should any of the liquid be lost or leak past the piston during the brake application, the necessary additional fluid is drawn in the moment the piston returns to normal and opens the port B.

To obtain compensation it is necessary to have port B open and in order to insure this, a slight

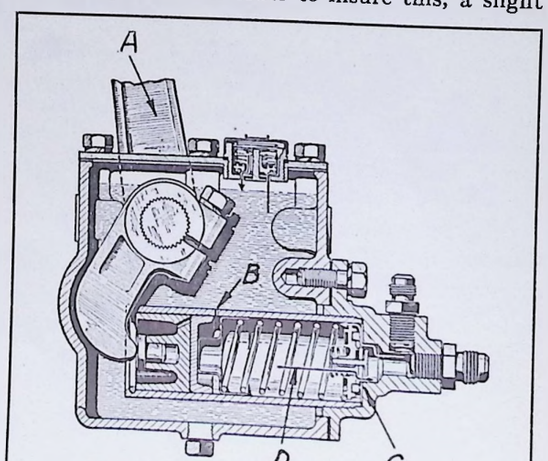


Fig. 8—Compensating Master Cylinder

clearance is necessary between the pedal and piston. This is best checked by noting the free pedal travel when in returned position. It should be about ½" or less as measured at top of pedal.

At C, Fig. 8, is a double check valve which permits fluid to flow out of the cylinder at low pressure in the direction D but requires a higher pressure in order to flow back again into the cylinder.

The function of such a double valve is to permit of readily filling the system, using the master cylinder as a fluid pump, and drawing fluid from the reservoir.

Bleeding the system or removing the air is accomplished by keeping the reservoir filled above the port at all times and pumping the foot pedal slowly eight or ten times while bleeding the system at each wheel separately.

Remote Tank Compensating Cylinder

Not all compensating master cylinders are submerged in the reservoir. Some have a separate or remote tank, the tank being open and containing no shut-off valve such as used with the simple cylinder.

In general construction, the cylinder is similar to the compensating type. (See Fig. 9.) It has the double check valve A and vent hole or port B. The tank is connected to outlet C.

The piston is of different construction in that it forms an outer chamber which is filled with fluid from the tank. When the piston is in the return position as shown, the fluid may flow from the tank through port B into the system and also through port D into the space around the piston. Pedal movement will move the piston and close port B, forcing the entrapped liquid into the system as in the other type master cylinders. The liquid surrounding the piston is also displaced and is forced through port D into the tank, only to flow back upon return of the piston to normal. Since there might be some loss of fluid into the boot E, a vent hole F is provided to drain the lost liquid.

Dragging Brake with Compensating Master Cylinder

Should the brakes drag or the shoes not return to the "off" position when the brake pedal is in the released position and the clearance cams are properly positioned, it is quite possible that the vent hole in the master cylinder is closed from dirt or foreign substance. Closing the vent traps the liquid in the system, and the expansion due to heat forces the shoes against the drum, causing brake to drag.

Dragging may also be caused by improper adjustment of the brake pedal. It is important that the pedal be adjusted so as to allow the piston in the master cylinder to return to its "off" position. If a slight clearance is allowed between the pedal and the piston rod when in returned position, the hole in the cylinder will be open if not closed by foreign matter.

Filling the System

Filling the system is accomplished as in the compensating type with combined reservoir. It is important to keep the tank filled with liquid to prevent drawing in air should the level of the fluid become too low. The stop light switch is shown at G and is operated by the pressure in the system when brakes are applied.

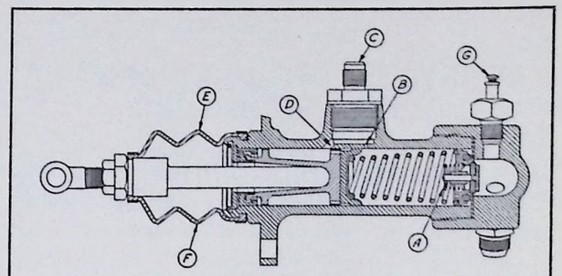


Fig. 9—Remote Tank Compensating Cylinder

Cylinders, Pistons

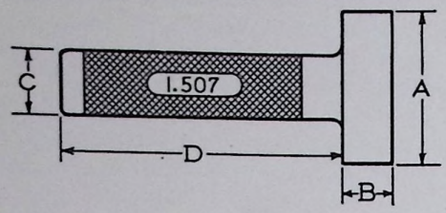
The pressure in the hydraulic system is quite high and unless the system is tight at all points it will not function properly. Should cylinders become pitted through the use of improper fluid or scored from sand or grit, the damaged surface will destroy the rubber packing cups and cause leakage.

The cylinders should be examined carefully where leakage is present and if found damaged should be carefully honed until a smooth uniform surface is present. The honing process is the same as employed for engine cylinders and hones are available for all sizes of cylinders.

The rubber cups will remain tight throughout a large range of cylinder sizes, but if the cylinders are honed too much they will leak and must be replaced. This can best be determined by a plug gauge. If gauges measuring as indicated in the chart on page 68 will enter the cylinder, the bore is too large for service and the cylinder should be replaced. Gauges should be of hardened steel.

All cylinders, pistons and cups should be washed in alcohol to remove traces of grease or oil, which will have a detrimental effect if not removed.

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CYLINDER SIZE	A	B	C	D
1¼"	1.257"	½"	9/16"	2½"
1⅜"	1.382"	½"	9/16"	2½"
1½"	1.507"	½"	⅝"	2¾"
1⅝"	1.636"	½"	¾"	3"
1¾"	1.757"	½"	¾"	3"

Fig. 10—Lockheed Cylinder Plug Gauges

LOCKHEED INTERNAL SINGLE-PIECE SHOE TYPE

The compensating master cylinder type is generally employed with the internal type brake. The brake shoes being internal it is difficult to see or measure the clearance between the drum and shoe.

Later cars are provided with an inspection hole in the side of the drum through which the clearance of the shoe can be measured with feeler gauges. The toe, or upper part, should be set to .010" clearance and the heel should be set to .004".

Where no inspection plate is provided, the clearances are set by means of a skeletonized drum as shown in Fig. 11, or by means of a drum truing gauge. (See page 61.)

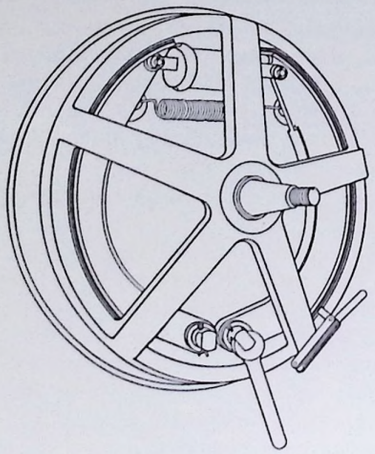


Fig. 11—Setting Shoe Clearance

These skeletonized drums are made in sizes which correspond to the various brake drum diameters. However, their diameter will vary somewhat from that of brake drums of similar size if the drums happen to be worn or have been resurfaced in a lathe.

Adjustment

Assuming the hydraulic system to be in good condition adjust by following procedure: Rotate nuts 5, Fig. 12, as indicated by arrow until cams 6, Fig. 12, are against stop pins; this will cause wheel to bind. While rotating the wheel, back nut 5 until the wheel is just free. Repeat for each wheel and shoe.

If difficulty is experienced with stopping the car after the above adjustments have been made and the hydraulic system is in good condition it may be

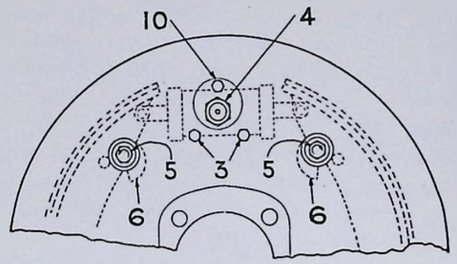


Fig. 12—Adjustment Lockheed Internal Brake

necessary to adjust the shoe anchors 7, Fig. 13, page 69, which are eccentric studs. These may not be provided with any flats for a wrench except on inner side which is inaccessible when wheel is in place.

However, if these shoe anchors are removed and the end of the screw portion slotted for a screwdriver at 8, Fig. 14, the shoe anchors can be readily adjusted from the outside. Late cars are provided with exterior means of anchor adjustment.

By rotating the wheel and carefully rotating the studs 7 in the direction as indicated by arrows, Fig. 13, also rotating nut 5, Fig. 12, the shoe will be located in the drum so that the entire surface of the shoe will be in contact. Back both nut 5 and stud 7 away so that the wheel does not drag.

Then tighten the shoe anchor nuts 9, Fig. 14.

This adjustment will have to be made either blindly or by means of a drum truing gauge (page 61) or a dummy drum, as there is no way to determine the clearances obtained. Use of dummy drums is the standard method employed where no inspection plates are provided.

Filling the System

After proper adjustment of the brakes has been made and the foot pedal presses to the floor without effort, or the system has been disconnected at any of the cylinders, air has entered the system and must be removed.

This is accomplished by filling the master reservoir with fluid. (Use only genuine Lockheed brake fluid, or that supplied by car manufacturer.)

Remove cap screw 10, Fig. 12, and attach bleeder hose 11 as indicated in Fig. 14, placing free end in a glass container.

Depress foot pedal slowly by hand, returning each time to "off" position. Keep master tank filled to prevent air again getting into system. About a dozen strokes will be necessary for each wheel. Keep free end of hose below surface of drained fluid to prevent entrance of air.

When bubbles no longer come from the hose replace cap screw 10. Repeat for each wheel.

The master cylinder will also be freed of air at the same time.

To Remove Shoes

Wheels must be removed.

Unhook return spring 1, Fig. 13, and remove clip washers 2. The shoes can then be removed.

It is advisable to have handy a U-shaped piece of flat metal which can be placed over the ends of the plunger rods. This prevents the pistons from being forced out when shoes are removed, thus losing the liquid and necessitating removing the air from the system. To replace shoes—reverse the operation.

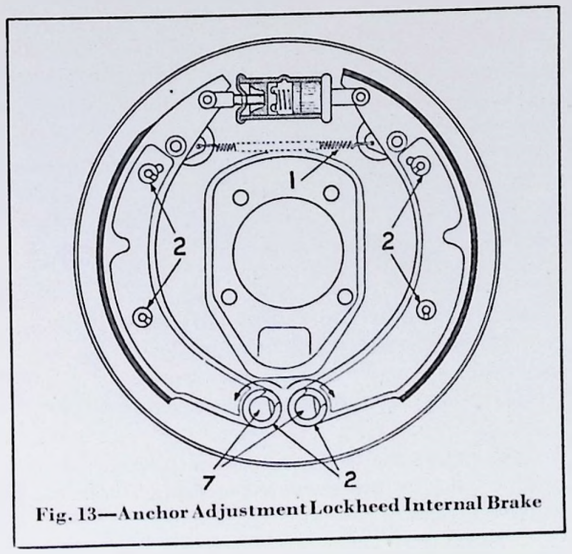


Fig. 13—Anchor Adjustment Lockheed Internal Brake

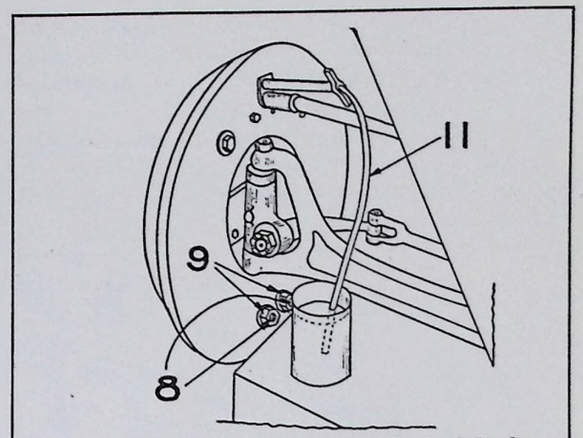


Fig. 14—Bleeding Lockheed Internal Brake Cylinders

To Remove Wheel Cylinders

If necessary to remove wheel cylinders to replace cups or free frozen pistons proceed as follows:

Front

Disconnect hose from copper tube at frame.

Disconnect return spring 1, Fig. 13.

Remove bolts 3, Fig. 12, page 68, and then withdraw cylinder and hose.

Rear

Same as for front except tubing connection 4, Fig. 12, at cylinder is disconnected. Removal of any tubing connection necessitates bleeding the system to remove air.

Relining

Reline Lockheed Internal Brakes with Johns-Manville Moulded Lining.

This lining can be attached in the usual manner except the rivets can be countersunk more deeply as the material is high in strength. After attachment remove all burrs around the rivet holes.

Apply lining, using brass tubular rivets, the heads of which should be countersunk beneath the surface of the lining at least one-half the thickness of the lining.

Adjusting the brakes is accomplished in the usual manner. "Burning-in" is condemned. (See page 12.) The material will readily seat itself if the brake is properly adjusted with a few brake applications on the road, but the temperature of the brake should not be raised unnecessarily to high values at first. Hot brake drums are more likely to cut. Since the brake drums are very likely to have a few ridges caused by grit embedded in the

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old lining, the tops of one or more ridges may become bedded in the new linings, due to the high temperature and heavy pressure on the ridge area, thus causing future trouble.

The brake, when in proper adjustment and with the material properly applied, will be found very smooth, uniform and quiet in operation and with no tendency to grab.

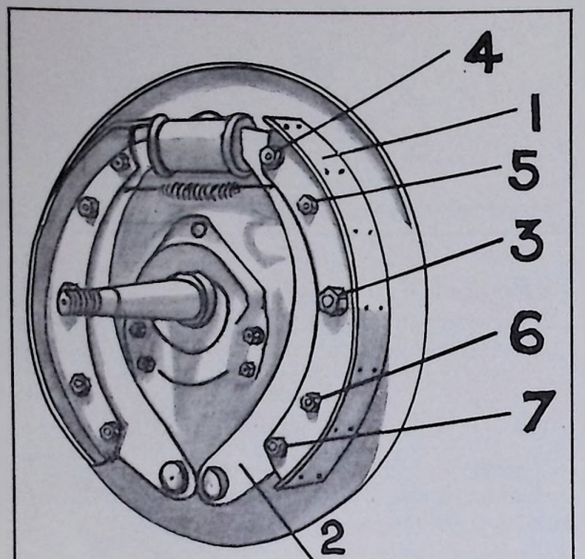


Fig. 15—Lockheed 2-Piece Shoe Brake

LOCKHEED 2-PIECE SHOE BRAKE

In addition to the single piece internal shoe type brake made either with cast or pressed metal shoes, the Lockheed Brake is supplied with shoes made of two pieces, as indicated in Fig. 15.

The shoe anchors are not adjustable as the two-piece construction of the shoe makes it unnecessary.

The two-piece shoe consists of a shoe 1, Fig. 15, on which the brake lining is attached and a support 2, to which the shoe and lining are bolted as shown. The center bolt 3 is carefully fitted to the holes in both shoe and support, and permits of rocking the shoe on its support.

Adjustment

Minor adjustments are accomplished by the clearance cams (not shown) as in all Lockheed Brakes. (See Lockheed Internal Brake Adjustment, page 68.)

Locating the shoes after applying new lining is accomplished by removing the inspection cover plates from the drums when the wheels are in place.

With a socket wrench loosen nuts 4-5-6-7 by working through inspection hole. Apply the brake and tighten the nuts 4-7-6-5 in order given. It will be necessary to release brake in order to turn wheel to new position for each nut, but tighten the nut when brake is applied. Repeat for each wheel.

It is recommended by the makers of the brake to attach a 200 pound gauge to the bleeder fitting on one wheel and to apply 175 pounds to the gauge by means of the brake pedal when centering the shoes.

Approximately this pressure can be obtained by depressing the brake pedal one inch below the point where the first resistance is felt.

The gauge referred to is a standard dial pressure gauge such as is often used on air compressor tanks and can be obtained without difficulty. A copper tube and suitable fittings will readily permit of attachment as referred to above.

When shoes are all properly located the minor clearance adjustment is made on all four brakes as in all types of Lockheed Brakes. Be sure to replace the inspection hole cover plates.

NASH 4-WHEEL BRAKES

(Up to 1928)

Important

Before proceeding to reline be certain to secure Johns-Manville Moulded Lining for the brakes. This special lining is absolutely necessary for the satisfactory operation of these brakes. It can be secured from any Johns-Manville Automotive Distributor.

The rear brakes only may be relined with Standard Woven Lining if desired. Under no circumstances should the brakes be "burned-in." Several brake applications on the road may be made before a final adjustment if desired, but "burning-in" is not advised.

Brake drums are liable to become cut when heated, especially before the lining has become perfectly seated. The lining will seat readily with a few light applications of the brake.

Relining

Remove wheels and brakes without disturbing the linkage except the ball lever joints 19, Fig. 1, at the front and brake rods at rear brakes.

Parts should be thoroughly cleaned and all joints oiled.

Rear bands are relined in usual manner, using drilling and countersinking machines, and brass tubular rivets.

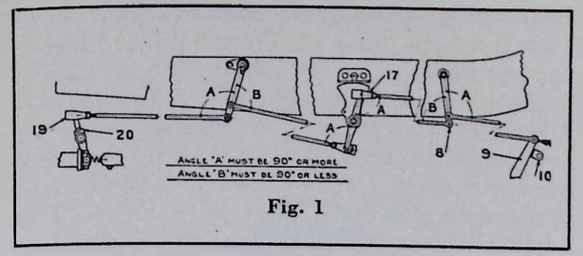


Fig. 1

If J-M Moulded Lining is used on the rear bands, the counterbore can be deepened so that the rivet head is slightly more than one-half the thickness of the lining below the lining surface.

The tapered ends of the special Nash linings for the front shoes should be placed at the ends of the shoes or away from the hinge pin 1, Figs. 2 and 3 (showing front brakes of Special 6 and Advanced 6), joining the two shoes. Clamp lining to shoes and fasten center rivets first, working toward the ends.

Drill and counterbore same as for regular lining except slightly deeper as noted above, transferring holes from holes in shoe.

Remove all burrs from the surface of the lining. Assemble front shoes, leaving anchor screws 2, Figs. 2, 3 and 4, loose. Wheel bearings must be properly adjusted.

Adjustment

Adjust front brakes first.

Loosen the brake shoe clearance adjustment screws 3F and 3R, Figs. 2-3-4. The ball end 4, Fig. 4, and pivot of the operating lever must be in same vertical plane as the center line 5, Fig. 4, of the axle when brake is applied. If not as above, drive the clamping plate 6, Fig. 4, toward the rear in direction of arrow until the operating lever 4, is in correct position. Then tighten the anchor screws 2, and re-check the adjustment. Tighten the rear shoe clearance adjusting screw 3R, while rotating wheel until rear shoe touches the drum, then release screw until free and tighten lock nut 7, Figs. 2, 3, 4. Tighten the front shoe clearance adjustment screw 3F, until shoe touches drum, then loosen until free and tighten lock nut 7.

Adjust Rear Brakes

Disconnect rear yokes 8, Fig. 1, of the rear center brake rods on all models. The brake band lever 9, Fig. 1, should now rest against the stop plate 10 on all models. Adjust the brake anchor screw 11, Fig. 5, until the band clears the drum 1/32".

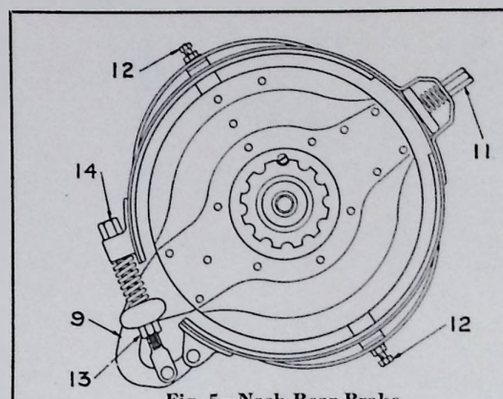


Fig. 5—Nash Rear Brake

Adjust the top and bottom guide screws 12, Fig. 5, for the same clearance. Adjust lower adjusting nut 13, Fig. 5, until the lower band has 1/32" clearance all around. Adjust the upper adjusting nut 14,

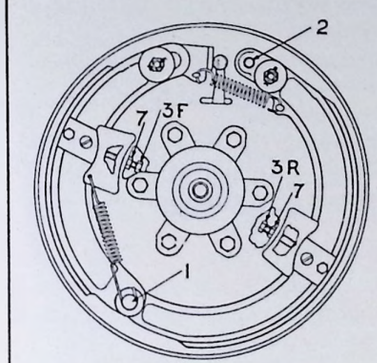


Fig. 2

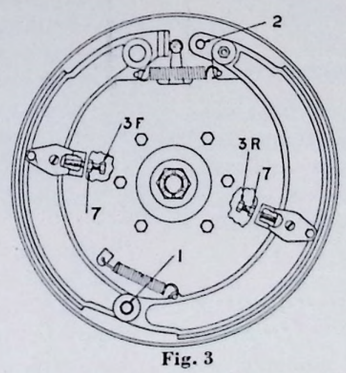


Fig. 3

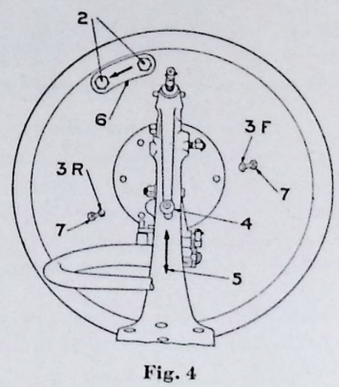


Fig. 4

Nash Internal Front Brakes—up to 1928

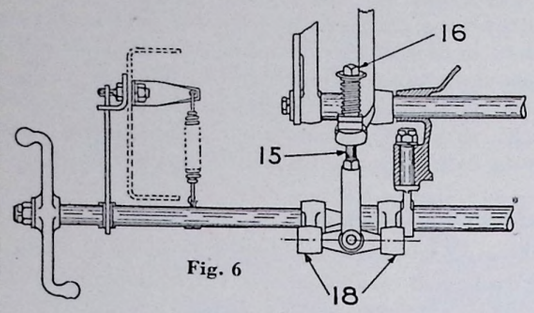


Fig. 6

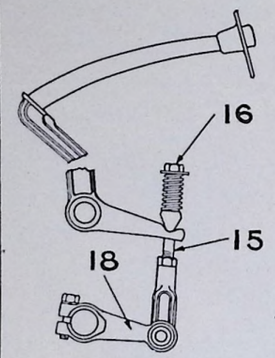


Fig. 7

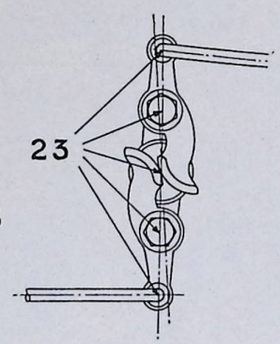


Fig. 8

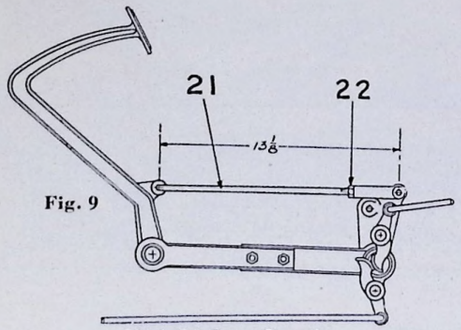


Fig. 9

Nash Linkage Details

Fig. 5, until the upper band has 1/32″ clearance. The entire band will now have 1/32″ clearance all around. While it is not generally necessary to disturb the linkage of the brake mechanism when relining the bands and shoes except at the individual wheels, a check-up is advisable.

Brake Rod and Equalizer Adjustment—Advanced and Special 6 Models Only

Examine pedal to brake equalizer connection 15, Figs. 6-7, showing Advanced and Special 6, and loosen the adjusting nut 16, Figs. 6-7. Nut 16 adjusts the pedal travel but not the brake. Loosen the rear center brake rod ball connections 17, Fig. 1, and adjust rods so that pins may be inserted at 8. When these rods are properly adjusted the equalizer levers 18, Figs. 6-7, will be in the same horizontal relation when the levers 9, on the rear brake bands are against the stops 10, Fig. 1. This adjustment is important and should be accurately made. The upper ball ends 17, should be to the rear of the vertical line as indicated by the angle. Adjust the front ball lever connection 19, Fig. 1, to proper length and connect to lever arm 20, Fig. 1. Repeat for each front brake and see that rod lengths are the same for both sides. Adjust the foot pedal to equalizer 16, so that the pedal when released is against the set screw stop on the Advanced 6 and against the floor board on the Special but with only sufficient pressure to prevent looseness in the connections.

Brake Rod Adjustment—Standard 6 Only

Check length of pedal to clutch shaft 21, Fig. 9, and adjust if necessary to dimension shown.

Lock nut 22 must be tight.

Depress pedal to extreme position and block. The equalizers on each side should now assume positions so that points 23, Fig. 8, are all in a straight line.

NASH SERIES 400

The series 400 Nash cars are equipped with brakes which are slightly different from the previous ones. The change is due primarily to the use of inclined king pins on the steering knuckles.

These brakes are adjusted as follows:

Front Brakes

The front brake operating ball joints 1, Fig. 10, should be disconnected.

Loosen the brake anchor screws 2, Fig. 10, and tighten the clearance adjusting screws 3, until shoe is tight against the drum.

When in proper position the ball end 1, of operating lever should be on center line of front axle and lever 4, Fig. 10, should be vertical. If not, adjust link 5.

Should the ball end 1, of lever not come to the proper position after adjustment above, move it until ball end is slightly ahead of the center line of axle and tighten anchor screws 2.

Loosen clearance screws 3.

Revolve the wheel and tighten the screws 3, one

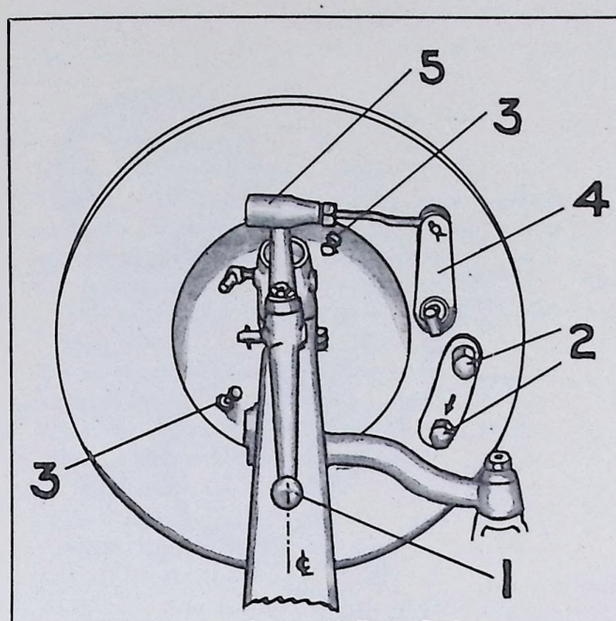


Fig. 10—Nash Series 400 Front Brake

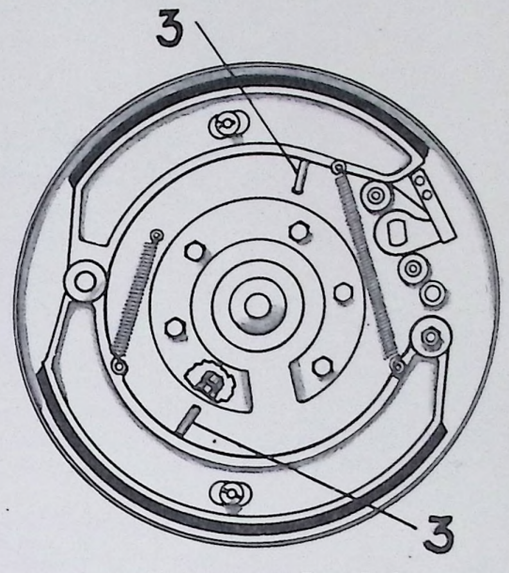


Fig. 11—Nash Series 400 Front Brake

at a time until shoe touches drum, then back off until the wheel is free, then tighten check nuts.

Rear Brakes

Adjust rear brake bands same as the previous models. The anchor screws first, upper and lower guide screws, then upper and lower band nuts until a clearance of 1/32″ obtains.

The chassis linkage is adjusted as outlined for previous models.

NASH, SERIES 480 AND 490

(*See also Bendix Duo Servo, page 37.*)

The 1930 Nash 480 and 490 models equipped with Bendix Duo Servo brakes are provided with an adjustment to vary the pedal effort.

To vary the amount of effort required to operate the brakes, three holes are provided at the end of the brake cross-shaft operating lever. Changing the position of the connecting pin to another hole will change the leverage and consequently the amount of effort required to operate the brakes.

OAKLAND 4-WHEEL BRAKES

Minor Adjustment

All bands are adjusted as follows:

Adjust anchor clearance to .010″ to .015″, being careful that the lining is parallel with the face of the drum. If the band is not in proper position the anchor should be twisted and care should be taken not to distort the band.

Adjust band guides 1, Fig. 1, page 74, so lining clears drum .020″ to .025″. Then adjust nuts 2 and 3 to obtain same clearance all around drum.

The ends of the bands should have 1/16″ clearance and it may be necessary to bend them outward at this point.

The bending out of the ends is important as it will prevent squeaking.

When the brakes are in proper adjustment the front wheels will lock after the rear when going forward on dry pavement.

The front brakes may be tested by backing the car. The front brakes only should cause wheels to lock just before stopping.

Pedal travel should be 5″ when the adjustments are proper.

Major Adjustment

While it is not generally necessary to disturb the linkage when adjusting the brakes, it is sometimes disturbed and then requires adjustment.

The linkage should be thoroughly examined and lubricated at every relining of the brakes. The linkage is adjusted as follows:

The top of the bend in the cross shaft 4 should be 1⅛″ from the front edge of frame cross member in cars earlier than model 54.

Johns-Manville: The Brake Re-Liner's Manual, Fourth Edition (1931)
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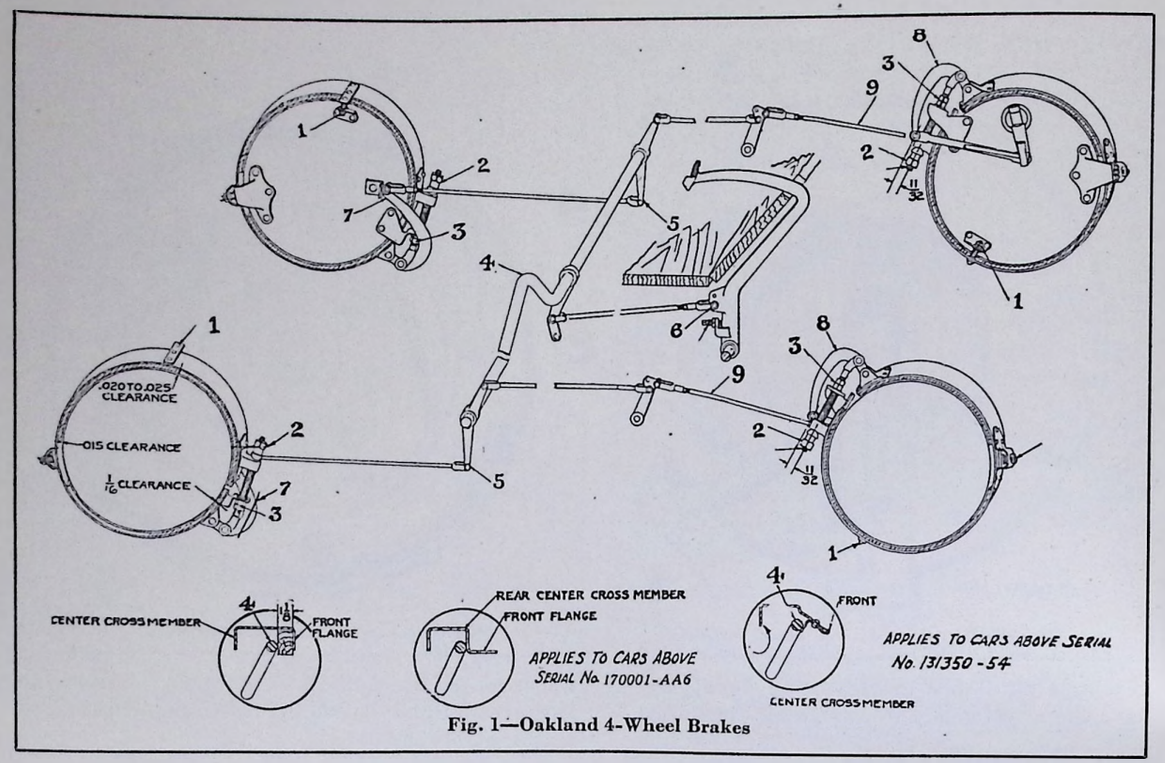


Fig. 1—Oakland 4-Wheel Brakes

On cars above serial number 131350-54, the top of this cross shaft should rest against the stop. On cars above serial number 170001-AA, the top of cross shaft should rest against the front side of cross member.

To correct the position of cross shaft, disconnect pull rod from brake pedal and rear pull rods at the front end 5.

Set cross shaft in proper position and brake pedal against stop so as to just clear floor boards.

Adjust pull rod 6 to proper length and connect. Do not move pedal or cross shaft.

With both rear levers 7 against the stops, adjust lengths of rear rods so they may be connected without moving 5 or 7.

The front brake operating levers 8 on early 54 models should be set 11/32" back of center line of bolt as indicated in diagram.

This adjustment is important as no stops are provided for lever 8.

On cars above number 131350-54 and 170001-AA the brake levers 8 on the front should rest against stops but the heads of the front pull rods 9 should not extend or be loose in the eyes of the toggle levers.

If not as above, adjust by rods 9.

OLDSMOBILE F-28, F-29

The front wheels are equipped with Bendix brakes but the rear have a two-band external brake of special design as shown in Fig. 2.

Adjustment—Front Brakes

For front wheels, see Bendix Brake, page 33.

Rear Brakes

As outlined under External Contracting Brakes, page 58, it is essential that the bands be curved to a uniform radius and contain no twists or other defects. With car on jacks, apply hand lever three notches.

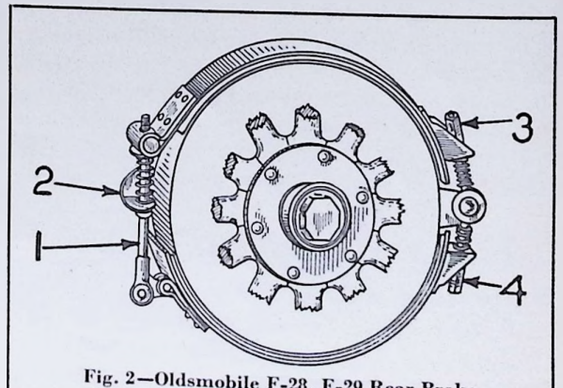


Fig. 2—Oldsmobile F-28, F-29 Rear Brake

The clearance of the collar on rod 1 and the underside of support 2 must be 3/16".

If not, loosen nuts 3 and 4.

Insert a 3/16" piece of metal as a gauge between the collar on rod 1 and the support 2 and tighten nut 3 until gauge is tight. Then adjust nut 4 until the metal gauge is free. Then release hand lever until wheel just turns and check opposite wheel for equal drag.

If one wheel is too tight, release nuts 3 and 4 an equal amount until equalization is secured.

When hand lever is fully released, the brake should not drag and the clearance should be about .015" all around the drum.

It may be necessary to screw rod 1 further into the upper band to secure uniform clearance at all points of the upper band.

Pedal ratio may be changed by relocating the rod in the equalizer, as there are three holes provided. It is better, however, to secure the necessary stopping or holding of the brakes by proper adjustment at the wheels.

OLDSMOBILE F-30

This model is equipped with Bendix Duo Servo Brakes having the cable and conduit type of control. Adjustments at the wheels are made in the usual way. (See page 37.)

The linkage layout is shown in Fig. 3. Instructions for correct setting of the various parts appear on the diagram.

PIERCE-ARROW—With Booster

(*For information on B-K Booster, see page 41.*)

Minor Adjustment—Rear Brakes

With the car securely jacked and the hand lever in released position, first adjust front upper brake shoe to .005" clearance by screw A, Fig. 1, page 76. Then make same clearance at lower shoe by adjusting nut B, Fig. 2, on rear pull rod.

Repeat for opposite wheel. Should the angle of lever C and the rod become greater than 90° when the brake is applied, the clamp bolt D should be loosened and lever C set to proper position on the shaft. Repeat for opposite side.

Front Brakes

First release clamp bolts F, Fig. 3. Then set front shoes for .005" clearance between the lining and drum by adjusting the screws E. After making this adjustment be sure to tighten the clamp bolts.

Major Adjustment

It is quite necessary to have correct relationship of rods and levers as shown in linkage layout, Fig. 4. Should it be found that changes have been made in this linkage, it will be necessary to check as for minor adjustment.

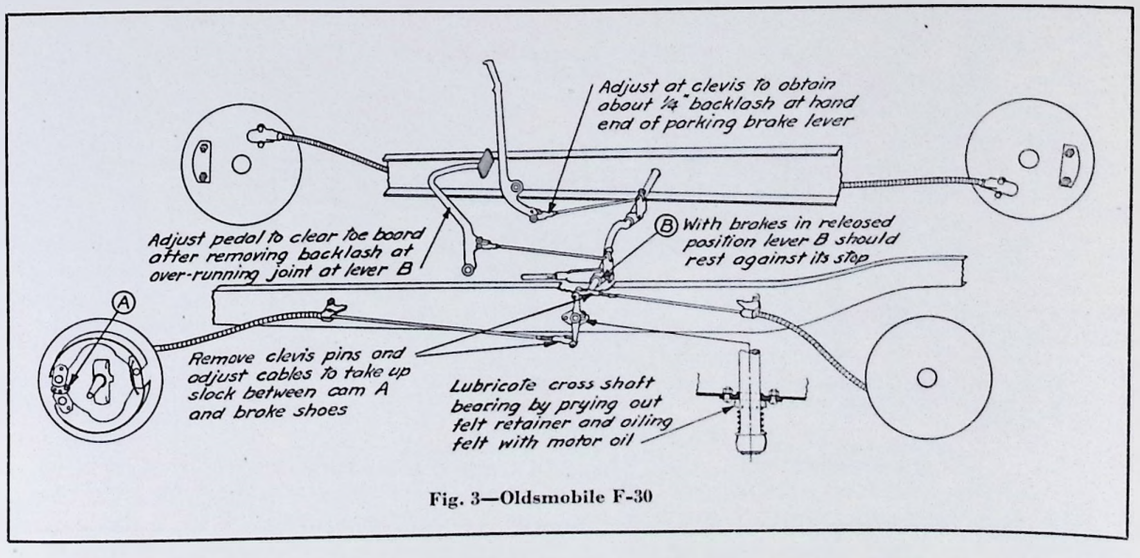


Fig. 3—Oldsmobile F-30

PIERCE-ARROW with Booster

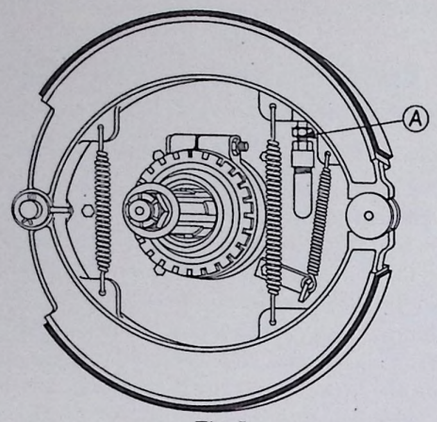


Fig. 1

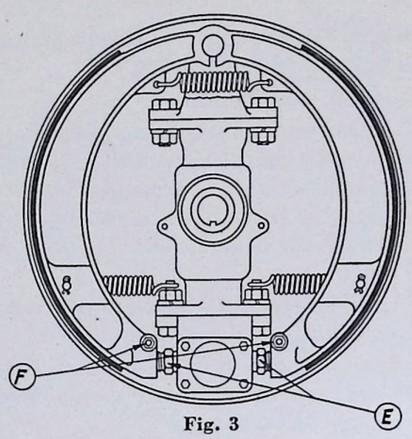


Fig. 3

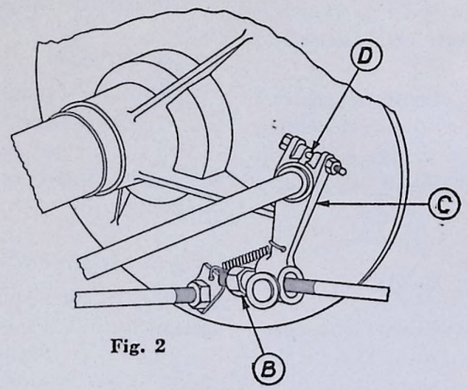


Fig. 2

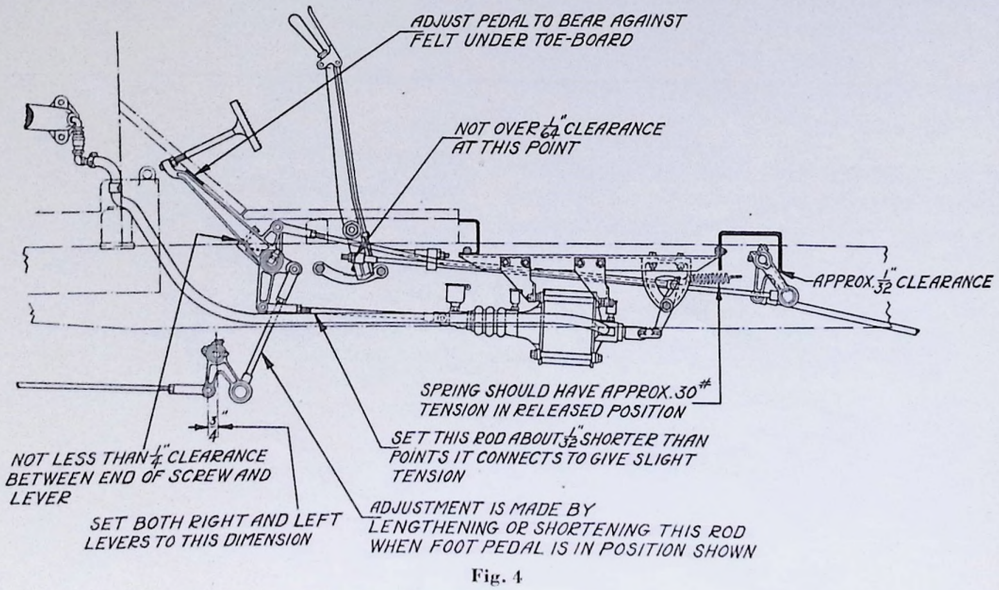


Fig. 4

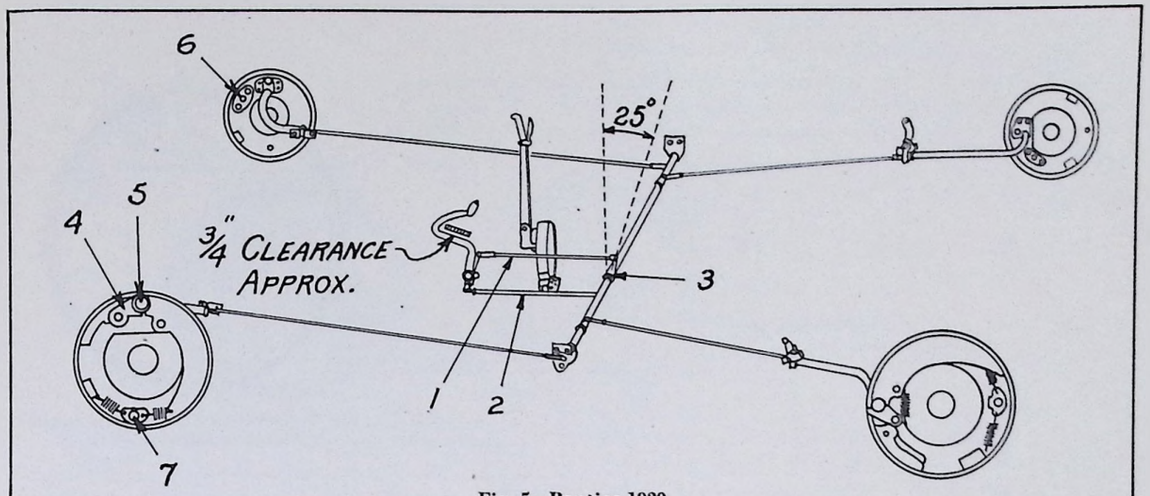


Fig. 5—Pontiac 1929

PONTIAC 1929

(See also Steeldraulic Brakes.)

These cars are equipped with Steeldraulic Brakes operating on the same principle as all brakes of this type, but differing slightly in details of construction and adjustment. The correct procedure follows:

Major Adjustment

1. Set pedal stop so as to obtain about 3/4" clearance between brake pedal and floor board.

2. Adjust pedal rods 1 and 2, Fig. 5, so that the top portion of cross shaft lever 3 forms an angle of 25° with the vertical, as shown. This adjustment is easily made with an adjusting templet obtainable from Oakland Motor Car Co., and known as part No. HM457.

3. With inspection hole covers removed at each wheel, adjust pull rods to give .030" clearance between adjuster 4 and pin 5. Lengthening rods decreases this clearance; shortening rods increases it.

Minor Adjustment

As on all Steeldraulic Brakes, large lining-to-drum clearances are necessary. These clearances, set at adjusting screw 6, should measure about 1/16" but should be slightly greater for the flexible than for the rigid side of the shoe. Use Oakland socket wrench, part No. HM438 for this adjustment.

This brake is equipped with a centralizing spring support 7 for centering the shoes in the drums. Unless clearances are approximately the same entirely around the drum, this spring support should be relocated until the shoes assume a centralized position.

STEELDRAULIC BRAKES

Description

The Steeldraulic Brake is a mechanical internal expanding combination band and shoe type, operated by rods and levers. The connection from the frame of the car to the wheel, however, consists of a specially designed flexible casing in which a flexible cable operates, thus transmitting brake pedal pressure and taking care of the movement of wheels and frame (See Fig. 1, page 78.)

The earlier design of Steeldraulic Brake consists of a rigid shoe, 1, Fig. 2, to which a flexible band, 2, is fastened. The friction lining 3, is fastened to the outer surface of this unit. The anchor is at 4.

When the foot pedal is depressed, the toggle 5 forces the end of the flexible band 2 in contact with the brake drum which in turn tends to carry it around in direction of the arrow and thus forces the shoe portion 1 against the drum with great force.

Adjustment for wear is cared for by an adjustable portion 6, at the end of the band 2, which increases the circumference of the band and shoe when in proper position in the drum.

Adjustment

(See Figs. 1 and 2, page 78.)

With the car on jacks and brake pedal depressed about 2 1/2 inches, remove inspection plates which

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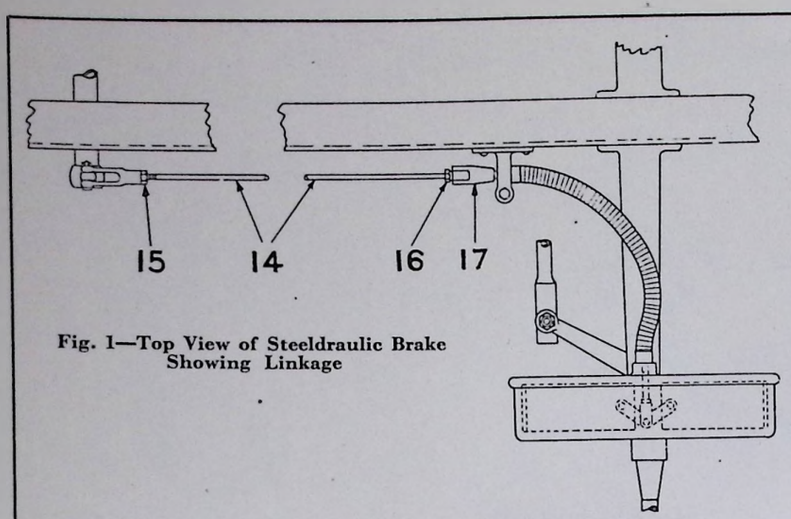


Fig. 1—Top View of Steeldraulic Brake Showing Linkage

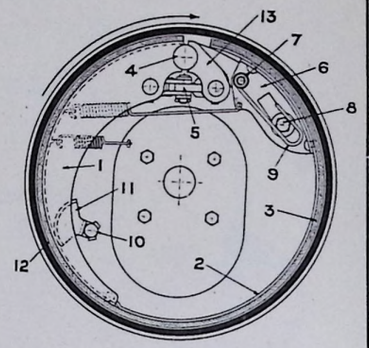


Fig. 2—Detail of Steeldraulic Brake Showing Adjustments

cover holes in the sides of the brake drums. Turn wheel until inspection hole is in line with nut 7. Release nut 7 one and one-half turns, or until brake drags heavily. Place inspection hole over nut 8 and tighten about one and one-half turns. A spring, 9, acts as a detent and will hold nut 8 in any position desired. All wheels should be tightened the same amount except when equalizing the brakes. The amount can be determined by counting the "clicks" of the spring. Be sure to tighten nut 7 before replacing inspection covers.

Clearances

This brake generally requires about 1/16" clearance between lining and drum when the brake pedal is in return position. If the clearance is less than this, greater pedal pressure is required. The clearance is checked by turning inspection hole directly over screw 10. Release nut on outside of splash plate holding 10 and with screwdriver turn 10 so that cam 11 will force shoe 1 against a 3/64" feeler which is inserted between lining and drum at point 12. Tighten nut on outside of splash plate. If difficulty is experienced in equalizing brakes the travel of the shoes should be checked as follows:

With the brake pedal in return position, turn inspection hole over anchor pin 4 and check movement of adjuster 13 away from pin 4. This should measure from .010" to .030". If not equal on all wheels, shorten rod 14, Fig. 1, on brake with least travel or lengthen the rod 14 on the brake with the most travel.

Rod 14 is adjusted by loosening nut 15 and turning rod 14 with pliers while holding nut 16. Rod 14 swivels in part 17. Then tighten lock nut 15. All slack should be removed from the brake pedal by shortening the pedal rod. Adjusting rods and levers is generally not necessary unless some inexperienced person has disturbed the system or the cables have been stretched.

This brake has been designed for moulded lining, and moulded lining should be used for replacement. Woven or soft linings will cause brake to grab if friction is high. Moving joints should be lubricated but it is not necessary to relubricate the flexible portions as they are packed with sufficient grease for their life.

When relining or where the wheels have been removed, the adjustment can be quickly made to approximately correct position by setting the circumference to the dimensions as indicated below. The clearance will be proper for each size and the brake will not drag if the shoe band has been properly centralized and is not distorted.

10" Diameter—3/64" Clearance—31 1/64" Circumference
11" Diameter—3/64" Clearance—33 3/8" Circumference
12" Diameter—1/16" Clearance—37 5/16" Circumference
14" Diameter—1/16" Clearance—42 13/32" Circumference
15" Diameter—1/16" Clearance—47 7/64" Circumference

Fig. 3 illustrates method of measuring circumference by means of a steel tape laid around the band. Adjust screw 10, Fig. 2, as outlined under "Clearances" until proper circumference is obtained.

Toggles

The spreading of the shoe and band ends or the application of pressure in this brake is accomplished by means of a toggle.

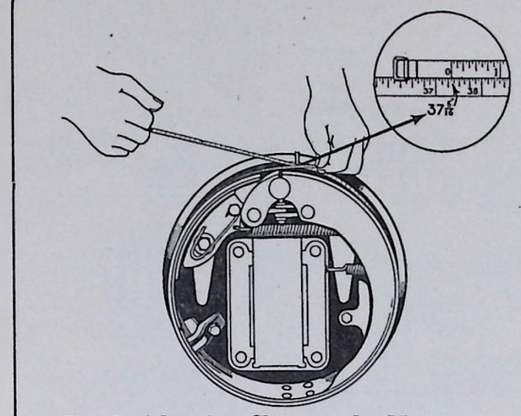


Fig. 3—Adjusting Clearance by Measurement

The manufacturer's instruction calls for adjustment of the clearance between the lining and drum to about 1/16" and the use of moulded lining. This clearance seems excessive for an internal brake, but it is the correct amount in most cases for this type of brake, although setting the toe of the band to 1/16" clearance and toe of shoe to .020" clearance will be found satisfactory also.

The reason for this is to allow enough movement to the toggle to bring it into a position where it will exert sufficient pressure on the brake to stop the car.

Fig. 4 illustrates the toggle position when the clearance between the lining and drum is too little. Figs. 5 and 6 illustrate position where clearance is greater. It will be noticed that with the same pedal pressure, the pressure exerted on the ends of the band and shoe is considerably increased as the toggle becomes more nearly straight. If the clearance between the lining and drum is insufficient, the pressure required on the foot pedal may become too high, leading one to believe the linings are at fault in not having sufficient friction.

Increasing the clearances will permit of increased pressure and this will correct the hard pedal complained of.

Brake Rattles

(See diagrams on page 80.)

Brake rattles sometimes develop in Steeldraulic Brakes. In locating rattles it is advisable to check at two points. Fig. 7 is a section of the cross pin in the rigid side of the shoe. Two cotter pins hold the pin in place. If more than 1/64" clearance is found between these pins and the flanges of the shoe, side play of the shoe against the apron may cause rattles at this point. To correct, remove the shoe and one of the cotter pins in the cross pin, place shoe in vise as shown in Fig. 8 and bend the flanges together as shown until correct clearance is established. Fig. 9 shows anti-rattler which is located on forward band side of apron. When noises, due to looseness of this part are present, or when the spring that applies the tension on the anti-rattler is not strong enough, a small washer, placed as in Fig. 10, should remove the noise.

In order to remove all noises from the anti-rattler, it may be necessary to practically close the spring solid with washers under the nut on the outside of the apron. All the adjustable parts of brakes should be tightened securely after adjustments have been made, as this is one of the chief causes of noise.

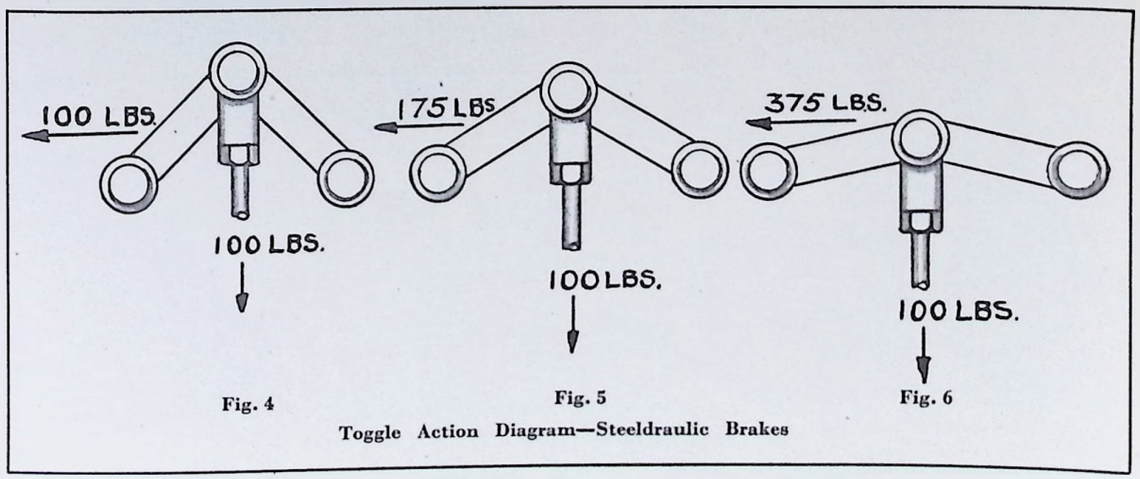


Fig. 4 Fig. 5 Fig. 6

Toggle Action Diagram—Steeldraulic Brakes

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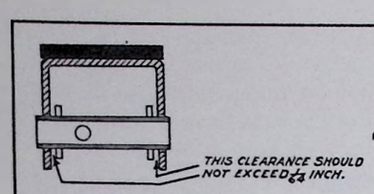


Fig. 7

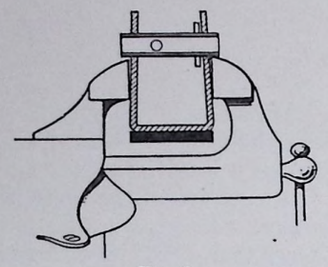


Fig. 8

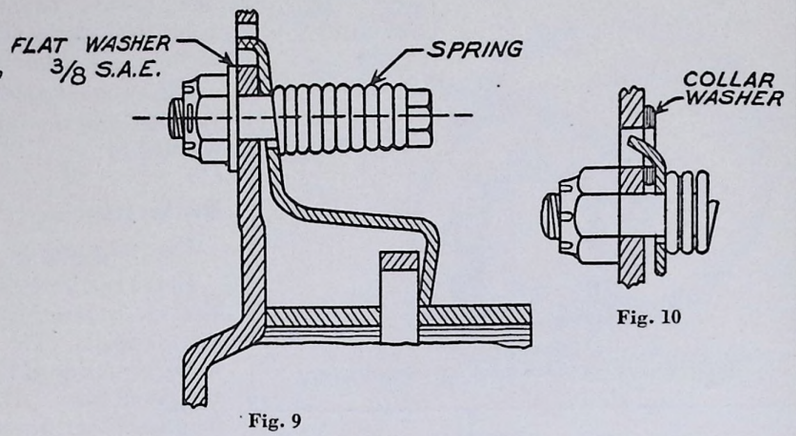


Fig. 9

Fig. 10

Squeak or Chatter

When squeaking is encountered, the position of the shoe in relation to the drum should be checked. When the shoe lies too low in the drum, as shown in Fig. 11, it permits too little clearance directly opposite the anchor pin and too much clearance between drum and lining at the anchor pin. This can be corrected by filing out the anchor seat on the rigid half of the shoe, as shown in Fig. 12. Should the squeaking shoe be found out of round, place a 1/8" x 1/4" wide flat piece of stock between lining and drum at the high point with brakes released. Apply brakes quite solidly. On removing the flat stock from the high point, it will be found that the shoe has rounded itself to proper shape. Should there be more than one high point, it is necessary to duplicate the operation. This method has been found very satisfactory when the portion of the shoe or band directly opposite the anchor pin is dragging, causing squeaks and brake noises.

When brakes chatter just as the car comes to a stop, it may be found, on removing wheels, that some foreign material has found its way on to the lining, changing its friction, which is noticeable in the form of chatter at low speeds. This can be removed by cleaning the lining.

Eccentric Wear on Lining

Care should be taken when adjusting the location of the shoe band on the apron. Should too much pressure be exerted by the rigid shoe, causing lining to drag in drum at this point, wear only on the brake shoe will occur and necessitate relining. Clearance of slightly less than 1/16" should always be maintained between the lining and the drum face at the shoe stop or cam. When this clearance is held, uniform wear of the lining will result. After

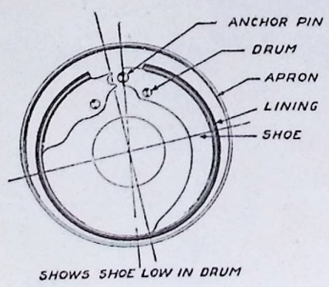


Fig. 11

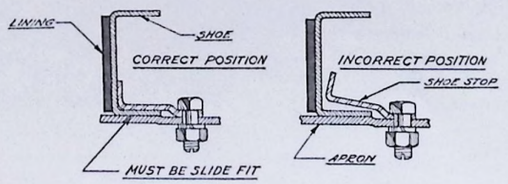
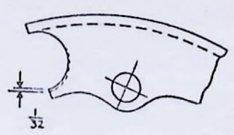


Fig. 13



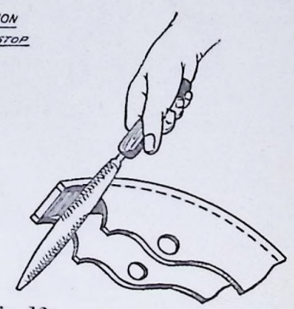


Fig. 12

adjusting cam, be sure that it is fastened securely. Shoe should just barely slide between apron and cam. If there is excessive clearance a rattle or noise will result. This condition often occurs when shoe is roughly removed from apron, resulting in bending the cam in an outward direction. Fig. 13 shows these conditions. Cam can be reformed without removing from apron, if not twisted.

STEELDRAULIC T-SECTION BRAKE

Improvements in construction in the later types of Steeldraulic Brakes are shown in Fig. 1.

Shoe Adjustment

After removing adjusting hole covers in drum and apron, and with the car on the testing machine or jacks, pedal blocked to within 2½" or 3" of the floor boards, proceed by turning adjusting nut shown in Figs. 1 and 2. If brakes are too loose, nut should be tightened. If too tight, it should be backed off.

In making this adjustment to tighten the shoe, remember that the adjusting nut must be turned clockwise (as seen from the anchor pin) and to loosen, it should be turned counter-clockwise. (See Fig. 2.) This is the only adjustment necessary to obtain equal braking effort on all four wheels. After

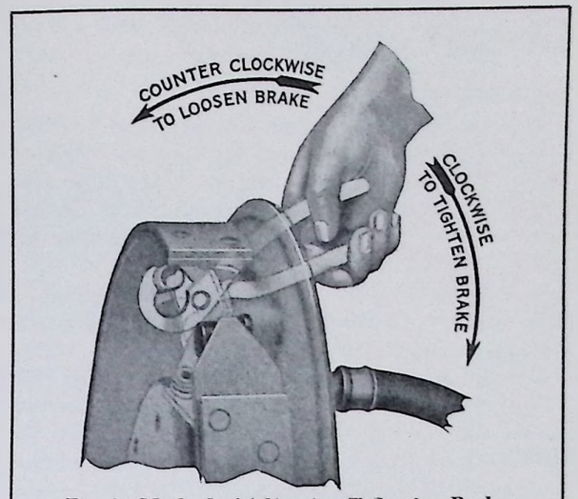


Fig. 2—Method of Adjusting T-Section Brake

this adjustment is completed, check all wheels for brake drag. If wheels turn freely with no sign of dragging, it is not necessary to check for clearance in the brake drum.

Should any of the brakes drag it is only necessary to loosen locking nut on the cam C carried on the apron, as shown in Fig. 3, page 82, and turn cam to the right or left as necessary to relieve drag and centralize

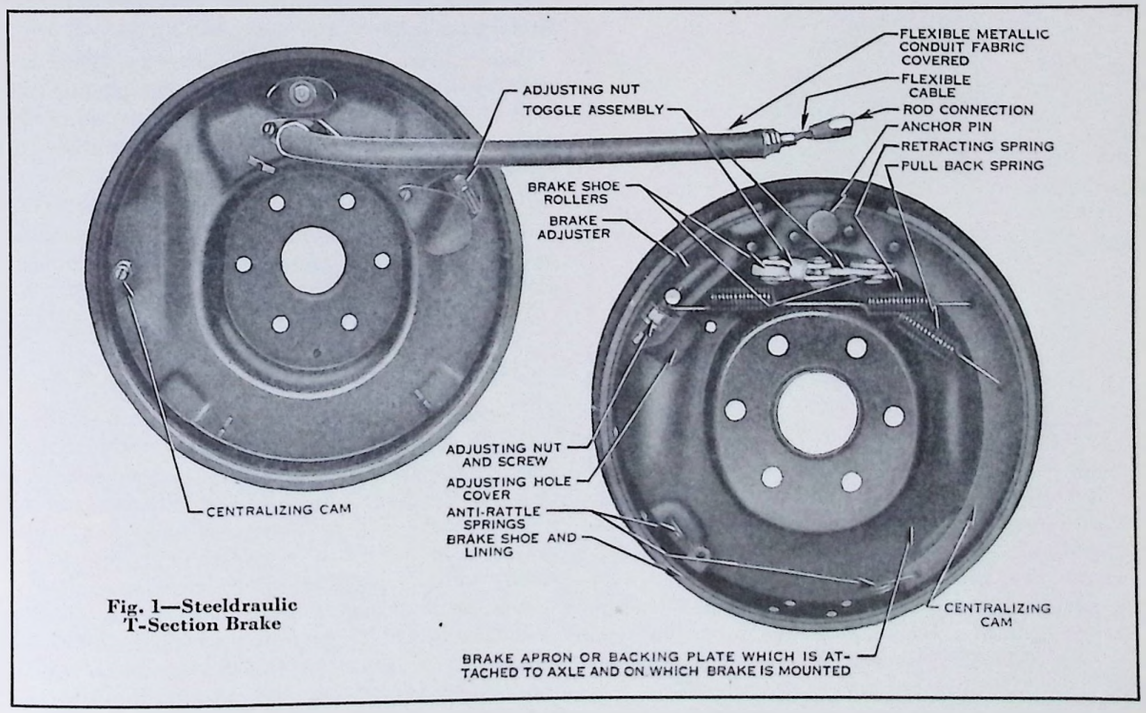


Fig. 1—Steeldraulic T-Section Brake

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shoe in drum. Hold the cam in position while locking nut is tightened.

Clearances

Due to concentric grinding of the shoes on 1931 cars the clearance between the edge of adjuster and the anchor pin, Fig. 1, can be 1/32″ minimum and 1/16″ maximum. On all Steeldraulic Brakes used on previous cars the clearance should measure from .010″ to .030″.

These clearances, checked with brake pedal in full released position, should be approximately the same at each wheel. If they are found to vary, a pull rod adjustment is necessary. (See page 78.)

The proper clearance between lining and drum at the centralizing cam C, Fig. 3 is from .025″ to .032″. It is slightly less for the rigid side of the shoe than the flexible side. On Steeldraulic Brakes used on cars previous to 1931, these clearances should be about 3/64″ for the 10″ and 11″ diameter brakes and 1/16″ for the 12″, 14″ and 15″ diameter brakes.

Final adjustment on the T-Section Brake should be checked with brake pedal blocked to within 2½″ or 3″ of the floor board. This adjustment is made at the adjusting nut (See Fig. 2), and the centralizing cam C, Fig. 3, as outlined under "Shoe Adjustment," on page 81.

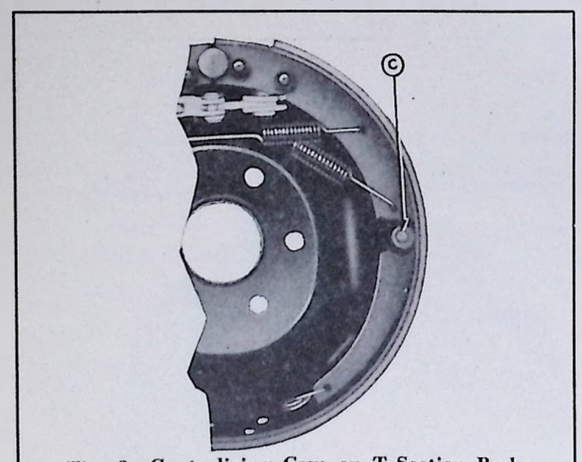


Fig. 3—Centralizing Cam on T-Section Brake

Although mechanics sometimes have trouble in adjusting the Steeldraulic Brake, the fault seldom lies with the brake or the lining. It is usually due to the mistaken idea that lining-to-drum clearances should be set close, as on other brakes. The Steeldraulic Brake is simple in design and easy to adjust and when clearances are set as noted no difficulty should be experienced.

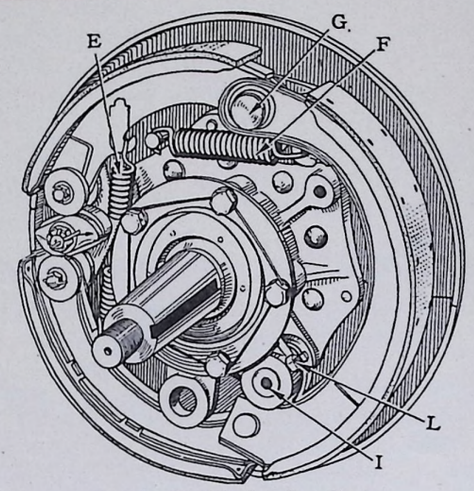


Fig. 4—Studebaker Bus Brake

STUDEBAKER BUS, MODELS 77, 88, 99

(*See also Bendix Brake, page 33.*)

Anchor pins on model 99 are not adjustable.

To Remove Shoes—Model 99

Remove return springs E, and fold primary or upper shoe (See Bendix Brake, page 33) back on pin G, then remove spring F. (See Fig. 4.)

Loosen lock nut and remove screw L. Then insert a ½″ cap screw at I so that the anchor pin may be drawn out and the three shoes removed. After relining, the shoes are properly assembled by reversing the operations.

NOTE—The wing nut adjustment at the front end of the brake pedal rod should not be changed, as this will affect the operation of the Westinghouse amplifier. (See Westinghouse Booster, page 91.)

For parking brake, see Tru-Stop Brake, page 86.

STUTZ HYDROSTATIC BRAKE

The Stutz Model AA is equipped with Hydrostatic Brakes on all four wheels, controlled by the foot pedal. The hydrostatic brakes are a development of the hydraulic principle. The actuating fluid is a 50% solution of alcohol and water. The system is hermetically sealed and leakage is practically impossible. Pressure is developed in the system by a plunger, connected directly to the brake pedal, which compresses a bellows contained in a metal housing. No liquid is in contact with the plunger, but depressing the pedal causes the

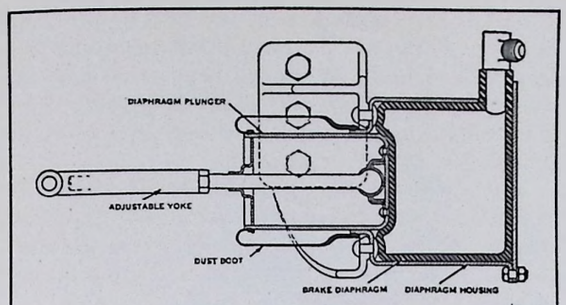


Fig. 1—Master Cylinder in Section

plunger to distort the rubber bellows, forcing the liquid out into the system. (Fig. 1.)

In each wheel is a brake fluid chamber, Fig. 2, somewhat similar to a small flat inner tube. This tube is rigidly encased on three sides, the open side corresponding to the tread on a flattened inner tube. Six shoes or segments rest around the circumference of the open side of the tube. Six springs and six anchor pins hold the shoes down against the rubber tube, preventing the shoes from dragging and preventing rattle.

When the pedal is depressed, the fluid flows through sealed pipes and establishes an equal pressure throughout the system, expanding the tubes in the four wheels and pressing the six shoes in each wheel out against the brake drum. The shoes are each restrained from rotating in either direction by anchor pins or stops.

The pins which restrain the shoes from rotating are locked in place by flat laminated springs, which hold the shoes against the rubber tube. Each pin is turned to a smaller diameter at its center section and the flat spring fits into the smaller section. The

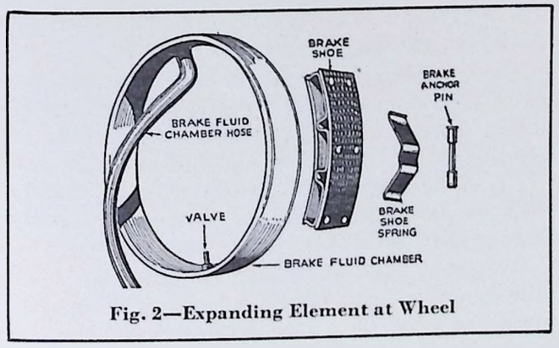


Fig. 2—Expanding Element at Wheel

pins are also held in place by a thin head on the outside end and a cotter pin on the inside end.

The brake shoes or segments, Fig. 3, may be removed. Pressing on the screwdriver will flatten the spring and release the pin so that it may slide out after the cotter pin is removed. The brake shoes may then be relined.

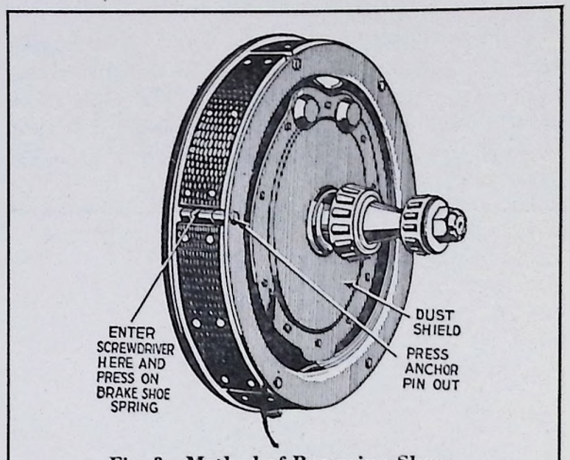


Fig. 3—Method of Removing Shoes

Adjustment

Brakes require very little attention and infrequent adjustment, since wear on the braking surface is extremely gradual.

Brake Supply Tank

The brakes are adjusted and liquid added to the brake system by means of the supply tank. This tank is connected to the brake system through a pipe line to the diaphragm connection. The tank contains a supply of brake liquid which may be admitted to the brake system should it be necessary. On the top of the tank is the brake supply pump which permits air pressure to be developed, forcing liquid into the brake system when the brake supply tank valve, located beneath the tank, is opened.

To add more liquid to the brake system, open the valve and operate the pump until sufficient liquid has been added to the brake lines, then close the valve. The handle of the tank pump must be screwed down tightly and the shut-off valve below the tank must be closed securely after adding liquid and must be kept so at all times. The wheels should turn freely after liquid has been added.

Excess liquid may be eliminated from the lines by unscrewing the supply tank filler plug and opening the shut-off valve, permitting fluid to drain back into the tank to obtain the proper adjustment.

Liquid is added to the tank through the filler plug, which must be kept tight at all times.

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The brakes will not function properly with air in brake system. The presence of air in the system is indicated by the brakes dragging when the pedal pressure is released and by soft action of the brake pedal which permits depressing the pedal all the way to the toe board, without any braking effect. This condition may be corrected by refilling the brakes.

Refilling the Brakes

Stutz Service Stations have special pressure tanks or pumps for filling the hydrostatic brake system.

Before attempting to refill the system, check the adjustable yoke between the brake diaphragm plunger and the brake pedal and shorten to the limit of the adjustment.

Remove the filler plug from the brake supply tank. A goose neck pipe should be installed where the pipe plug was removed. This goose neck should have a shut-off valve and a bend at the top of the pipe should direct the overflow into the glass jar.

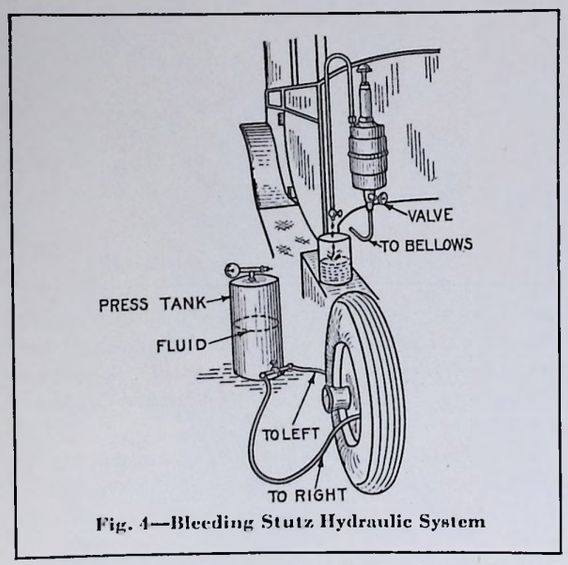


Fig. 4—Bleeding Stutz Hydraulic System

Each of the rubber tubes in the four wheels is provided with a valve similar to the valves used on inner tire tubes. These valves are located opposite the point of attachment of the rubber hose through which the braking fluid flows into the tube. The hose enters the front wheel tubes at the top and the rear wheel tubes at the bottom. A special tank is used which has a double connection at the bottom, as shown.

There should be two hose connections from the supply tank and each of these hoses should carry a special connection. Attach the two supply tank connections to the valves at the bottom of the two front wheel brake tubes, without removing the valve centers. Turn on both supply tank lines. The supply tank pressure should be from 60 to 80 pounds per square inch.

Any air in the tank line should, of course, be blown out before the line is connected to the front wheels. Bleed the fluid out at the goose neck attached to the brake supply tank until no more air bubbles come through.

Remove the two brake refilling tank hose connections and attach to the rear fluid chamber valves. These valves are at the top of the rear wheel fluid chambers. Repeat the operation just completed on the front brakes. When no more air bubbles appear, shut off the valve in the goose neck first, then shut off the valve below the supply tank. Remove the brake refilling tank hose connections and replace filler plug. Shut off valve below tank and drain out through the filler plug hole in the supply tank by opening the shut-off valve slightly. After brakes are adjusted remove goose neck and replace filler plug. Shut-off valve below tank must be closed tightly.

TIMKEN DUPLEX BRAKE

The Duplex type brake is supplied with axles made by the Timken Detroit Axle Company and is used extensively on buses and trucks.

The brake consists of two internal expanding shoe brakes operating within the same brake drum.

Each pair of shoes is operated by a cam as in conventional two shoe brakes, making two cams and four shoes (see Fig. 1). This construction makes it possible to employ one set of shoes for the service or foot brake, and the remaining pair of shoes for the hand, parking, or emergency brake.

It is also possible to connect both camshafts together and employ all of the shoes as the service brake. In this case it is necessary to provide an additional brake on the vehicle, such as on the propeller shaft, as a hand brake in order to comply with the law which requires two independently operated brakes on the vehicle.

Where the hydraulic system of operation is employed, cylinders are provided between the operating levers as shown. In this case the four shoes are operated at once. (See Lockheed Hydraulic Brake, page 64.)

When relining, it is generally only necessary to remove the shoes, and after relining replace them, but it is advisable to replace in the same position as

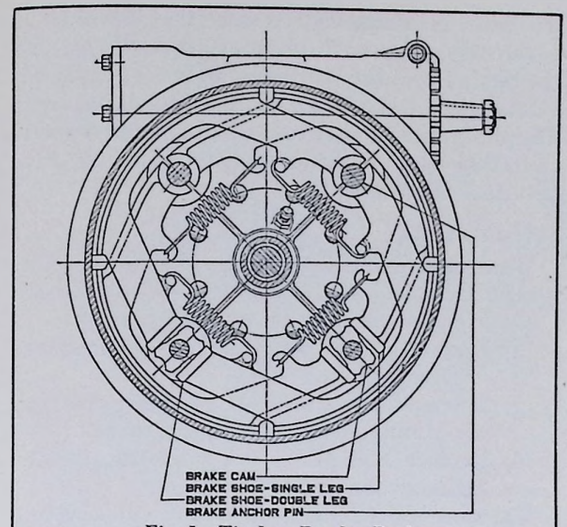


Fig. 1—Timken Duplex Brake

originally, as this will make the lining seat itself more readily. Any possible change in the shoes due to heat might prevent a good fit at any other point and make it necessary to relocate the cam bracket. In case it is necessary to adjust the brake shoes so as to have both seat at the same moment, provision is made to adjust the cam supporting bracket. (See Fig. 2.) The bracket supporting bolts A are loosened and the brake applied, which will centralize the cam and bracket. The bolts are then tightened. This is necessary for each pair of shoes.

Adjustment

Wear on the brake linings is taken up by relocating the operating lever on the cam-shaft which is serrated, and lengthening the pull rods. Move the lever one or two serrations as may be necessary.

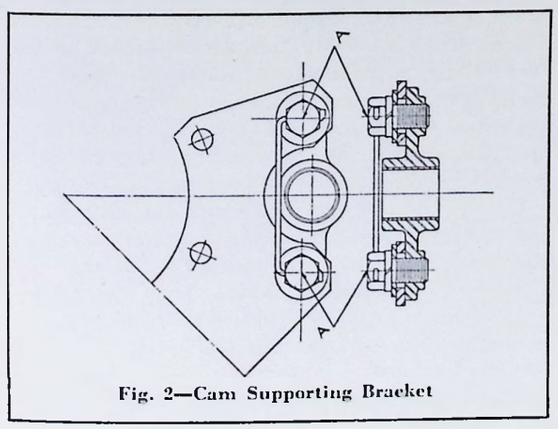


Fig. 2—Cam Supporting Bracket

This is the only adjustment, but if new linings are applied, the lever must be returned to its original position.

In the hydraulic operated brake, the lever is provided with a worm and worm wheel micrometer adjustment which permits of accurately adjusting the relation of cam to lever without removal of the lever from the shaft. (See A, Fig. 3.)

The brake will be found simple in design, strong, and rugged and when used with suitable lining for service intended, and possibly special hard drums, the most satisfactory service will be rendered. (See Relining Brakes, page 20; Drums, page 11; Brake Blocks, page 22.)

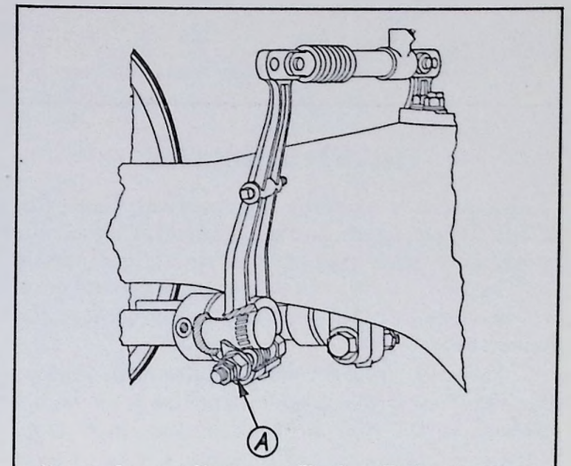


Fig. 3—Lever Adjustment Timken Hydraulic Type

TIMKEN SIMPLEX BRAKE

This brake consists of a heavy steel band which is expanded within the brake drum, and is therefore an internal expanding band type brake. The brake lining is attached to the outer surface of the band.

Adjustment

Adjustment for wear is accomplished by relocating the operating lever on the cam shaft in the same manner as with the Duplex type.

Equalization

The equalization of the brake is obtained by loosening bolt A, Fig. 4, page 86, and then applying the brake. This will permit the cam to adjust itself or to equalize the pressure on each band end. The nut is then tightened. Make any other adjustments necessary on the rods and levers.

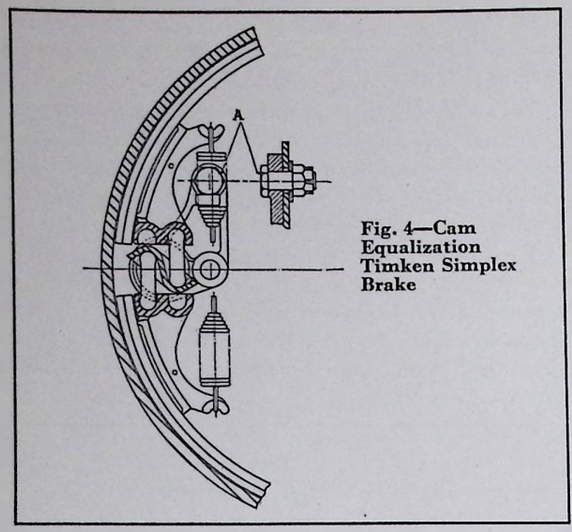


Fig. 4—Cam Equalization Timken Simplex Brake

TRU-STOP BRAKE

This brake is made by the American Cable Co. of Bridgeport, Conn. and is designed for use on the propeller or drive shaft of a vehicle. It is generally mounted on the rear of the transmission case or on a cross member of the frame and is used as the hand brake.

Since most propeller shaft brakes heat quickly, the Tru-Stop Brake is so designed as to be highly efficient in the dissipation of heat or in cooling.

This is accomplished by using a steel disc of special design as the drum. This disc is provided with air passages between its two faces and is so arranged that due to its high speed of rotation a large volume of air passes between the discs and cools them. Two friction pads grip the faces of the disc near its outer edge and since the pads or shoes cover only one fourth of the surface of the disc, the air can cool the remainder as it is in rapid circulation due to the fan action of the air passages. The shoes are supported on a swinging bracket so as to take care of any movement of the disc from thrust of the shaft.

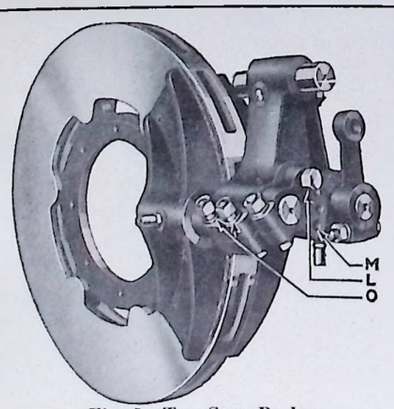


Fig. 5—Tru-Stop Brake

Adjustment

If the clearance between shoes and disc becomes greater than $\frac{1}{8}''$, the brake requires adjustment.

(1) Place hand lever in released position.
(2) Release clamp bolts O, Fig. 5, and remove locking bolt L.
(3) Move adjusting lever M one hole or so that shoes will move to take up clearance.
(4) Replace bolt L to lock adjustment, then tighten clamp bolts O.

CAUTION—The brake pull rod or cable should never be shortened to take up for wear on shoes. Always adjust brake as outlined.

WESTINGHOUSE AIR BRAKE

The Westinghouse Air Brake is a power brake system which uses compressed air as its power medium. It is used on commercial vehicles—buses, trucks, tractors, fire apparatus, etc., where its higher braking force, greater flexibility and ease of control permit of a wider utilization of the vehicles' possibilities than is attainable with the ordinary foot pressure brake. It affords complete control of trailing units which, therefore, may be used for many classes of service not otherwise possible.

Fig. 1 is a diagram of the equipment for bus or truck with four wheel brakes. Source of power is an Air Compressor, Fig. 6, page 89, driven by the engine. The compressed air is stored in a Reservoir. Brake control is effected by a Brake Valve, Fig. 9, page 90, operated from the brake pedal to admit to and discharge air from Brake Chambers, Fig. 8, page 89. The latter are connected to the brake rods and convert the stored energy of the compressed air into mechancial power to apply the brakes. A Governor, Fig. 7, page 89, controls compressor operation, thereby keeping the pressure in the reservoir to a desired and predetermined range.

Fig. 2 shows the equipment for a four wheel double end trailer. Connection to the pipe lines on the truck is made by couplings as shown. The Combined Application Valve and Emergency Valve, Fig. 4, page 88, serves first, to relay application and release from the truck to trailer and second, to cause an automatic brake application in case the trailer is disconnected from the truck.

WESTINGHOUSE AIR EQUIPMENT

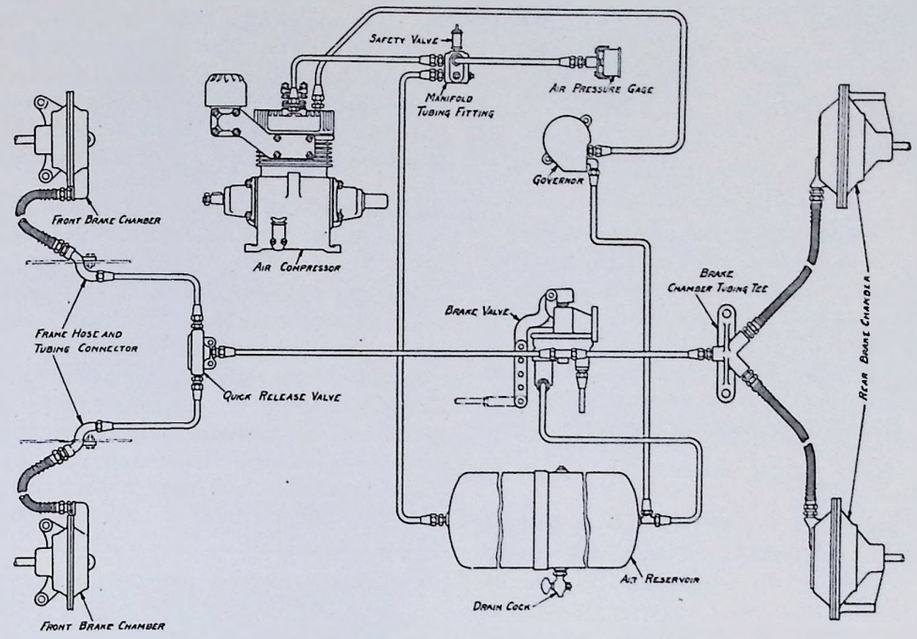


Fig. 1—Westinghouse Equipment for Truck or Bus with 4-Wheel Brakes

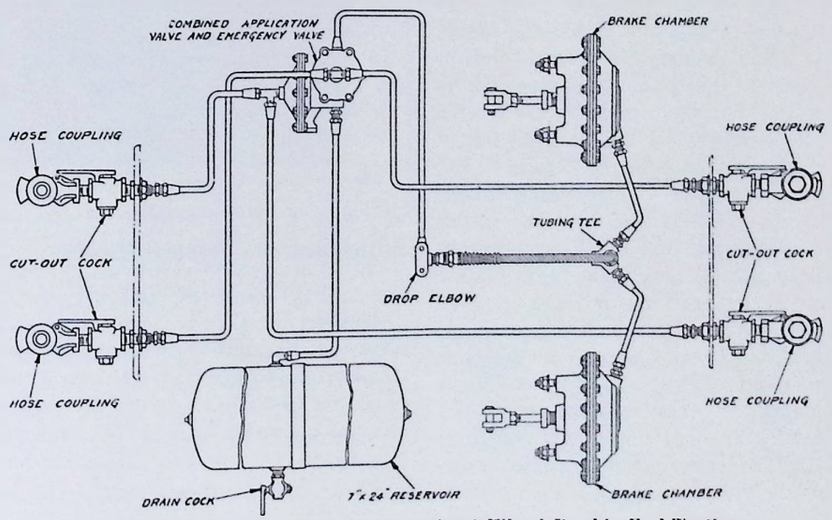


Fig. 2—Westinghouse Equipment for 4-Wheel Double End Trailer

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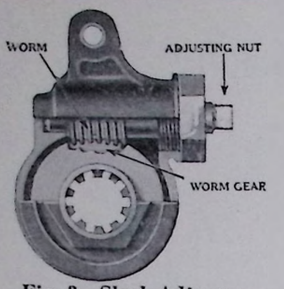


Fig. 3—Slack Adjuster



Fig. 4—Combined Application and Emergency Valve

Most of the leading manufacturers of trucks and trailers now provide axles on which brake chambers are directly mounted. On brake application, movement of the brake chamber push rods rotates the cam shafts which lift the cams, the latter thereby expanding the shoe heads against the drums. Slack adjusters, Fig. 3, are used to provide a means of brake adjustment so that braking force is always equalized.

Brake Operation

Brakes on both truck and trailer are applied and released by manipulation of the brake valve on the truck, controlled by the foot pedal. During application, air flows from the reservoir through the brake valve directly into the brake chambers on the truck and into the pipe leading to the combined Application and Emergency Valve on the trailer. This valve is thereby actuated to pass air from the trailer reservoir to the brake chambers. When the brakes are released, pressure is exhausted from truck brake chambers through the brake valve to atmosphere and from the trailer brake chambers through the Application and Emergency Valve to atmosphere. The brake valve thus acts to apply and release truck brakes and to "pilot" the Application and Emergency Valve so that the latter produces more prompt action of the trailer brakes than would be possible if all the pressure were compelled to flow through the brake valve.

The emergency feature of the combined Application and Emergency Valve functions only in event that the trailer should break away from the truck when parting of the hose connection between the two vehicles reduces the pressure in the emergency pipe. This would cause the emergency valve to admit air from the trailer reservoir to brake chambers, thus automatically applying trailer brakes.

Adjustment of Brakes

Wheels should be jacked up and brakes taken up evenly to the point where each wheel begins to drag with brake chamber push rod pressure plates at the beginning of their stroke and firmly seated against the diaphragms. Apply the air brake several times to compress the lining (if new flexible lining) and readjust if necessary. Then measure Brake Chamber push rod stroke with air applied which for first adjustment on new lining should be not more than ¾" for 6¾" brake chambers and ⅞" for 9" brake chambers. 6¾" chambers should be readjusted before push rod stroke exceeds 1¼" and 9" chambers before push rod stroke exceeds 1¾".

Adjustment of Brakes on Vehicles Having Axles with Brake Chambers Directly attached

Make a brake application and measure the stroke of each push rod. Turn slack adjuster adjusting nuts, to equalize all strokes to 1" or slightly less. Minimum push rod travel to produce running clearance is ⅞" for rear and ¾" for front chambers. Never allow stroke of rear chambers to exceed 1¾" and of front chambers 1¼". Cam shafts generally have enough total lift to allow wear of a full thickness of brake shoe lining.

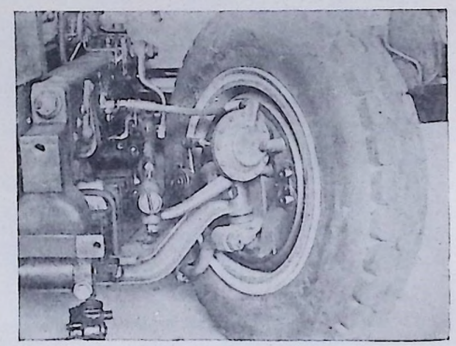


Fig. 5—Brake Chamber mounted on Front Wheel

Maintenance Instructions

Compressor

Test oil level daily and replenish if necessary. Every 1,000 miles drain the crank case, flush with clean oil, and refill with the best grade of medium or heavy motor oil. (Complete specifications for the most satisfactory oil will be furnished on request.)

Every 10,000 miles remove the inlet and discharge valves, and clean the passages, valves and seats. If Compressor is the unloading type, the unloading valves, seats and passages should be cleaned.

The unloading valve adjusting screws should be adjusted so that there is .010" to .015" between top of valves and adjusting screws.

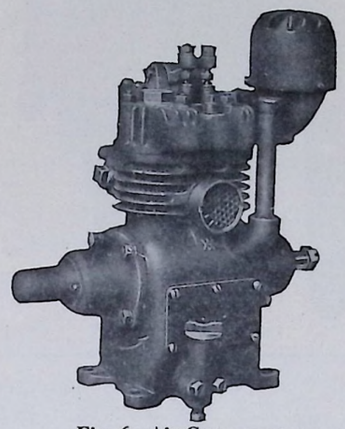


Fig. 6—Air Compressor

Every 10,000 miles the pulled curled hair should be removed from air cleaner, washed in gasoline, and replaced. If centrifugal air cleaner is used, remove complete unit every 10,000 miles, thoroughly clean and replace. Do not oil the revolving parts.

Every 10,000 miles check the Compressor Mountings to be sure that the drive is in alignment and all bolts are securely fastened.

Every 50,000 miles remove the Compressor and overhaul it completely.

Reservoir Pressure Limiting Devices

Governor—(For use with Compressor having unloading valves.)

Every 5,000 miles test the Governor for leakage and check the pressure setting.

To test Governor for leakage, apply soap suds to exhaust port (small hole in valve guide); if air leaks through this port when governor is cut in (compressor operating against pressure) it indicates that lower valve is not seating properly. If air leaks through this port when governor is cut out (compressor idling) it indicates that upper valve is not seating properly. If either valve is not air tight, it should be removed, cleaned and ground with soap to a tight seat. Do not use grinding compound.

The governor cut-in pressure should be 70 lbs. per square inch, and have a range of 15 lbs.

To raise cut-in pressure, increase tension of tube on valve by screwing down adjusting screw.

To increase cut-in and cut-out range, remove one or more shims from underneath upper valve guide.

Pressure Regulating Valve—(For use with Compressor without unloading valves.)

Every 5,000 miles test valve for leakage and check the pressure setting.

To test valve for leakage, apply soap suds to exhaust port. If air leaks through this port before pressure in reservoir has reached the pressure determined by setting of valve, it indicates that diaphragm valve is not seating properly, and should be removed, cleaned, and ground with soap to a tight seat. Do not use grinding compound.

Pressure setting should not be more than 75 lbs. per square inch. If pressure varies 5 lbs. from orginal setting, adjustment should be made. To raise pressure setting, screw down adjusting screw.

Every 10,000 miles the pulled curled hair should be removed, washed in gasoline and replaced.

These devices regulate the reservoir pressure only; the pressure admitted to the brake chambers is determined by the brake valve setting.

Reservoir

Drain daily in cold weather and every week in warm weather.

Brake Valve

Every 5,000 miles test valve for leakage, and check with test gauge the maximum pressure delivered from the valve to the brake chambers.

To test valve for leakage, apply soap suds to the exhaust port; leakage through this port, when the brakes are released (no air pressure in brake chambers) indicates that the intake valve is not seating properly. Leakage through exhaust port when the brakes are held applied (with air pressure in brake chambers) indicates that the exhaust valve is not seating properly. If either valve is not air tight, it should be removed, cleaned and ground with soap to a tight seat. Do not use grinding compound.

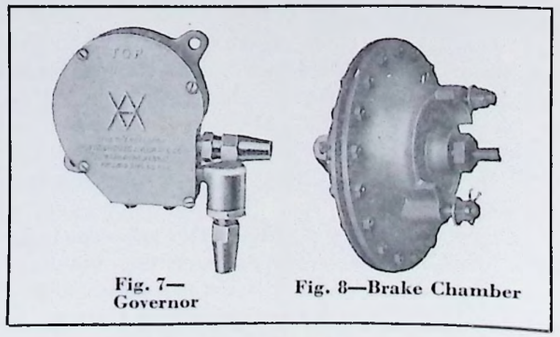


Fig. 7—Governor

Fig. 8—Brake Chamber

If pressure setting varies 5 lbs. from original setting, adjustment should be made.

Pressure delivered from valve can be raised by placing shims between loading spring and plunger.

Exhaust valve stroke of foot operated valves must not be less than 5/64" and on hand operated valve must not be less than 3/64". Care must be taken when placing shims between spring and plunger, so as not to decrease this stroke.

Every 10,000 miles the lambs wool and screens should be removed from the hand operated valve, washed in gasoline and replaced.

Application Release Valve

(For use on trucks and buses having Hand Control Brake Valve.)

Every 5,000 miles test valve for leakage.

To test valve for leakage, apply soap suds to exhaust port; leakage through this port when the brakes are released (no air pressure in brake chambers), indicates that the intake valve is not seating properly. Leakage through exhaust port when the brakes are held applied (with air pressure in brake chambers), indicates that the exhaust slide valve is not seating properly. If either valve is not air tight, it should be removed, cleaned and ground with soap to a tight seat. Do not use grinding compound.

Every 10,000 miles the lambs wool and screens should be removed, washed in gasoline and replaced.

Remove the diaphragm and replace with a new one at least every two years.

Emergency-Application Release Valve

(For use on trailers.)

Every 5,000 miles test valve for leakage.

To test application release portion of this valve for leakage, apply soap suds to exhaust port; if air leaks through this port when the brakes are released (no air pressure in brake chambers), it indicates that the intake valve is not seating properly. If air leaks through exhaust port when the brakes are held applied (with air pressure in brake chambers), it indicates that the exhaust slide valve is not seating properly. If either valve is not air tight, it should be removed, cleaned and ground with soap to a tight seat. Do not use grinding compound.

To test emergency portion of this valve for leakage, disconnect emergency connecting hose between truck and trailer with air pressure in trailer reservoir. The trailer brakes should then apply

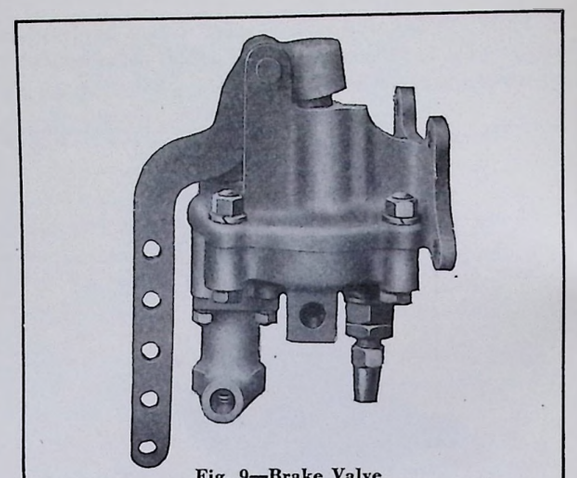


Fig. 9—Brake Valve

automatically. Apply soap suds to emergency hose or coupling on trailer; if air leaks through this hose or coupling from trailer, it indicates that the diaphragm is not seating properly. Then apply soap suds to exhaust port of application release portion; if air leaks through this port it indicates that the emergency valve is not seating properly. If the diaphragm is not seating properly, it is caused either by the diaphragm being worn out or dirt on top of the diaphragm is holding if off its seat. It should be removed and cleaned, and if worn out, should be replaced. If the emergency valve is not seating properly it should be removed, cleaned and ground with soap to a tight seat. Do not use grinding compound.

Remove the diaphragms and replace with new ones at least every two years.

Quick Release Valve

Every 5,000 miles test valve for leakage.

To test valve for leakage, apply soap suds to exhaust port with the brakes applied (with air pressure in brake chambers.) If air leaks through this port, it indicates that the diaphragm is not seating properly. If leaking, it is caused by either the diaphragm being worn out or dirt on top of the diaphragm holding it off its seat. It should be removed and cleaned and if worn out, should be replaced.

Remove the diaphragm and replace with a new one at least every two years.

Brake Chambers

Every 5,000 miles test brake chambers for leakage.

To test brake chambers for leakage, apply soap suds to outer edge of brake chamber and also to the diaphragm clamping bolts. If leaking, tighten the clamping bolts.

Every 2,000 miles, check the push rod travel. Adjust so that initial travel of rear axle brake chamber push rod is not more than 1/8" and the initial travel of the front axle push rod is not more than 3/4". (Be sure that the push rod is against diaphragm in release position.)

The maximum stroke of the rear axle brake chamber push rod should not exceed 1 3/4", and the maximum stroke of the front axle brake chamber push rod should not exceed 1 1/4".

Remove the diaphragm and replace with a new one at least every two years.

Tubing and Fittings

Every 10,000 miles test for leakage. Apply soap suds to tubing and fittings with air pressure in tubing. If leaking, tighten tubing fitting sleeve.

General Maintenance

Every 1,000 miles thoroughly lubricate the following: camshaft bushings, brake shoe anchor pins, brake linkage, levers, yokes, pins, etc.

WESTINGHOUSE BOOSTER

This device operates from the difference of air pressure caused by the suction of the engine.

In principle, it is the same as the B-K Booster. (See page 41.)

Adjustment

With the brake pedal in released position and levers A and B against the stops, adjust rod C until

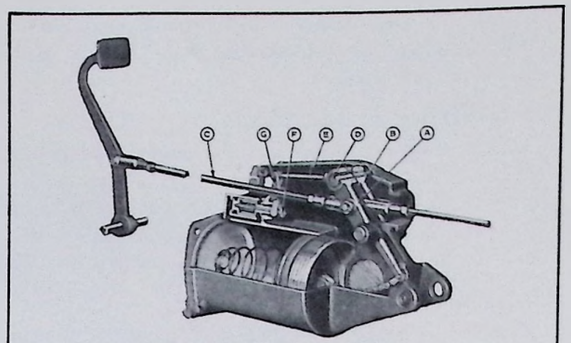


Fig. 1—Westinghouse Booster

pin D has 1/8" clearance all around the bore of the lever A. Adjust rod E and nut F until the end of lever G and nut F have 1/32" free movement. The device should now function properly, but if any difficulty is experienced, examine piping for leakage, also piston cup and valve seats, which should be smooth. Valves are lubricated with light grease.

The strainer should be thoroughly cleaned.

WILLYS-KNIGHT, MODEL 70

Minor Adjustment

Rear Wheels

The rear wheels should be adjusted first with car on jacks. Disconnect pull rod A, Fig. 2, then adjust anchor B, to .010"; upper and lower band to .025" clearance. The top eye of lever C should now be from 1/8" to 3/16" back of the center line of the band adjusting bolt as shown.

Front Wheels

Adjust screw D, Fig. 3, page 92, until brake drags heavily, then release until just free.

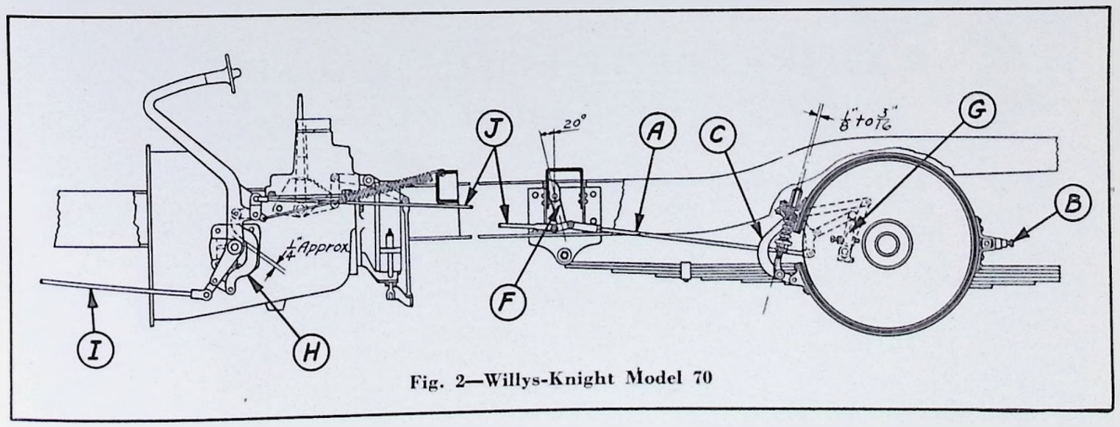


Fig. 2—Willys-Knight Model 70

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Check for equalization and release tight side. When in proper adjustment rear wheels will lock before the front.

Centralizing Front Shoes

This is done by means of a skeletonized drum and the shoes raised or lowered by means of the screws E, Fig. 4, so as to obtain between .010″ and .015″ clearance at upper and lower ends of the shoes as shown.

Major Adjustment

The rocker shaft lever F, Fig. 2, page 91, should be at an angle of 20°, as shown, when the brake is in released position and the rear cam shaft levers G are against the stop. If not, adjust rod A.

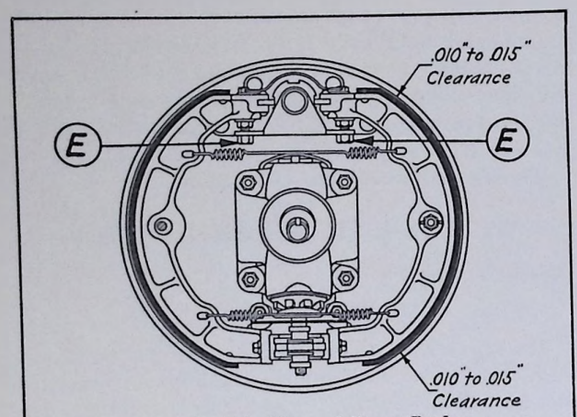


Fig. 4—Side View of Front Brake

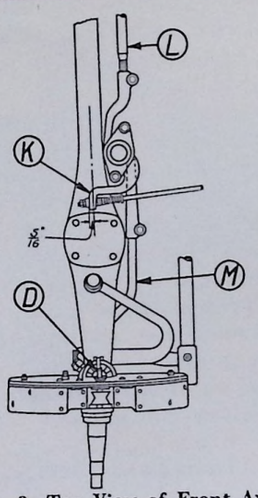


Fig. 3—Top View of Front Axle

Adjust brake pedal stop so that pedal clears the toe boards. The equalizer yoke H should now clear the hub of the brake pedal by ¼″ as shown. If not proper clearance, disconnect pull rod I and pedal rod J and set H to proper clearance, adjusting rods I and J so that they may be connected without disturbing the set clearance of the yoke or moving other rods or levers.

Front axle equalizer K, Fig. 3, when in proper position, should be 5/16″ ahead of center line of axle as shown. If not, adjust rods L and M.

ADJUSTMENT IS THE CAUSE OF MOST TROUBLES

BRAKE TROUBLES AND THEIR REMEDIES

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A TROUBLE SHOOTING CHART

COMPLAINT	CAUSE	REMEDY
Brakes Drag	Broken or weak pull back springs	Renew
	Release springs unseated or in improper position	Relocate
	Lack of linkage lubrication	Lubricate
	Brake pedal interferes with floor or brake linkage with chassis	Clear
	Eccentric improperly adjusted (Bendix Brakes)	Readjust at eccentric
	Improper leverage or obstruction	Locate and adjust
	Improper adjustment—unequalized	Readjust
	High spots	Remove
	Ends of external band touching	Adjust for clearance
	Bands distorted—unequal clearance	Correct and adjust
Squeaking Brakes	Exposed rivets in contact with drum	Redrive rivets or reline
	Road grit, drum dust or metal particles in lining	Remove with wire brush
	Loose wheel bearings	Tighten
	Rusty band, anchor and lever pins or cams	Lubricate
	Drum out of round	Turn or grind
	Band out of shape	True up band
	Equalizer frozen	Lubricate or readjust brakes
	Loose rear anchor stud	Tighten or replace
	Ends of external band touch first	Bend out points
	Glazed lining	Reline
	Band frozen on rear anchor	Lubricate so band moves freely
	Drum scored	True drum
	Loose rods, causing vibration	Tighten
	High areas of unequal pressure	Readjust
	Worn anchor pins	Renew or build up
	Twisted anchor pins	Straighten
	Distorted shoe	Replace
	Thin drum distorted under pressure of shoe	Replace
Chattering	Badly worn shoe or band support	Renew pins or rebush
	Loose wheel bearings or axle spring seats	Tighten
	Weak rear springs	Add extra leaves or install heavier springs
	Drum out of round	Turn down
	Lining loose on rivets	Reline or rerivet
	Loose rear anchor bolt	Tighten or replace
	Grease on linings	Clean or renew
	Broken or weak return springs	Replace
	Dry or rusty control parts	Free and oil
	Rod movement obstructed	Locate trouble and free
	Worn rear anchor	Build up by brazing or shims
	Anchor pin twisted	Straighten
	Too much clearance on lower half of band	Adjust
	Improper linkage adjustment	Check up
	Action of some lining "dopes"	Reline
	Loose dust shield and brake supports	Rerivet

FOR BRAKE SERVICE STATIONS

COMPLAINT	CAUSE	REMEDY
Grabbing	Loose wheel bearings	Tighten
	Sticky or grease-coated linings	Reline or clean
	Adjustment on pull rods incorrect	Adjust
	Equalizer frozen or off-center	Free and equalize properly
	Rear axle loose on springs or frame	Make necessary repairs
	Carrier bracket too free	Readjust and set
	Drum out of round	Turn or grind true or replace
	Lining loose on rivets	Reline or rerivet
	Loose, worn or twisted anchor pins	Tighten or renew
	Weak rear springs	Add more leaves to spring
	Band twisted	Straighten
	End of bands touching	Adjust
	Anchor clearance too great	Adjust
One Brake Slips	Lining coated with grease	Clean or reline
	Equalizer off-center	Adjust
	Band out of shape	Reshape
	Loose, worn or twisted anchor pins	Tighten or renew
	Rivets touching drum	Rerivet or reline
	Glazed lining	Reline or remove
	High spots on lining	Smooth up
	Sand, pebbles, embedded in lining	Clean
	Unequal adjustment	Readjust
	Bent brake parts interfere with operation	Straighten
	Rods and levers not moving freely	Clean and lubricate
	Lining worn	Reline
	Release spring fully compressed (band brake)	Shorten spring or replace
	Lever position incorrect	Release pull rods and adjust—starting at brake bands
	Pull back springs too strong	Relieve tension or replace with lighter springs
Brakes Pull to One Side	Unequalized	Adjust
	Sticky or gummed lining ("brake dope")	Reline
	Loose lining, loose rivets	Rerivet or reline
	Band clearance adjustment worn or lost	Replace and readjust
	Drums scored or out of round	True drum
	Loose wheel bearings or spring clip	Tighten
	Twisted or out of round bands	Straighten or round
	Equalizer rusted or off-center	Free up, adjust, oil
	Incorrect toe-in (front wheels)	Adjust caster angle of front axle to 15-20°. Adjust wheels.
	Play in steering joints	Reduce play to ½" turn in wheel
Lining Wears Rapidly	Drums scored	Turn or grind drums
	Brakes dragging	See "Brakes Drag"
	Too soft lining on hard or scored drum	Use proper lining and true drum
	Play in spring shackles, bolts, etc.	Locate and adjust
	Unequal brakes	Readjust

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BRAKE TROUBLES AND THEIR REMEDIES

IT has been customary in the past to attribute all of the difficulties experienced with brakes to the brake lining. It seems quite logical to consider such troubles as grabbing, slipping, or squeaking to be caused by the lining, especially where these difficulties are often eliminated when the brake linings are replaced with a different type of material.

Distribution of information on the subject of brakes has changed this impression considerably and it is today generally known that the adjustment of the individual brake parts is the greatest factor in obtaining satisfactory operation.

Some difficulties however, such as grabbing, squeaking, glazing and slipping when wet, may or may not be corrected by adjustment, these difficulties sometimes being caused by the condition of the brake lining.

If trouble is experienced after new lining has just been applied, it can be corrected by adjustment, but after the linings are in use the surface conditions may change due to grease, dirt, the use of dressings, or dragging, and when this has taken place, the remedy is not always by adjustment.

The Trouble Shooting Chart shown on pages 94 and 95 will be found helpful in locating the more common causes of brake troubles and correcting them.

Front End Alignment

Other difficulties than the above may be caused by the alignment of the front wheels. There are three settings or adjustments of the front wheels which must be correct before good steering and satisfactory braking can be obtained. These settings are known as camber, caster and toe-in.

Incorrect front wheels alignment causes excessive tire wear, shimmy, skidding, and under certain conditions it may result in a complete loss of control when the brakes are applied. Since the symptoms cannot always be detected when the car is on the testing machine, a road test may be necessary in order to locate the trouble.

Front wheel alignment requires special equipment and a knowledge of the correct settings for each make of car. Further information regarding this work and the selection of suitable equipment will be furnished on request.

Chatter

(*See also* SQUEAKS, page 100.)

Chatter is a low rate vibration which is caused by the brake alternately grabbing and releasing. It is more common on propellor shaft or parking brakes. (See Propellor Shaft Brakes, page 5.) If not corrected, it may develop into a grab. (See Grabbing, page 98.) Adjustment will generally correct chatter complaints.

It is often caused, however, by grease on parking brakes, and when such is the case, can be corrected by adjustment or cleaning, or both.

Chevrolet and Pontiac External Brakes

Chatter when backing the car is often experienced with the early Chevrolet and Pontiac external brakes. This can often be overcome by removing the anchor screw spring and locking plate and inserting washers between the anchor and anchor band. Set the clearance by means of the washers. Replace the regular screw with a standard cap screw and clamp the washers tight, making sure that the end of the screw does not touch the band.

Franklin Shaft Brake

Some external band brakes, such as the Franklin propellor shaft brake, are lined with one continuous piece of brake lining. Where chatter is present in these brakes, and adjustment does not remove it, a section of the lining about 2″ in length should be cut out of the band at the anchor, leaving the lining in two pieces, as shown in Fig. 1. This will usually overcome the difficulty.

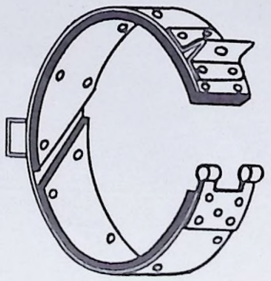


Fig. 1—Showing attachment of lining in two pieces on External Band Brake

Other cases of chatter on external band brakes are caused by weak or broken return springs and loose rear anchor bolts.

Nash Front Wheel Brakes

Chatter in the front wheel brakes on Nash cars up to 1928 may be due to using woven or flexible lining. This brake will not be successful unless lined with the same material as originally equipped. It requires a very hard moulded lining.

Moulded lining is quite free from chatter.

Internal Shoe Brakes

Chatter in internal shoe brakes is due to loose or broken return springs or worn anchor bushings.

Cutting or Scoring

Brake drums are generally made from a sheet of flat steel which must necessarily be soft to withstand the forming operation. This operation will harden them to a certain degree as they are usually formed cold.

Some drums are quite soft, in fact, so soft that the brake lining will pick up metal from the surface. If a highly resistant lining is used on these drums severe cutting will result.

Higher carbon content in brake drums is coming into use and the wear and cutting of drums is lessening because of the increased hardness of the steel.

Steel vs. Cast Iron Drums

The most satisfactory drum surface is cast iron, but its physical characteristics make it unsuited for light brake drums such as used on light cars. Cast iron will readily crack when heated, whereas steel is quite ductile and will not crack when subjected to sudden temperature changes unless it is of very high carbon content.

The free carbon which is found in cast iron apparently prevents the combining of the released particles of iron which readily occurs with steel drums when scoring is present. Steel does not contain very much free carbon. It is mostly combined.

Gun Iron or Special Alloy Drums

The gun iron or alloy drums sold in the replacement field and which are so successful, contain free carbon which prevents abrasion and are highly recommended where service is severe and drum cutting is present.

The use of this type of drum permits the application of heavy duty types of lining which are highly resistant to wear, but which readily cut soft type drums.

Rivets

After the lining has worn, the rivets, if not properly countersunk, are likely to come in contact with the drum and cause cutting, especially if the rivets are copper or steel copper covered. Brass tubular rivets show the least tendency to score and are recommended for all brake relining work. (See Rivets, page 24.)

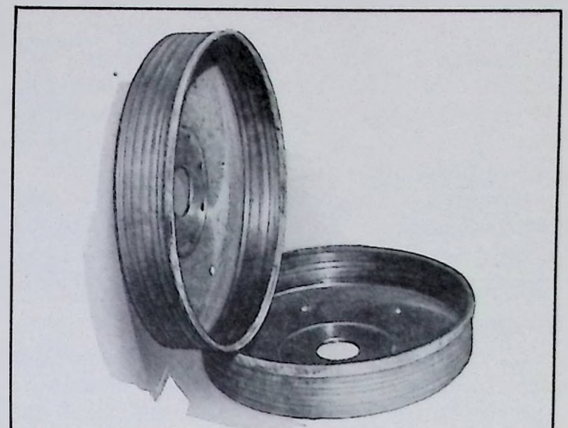


Fig. 2—Scored Drums

Inspect Drums When Relining

If a new lining is applied to a badly scored brake drum (See Fig. 2), the high ridges of the drum are likely to be cut off by the excessive pressure of the brake band on so small an area. Once the metal becomes bedded in the lining, the cutting progresses until the surface of the lining is covered.

For this reason, it is always advisable to check the condition of the drums when relining. They should be smooth and flat so that the lining surface will make contact over their entire area.

Dust Also Causes Cutting

Scoring may also develop even where the rivets are properly countersunk and the drums smooth. It is sometimes caused by the accumulation of dust in the brake. This dust, which contains small particles of metal as well as material from the lining, gets between the lining and the drum and starts scoring. If blown out frequently by means of an air hose, it will have less chance to cause damage. (See Dirt, below.)

Dirt

It is just as important to keep the brake and its parts free from dirt as it is to keep any other part of the car clean.

If dirt is allowed to remain on the brakes and

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brake mechanism, it not only absorbs the oil from the joints but is likely to become embedded in the lining and cause rapid wear on the brake drum.

Where available, an air hose can be used for removing accumulations of dirt from the drums of internal brakes. On brakes provided with inspection plates, this can be done without removing the wheels by holding the nozzle of the hose over the hole while the wheel is revolved by hand.

The joints of the brake linkage frequently become covered with mud which is thrown up by the wheels. This mud contains moisture which rusts the moving parts of the mechanism, interfering with their smooth operation and causing a reduction of pedal pressure at the wheel brakes.

It is always a good plan to inspect the linkage before making an adjustment, cleaning off and lubricating the various joints, clevis pins and toggles whenever they are found in this condition.

Dragging

A dragging brake is often the result of improper adjustment or it may be caused by the fact that the bands are distorted so that they touch the drum only in spots. Dragging not only retards the car but may heat the drum to such an extent that the paint on wheels and drums becomes burned or blistered. In time, it also causes the surface of the lining to become burnished.

Drums which are out of round may also cause a brake to drag.

Another cause of dragging is weak or broken return springs. (See Return Springs, page 10.)

The heat of the dragging brake expands the drum and causes the condition to become worse on external type brakes. Careful inspection and readjustment are necessary for its correction.

If the brakes have been dragging, examine the brake lining for a burnished spot, especially if it is difficult to equalize the brakes. Roughen the polished surface with a file or grinder.

Early Hydraulic Brakes

As the weather becomes warmer a hydraulic brake of the early type may begin to drag due to the heat expanding the liquid in the system. This is very easily taken care of by releasing the plunger valve in the reservoir for a moment in the dash reservoir type. This will permit the wheel pistons to return to the "off" position and still maintain a full system. (See Lockheed Brake, page 64.)

Dragging Clutches

In clutches, dragging refers to the tendency of the driven shaft to continue to rotate after the clutch is released, which makes it difficult to shift gears without clashing. Grease from the clutch release bearing may find its way to the friction surface and cause a gummed facing, or the springs releasing the plates may be ineffective. To remove the gum, wash the clutch out with kerosene when it is in the released position. If the clutch is equipped with a clutch brake, the brake may not be functioning properly.

Dressings

Friction dressings for flexible linings have appeared on the market in various forms and consist of combinations of various oils, Fullers' earth or pitches.

While dressings are effective in temporarily reducing squeaking they do so at the expense of brake efficiency, because they add lubrication which necessitates increasing the pedal pressure to such a point that the parts are held rigid. This lubrication gradually absorbs and the brakes, when heated, will harden the dressings, forming a very smooth hard surface. (See Glazing, below.)

Flexible linings to which dressings have been applied and which are giving trouble can only be corrected by removing the bands or shoes from the car, scraping the surface free of the material and then washing the lining with gasoline. If trouble is still experienced, it is necessary to replace the lining.

Do not use brake preparations. Brake linings are designed to operate without further attention except for possible cleaning of foreign matter, such as dirt or grease.

Glazing

Glazing is the formation of a hard, highly polished surface coating on a friction lining. It is generally caused by oil, grease, soap, or mud of fine consistency finding its way to the frictional surface.

The glaze must be removed before satisfactory braking can be obtained. The best way to do this is by scraping, which necessitates removal of the bands or shoes.

A slightly dragging brake will become highly polished due to the burnishing effect of the brake drum and though it may not be glazed, will have the same effect in operation.

Brakes with glazed or burnished linings are greatly affected by water unless the possible pressure is sufficient to break the water film.

Grabbing

When the brake is applied and it suddenly seizes the wheel and stops its rotation, even though the pressure applied to the pedal is light, the brake is said to grab.

A glazed, burnished or gummed brake lining, a drum out of round, or a brake which is out of adjustment or chattering is likely to grab.

The most frequent cases met are on brakes which are out of adjustment.

In cases where the torque or driving action is absorbed by the springs of the vehicle (See Hotchkiss drive, page 10) there is a possibility of the twisting of the axle in braking causing brakes of the mechanical type to lock. If the brake rods and levers are in the proper position however, the motion of the axle will not have any serious effect on the action of the brake.

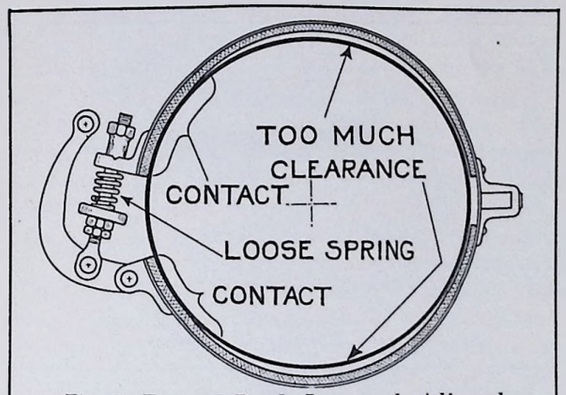


Fig. 3—External Band—Improperly Adjusted

External Brakes

If the upper band on an external brake is quite stiff and is so adjusted that the first part to make contact is at the leaving end, it will frequently grab, due to the bands being suddenly applied with full contact by the action of the end of the band which is drawn tight through its contact with the drum. Loose springs may also cause the band to wrap suddenly around the drum. Bend the end of the band slightly outward so that the contact is more uniform, and be sure the bands are concentric and the drums true.

Internal Brakes

Some types of internal brakes, such as the later Chevrolet brakes, have a tendency to grab unless lined with the correct type of lining. These brakes have a high self energizing effect and require a low friction lining. Johns-Manville produces a special type of Die Formed lining which will eliminate this complaint on Chevrolet cars. (See J-M Catalog Section.)

Loose Spring Clamps

Car springs are usually attached to the axle by means of U-shaped clamps. These clamps should be examined carefully to see that they are tight. If loose, they may permit the axle to move slightly when the brakes are applied with the possibility of shearing off the pin which holds the leaves of the spring together.

There may be some slight motion on the pin, due to the loose clamps, which will cause some mechanical brakes to grab, as it suddenly moves the axle backward a short distance and so tightens the brake.

Grease

Grease should be kept from brake surfaces as it not only reduces the friction but eventually results in the formation of a gum or glaze, which causes grabbing. In the case of folded lining, it causes swelling and may result in dragging.

Once a lining of the woven or folded type becomes covered with grease it is difficult to obtain equalization of the brakes. In most cases it is advisable to replace the linings and prevent future occurrence of the grease leakage. It is almost impossible to remove all traces of the grease as it becomes entrapped in the spaces between the yarn.

However, if the leakage is noticed in time it can be washed from the lining with gasoline after which a strong water solution of washing soda or lye should be used to remove the remaining oil from the gasoline.

Some apply a heating torch and burn the grease out but this generally carbonizes the oil and eventually causes a glaze. Moulded linings are more readily cleaned of grease.

Slipping

Slipping is a condition where the brakes do not hold properly. It may be caused by grease, water or improper adjustment. External brakes, being exposed to water, are subject to slipping when wet or after having been wet with soapy water when washing the car.

The present day high pressure car washers will force water into the drums of internal brakes and cause slipping when the car is first driven. This condition, however, is only temporary. A few applications of the brake will correct the difficulty.

A liquid, whether it be oil or water, will act as a lubricant and the brake pressure, if sufficient, will squeeze the liquid out. A light liquid is easily squeezed out, whereas, a heavy oil will remain between the surfaces due to its viscosity or fluid

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thickness. Where air or booster brakes are used, the pressure is high enough to force the water out and there is little, if any, noticeable effect of the water in the action of the brake.

Where brakes are often exposed to water, the adjustment must be set to obtain the greatest possible pressure and nothing further can be done, except to apply a Booster to increase the pressure. (See Booster Brakes, page 41.)

The soap used in car washing, if not properly washed out, may cause a coating on the lining and drum. If this coating becomes burned it will cause a glaze which must be removed by scraping. (See Glazing, page 98.)

On certain Bendix three shoe brakes, slipping or a hard pedal may be caused by assembling the cam separating the shoes upside down. This cam is stamped with an arrow which should point upward for front brakes and downward for rear brakes. The long end of the cam operates against the primary shoes. (See Bendix Brakes, page 33.)

Squeaks

All audible sounds are vibration of the air and travel away in all directions from the vibrating object as do waves on the surface of a pond into which a stone has been thrown. The tone or pitch of the sound depends upon the rate of vibration.

Squeaks in brakes are caused by a very high rate of vibration, set up in some of the brake parts; it may be the brake drum or it may be the metal brake band or shoe. If these parts were heavy there would be practically no tendency to squeak as the necessarily high vibration of the parts would require such energy as the brakes are unable to produce. It may result, however, in brakes "grunting," which is low-rate vibration or chatter.

Many believe that brake lining is the cause of squeaks, when, as a fact, it is more usually the *way* the brake band is applied to the brake drum. As an illustration, if a violin bow is drawn lengthwise over a violin string, it will not create a sound. It requires a cross-action before sound will be produced; and small strings produce high notes, large strings, low. Under these two conditions the friction has not been changed. It is the way the bow has been applied. The same is true with the brake bands or shoes. If they are applied to the brake drum incorrectly through improper application of the lining or by wrong adjustment, they are likely to cause vibration, either singly or together. You will see from the above that squeaks are the result of uneven or improper contact and do not usually come from the brake band lining itself.

Many are inclined to differ with this conclusion from having had the experience of changing the lining to a different make and correcting the trouble. But perhaps they have not considered that the removal and replacement of the bands or shoes for relining have actually changed the adjustment of the bands and that this was the real factor which eliminated the trouble.

Localized Pressures Cause Squeaks

If the brake lining is worn so that rivets come in contact with the brake drum the brakes will not only squeak but the rivets are likely to cut the brake drums severely. (See Cutting, page 97.) In this case, it is the high localized pressure of the small rivet head on the drum which causes the squeak.

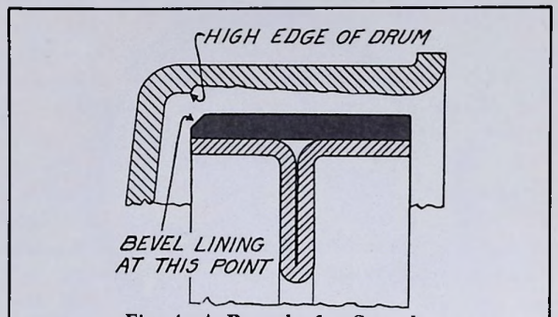


Fig. 4—A Remedy for Squeaks

Uneven wear of the brake drum surface also causes high pressures which result in squeaks. An example of this condition is shown in Fig. 4. The high edge on the inside curve of the drum prevents a perfect lining-to-drum contact, producing excessive pressure between it and the corresponding edge of the lining when the brake is applied.

Where equipment for turning is not available and a moulded lining is used, a simple remedy is to bevel the edge of the lining, as shown. By making it fit the contour of the drum in this way, the squeaking condition will be reduced, if not entirely eliminated.

Loose Front Wheel Bearings

There has developed a tendency at times for the front brakes to squeak even though all of the ordinary brake adjustments and proper method of attachment have been looked after. This squeak is not excessive but is annoying and can usually be corrected by tightening the front wheel bearings, which adds to the rigidity of the wheel and prevents the squeak. The complaint occurs with practically all four-wheel brakes whether they are external or internal type.

External Brakes

Most squeaky external brakes will be found adjusted so that the upper band end contacts first. The drum carries the band around due to friction, but the spring of the distorted band overcomes the friction and it assumes its original position, only to repeat the cycle. This occurs very rapidly, thus causing squeaks. If the clearance is very little at the back portion of the band, it may result in a grab. (See Grabbing, page 98.) There is a tendency for mechanics to keep the band away from the drum at the top and this causes the condition explained above. (See Fig. 5.)

The lower band may also be distorted and act in a similar manner. A squeak may appear only for a short period. This is caused by the wearing of the lining changing its relation to the drum. Further wear changes the relation further and out of the range of squeak. Moisture in the air will also have its effect in two ways, one by changing the friction through its lubricating effect and, more often, by swelling a flexible type lining through slight absorption and changing the relation of the parts.

In some cases where brake squeaking is a common complaint, the application of the brake band lining in a slightly different manner will help. In the average external brake, the lining should be attached in two pieces, one on the upper half of the band and one on the lower half, with a gap at the anchor point. This also applies to propellor shaft brakes to which the lining is often attached in one piece. (See Fig. 1, page 96.)

Wire Wheels

Since squeaks are the result of vibration, and wire wheels are quite resilient, tortionally, it is to be expected that brakes on cars with wire wheels are more likely to develop squeaks unless they are kept in more nearly perfect adjustment.

The more flexible supporting of the front wheels makes it necessary to be quite careful of the shoe adjustment on the front brakes if quiet brakes are to be maintained.

The rigid supporting of the rear wheels permits the standard adjustment of the rear shoes.

Other Causes of Squeaks

Squeaks are frequently caused by the drums being out of round or worn thin, and cases of this kind are almost impossible to remedy except by the renewal of the drum.

Accumulations of dust and worn particles of lining inside the drum on internal brakes may also cause squeaks. Blowing out these accumulations

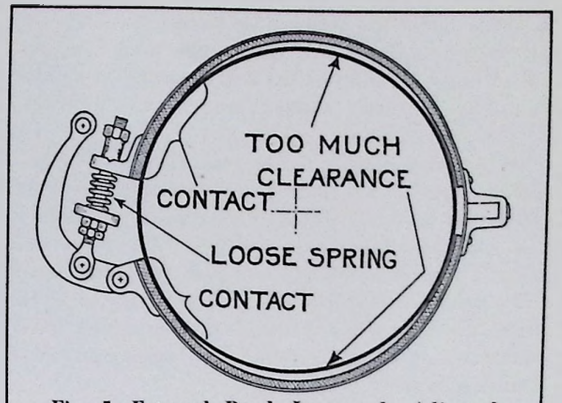


Fig. 5—External Band—Improperly Adjusted

with an air hose as outlined under Dirt, page 97, will overcome this complaint.

Weak anchor springs on external brakes or weak return springs on internal brakes will sometimes cause heavy vibration when the brake is applied.

It must be remembered that the introduction of lubricating material such as vaseline, castor oil, graphite, Neats foot oil or other brake dressings, reduce efficiency of the brake and that in most cases their success is only temporary. Dressings are not recommended, but if used care should be exercised in driving the car immediately after application, as the stopping distance required will be considerable. (See Dressings, page 98.)

Most squeak troubles are a result of improper application of the lining to the band or shoe or to one of the other conditions mentioned above and the elimination of the squeaks is usually a matter of locating and correcting the particular condition.

Brake Clearance

It is quite generally known that every car or brake has certain peculiarities, although to all general appearances the brakes are the same in construction. While brake adjustment is standard in most cases, it becomes necessary at times to vary the adjustment slightly from standard practice in order to obtain satisfaction. The variation is mostly in the clearances between the lining and the drum, which clearance, in a way, is an indication of the position of the anchor pin where adjustable.

Lockheed Internal Brake

Past experience has indicated that the most generally satisfactory clearance of these shoes and the drums is to set the toes or upper part of the shoes to .010" clearance by means of the cams

and the heels or portion near anchor pins to .004" clearance by means of the anchor pins. This is quite easily accomplished where inspection plates are provided or by means of a skeletonized dummy drum.

While this setting of the clearance will be generally satisfactory there will be cases where slight variation of these settings will be required as in the Chrysler 75 wire wheel job. On these cars it has been found effective to give the shoes on the front brakes only .027" clearance at the toe of the front shoe and heel of the rear shoe, and .012" clearance at the heel of the front shoe and toe of the rear shoe.

Bendix Three Shoe Brakes

The general average clearances between the shoes and drum for Bendix three shoe brakes, which will give a soft pedal and smooth action are as follows:

Set toe of primary shoe to .018" clearance
Set heel of primary shoe to .010" clearance
Set heel of secondary shoe to .004" clearance.

These clearances can be obtained by adjustment of the clearance cams and variation of the position of the shoe anchors.

The shoe anchors, if released by slightly loosening the nut on the back of the backing plate, may be jarred into a new position by means of a lead hammer.

Variation of the above clearances may be found necessary in some cases, to vary the action of the brake to meet special conditions, but these will be found infrequent, and attention will be called to them as they arise.

Bendix Two Shoe Brakes

The clearance of the drum and shoe on the two shoe Bendix brake, for general satisfaction should be set to .008" at the cam end of the shoe and .014" at the toe end of the shoe or where the notched adjustment wheel is located. Variation of these clearances may be necessary in some cases.

These clearances can be determined by the use of feeler gauges through inspection holes where provided in the drum, by the use of skeletonized dummy drums or a drum truing gauge. (See page 61.) The Lockheed dummy drums in some cases can be used for this work.

Steeldraulic Brakes

Proper lining to drum clearance on Steeldraulic brakes is very important. As used on cars up to 1931, clearances at the centralizing cam should be approximately as follows:

10" and 11" diameter brakes —3/64" clearance.

12", 14" and 15" diameter brakes—1/16" clearance.

Due to slight modifications in construction, the clearance at the centralizing cam on Steeldraulic brakes used in 1931 cars should be set somewhat smaller. Between .025 " and .032" will be found satisfactory.

External Band Brakes

Where external bands are used on the rear wheels a good average clearance between the drum and band is .010" at the anchor and .025" to .028" at the band ends. The bands must be concentric or have as uniform a clearance all around the band as the above clearance will permit.

SQUEAKS ARE NOT ALWAYS CAUSED BY THE LINING

SERVICE STATION EQUIPMENT

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SERVICE STATION EQUIPMENT

THE servicing of vehicle brakes has become specialized and has resulted in the development of a large number of special mechanical devices, many of which are essential to the proper operation of the Service Station.

The flat rate system of charges for repairs makes it necessary to include as a part of the equipment, various other devices or machines which will expedite the different operations necessary in producing first class workmanship in a limited time.

The more completely equipped station is in a better position to function, and, as investigation has brought out, generally commands the major portion of the available or potential business.

Space does not permit a description of every item of special equipment which is available, but the list given on the following pages will be found fairly complete. Information regarding a particular tool or device not described may be secured by writing to Johns-Manville.

MINIMUM EQUIPMENT FOR SERVICING BRAKES

At the present time, brake relining service cannot be properly rendered without the following equipment:

Jack
Wheel Puller
Brake Lining Cutter
Drilling and Counterboring Machine
Rivet Press
Pedal jack, wrenches and small tools

The above equipment is not sufficient to properly conduct a Brake Service Station, but is considered sufficient for the general repair shop which has occasion to reline brakes as a part of the service rendered.

EQUIPMENT FOR A FIRST CLASS BRAKE SERVICE STATION

Where the major service rendered is confined to brakes, it becomes necessary to properly equip the station in order to meet competition and render quick and efficient service.

The minimum equipment necessary for a first class Brake Service Station is as follows:

Jack
Wheel Puller
Rivet Press
Brake Lining Cutter
Drilling and Counterboring Machine
Brake Drum Lathe or Grinder
Brake Tester
Suitable air compressor, pedal jack, wrenches and small tools.

Expansion of the business will necessitate the need for more than one of the above units, such as the drilling and counterboring machine or the rivet press. Since these units are limited in capacity, due to the great number of rivets required for each brake shoe, they cannot keep pace with the other operations.

Many stations are installing lifts such as used for greasing, as these permit of raising the car to a convenient height for rapid work.

Carriage Jacks

There are many types of carriage jacks on the market, some being mechanical lever types and others hydraulic. (See Fig. 1.)

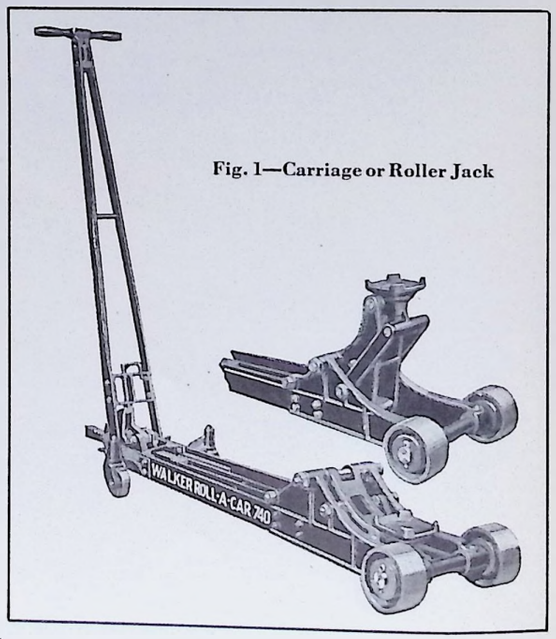


Fig. 1—Carriage or Roller Jack

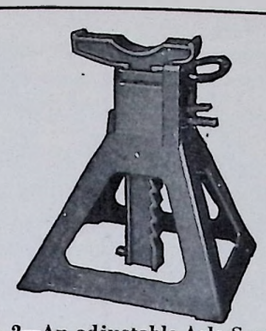


Fig. 2—An adjustable Axle Support

Carriage jacks not only permit of quickly raising the car, but also of moving it easily in most any direction in a limited space. These jacks generally have a small supporting pad which becomes covered with grease due to placing it directly under the center of the rear axle where grease has leaked from the differential housing. This should be carefully located to prevent possible slipping with injury to the mechanic.

A better way to support the vehicle after it has been raised on the carriage jack is by means of an adjustable support, placing one under the axle near the spring. These supports (See Fig. 2) are safe and rigid and their use also releases the jack for other work instead of tieing it up while the car is being serviced.

Wheel Pullers

There are several of these available in the market. There are two types used: the direct pull type and the shock type.

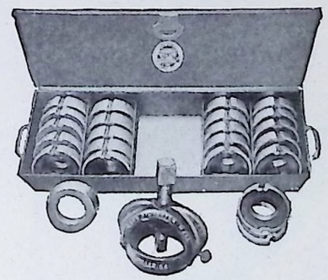


Fig. 3—Direct Pull Type Wheel Puller

Direct Pull Type

The direct pull type consists of a cap, which is screwed on to the threads holding the hub cap and may be tapped to fit a thread of certain diameter and pitch or may contain collars or rings of various thread diameters or pitches, the suitable collar being selected for the job in hand.

In the center of the cap in line with the end of the axle is a heavy screw which, when the cap is screwed on the wheel, will push the axle shaft out of the wheel or pull the wheel off the shaft as the case may be. (See Fig. 3.)

This type of puller is the better type as it does little damage when properly screwed in place and properly used. It is an expensive type as there are generally many collars necessary for the various makes of cars.

Another pull type is shown in Fig. 4, the difference being in the use of a wedge in place of a screw as shown.

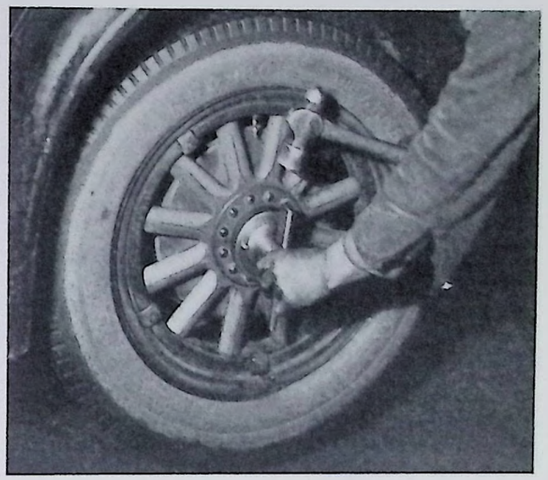


Fig. 4—Wedge Type Wheel Puller

Shock Type

The shock type consists of a short heavy hexagonal bar of tough steel, one end of which is tapped with a thread which will fit the end of the axle shaft, in place of the retaining nut.

The bottom of the tapped hole is square so as to butt firmly against the end of the shaft.

When used, it is screwed in place with the wheel resting on the floor. The opposite wheel is raised so as to permit of the shaft's moving when the puller is struck with a heavy hammer which drives the axle shaft free from the wheel.

When removing the opposite wheel, it is lowered so as to rest on the floor and the loose wheel jacked up and removed from the shaft.

It should be remembered that a light hammer will only rivet the head of the puller and that a very heavy sledge will do less damage and easily remove the wheel, generally with one blow, which is really a very heavy push. (See Fig. 5, page 106.)

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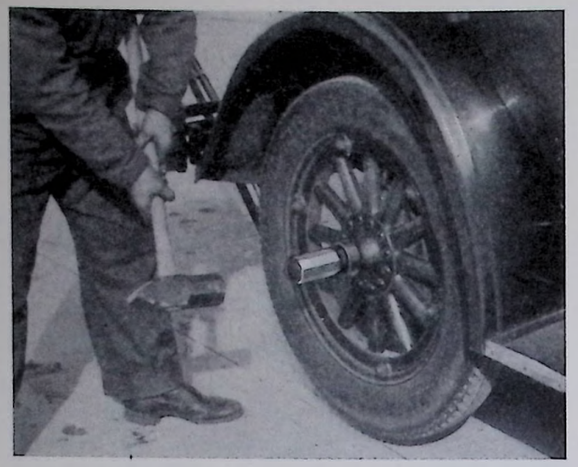


Fig. 5—Shock Type Wheel Puller

Care should be taken not to hit a glancing blow or the end of the shaft might be bent.

Drilling and Counterboring Machines

It is quite essential that rivets be countersunk beneath the surface of the friction material, and, with the harder types of linings, it is necessary to drill the holes and counterbore them.

Several machines are available to do this work, all being specially designed for this service.

This unit should have sufficient clearance to take care of all bands and shoes and should be driven by at least a one-quarter horse-power motor capable of continuous operation without undue heating. It should be supplied with various drills and counterbores which can be quickly attached.

Drilling and counterboring machines are frequently equipped with a wide grinding or sandpaper wheel on the back side of the motor for surfacing the lining or removing the burrs around the counterbores.

Rivet Presses

Special foot operated presses are available for clinching or heading rivets, and where a great demand is made on the presses, automatic rivet feed attachments are available also. In such cases the press cannot be used for removing old rivets.

This unit should be capable of removing the old rivets either by cutting and pushing out or by punching alone. It should be equipped with readily attachable tools for properly rolling over the tubular rivets when used in the bands and to split the tubular portion into a star head when used for clutch facings. The press also should have sufficient clearance to take all of the various sizes of bands and shoes and be sufficiently strong to head over solid rivets in case the same rivet is used to hold the fitting on the bands as well as the lining.

Dies should be supplied for solid rivets also.

For economy of space, the drilling and counterboring machine and the rivet press are frequently combined into one unit, as illustrated in Fig. 7.

Brake Drum Lathes or Grinders

Since it is necessary for the brake drum to be true and also free from grooves or scores, it is sometimes necessary to either replace the drums or turn them for a new surface.

The average lathe will not swing the wheel unless the head and tail stock is built up or the lathe is one known as a gap lathe.

The special machines available for truing drums are either lathes which cut the metal, grinders which remove the metal by means of an abrasive wheel, or combinations of both.

Very hard drums must be ground, but in most cases drums are sufficiently soft to turn and while the lathe may be designed for turning, attachments are generally supplied for grinding also. Drum grinding machines are generally provided for turning drums as an added feature. (See Fig. 6.)

Most drum lathes are rather large and heavy and are classed as stationary equipment. The special boring tool shown in Fig. 8, however, is of the portable type and can be carried to the work and

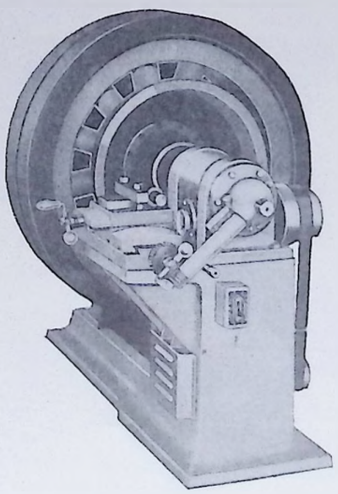


Fig. 6—Drum Lathe

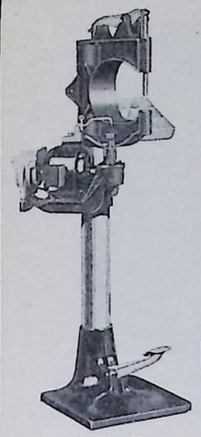


Fig. 7—Drilling and Counterboring Machine and Rivet Press

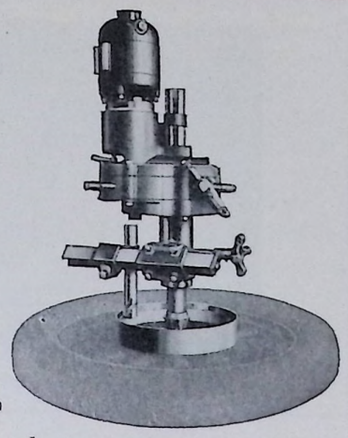


Fig. 8—Portable Boring Fixture for turning Drums

mounted on the wheel. This feature is an advantage in grinding bus and truck wheels, which are sometimes very heavy and difficult to move about from one place to another.

The machine illustrated in Fig. 8 is reasonably priced and operates by revolving the cutting tool rather than the wheel of the vehicle.

Brake Testers

The introduction of four wheel brakes made it necessary to have some quick means of determining whether all brakes were holding alike and also which one, if any, needed further adjustment.

This is accomplished by means of a brake tester, various types of which appear on the market in a considerable range of prices.

These testers are of vital importance to the Brake Service Station as they will readily indicate to the car owner in a manner he can easily understand, what the trouble is with his brakes. They are without question, a factor of considerable importance in increasing the income of the station.

A brake tester, or in fact, any unusual machine, creates interest, and testers should, where possible without decreasing shop efficiency, be so located as to be readily seen by the passing motorist.

Where a drum lathe or grinder is a part of the station equipment, this also can be advantageously located. Care should be exercised however, to keep the machine neat and clean.

Principle

Brake testers all operate on the same general principle, that of measuring the resistance of the brake on each wheel.

Hand Type

The simplest and most inexpensive form is the hand type, consisting of a lever which is fastened to the jacked wheel. The lever contains some means of indicating the pull necessary to turn the wheel when the brake is set. Since each wheel must be tested separately, the operation is slow and the device limited to use in small stations. (See Fig. 9.)

Platform Type

This form tests the four wheels simultaneously. It consists of platforms on which each wheel rests. The car is either driven on and the brakes applied, or the car or platforms are moved by an air cylinder or other means. (See Fig.10.)

Where the car is driven on and where the car is moved by an air cylinder whose plunger is attached to the car, the platforms are connected individually

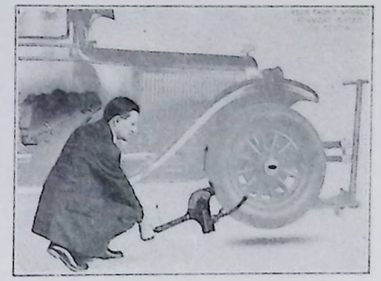


Fig. 9—Hand Type Brake Tester

to an indicating means such as a dial or gauge, which indicates the drag of each wheel.

Dynamic Type

This type (See Fig. 12, page 108) supports the vehicle on rollers rotated by an electric motor, the resistance to rotation provided by each brake

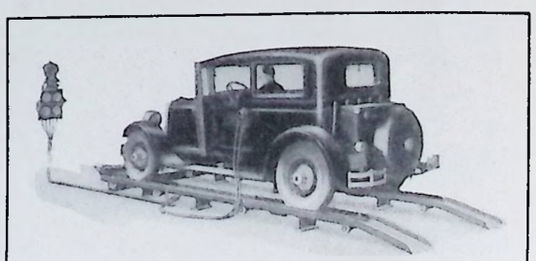


Fig. 10—Platform Type Brake Tester

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being registered on a dial. This is the most common and also the most expensive type.

Another dynamic type consists of rollers on which the vehicle is mounted, each wheel resting on a single roller.

All of the rollers are temporarily connected by shafts and gears, and each roller has a heavy flywheel also mounted on its shaft.

The car, which is driven in the usual manner, drives the rollers front as well as rear to a certain speed depending on the weight of the car being tested. This is to store sufficient energy into the fly wheels to be equivalent to a speed of twenty miles per hour of that weight car on the road.

The brakes are then applied as if stopping and at the same instant the rollers are disconnected from each other. Dials indicate the number of feet the rollers travel before they stop and equalization is determined by comparison of these distances. The tight brake will show lowest distance.

Instructions for the operation of any of the above types of testers are furnished by the manufacturers.

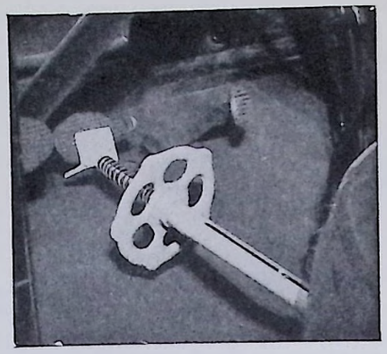


Fig. 11—Pedal Depressor in Use

MISCELLANEOUS EQUIPMENT

Air Compressors

Since proper inflation of the tires is necessary for efficient brake action and since air is also generally useful for cleaning, an air compressor should be a part of the equipment of every service station. There are many types available on the market.

Pedal Jacks

These are used to apply the brake pedal when adjusting brakes. Some are equipped with indicating means to show the amount of pedal pressure being applied. If it is desired to have wheels lock at, say 70 pounds pressure for a woman driver, the jack is set to 70 and the brakes adjusted until they will lock or have the desired resistance. The indicating device is not essential but is sometimes useful.

Bench Grinders

These are obviously useful in most any shop for sharpening tools, drills, or for the rapid removal of metal from a part which would otherwise have to be done by a hand file. When equipped with a wire brush, the bench grinder can also be used for cleaning shoes or bands. (See Fig. 13.)

Brake Lining Grinders

Special grinders have been developed for the purpose of making the relined shoes accurately fit the drum by grinding off the surface of the lining after its attachment to the shoe. Figs. 14 and 15 show two of several types of brake lining grinders which are available. Although the degree of precision in the fit of the shoes depends both upon the equipment and the skill of the operator, these machines are helpful in assuring quiet brakes and in eliminating the second adjustment often necessary after the lining has worn in.

The grinder shown in Fig. 15 consists of a grinding wheel which projects above the surface of a finished metal casting turned to the correct drum diameter. By passing the brake shoe across the grinding wheel, the lining is ground to fit it to the curvature of the casting. Several castings, having curvatures corresponding to different drum diameters, are supplied with the machine.

The grinder shown in Fig. 14 will grind the surface of the lining to the exact diameter of the brake drum, but it requires setting for each shoe. The shoe is supported on a pin through the anchor hole and is rotated against the grinding wheel. This machine is very accurate and produces very close work.

Further information regarding these grinders will be supplied on request.

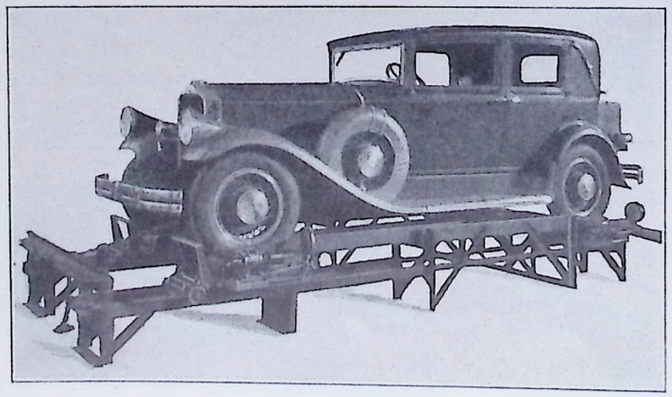


Fig. 12—A Dynamic Type Brake Tester

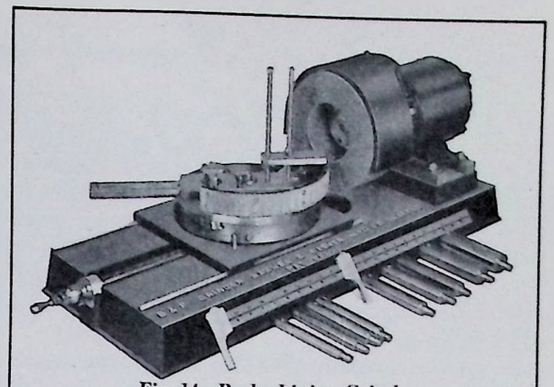


Fig. 14—Brake Lining Grinder

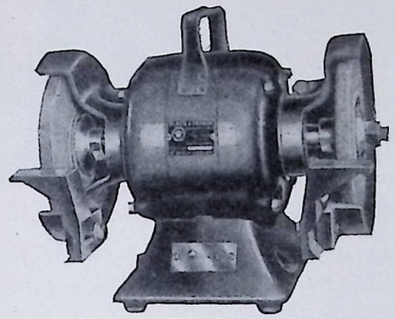


Fig. 13—Bench Grinder

Drum Truing Gauge

This device, while not essential where brake lining grinders of the type described above are available, will often be found useful, especially on those jobs where very careful adjustments are necessary to secure quiet brakes. Its use permits of properly fitting the shoes so as to obtain a full area contact between the brake lining and the brake drum. (See Fig. 16.) The device is carefully made and comes packed in a portable case as shown.

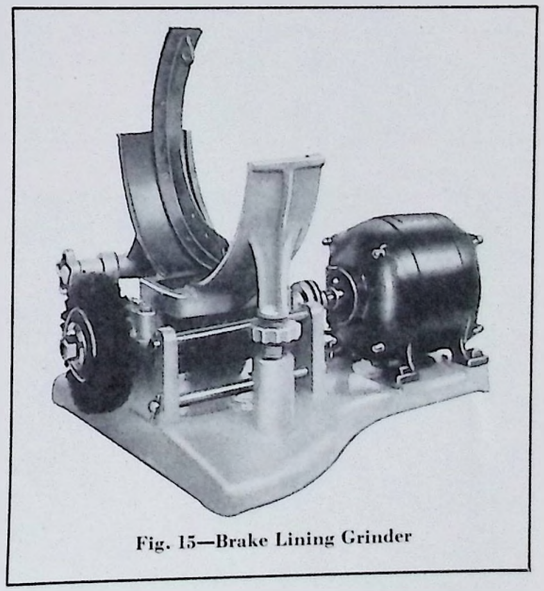


Fig. 15—Brake Lining Grinder

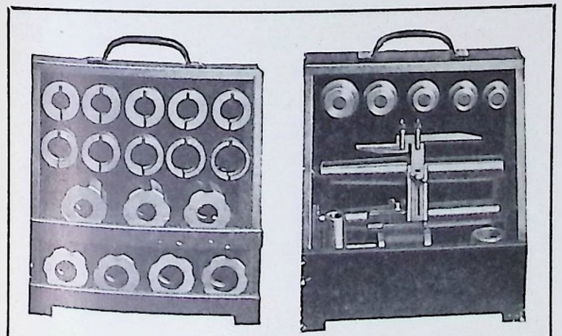


Fig. 16—Drum Truing Gauge

Wrenches, Tools

Large and small sockets with ratchet and plain holders, end wrenches, pliers, cotter pin pullers, clamps, sledge hammer, hammers of steel and lead,

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extension drop lights, chisels, files, hack saws, electric drill and pinch bars should be included in the small tool equipment.

Each tool should have it place, and after using should be put back so it can be readily located when needed again. The efficiency of the shop will be greatly reduced if it is necessary to hunt for tools which are not in their accustomed place.

A board provided with hooks or other means of support and fastened to a wall makes a handy place for keeping wrenches and other small tools and helps prevent loss.

A very useful device is a thread file which is used to correct a thread which has been abused. A great deal of time can be lost trying to start a nut on a burred thread and there is always the chance of crossing it and ruining both shaft and nut. This device is shown in Fig. 17.

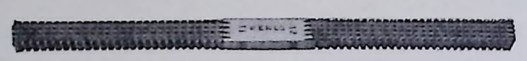


Fig. 17—Thread File

Lockheed cylinders become pitted and scored at times and require reconditioning. This is accomplished with a hone, which should also be a part of the equipment. Hones can be purchased from your jobber.

It is necessary to remove hub caps before removing wheels and there are many shapes which require special wrenches. Hub caps are frequently made of soft metal and are generally polished and easily bruised.



Fig. 18—A Handy Wrench for removing Hub Caps

The wrench shown in Fig.18 can be readily made from a piece of cotton farm belting, a piece of hard wood and a few bolts.

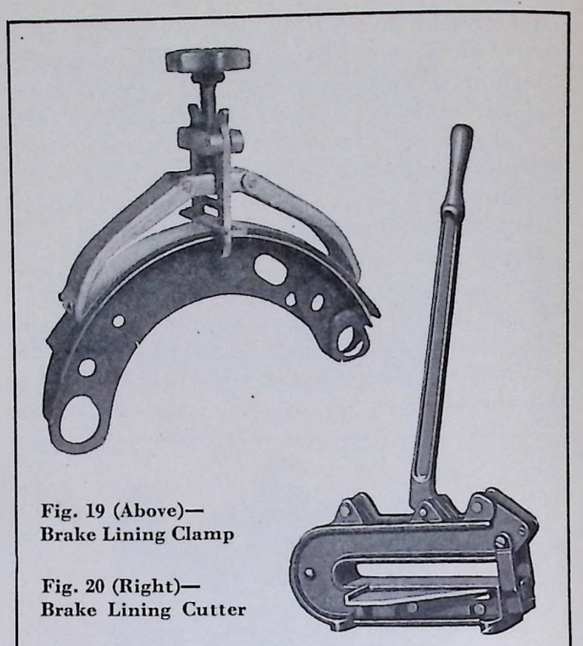


Fig. 19 (Above)—
Brake Lining Clamp

Fig. 20 (Right)—
Brake Lining Cutter

Brake Lining Clamps

A clamp for holding the lining in place when drilling and counterboring will be found helpful in obtaining a tight fit between lining and shoe. There are several of these available, a very good one being shown in Fig.19. It is light, strong, and reasonable in price and may be had in two sizes. Full information on request.

Brake Lining Cutters

For the service station handling woven linings and moulded lining in coils, a brake lining cutter is necessary. There are several of these on the market, most of which will cut lining of either type. (See Fig. 20.)

Brake Block Cutter

The standard brake lining cutters mentioned above are not suitable for J-M Brake Block sheet stock, which is a hard, rigid material supplied in sheets. (See Brake Blocks, sheet form, page 22.)

A special band saw, shown in Fig. 22 has been developed to cut this material. Full information regarding it will be supplied on request.

Spring Tongs

The special spring tongs shown in Fig. 21 will save time in replacing the return springs after the shoes have been removed. The larger pair is designed specially for Bendix Duo Servo and three shoe types of brakes as used on trucks, while the smaller pair is intended for similar brakes on passenger cars. See page 10 for illustration showing how the tongs are used.

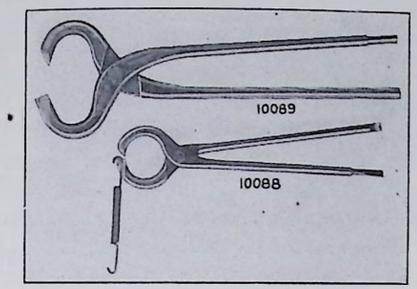


Fig. 21—Spring Tongs for Bendix Brakes

Bench Anvil

The bench anvil is a special shaped heavy casting which can be bolted to the bench and is useful for removing kinks from external bands. See Fig. 23.

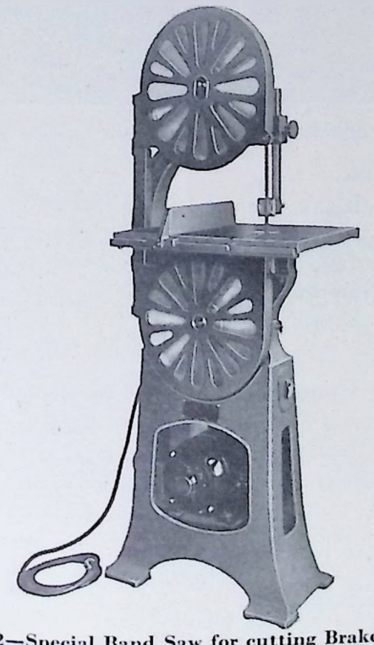


Fig. 22—Special Band Saw for cutting Brake Block Sheet Stock

Penetrating Oil

Where the brake mechanism is neglected and the various parts have become frozen or rusted tight, time can be saved by the use of penetrating oils, several brands of which are available.

These oils have high penetrating characteristics and will quickly loosen any rusted or frozen parts. Every brake station should include this material as a part of its regular supplies.

Supplies

Aside from the general supply of brake lining and rivets, an assortment of brake springs and grease retaining felt washers as well as a supply of cotter pins and lock washers of various sizes should be a part of every service station stock.

It is also advisable to have an assortment of Lockheed piston cups, a supply of Lockheed fluid and a few spare brake cylinders for this brake.

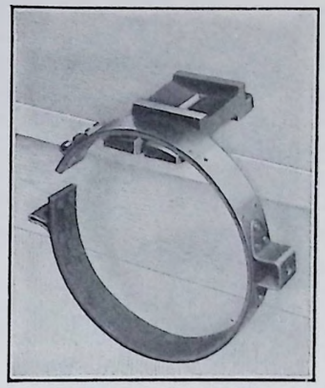


Fig. 23—Bench Anvil

APPROVAL OF EQUIPMENT

Johns-Manville engineers are constantly investigating new equipment for brake service work. The standards set are of the highest order and equipment found wanting is not approved.

The object of this work is to help the service station maintain a high quality of workmanship to the end that the service rendered the customer is efficient and satisfactory.

Brake Service Stations may purchase any equipment recommended by Johns-Manville with the assurance that the latest and most modern type of device of its class will be obtained. Full information regarding equipment which has been approved and is recommended will be supplied on request to any Johns-Manville Brake Service Station.

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An Attractive Front invites Customers

ESTABLISHING A BRAKE SERVICE STATION

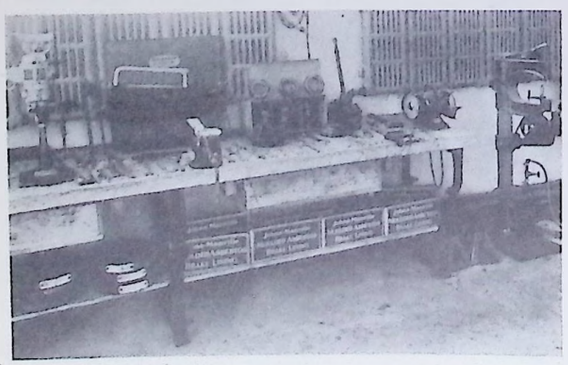
Location

Establishing a Brake Service Station presents a problem which is worthy of considerable thought.

Of first importance is the locality, which should be determined by the potential business possibilities. Having fixed this, a site should be selected which will be readily accessible to the greatest number of car owners in the locality—preferably one which is on or near a main traffic thoroughfare.

Building

Next of importance is the building itself, which should have electric service. The building should also be light, steam or hot water heated, well ventilated, free from posts, and if possible, should have a show window and suitable wide doors. It is also advantageous to have two doors, one as an entrance and one as an exit. The floor should be level concrete, free from cracks or broken places.



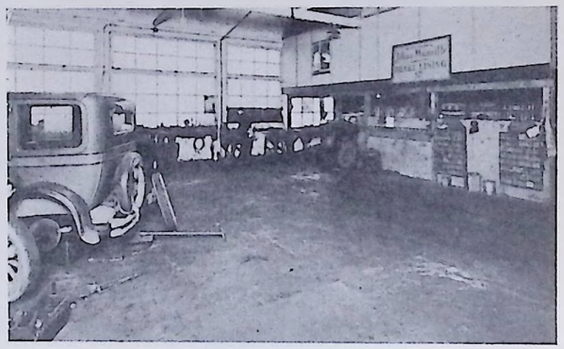
Good Equipment promotes Good Workmanship

The building should be attractive and should always be kept neat and clean.

Signs

An attractive sign which may be easily read by passing motorists is a most valuable asset. Such a sign should prominently display the words "Brake Service" or a similar short message. Its size will depend on the available space, but in any event the lettering should be large enough to be easily read from a distance.

If the business possibilities warrant, an electrically lighted sign is highly desirable since it can be seen at night as well as during the daytime. Special electric signs have been designed by Johns-Manville and are available to all J-M Brake Service Stations at prices which are considerably lower than they could be purchased for elsewhere. Complete information regarding prices and convenient time payments will be furnished on request.



Ample Floor Space makes for Efficiency

Floor Space

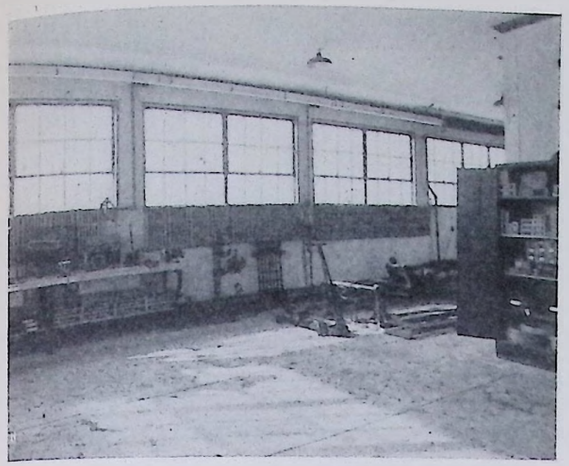
Depending on the extent of equipment desired, the floor space should not be less than 4,000 square feet for a first class Brake Service Station. This space will permit of the proper installation of the essential equipment and will also give sufficient room for handling several jobs at the same time.

Storage Space

If a parking space can be secured adjacent to the building it will permit of proper storage of finished jobs as well as cars which are to be serviced. Such space may also be used to accommodate a greasing service, which can be profitably handled in conjunction with brake work.

Other Services

Floor space permitting wheel aligning, battery, spring or tire service may also be desirable, as



Neatness is Another Asset in the Service Station

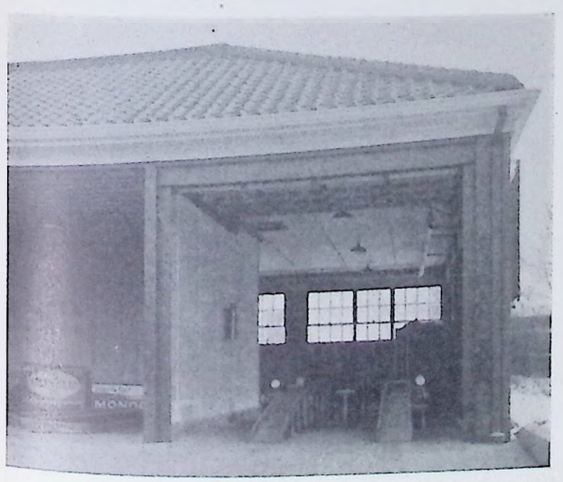
these services, too, are often handled advantageously in connection with brake service.

Service Charges

As in other services rendered motor cars, the system employed for charges for brake relining or adjustment is the popular Flat Rate system.

It is impossible to compile a flat rate system which would be universally practicable, as there are several factors entering into the establishment of the rate which vary considerably. Shop equipment, overhead and prevailing labor costs, which differ throughout the country, must all be considered.

After careful investigation, a guide has been prepared in convenient form, so that a rate can be quickly selected which will meet your local conditions. This guide, the Johns-Manville Flat Rate Guide, will be found quite complete and simple to use. It is furnished on request to all J-M Service Stations.

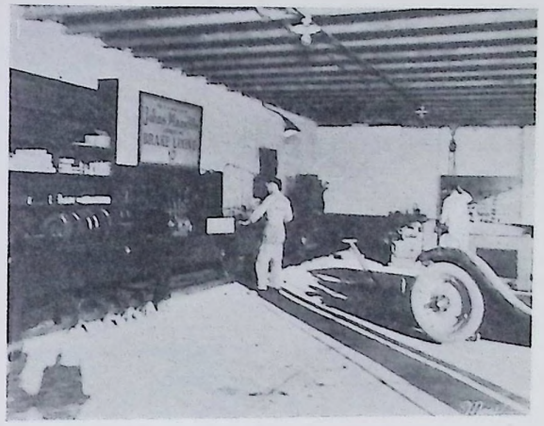


Tester Prominently Located creates Interest

Records

It is advisable to have a card system to record the name of owner, type of car, mileage when the lining was applied, and kind of lining applied. Other information, such as condition of the drums, whether the axles were packed against grease leakage, or new cups or cylinders were attached, which mechanic did the job, etc., should be noted so as to have a complete record of the operations.

This information will be found useful in the event of the customer registering a complaint or making claims for which you are not responsible. It will indicate whether your workmanship is such as to satisfy your trade, and by enabling you to



A Clean, Well-lighted Shop is of First Importance

locate cases where a customer fails to return for further service, it will help in building up your list of active accounts.

Such a record will also serve as a mailing list whenever you want to circularize your trade through the use of the mails.

Johns-Manville will gladly help you select cards for suitable records to meet various needs.

Courtesy

If inquiry is made among motorists, it will perhaps be surprising to hear their comments on the subject of courtesy as applied to the Automotive Service industry. This has perhaps been brought about through past contact with unscrupulous garages and gas stations, most of which, however, have now passed out of existence.

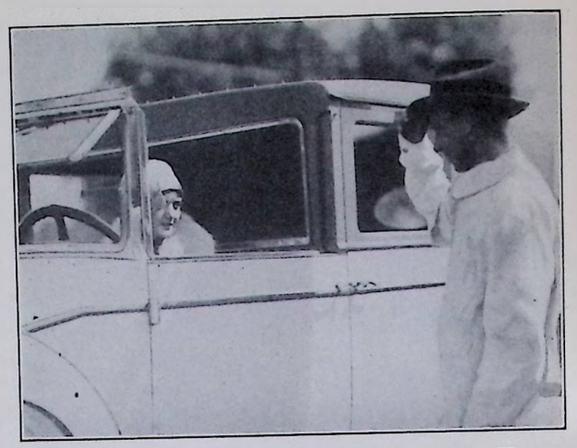
We are glad to note the value of courtesy is well recognized at the present time for with many

Johns-Manville: The Brake Re-Liner's Manual, Fourth Edition (1931)
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women operators now contacting with service stations, it becomes imperative to practice the utmost care and caution in conversation and attitude. Ladies are generally more sensitive to breach of etiquette and require more cautious handling, and even though frequent callers, familiarity should never be attempted.

When women customers drive in, always remember to have those with whom they contact lift the hat in greeting. This may seem a small matter but it is a mark of respect to which women are entitled and it should not be overlooked. You will find, too, that women will appreciate your thoughtfulness in such little matters as giving them crisp, new bills in change and in providing them with a comfortable, clean chair in case they are obliged to wait in your office or showroom.

In fact, there are any number of ways to please customers and gain their good-will by making courtesy a part of your service. Many of these are interestingly set forth in a booklet called "The Handbook for Service Station Salesmen," issued by the Vacuum Oil Company, 61 Broadway, New York City. They will be glad to supply a copy to any Brake Service Station on request.



In Greeting Women Customers always lift the Hat

MAKE COURTESY A PART OF YOUR SERVICE

JOHNS-MANVILLE AUTOMOTIVE CATALOG

Moulded Asbestos Brake Lining 117

Standard Woven Asbestos Brake Lining 118

Folded and Compressed Asbestos Brake Lining 118

Heavy Duty Asbestos Brake Lining 119

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Brake Blocks 122

Brake Block Sheet Stock 122

Brake Lining for Ford, Chevrolet, Pontiac 120

Woven and Moulded Asbestos Clutch Facings 123

Brake Band Rivets 119

Automobile Tape 121

Service Sheet Packing 124

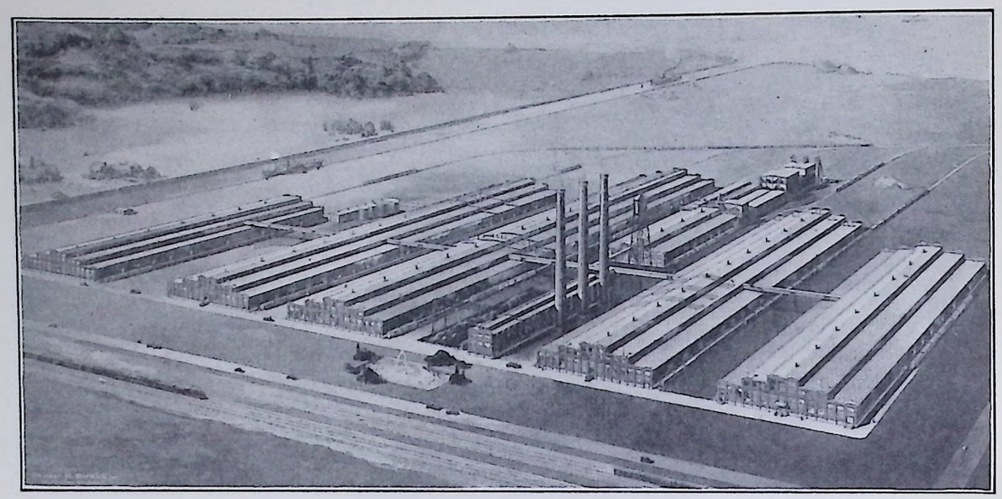
Seigelite Sheet Packing 124

Twisted Mogul Packing 124

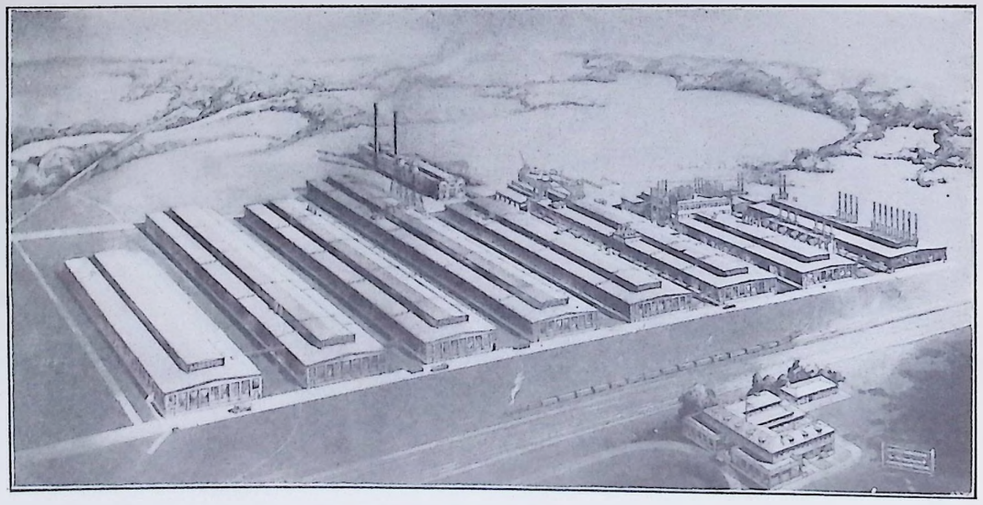
Asbestos Wick Packing 124

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THIS IS WHERE JOHNS-MANVILLE BRAKE LINING IS MADE



WAUKEGAN FACTORY, WAUKEGAN, ILL.



MANVILLE FACTORY, MANVILLE, N. J.

J-M MOULDED ASBESTOS BRAKE LINING

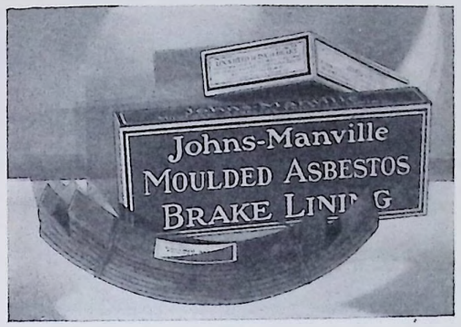
Johns-Manville Moulded Brake Lining is the outstanding development of recent years in friction materials. It is the original moulded lining, developed over six years ago by Johns-Manville and today the standard type of lining for internal brakes.

Uniform in composition throughout, J-M Moulded is noted for its smooth quiet braking action. With brakes properly adjusted this lining is practically squeakless. Although a lining of great toughness and strength, it is also semi-flexible and will conform readily to the band or shoe.

Another feature of J-M Moulded is its adaptability to the small clearances necessary on most internal brakes. It is held to close tolerances in manufacture, assuring a proper fit between lining and drum with a minimum of adjustment.

J-M Moulded is recommended for internal brakes as well as some protected external brakes. It is available in two forms—in cut-to-fit sets and in coils, as described below.

Write for the latest list of sizes and cars for which this lining is suitable.



J-M Moulded in Cut-to-Fit Sets

J-M Moulded Lining is packaged in attractive individual cartons in cut-to-fit sets, one set for front or rear wheels only to a container. Each segment is cut to the required length with the ends taper ground where necessary, and is curved to the proper radius to fit the particular brake shoe for which it is intended. Although it does not stretch or compress, the lining is sufficiently flexible to conform readily when applied to the shoe.

J-M Moulded in Coils

The same grade of J-M Moulded Lining as sold in cut-to-fit sets is also furnished in standard packages containing two 10½ foot coils, in all widths and in thicknesses from 5/32″ to 5/16″ inclusive.

This type is particularly suited to the smaller garage or service station, for it permits a wide range of service with a minimum investment in stock. By carrying as few as 10 coil sizes you can service 90% of all cars equipped with internal brakes. One size alone (2″ x 3/16″), fits 35 different passenger car and truck models.



List Prices per Foot—J-M Moulded in Coils

Thickness in Inches	WIDTH IN INCHES																		
	1¼	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾	4	4¼	4½	4¾	5	5¼	5½	5¾	6
5/32	$0.75	$0.90	$1.00	$1.20	$1.30	$1.50	$1.75	$1.90	$2.05	$2.20	$2.40									
3/16	.80	1.00	1.15	1.25	1.40	1.55						$3.40	$3.55	$3.75	$4.00	$4.25	$4.45	$4.65	$4.80	$5.00
7/32		1.25	1.50	1.70	1.90	2.15	2.30	2.50	2.75	2.95	3.15	4.15	4.45	4.70	4.95	5.25	5.50	5.75	6.00	6.25
1/4	1.15	1.25	1.50	1.70	1.90	2.15		3.15	3.40	3.65	3.90									
5/16																				

JOHNS-MANVILLE ASBESTOS BRAKE LINING



Standard Woven Brake Lining

J-M Standard Woven is a high friction lining of moderate mechanical strength, made of superior asbestos fibres from Johns-Manville mines. The special compound with which it is impregnated adds to its durability and increases the naturally high resistance of the asbestos to the action of oil, grease and water.

Standard Woven provides long, satisfactory service wherever a lining of the woven type is suitable—on practically all medium and light weight passenger cars and delivery trucks equipped with external brakes operating under normal braking conditions.

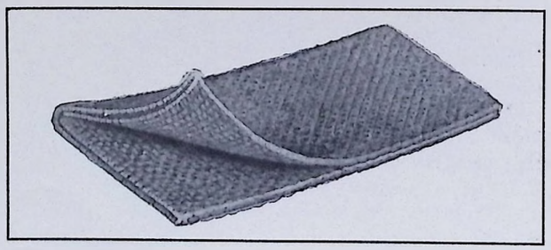
Sizes and List Prices per Linear Foot—Standard Woven and Folded and Compressed Brake Lining

Width, Inches	Thickness, Inches						Approximate Weights, Lbs.
	1/8	3/16	7/32	1/4	5/16	3/8*	50-ft. Rolls, 7/32" Woven
1	$0.45	$0.50	$0.55	$0.75	$0.95	$1.10	5
1¼	.55	.60	.65	.90	1.10	1.35	6½
1½	.65	.70	.80	1.00	1.30	1.55	8
1¾	.75	.80	.90	1.20	1.50	1.80	9½
2	.90	.95	1.00	1.35	1.65	2.00	11½
2¼	1.00	1.05	1.10	1.50	1.90	2.25	12
2½	1.10	1.20	1.25	1.70	2.10	2.50	14
2¾	1.20	1.30	1.40	1.85	2.30	2.75	15½
3	1.30	1.40	1.50	2.00	2.50	3.00	17½
3¼	1.40	1.50	1.65	2.20	2.70	3.25	19
3½	1.50	1.60	1.75	2.35	2.90	3.50	21
3¾	1.65	1.75	1.90	2.50	3.10	3.75	22¼
4	1.80	1.90	2.00	2.70	3.30	4.00	24
4¼	1.90	2.00	2.10	2.85	3.55	4.25	26
4½	2.00	2.10	2.20	3.00	3.75	4.50	28
4¾	2.10	2.25	2.35	3.20	3.95	4.75	30
5	2.20	2.40	2.50	3.40	4.20	5.00	32
5½	2.40	2.60	2.75	3.70	4.60	5.50	35
6	2.60	2.80	3.00	4.00	5.00	6.00	40

Standard sizes indicated by **heavy type.**

Sizes not listed above furnished on special order, subject to delay.

*Furnished in Folded and Compressed only.



Folded and Compressed Brake Lining

This lining is designed for cars and trucks equipped with braking systems which require a material of unusually high friction value.

Folded to the required width and thickness and hydraulically pressed into a material of great density, J-M Folded and Compressed Brake Lining combines exceptional strength with its high friction, providing unusually long service for a material of this type.

Another desirable feature of this lining is its tendency to smoothen or polish the drum surface, minimizing wear and making for an extra smooth brake action.

Folded and Compressed is supplied in 25 and 50 foot rolls, in widths from 3" to 6" and in 50 foot rolls in widths up to 2¾". This type of lining is also furnished in cut strips for Ford and Chevrolet passenger cars and trucks.

JOHNS-MANVILLE HEAVY DUTY BRAKE LINING

Many buses, trucks and other heavy vehicles demand a woven type of lining capable of standing up under severe service, and for these particular vehicles Heavy Duty is admirably suited.

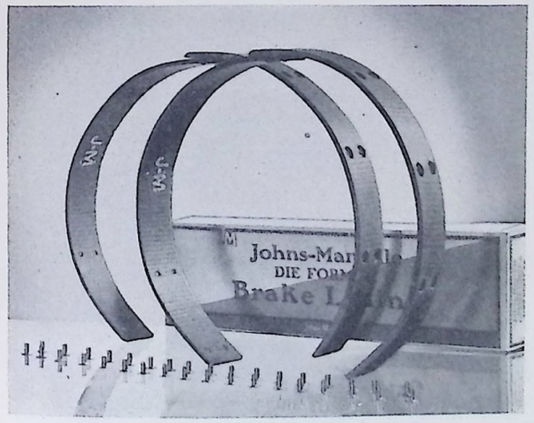
This lining is woven oversize, heavily impregnated with special oil, water and heat resisting compounds and then compressed into a dense, compact mass, square on both edges.

The finished product is tough and strong—a lining with ample mechanical strength for meeting the stresses and strains of continuous braking under heavy loads. It gives unusual service under such conditions, withstanding a severity of brake action under which linings of lesser strength would literally be torn to pieces.

Heavy Duty is furnished in 50 foot rolls in widths from 1½" to 2¾" and in 25 and 50 foot rolls in widths from 3" to 6" inclusive. Thicknesses are from 3/16" to 3/8". List prices supplied on request.



JOHNS-MANVILLE DIE FORMED BRAKE LINING



J-M Die Formed Brake Lining is the result of a year of study and research to produce a better brake lining for Ford, Chevrolet and certain Pontiac cars and trucks. It is a special material, made to meet the braking requirements of these cars only.

Formed in dies to exact size and supplied in segments already drilled and counterbored, this lining is easily attached to the band or shoe. Its special composition assures smoothness of stopping, freedom from scoring tendencies, and general all-round satisfaction on the above cars.

J-M Die Formed Lining is furnished in attractive cartons, with rivets, each carton containing material for front or rear brakes. Cut strips are also supplied in bulk, without rivets.

JOHNS-MANVILLE BRAKE BAND RIVETS

Johns-Manville Brake Band Rivets are a quality product, manufactured to the specifications of J-M automotive engineers. They are designed to provide an approved means of fastening the friction material to the brake band or clutch plate and to reduce the possibility of scoring to a minimum.

J-M Rivets are available in brass and aluminum, in split, tubular and semi-tubular types. They are supplied in ½ and 5 lb. packages, in boxes containing 1000 of each individual size and in 10 box packages, each package containing 100 rivets of any desired size. A special list showing the various sizes and types available and giving suggested service station assortments is available on request.

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JOHNS-MANVILLE ASBESTOS BRAKE LININGS

For Ford, Chevrolet and Pontiac Cars and Trucks

1931-28 FORD MODEL A PASSENGER

A good woven lining for front and rear brakes. Cut to size, drilled and counterbored, no cartons, no rivets.

Cat. 3102—8 pieces, 1 1/2 x .172/.182 x 14"....List price per set $ 6.80

A good woven lining for emergency brakes. Cut to size, not drilled and counterbored, no cartons, no rivets.

Cat. 5824—2 pieces, 1 x .172/.182 x 28-3/8"....List price per set $ 2.60

1931-28 FORD MODEL A PASSENGER, FRONT AND REAR
1929-28 FORD TRUCK, FRONT ONLY

Die Formed Lining. Furnished in cartons, with rivets, ready for attachment.

Cat. 310DF—4 pieces, 1-1/2 x .172/.182 x 14"....List price per set $ 3.40
Cat. 380DF—4 pieces, 1-1/2 x .183/.193 x 14", (Oversize)....List price per set $ 3.80

Die Formed bulk sets. Drilled, no cartons, no rivets.

Cat. 310DFB—4 pieces, 1-1/2 x .172/.182 x 14"....List price per set $ 3.40
Cat. 380DFB—4 pieces, 1-1/2 x .183/.193 x 14", (Oversize)....List price per set $ 3.80

Folded and Compressed bulk sets (Flat). Cut to size, drilled and counterbored, no cartons, no rivets.

Cat. 3167—4 pieces, 1-1/2 x .172/.182 x 14"....List price per set $ 3.40
Cat. 3168—4 pieces, 1-1/2 x .183/.193 x 14", (Oversize)....List price per set $ 3.80

1931-30 FORD MODEL AA 1 1/2 TON TRUCK, FRONT AND REAR

Folded and Compressed Lining. Cut to size, drilled and counterbored, no cartons, no rivets.

Cat. 555FCD—4 pieces, 2-3/8 x 1/4 x 18-5/8"....List price per set $10.50

1929 FORD MODEL AA 1 1/2 TON TRUCK, REAR ONLY

Folded and Compressed Lining. Cut to size, no holes, no cartons, no rivets.

Cat. 555FC—4 pieces, 2-3/8 x 1/4 x 18-5/8"....List price per set $10.50

Heavy Duty Woven Lining. Cut to size, no holes, no cartons, no rivets.

Cat. 555HD—4 pieces, 2-3/8 x 1/4 x 18-5/8"....List price per set $13.60

1931-30 CHEVROLET 6 CYL. PASS. AE, AD, FRONT AND REAR
1931-30 CHEVROLET 1 1/2 TON TRUCK, LT, LS, LR, FRONT ONLY

Die Formed Lining. Furnished in cartons, cut to size, drilled and counterbored, with rivets.

Cat. 548DF—2 pieces, 1-1/2 x 3/16 x 11-21/32" }
2 pieces, 1-1/2 x 3/16 x 5-29/32" } ....List price per set $ 2.50

1929 CHEVROLET 6 CYL. PASS. AC, FRONT ONLY
1930-28 CHEVROLET MODELS AB, LP, LQ, FRONT ONLY
1928 PONTIAC ALL MODELS, FRONT ONLY

Die Formed Lining. Furnished in cartons, cut to size, drilled and counterbored, with rivets.

Cat. 313DF—4 pieces, 1-1/2 x .155/.165 x 8-9/16"....List price per set $ 2.00

JOHNS-MANVILLE ASBESTOS BRAKE LININGS

For Ford, Chevrolet and Pontiac Cars and Trucks—Continued

1929 CHEVROLET 6 CYL. PASS. AND TRUCK AC, REAR ONLY

Die Formed Lining. Furnished in cartons, cut to size, drilled and counterbored, with rivets.

Cat. 336DF—2 pieces, 2 x 3/16 x 13-61/64" }
2 pieces, 2 x 3/16 x 16-13/32" } ....List price per set $ 5.10

1928-26 CHEVROLET 4 PASSENGER AB, SERIES V
1928-26 PONTIAC, ALL EXTERNAL BRAKES

Woven Lining. Cut to size, punched holes, no cartons, no rivets.

Cat. 5321—2 pieces, 2 x 5/32 x 33-15/16"....List price per set $ 5.44
Cat. 3161—2 pieces, 2 x 3/16 x 33-15/16", (Oversize)....List price per set $ 5.64

Folded and Compressed Lining. Cut to size, punched holes, no cartons, no rivets.

Cat. 5322—2 pieces, 2 x 5/32 x 33-15/16"....List price per set $ 5.44
Cat. 3162—2 pieces, 2 x 3/16 x 33-15/16", (Oversize)....List price per set $ 5.64

1931-30 CHEVROLET 1 1/2 TON TRUCK, LT, LS

Folded and Compressed Lining. Cut to size, no holes, no cartons, no rivets.

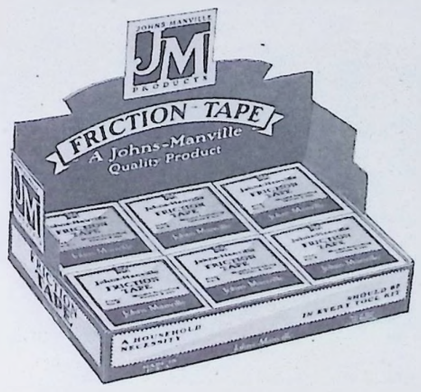
Cat. 562FC, Rear Brakes, 2 pieces, 2-1/2 x 1/4 x 16-9/16" }
2 pieces, 2-1/2 x 1/4 x 8-19/64" } ....List price per set $ 7.00
Cat. 563FC, Emergency, 4 pieces, 2-1/2 x 1/4 x 6-3/4"....List price per set $ 3.85

1930-28 CHEVROLET TRUCK, LR, LP, LQ, LM
1927-25 CHEVROLET TRUCK, SERIES X

Folded and Compressed Lining. Cut to size, no holes, no cartons, no rivets.

Cat. 577FC, Rear Brakes, 2 pieces, 2 x 3/16 x 36-23/32"....List price per set $ 6.00
Cat. 582FC, Rear Brakes, Oversize, 2 pieces, 2 x 1/4 x 36-23/32"....List price per set $ 8.50

JOHNS-MANVILLE AUTOMOBILE TAPE



This Display Container Holds 12 4-oz. Rolls

Johns-Manville Automobile Tape is strong and high in adhesive qualities, and will successfully meet the insulation requirements of automobile work.

To prove our confidence in this product, we will replace without cost, including transportation charges, any tape found defective within one year from date of manufacture.

One oz. rolls are shipped only in 3-lb. display containers.

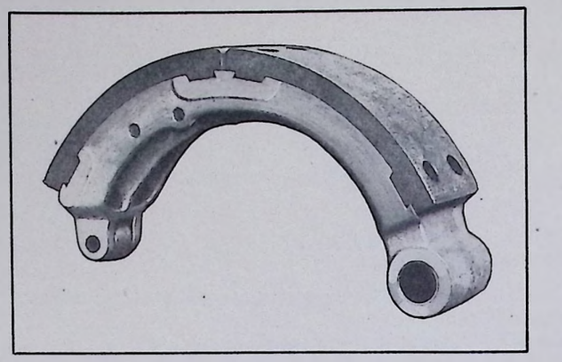
Two oz. rolls are shipped only in 3-lb. display containers.

Four oz. rolls are shipped either in 3-lb. display containers or in individual cartons.

Eight oz. rolls are shipped only in individual cartons.

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JOHNS-MANVILLE BRAKE BLOCKS



J-M Brake Blocks are specially designed for use with power-operated and high pedal ratio brakes. They are moulded to the exact size and shape required, are uniform throughout, and have the great toughness and strength required for high speed, heavy duty operation on heavy vehicles.

The uniform frictional qualities of these blocks provide a smooth, velvety brake which requires a minimum attention for adjustment and is dependable in all kinds of weather. These advantages coupled with their unusually long life in severe service, have led to their adoption by many of the leading fleet owners and bus operators throughout the country.

In countless instances, J-M Brake Blocks have run off mileage records of from 50,000 to 75,000 miles. Sixty companies, representing 90% of the more prominent operators in the bus business, have conducted extensive tests with J-M Brake Blocks, and excellent mileages have resulted in each instance. Only friction materials in which composition, density and hardness have been carefully controlled can give such excellent service.

J-M Brake Blocks are supplied in a variety of styles, including the "full coverage" type and the "keeper" type, in thicknesses from 3/16" to 1" inclusive, in widths up to 24" and in diameters to fit any size drum. Nearly 250 different catalog numbers, suitable for hundreds of models of busses, trucks and taxicabs are now available.

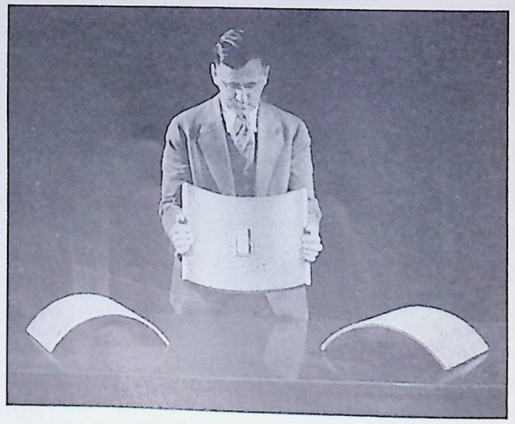
A list of available blocks will be furnished on request.

JOHNS-MANVILLE BRAKE BLOCK SHEET STOCK

Brake Block Sheet Stock is the newest addition to the Johns-Manville line.

This material differs from J-M Brake Blocks in form only and is made for the same type of service. It is supplied in sheets 24" and 36" in width and from 3/16" to 1" in thickness, the sheets being curved to fit various drum diameters. Pieces of any required size are readily cut from the sheets with a special band saw. (See Brake Block Cutter, page 110.)

A small stock of sheets will service practically all power-operated brakes, which assures quick, profitable turnover for the service station. Further information can be obtained from the Johns-Manville salesman or the nearest J-M office.

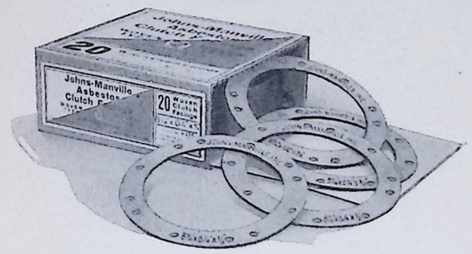


JOHNS-MANVILLE WOVEN AND MOULDED ASBESTOS CLUTCH FACINGS

For years, Johns-Manville Asbestos Clutch Facings have been known as quality products of long and satisfactory service. As standard factory equipment they have won the approval of a number of the foremost car manufacturers. As replacement facings they have met every need of the service station and repair shop.

Two types of J-M Asbestos Facings—woven and moulded—now provide perfect clutch action for all present-day clutches. Each has been developed to meet certain definite requirements of the service for which it is recommended. While differing in some characteristics, both types are made to exacting specifications, carefully surface ground to insure uniform frictional contact,—which means smoother clutch action, easier shifting and the elimination of chattering and grabbing. These facings do not require bothersome "wearing-in" because there are no high spots to wear off.

An assortment of J-M Facings in sizes to fit the more popular clutches requires only a small investment in stock—and there is a liberal profit for you in every one you sell.



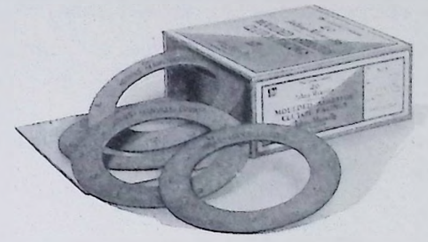
J-M Woven Facings

Noted for their satisfactory performance on practically all types of clutches, J-M Woven Facings are particularly recommended for use on plate clutches of the non-resilient type. They are surface ground to a soft, velvety finish, are highly resistant to heat and have the proper resiliency for providing smooth pickup. The quality of their woven asbestos material insures long life under the most severe conditions.

J-M Woven Facings come packed in cartons of twenty facings, accurately drilled and counterbored for easy application.

Recommendations

Use Woven Facings on Fuller, Chevrolet, Detroit Gear, Merchants and Evans, Brown-Lipe Standard, Covert, Hoosier and Detlaff clutches. Also on the early model A Ford passenger cars and on Borg and Beck clutches having free floating discs or where driven plate is not designed for mechanical resiliency. For resilient plate type clutches, use Moulded Facings.



J-M Moulded Facings

These Facings are designed to give excellent service on all multiple disc clutches, as well as on the newer types of plate clutches having radially slotted driven plates for providing proper resiliency. Moulded under great pressure into a hard, dense material, they are non-absorbent of grease and oil and unusually high in mechanical strength. Like J-M Woven Facings, their surfaces are ground to exact thickness.

J-M Moulded Facings are packed in cartons of twenty facings, drilled and counterbored to insure accurate fit.

Recommendations

Use Moulded Facings on Long, Rockford (using segments), 1929 Fords, Oakland, Borg and Beck 1929 and many 1928 models using a radially slotted driven plate, and on all multiple disc type clutches.

For plate clutches where the facing is not riveted to the plate, use Woven Facings.

Johns-Manville: The Brake Re-Liner's Manual, Fourth Edition (1931)
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JOHNS-MANVILLE AUTOMOTIVE PACKINGS

Seigelite Sheet Packing



Seigelite Sheet Packing is a fibrous material that resists the action of water, oils and gasoline. It has an extremely high tensile strength, and when immersed in water or other fluids becomes extremely tough, resembling rawhide.

Seigelite is recommended for gaskets on water manifolds, crank or transmission cases, differential housing, carburetors, clutch and timing gear covers but should not be used for cylinder heads or exhaust manifolds. It is tougher than wrapping paper or cardboard, and costs less than rubber.

This packing is supplied in rolls 36″ wide cut to any yardage required, in thicknesses of 1/64″, 1/32″ and 1/16″.

Not to be used for cylinder heads or exhaust manifolds.

Service Sheet Cartons



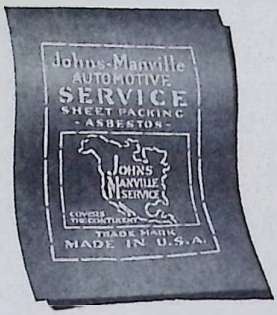
Service Sheet is also furnished in handy cartons, as illustrated above, each carton containing one roll 10″x 50″ in size and either 1/32″ or 1/16″ in thickness.

Asbestos Wick Packing No. 4202

Made of several strands of asbestos twisted into a total thickness of approximately ¼″—unlubricated.

For use around exhaust pipe coupling nuts. Furnished in 1-lb. balls.

Service Sheet Packing



Service Sheet is an emergency packing for practically any flange service in the automotive industry; it can be used for cylinder heads and inlet and exhaust manifolds where they bolt to the cylinder block.

Made of asbestos fibre bonded with a special heat-resisting compound. It is strong and dense, and does not squeeze thinner when the joint is tightened, thereby preventing leakage.

Graphited one side only, thus when joints are broken, the gasket will stick to one surface and part from the other. Scrap can be saved and used, as Service Sheet does not rapidly deteriorate with age.

This packing is supplied in sheets of 1/32″ and 1/16″ thicknesses, 50″ x 50″ in size.

Mogul Twisted Packing



For packing water pump shafts, transmission shafts or any other place where stuffing boxes require packing of a small size that will withstand any service to which it is subjected.

Mogul Twisted Packing is made of strong asbestos yarn, thoroughly impregnated with a lubricating compound and twisted into packing ⅛″, 3/16″ and ¼″ in size or diameter.

This is used where several sizes of packing are required, and the various sizes are obtained by untwisting the strands.

Form BL–1A–7-31

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