LOCKHEED BRAKES

The Lockheed Hydraulic Brake System is composed of a master cylinder in which the hydraulic pressure is originated, a cylinder operating the brake bands or shoes on each wheel drum, a supply tank by which the operating fluid in the system is replenished, and the line, consisting of tubing, flexible hose and brackets interconnecting the master cylinder, wheel cylinders and supply tank. (See Fig. Ll.)

There is no pressure in the system when the foot pedal is in the off position. When pressure is applied to the pedal, the master cylinder piston, with which the pedal is mechanically connected, is forced forward and causes the fluid to flow through the entire line, the pressure created in the master cylinder being transferred into each wheel cylinder with equal and undiminished force. The column of incompressible liquid entering the wheel cylinders between their opposed pistons causes the pistons to move outwardly and against the pressure of the retractor springs. By means of mechanical connection between pistons. and brake hands or shoes, these are brought into contact with the drums and the pressure on all four wheels is absolutely equalized.

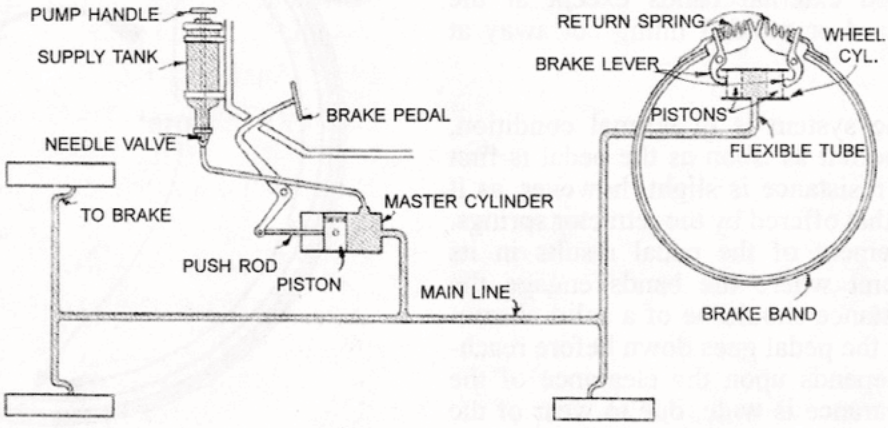


FIG. L1 - SCHEMATIC DIAGRAM OF LOCKHEED SYSTEM USING SIMPLE TYPE MASTER CYLINDER AND DASH SUPPLY TANK.

When the pedal is released the retracting springs force wheel cylinder pistons to their original off position and the liquid is forced out of the cylinder and back into the line. This forces the master cylinder piston backward and in position for pressure to be applied again.

General Types

The foregoing description applies to the various types of Lockheed Hydraulic Brakes, but in order to consider specific adjustments or repairs, and more particularly the diagnosis of trouble, it is necessary to do so, in part, under the following:

(a) External band type, with simple master cylinder and separate supply tank.

(b) Internal two-shoe type, with compensating master cylinder.

(c) External band type, with compensating master cylinder.

(d) Internal three shoe type with simple master cylinder used-on old model Flint cars and described in a future issue.

Models with Simple Master Cylinder

Minor adjustments on the external type brake are confined to the bands and are for the sole purpose of securing proper travel of the pedal and of securing free movement. It is important that each band be free from twists and adjusted within reasonable limits as follows:

1. First unlock the system by unscrewing the supply tank pump rod. Then with car raised, remove cotter and turn anchor adjusting screw (Fig. L2) until gap between lining and drum will admit a 0.010 in. feeler gage. At this time check carefully to see that the band moves freely on the anchor bracket, that the anchor spring is in place and that it brings the band back away from the drum promptly when the brakes are released, otherwise the band will drag, or will not make contact throughout its full length when in the 'on' position.

Use a good penetrating oil on all adjusting nuts and do not attempt further adjustment until certain that anchor is absolutely free and well lubricated.

Final clearance adjustment is made at the band end nuts. Set clearance to about 0.015 in. at long portion and 0.010 in. at short half of band as shown in Fig. L2. If it is impossible to get even clearance all around it indicates a deformed band

which should be brought to drum contour with a ball-pein hammer and band rounding tool.

Make sure that the band follows the center of drum from top to bottom, and lies flat around the surface of the drum. If it does not, look for a bent anchor pin or bent backing plate.

After these adjustments are made on each wheel and .equal braking effort does not result on all four wheels, the cause will usually be found at the surface of the brake lining. Grease is one of the worst offenders in this respect, and in some cases a fair measure of success may be had by a thorough cleaning with gasoline or alcohol and scraping with a file or wire brush. If this does not correct the condition, new lining of the same make and grade as used on the other three wheels should be applied. If soft or medium lining is used, do not cut away lining on Lockheed external bands except at the anchor. Using hard or molded lining cut away at anchors.

When the system is in normal condition, resistance will be felt as .soon as the pedal is first depressed. This resistance is slight, however, as it consists only of that offered by the retractor springs. Continued movement of the pedal results in its reaching the point where the bands engage the drums. The resistance should be of a solid character. The distance the pedal goes down before reaching this point depends upon the clearance of the bands. If the clearance is wide, due to wear of the lining, the pedal may go to the floor.

Loss of Fluid

2. If free movement of the pedal is noticed before any resistance is felt, it may be due to loss of fluid from the system. An inspection of all connections should be made to locate the leak. Carefully follow all lines even between connections, to see if the copper tubing is chafed or rubbed through where it touches the frame. If not located elsewhere,

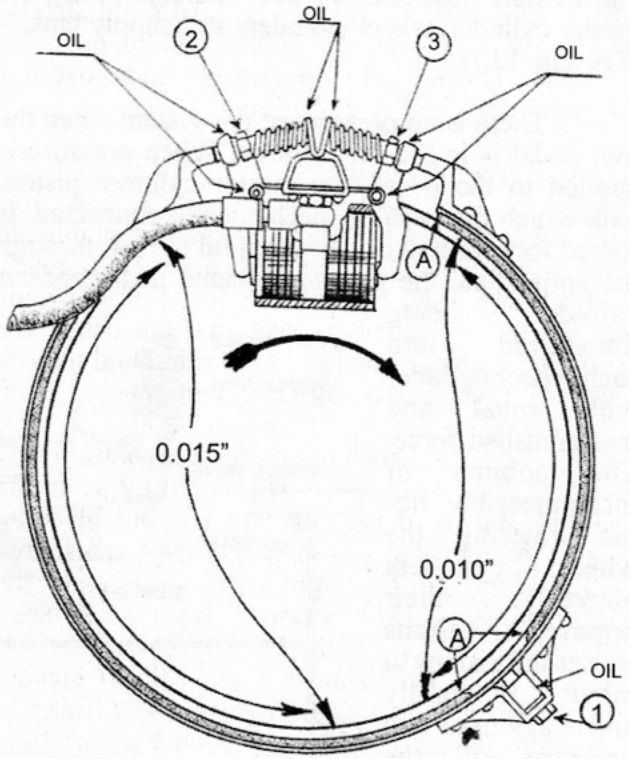


FIG. L2 - LINING CLEARANCES ON EXTERNAL TYPE BRAKES

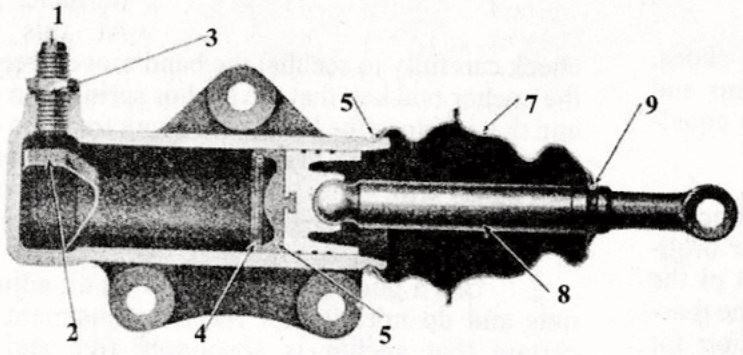


Fig. L3 - Master cylinder as used on Chrysler Lockheed installations. The cup expander 4 is not used on all Lockheed models.

1 - supply tank
2 - piston stop
3 - union gasket
4 - piston cup expander
5 - boot wire
6 - piston cup
7 - boot
8 - piston & rod assembly

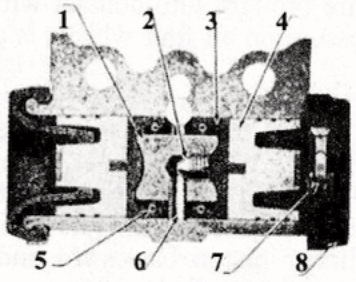


Fig. L4 - Wheel cylinder assembly as used on Chrysler Lockheed installations. The cup expamder 5 is not used on all Lockheed models

1 - piston cup stop
2 - stop pin screw
3 - piston cup
4 - piston and plug assembly
5 - piston cup expander
6 - piston cup stop pin
7 - boot strap
8 - boot

inspect wheel cylinder inlet connections and bleeders, and remove the boots 8, Fig. L4 covering the cylinder ends. If the wheel cylinder cups are leaking the fluid will be noticed at this point. Loss of fluid from the line will result if the supply tank pump rod is not tightened securely, or if the point on its lower end does not seat tightly in the brass outlet fitting.

The master cylinder Fig. L3 should also be inspected for leakage at its outlet fittings or by its cup. If the leakage is by the cup, the boot covering the end will be wet with fluid.

Air in System

3. The presence of air in the system manifests itself by a 'springy' pedal It does not seem to reach a point where solid resistance is felt. Before deciding that air is present be sure that the bands are properly adjusted, because very wide band adjustment will give exactly the same symptom.

4. Air in the system can be removed only by bleeding. Best results will be secured by using the methods shown in Fig. L6 and L7, but bleeding may be done by using dash supply tank as a source of fluid. First, fill the supply tank and replace the pump rod, but do not screw it down on its seat. Remove dust screw from bleeder connection (B Fig. L5) on wheel cylinder. Force end of bleeder hose over bleeder connection, or screw in fitting of hose, depending upon type of bleeder connection. Allow bleeder hose to hang in a bottle or container. Unscrew bleeder connection (B) about three-quarters of a turn.

Move supply tank pump rod slowly up and down. Bleed out a half pint, and close the bleeder connection (B). Then refill the supply tank, but do not use the old fluid. Repeat the operation on the other three wheels, one at a time, not forgetting to fill the supply tank after each operation.

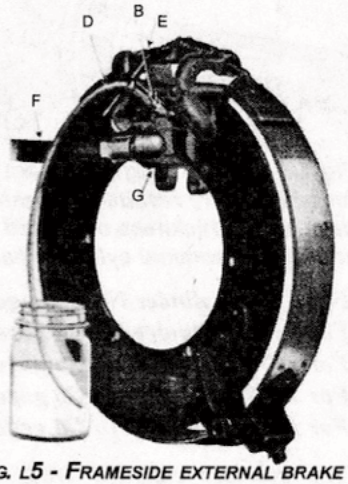


FIG. L5 - FRAMESIDE EXTERNAL BRAKE SHOWING BLEEDER WRENCH AND HOSE ATTACHED.

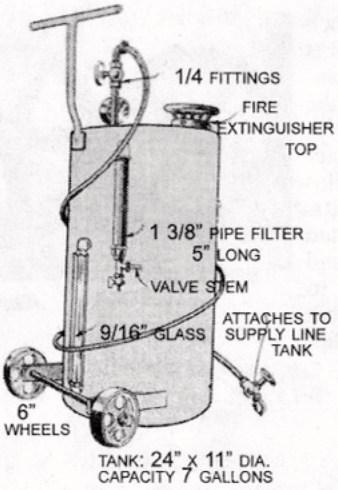


Fig. L6 - High pressure bleeding and testing tank. The tank can also be used for pressure flushing with alcohol to remove pipe line sediment. It is faster than gravity feed system shown in Fig. L7.

5. Now bleed the master cylinder by unscrewing the pump handle, and then force the pedal slowly to the floorboards.

Now move the supply tank pump rod slowly up and down until the pedal is returned to its normal 'off' position, and free play eliminated.

The method of bleeding described above, using the supply tank, is much too slow for a shop doing much hydraulic work. The pressure methods described on this page are faster and more positive, but apply only to the systems with simple type master cylinder.

Sluggish Pedal

6. A sluggish action of the pedal always means a corresponding sluggish band action. This will be found to be due to one of three causes:

a. Thick fluid.
b. Mineral oil in system.
c. Tight bearing on pedal.

Thick fluid may be the result of evaporation of the alcohol content, or a home-made mixture which is too thick may have been put in the system. In either case, the correct thing to do is to wash out the whole system with clean alcohol, refill, and bleed, using genuine Lockheed Brake Fluid.

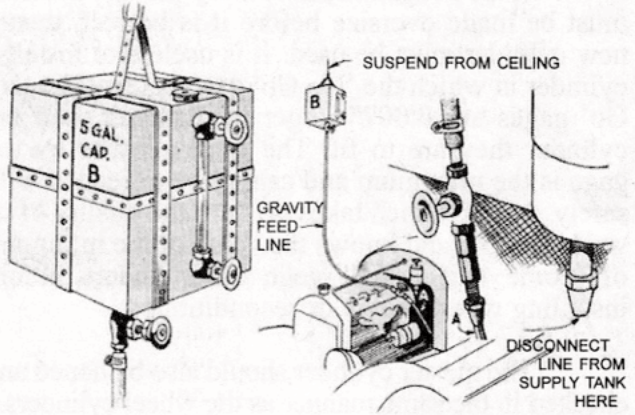
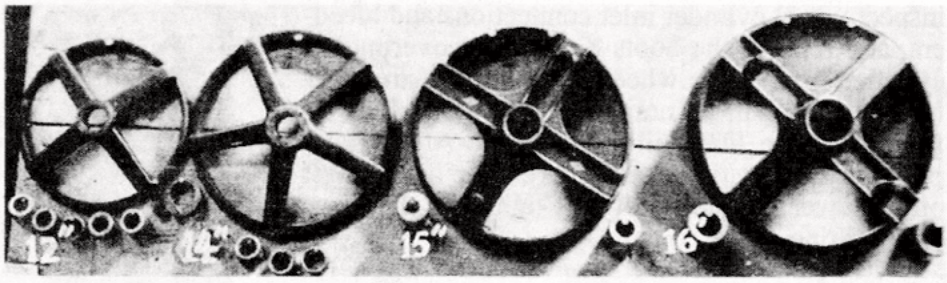


FIG. L7 - ONE MAN CAN BLEED A LOCKHEED EXTERNAL SYSTEM USING THE GRAVITY TANK OUTFIT SHOWN HERE.

When any mineral oil, such as gasoline, kerosene or cylinder oil is put in the system, or is used in cleaning the internal parts, the action on the wheel and master cylinder cups is to swell them, increasing their diameter until they work so tightly in the cylinders that sluggish action results. Eventually, the cups are so distorted that they cannot seal the cylinders and leakage results. The remedy is to remove all five cylinders, disassemble completely, wash in alcohol, install new cups, wash out all lines with alcohol, bled and refill as described above.



Assortment of Wagner Electric Co. ring gages and adapters.

Fig. 8 - All parts should be washed with alcohol. Do not use kerosene or gasoline.

Cylinder Repairs

When inspection shows a leak at a wheel cylinder, proceed as follows:

7. Remove boots, pistons, and cups and wash them in alcohol. See Fig. L8. When the cylinder is clean, test with proper size 'No Go' plug gage (shown and described in Fig. L9) and if not oversize, polish out with hone (shown in Fig. L10), just enough to clean and polish the bore so that an inspection can be made for pits and scores. If the cylinder is not perfectly smooth it should be honed until it is so, but frequent tests should be made with the plug gage to see that it does not get oversize.

If the irregularity is so deep that the cylinder must be made oversize before it is perfect, then a new cylinder must be used. It is useless to install a cylinder in which the 'No Go' gage enters. The 'No Go' gages are 0.007" larger in diameter than the cylinder they are to fit. The limit allowed by the gage is the maximum and cannot be exceeded with safety. A shop which takes pride in the quality of its workmanship and knows the value of the minimum of 'come backs' will gage all cylinders before installing whether new or reconditioned.

The master cylinder should also be honed and checked in the same manner as the wheel cylinders.

After honing, wash in alcohol again to remove all kerosene, as in Fig. L8, then cover the inside of the cylinder with clean brake fluid. Put in new cups, after dipping them in clean brake fluid, and replace pistons. The rubber boots of wheel cylinders should fit the cylinders tightly to exclude water and dirt. If they are loose and swollen due to the action of grease, new ones should be used.

Compensating Master Cylinder

This unit is becoming increasingly popular, being used on all of those cars and trucks having Lockheed Hydraulic Internal Brakes, and on some external brake models.

The 'Compensator' combines the functions of the master cylinder and supply tank, and in addition, it maintains, automatically, the operating fluid at a constant volume. It compensates for expansion and contraction of fluid due to temperature changes, and for any loss of fluid which might result from seepage.

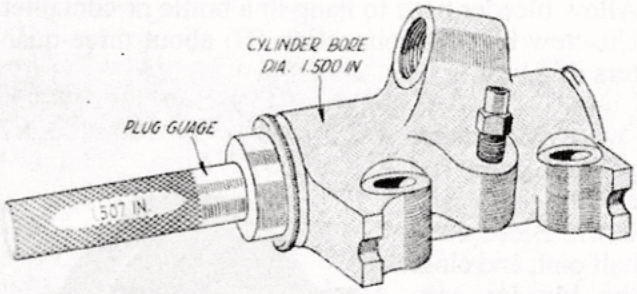
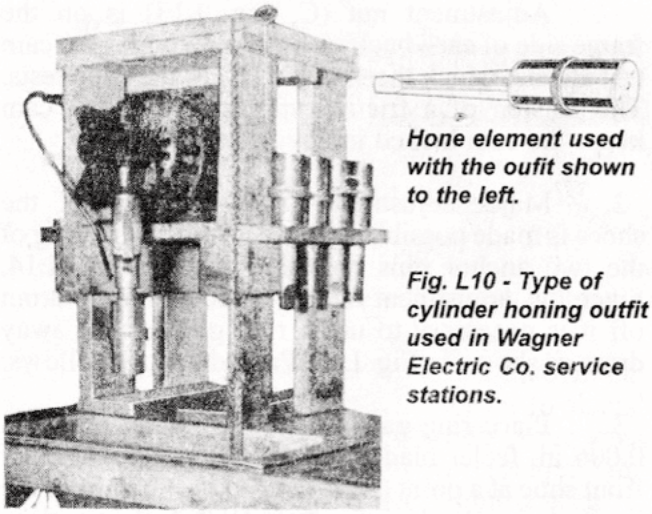


Fig. L9 - No Go plug gages are an absolute necessity for satisfactory results on Lockheed brakes. The gages have a face thickness of ½" and a diameter 0.007" larger than the nominal cylinder diameter.

For 1 1/4" cylinder No Go gage should mike 1.257"
For 1 3/8" cylinder No Go gage should mike 1.382"
For 1 1/2" cylinder No Go gage should mike 1.507"
For 1 5/8" cylinder No Go gage should mike 1.636"
For 1 3/4" cylinder No Go gage should mike 1.756"

(The cylinder called 1 5/8" size does not measure exactly 1 5/8" which explains the gage diameter for that number.)



Hone element used with the oufit shown to the left.

Fig. L10 - Type of cylinder honing outfit used in Wagner Electric Co. service stations.

The master cylinder is contained within the supply tank, upon which are mounted the clutch and brake pedals. The supply tank in turn is mounted to the frame of the car. It serves to carry the supply of fluid and protect the master cylinder submerged in the fluid from any danger of taking in air, dirt or water.

Fig. Lll shows the complete unit. (N) is the shaft on which the brake pedal fits on the outside of the tank. (L) is a falcon lever on the inside of the tank, fitting on the same shaft and engaging with the piston.

Fig. L12 shows the details of the master cylinder. The valve assembly indicated by (F) and (D) in the bottom of the cylinder plays absolutely no part in the braking operations and even if it was absent this fact would not be known unless bleeding was attempted. It is included to make the bleeding operation simple and quick. The return spring (C) presses the cup (A) against the piston. The cup is not fastened to the piston and is self-centering.

For braking operations action of this cylinder is exactly the same as simple master cylinder described before.

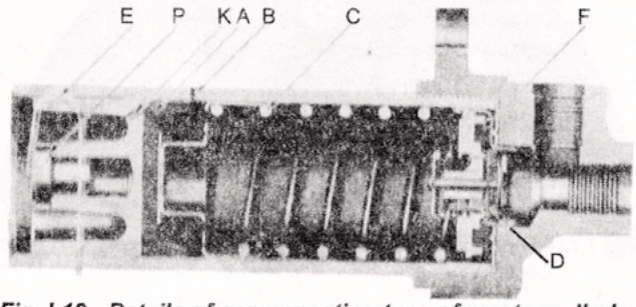


Fig. L12 - Details of compensating type of master cylinder.

Bleeding

Prepare to bleed the cylinder exactly as described for simple type cylinder with supply tank.

Remove filler plug and if fluid level is not to top of tank, fill to that point with Lockkeed Brake Fluid. Now push pedal to floorboard ten times, close bleeder connection. Fill tank again and repeat on the other three wheels. This completes the operation of bleeding.

It is important to fill the tank after each cylinder is bled because if the fluid level gets as low as the master cylinder barrel it will pump air into the system and the whole operation will have to be done over again. Do not use again the fluid drawn from the cylinders in bleeding.

Compensating Action

In the master cylinder barrel, at (B) Fig. L12, a small port, the diameter of a No. 70 drill hole is just uncovered, by the cup when in its full 'off' position. If an increase in temperature takes place the expansion of the fluid in the lines dissipates itself by lifting the valve F from its seat, passing fluid into the master cylinder and out through the port (B) into the tank. Since the retractor springs on the shoes have a weight of from 45 to 75 pounds (depending upon the type) , and the master cylinder spring (C) a weight of only 7 pounds, the valve (F) permits the fluid to come in without changing the position of the brake shoes. It will be readily seen that this action would take place whether the valve (F) were there or not.

When a drop in temperature occurs, the decrease in volume of fluid in the lines causes an additional amount to flow in through the port (B) by

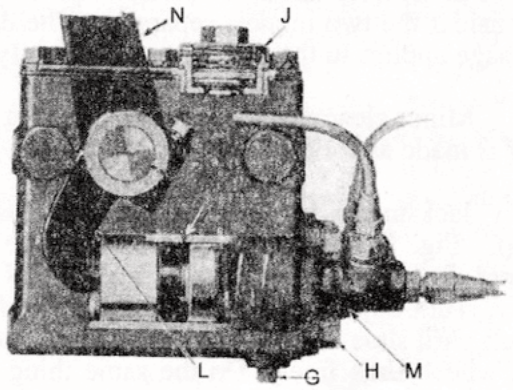


Fig. L11 - Complete compensating master cylinder and integral supply box unit used onlatest model Lockheed systems.

the very weak spring of valve (D) and into the lines. It is not possible to create and sustain a pressure in the system by repeated operation of the pedal, since the port (B) is uncovered at the off position and would relieve any pressure.

Since the compensation feature is entirely dependent upon the port (B) it naturally follows that if the cup does not uncover this port when it is in its off position, compensation will not take place. When the piston and cup are in the off position, with the piston against the wire stop (E) the falcon lever (L) does not quite touch the hardened button in the piston (P). This results in a slight free play of the pedal, amounting at the top to one-quarter to one-half inch. If this play is present you can be sure that the cup has properly uncovered the port (B).

If mineral oil of any kind, or any fluid having mineral oil in it, reaches the cup, the swelling which will result will be sufficient to cause the cup to close the port. If the port is covered the certain result, as soon as the car is driven for a while, will be dragging brakes.

Clearance and Centering Adjustment

One Piece Cast Shoe Type, Used on
Auburn (1928)
Dodge Bros. (Victory and Senior)
Franklin
Reo Flying Cloud
Reo Wolverine
Gardner (1928)
Graham-Paige (619,629,835)
Velie 8

Lockheed two shoe internal brakes are made in two models. One model has a one piece cast shoe and the other a two piece shoe usually of stamped construction. Since the major adjustments are handled in an entirely different manner it is necessary to consider the two models separately. The data on this page applies to the one piece cast shoe type.

Minor clearance adjustment for slight lining wear is made as follows:

1. Jack up all four wheels. Rotate adjustment nut (C, Fig. L13) on front shoe until shoe drags against drum, then back off until wheel turns freely., Turn adjustment (C) on rear shoe (of same wheel) until shoe drags against drum, then back off until wheel turns freely. Do the same thing to the other three wheels.

Adjustment nut (C, Fig. L13) is on the frame side of each backing plate and rotates the cam (A) against which the stop pin (B) of the shoe rests. The tension of a friction spring under each cam keeps the cam locked in any position.

2. Major adjustment or re-centering of the shoes is made possible by the eccentric mounting of the two anchor pins indicated at E in Fig. L14. Since this adjustment must be made with the drum off it is necessary to use a ring gage or cut away drum as shown in Fig. L15. Procedure is as follows:

3. Place ring gage on shoe assembly. Insert a 0.006 in. feeler blade between lining and drum of front shoe at a point (A, Fig. L14) one inch from the lower end or heel of the shoe. With feeler in place turn eccentric anchor (E, Fig. L14) until feeler blade is just gripped.

4. Now insert a .010 in. feeler blade at a point (B, Fig. L14) one inch from the upper or toe end of the lining. If the .010 blade will not go in, rotate cam (C) a very little and try both ends again. .The adjustment is right when the .006 feeler blade just enters at-the heel and the .010 blade just enters at the toe. These limits are for a firm, dense, solid type of lining. A soft type of lining requires a clearance adjustment of .015 at the top, and .005 at the bottom.

Adjust the other shoe of the same wheel to these standards and then repeat the operation on the other three wheels. Make sure that lock nuts on back of shield are securely tightened after making their adjustments.

5. Reinstall all four brake drums and then readjust for toe clearance only as outlined above.

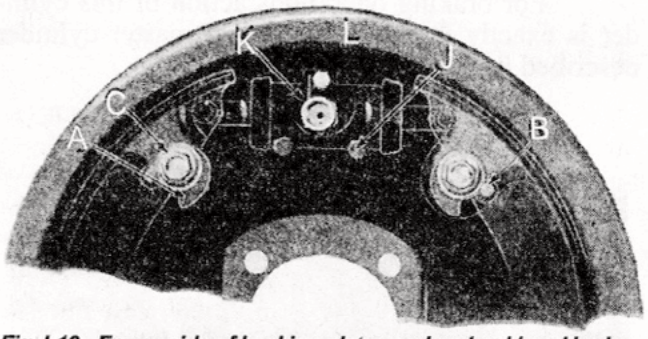


Fig. L13 - Frame side of backing plate used on Lockheed brakes

Clearance and Centering Adjustment Two Piece Self Aligning Type Used on

Chrysler 80 Stutz (1928)

The differences in construction between the one piece cast shoe type of assemblies and the two piece type are easily seen in Fig. L16. The two piece type as will be seen consists of a sole to which the lining is riveted and a web to which the sole is bolted. The center bolt holding the sole to the web is a reamed fit in its hole; the other four bolts are mounted in holes that are slightly elongated. The lower end of each shoe web is pivoted on an anchor pin but the anchor pin is not eccentric. It is rigidly mounted on the backing plate and is non-adjustable.

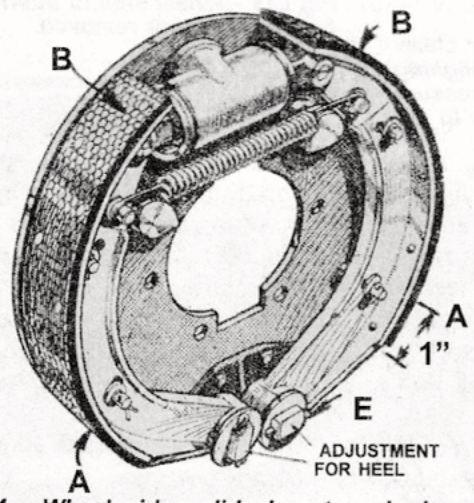


Fig. L14 - Wheel side solid shoe type brake showing eccentric anchors at E.

Minor clearance adjustment for slight lining wear is made at the cams controlling the toe clearance exactly as described for the one piece cast shoes on the previous page.

Major adjustment or recentering of the two piece type shoes is accomplished without removing the brake drum as follows:

6. Jack up all four wheels and remove inspection cover plates from all drums. Insert pressure gage with copper tubing in bleeder connection of one wheel as shown in Fig. L17 and L19.

7. Loosen shoe sole lock nuts N', N2, 0' and 02. Turn drum until port is aligned with nut N'. Have one man sit in driver's seat and push down on pedal until gage shows 1751bs. pressure. Now tighten nut N' as tightly as possible with T handled socket. Release pressure by removing foot from pedal and turn drum port to nut 0'. Apply same pressure and tighten nut 0' while pressure is still on. Then proceed to 0' and lastly to N'. In other words if the bolts are numbered from top to bottom 1, 2, 3 and 4, they should be tightened in the order 1, 4, 3, 2. Each of the remaining 7 shoes should be adjusted likewise.

Removing and Installing Shoes

The two piece type of shoe can be removed and installed easily if these directions are carefully followed.

8. Remove horseshoe washers from anchors. Pry right hand shoe off of anchor with screw driver. Move lower end of shoe to left until button on back of (R, Fig. LI6) disengages from flat spring (X, Fig. L18). Return spring can now be unhooked, and upper end of shoe pulled out of cylinder boot and piston. In this operation, carefully avoid damage to cams (A). Pry out lower end of left hand shoe and remove.

Install shoes exactly as follows: Turn all eight of the adjustment cams to the low point.

Make sure that slot in end of each wheel cylinder piston is standing straight up and down. Take the left shoe (facing wheel) and enter its top end into the boot and on into the slot in end of piston. With the point of a screw driver inserted between the backing plate (dust shield) and the spring (X) pry up on the latter so as to allow back end of shoe guide pin to enter. Place bottom or heel end of shoe over anchor pin and install anchor pin locking horseshoe.

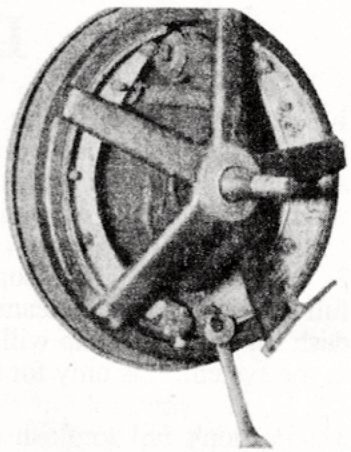


Fig. L15 - Using ring gage and feeler to make major adjustment on solid shoe.

Attach retractor coil spring to left shoe at top. Now take hold of the right hand shoe and hook it to the free end of the retractor spring. Enter the top end into the piston slot through boot. Pry up on flat spring (X) and enter guide pin under spring. Fit lower

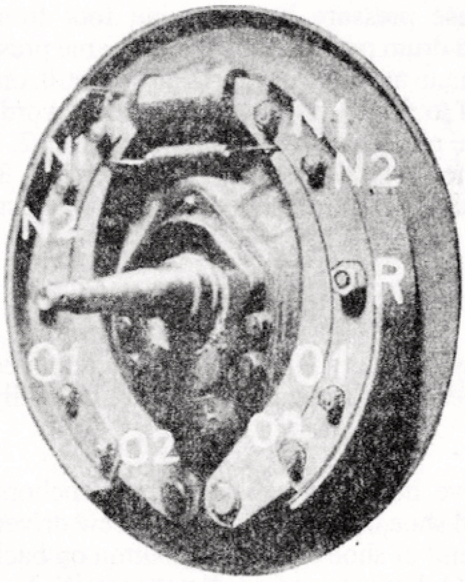
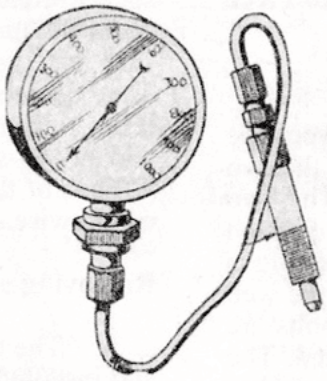


Fig. L16 - Wheel side of a two-piece aligning shoe type internal brake showing the 8 clearance and the centering adjustment bolts.



Above:
Fig L19 - Gage, 6 fet of tubing and bleeder fitting used on self-aligning shoe brakes.

Below:
Fig L17 - Making a major clearance adjustment on self-aligning shoe type brakes. Note pressure gage connected by length to left front wheel bleeder valve.

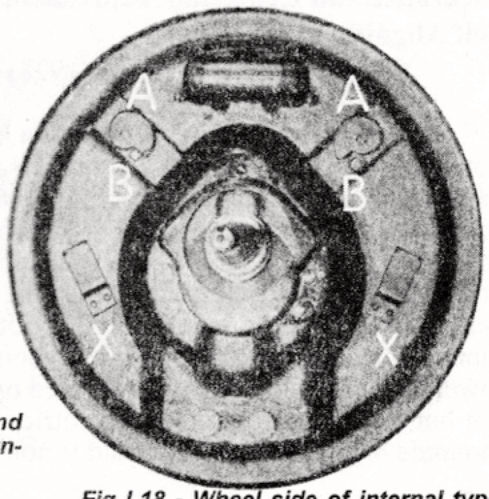
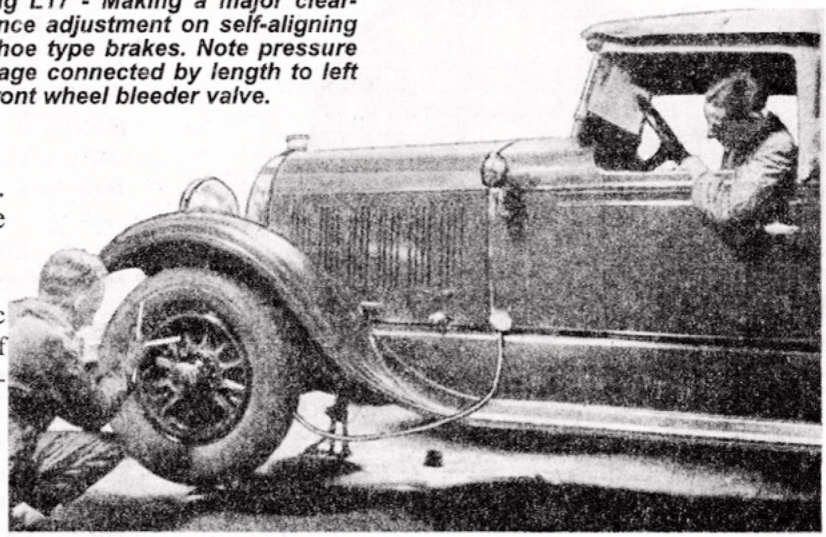


Fig L18 - Wheel side of internal type brake with shoes removed.

end over anchor. Install horseshoe. Squeeze both ends of both horseshoe washers so as to lock them.

Acknowledgement is made to the Wagner Electric Co., and to Mr. W.S. Regan, Service Manager of the Philadelphia branch, for assistance in the compilation of this chapter.



Don'ts for Lockheed Brakes

1- Don't use anything but genuine Lockheed fluid except in an absolute emergency. Equal parts alcohol and castor oil may be used in those cases where genuine fluid is not available.

2- Don't expect the supply tank pump to give full pedal if the band clearances are too great. The dash supply tank pump will not build up a pressure in the system; it is only for replenishing fluid lost.

3- Don't fail to flush the entire system with alcohol on all overhaul jobs. The high pressure test and bleeding tank may be used for this work but a pressure in excess of 30 lbs, should not be used.

4- When any cups, pistons, cylinders, etc., are removed they should be washed in alcohol before reinstalling. Do not use gasoline or kerosene. Don't fail to dip cups and pistons in new clean fluid before reinstallation.

5- Don't forget that the heel or lower end of internal shoes should contact before the toe or upper portion of the shoe. If toe contacts first the. brakes will be inclined to squeak, grab or chatter.

6- Don't forget to test all wheel and master cylinders with proper size 'No Gage' plug gage in all cases of leakage at cups. Don't forget to polish the inside of all cylinders in which cups have been renewed.

S.K.