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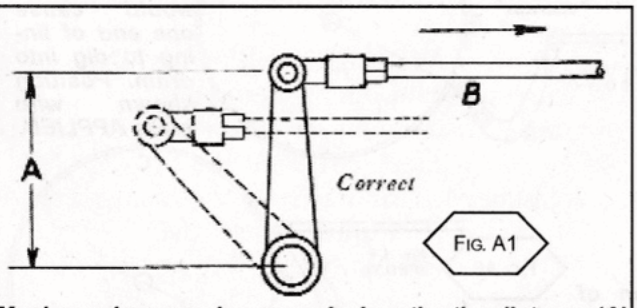
FUNDAMENTALS OF BRAKE MAINTENANCE

The most important practical requirement for securing satisfactory results in the adjustment and maintenance of brakes is ABS0LUTE FREEDOM OF MOVEMENT AT ALL PARTS OF THE BRAKE OPERATING LINKAGE. Unless all bearings, toggles, cams, flexible shafts, springs, clevis pins, etc., are perfectly free it is **impossible** to get a permanently satisfactory adjustment.



Maximum leverage is secured when the the distance 'A' is at its maximum, which will be the perpendicular position shown in solid lines. Adjust rod length to get this position with the brake APPLIED.

Because of the necessity for 'free working' of the brake linkage all routine brake adjusting jobs should begin with the Cleaning, Loosening and Lubrication of all Clevises, Levers and Bearings on all the BRAKE RODS, ROCKERS, CROSS SHAFTS and BAND or SHOE ASSEMBLIES in the system. Clean with gasoline or kerosene, loosen with some good make of penetrating oil and **lubricate** with oil or high-grade, non-caking grease.and lubricate with oil or high-grade, non-caking grease.

Never attempt to adjust any type of brake without first adjusting the front and rear wheel bearings. This is very important.

Necessity of Leverage

The second requirement for satisfactory brake adjustment is proper leverage. In order to get the desired pressure of the brake lining against its drum it is necessary that the various levers and cranks in the linkage be set at certain relative positions. The desired lever angles for the RELEASED position of the brakes may vary slightly on the different makes of cars, but even where the mechanic does not know the exact factory recommendations he should be able to get fairly satisfactory results by

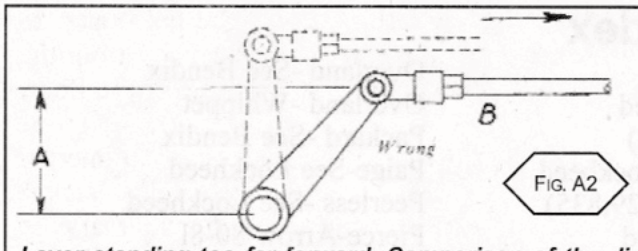


FIG. A2

Lever standing too far forward. Comparison of the distance 'A' with Fig A1 shows leverage has been reduced almost one-third. Get proper leverage by lengthening pull rod or changing lever on its shaft.

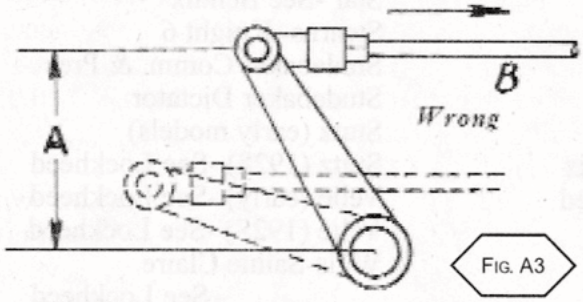


FIG. A3

Lever stands too far backward. Loss of leverage same as in Fig A2. Get proper leverage by shortening pull rod or changing lever on its shaft. Lever should stand perrpendicular when brakes are APPLIED.

using common sense based on a preliminary knowledge of mechanics.

An almost infallible rule that the brake mechanic should memorize and apply, is as follows:
WITH THE BRAKES FULLY APPLIED ALL OPERATING LEVERS SHOULD STAND AT THE PERPENDICULAR, OR RIGHT-ANGLED (90 degree) POSITION.

The accompanying illustrations, Figs. A1, 2, 3, 4, 5, 6, show the correct and incorrect lever positions for maximum torque or leverage. It is urged that the mechanic CAREFULLY STUDY these drawings, because he must have a full understanding of the PRINCIPLES OF LEVERAGE BEFORE HE CAN EXPECT TO DO A SATISFACTORY JOB OF BRAKE ADJUSTING.

Equalizers and Rods

Equalizers on mechanical type brakes are often a source of considerable trouble. In some cases better results are obtained by eliminating them, Where the car is equipped with an equalizer always be sure that the PULL RODS are so adjusted AS TO BRING THE EQUALIZER BAR SQUARE ACROSS, as indicated in Figs. A7 and 8. Also be sure that the rod from equalizer to pedal is properly adjusted to give clearance at floorboard and proper leverage.

The brake pedal on practically all cars is equipped with a stop to limit its backward travel In the absence of definite specifications it is advisable to set the pedal stop so that the pedal arm clears bottom of floor boards by about 3/16 of an inch.

Mechanics sometimes make the mistake of shortening rods to remove slack, without first making sure that the various levers are properly positioned. All mechanical brake systems are built to have a certain amount of free travel of the pedal before the brakes are actually applied. Never shorten brake rods without first making sure that the levers in the system are against their stops. Where there are no stops be sure that the levers are at the correct angle. Then, and only then, is it permissible to shorten the rods just enough to permit insertion of the clevis pins

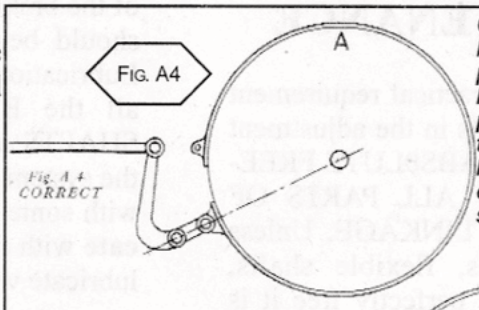


FIG. A4

CORRECT relative position of band operating lever and lever pins. With brake APPLIED the lever should be approximately perpendicular and a line drawn through the CENTERS of both lever pins should pass through center of axle or spindle as shown.

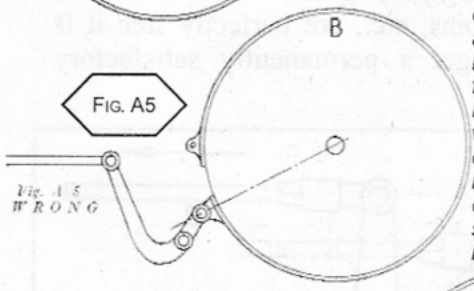


FIG. A5

WRONG position of band operating lever and pins. Top of lever is too far forward. Position of pins would cause one end of lining to dig into drum. Position shown with brake APPLIED.

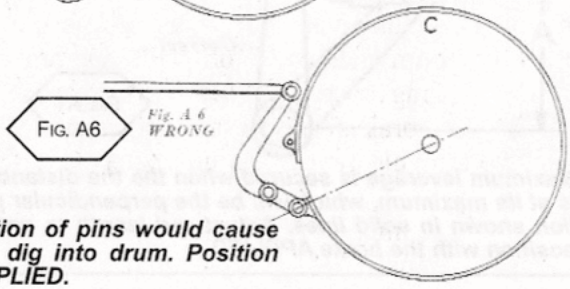
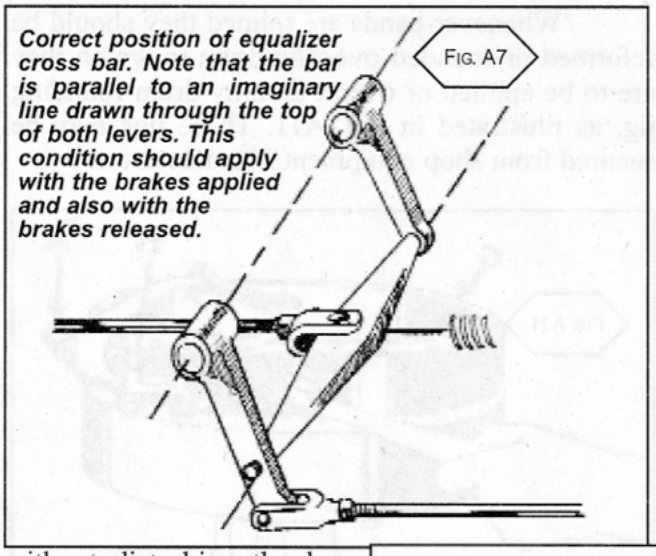


FIG. A6

WRONG position of band operating lever and pins. Top of lever is too far back. Position of pins would cause one end of lining to dig into drum. Position shown with brake APPLIED.



Correct position of equalizer cross bar. Note that the bar is parallel to an imaginary line drawn through the top of both levers. This condition should apply with the brakes applied and also with the brakes released.

without disturbing the lever positions.

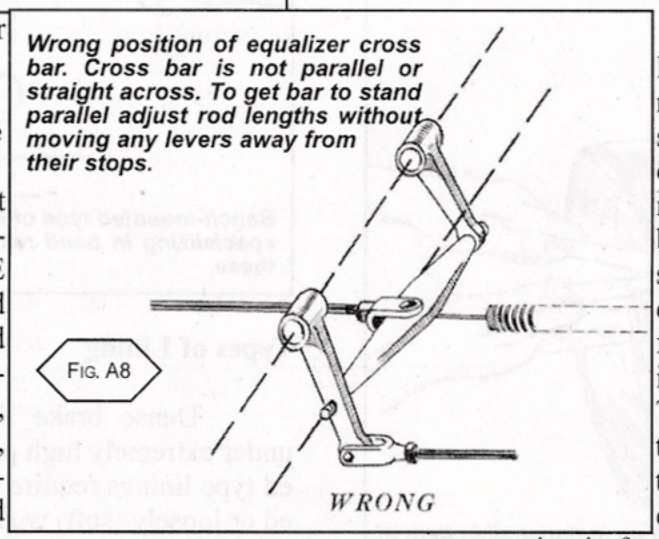
Lining-to-Drum Clearance

The third requirement in successful brake maintenance is CLEARANCE between the brake lining and its drum. Clearance and leverage are closely interrelated. Leverage, however, is the more important factor, and although clearance specifications should be followed wherever possible, it is better to alter the clearance and get PROPER LEVERAGE than to REDUCE or DESTROY the LEVERAGE in order to get any specified clearance.

In connection with lining clearance it should be borne in mind that repeated use of the brake, such as in descending a mountain or making frequent, quick stops, causes a rise in temperature of the brake drum. On an EXTERNAL type brake this expansion of the drum (due to the drum heating) will decrease the lining-to-drum clearance. This means that the hotter the drum gets the more will the brake be inclined to drag or seize. This is the reason why EXTERNAL brakes almost always carry MORE lining-to-drum clearance than internal type brakes.

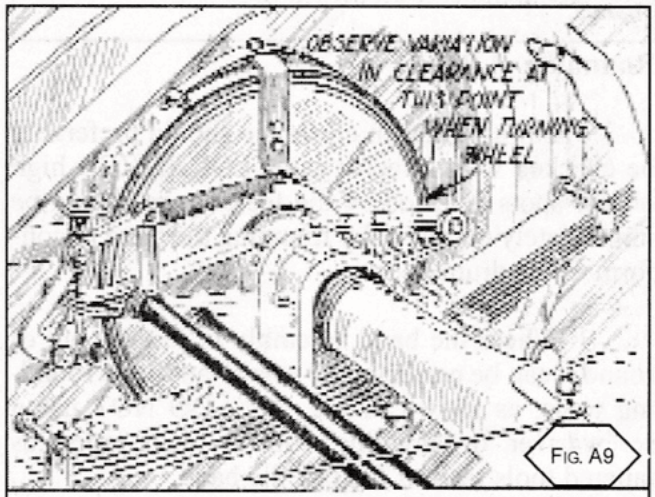
On the internal type brake heating, and consequent expansion of the drum, produces an increase in clearance. This means that the hotter the drum gets the less effective will be the brake. In other words, the drum may expand away from the lining so far that the pedal pad will strike the floor.

Because heating of the drum of an internal brake reduces the effective pedal travel, this type should have LESS clearance than the external type brake. Many makes of internal brakes are adjusted to the point where the lining drags and are then backed off just enough to eliminate the drag. The average internal brake carries not to exceed 0.010 of an inch clearance. An exception to this general rule is the Steeldraulic make of brake, which is given an average clearance of approximately 0.050 of an inch.



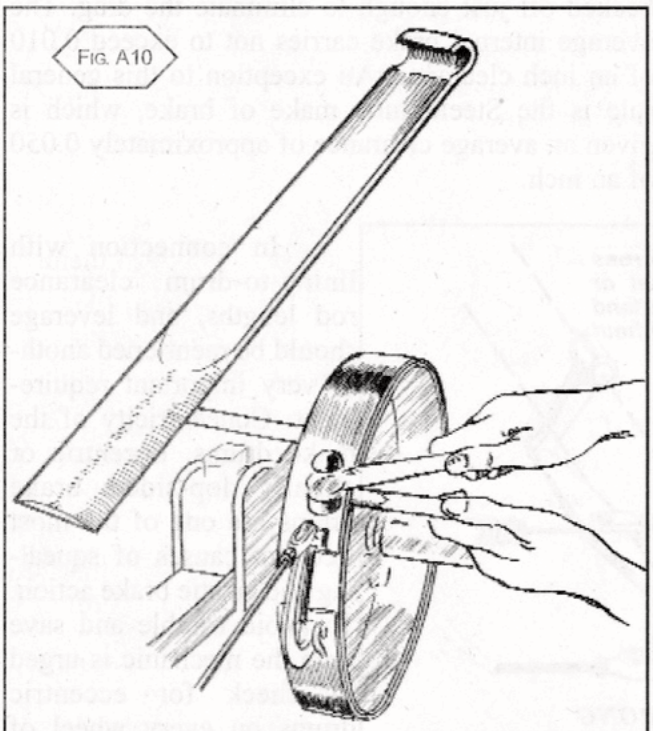
Wrong position of equalizer cross bar. Cross bar is not parallel or straight across. To get bar to stand parallel adjust rod lengths without moving any levers away from their stops.

In connection with lining-to-drum clearance rod lengths, and leverage should be mentioned another very important requirement: Concentricity of the brake drums. Eccentric or slightly lop-sided brake drums are one of the most frequent causes of squealing and erratic brake action. To avoid trouble and save time the mechanic is urged to check for eccentric drums on every wheel of every car coming in for adjustment or relining. The



Test for eccentric drum. Done by revolving wheel while observing clearance at some point along band, such as the anchor. This test should be made on all wheels on every adjustment or reline job.

check for eccentric drums is easily and quickly made by turning the wheel by hand and noting the clearance at any given point (as, for instance, at the anchor). If the clearance increases or decreases more than 0.010 in. while the wheel is being turned the drum should be reconditioned. A feeler gage may be used to detect the difference in clearance, but it is, of course, necessary that the wheel be REVOLVED during the test. See Fig. A9.



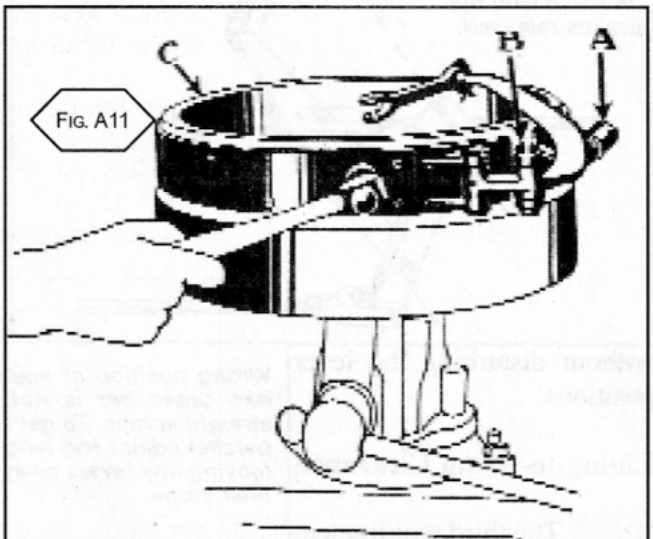
The hand-type rounding tool is an indispensible item of brake repair equipment. Do not use a chisel or screwdriver for this work, as plain tapered tools tend to twist bands.

Rounding of Bands

Lining-to-drum clearance should preferably be checked with a feeler gage. LOCALIZED high or low spots detected by the feeler gage should be immediately corrected by rounding the band to conform to the drum.

Where the band assembly is slightly out of round it can be corrected by using hand-type rounding tools, as shown in Fig. A10. DO NOT use a screwdriver or anything with a plain taper, as tapered tools tend to TWIST the band.

Whenever bands are relined they should be reformed or rounded over the drum to which they are to be applied or over a dummy drum-rounding jig, as illustrated in Fig. A11. These jigs may be secured from shop equipment manufacturers.



Bench-mounted type of band rounding tool. The shop specializing in band relining should have several of these.

Types of Lining

Dense brake linings of the type bonded under extremely high pressures and all of the molded type linings require less clearance than the folded or loosely (soft) woven types. This is due primarily to the fact that the denser lining does not expand as much as the more loosely woven materials. It is also theoretically true that the denser lining absorbs less moisture and therefore will not swell as much as the less dense lining.

In adjusting the clearances on any brake system it is advisable, therefore, to first consider the type of lining being used; second, the service to which the car is being subjected; and third, the atmospheric temperature at which it will be operated. A car with external brakes of the mechanical type operated in level country where the air is cool, can be run with considerably less clearance with no chance of the brakes seizing than the same car operated in hilly country in the warm summer months, assuming the same make and grade of lining in each case.

Elementary Adjustments

External and Internal

After the mechanic has acquired an understanding of the fundamental requirements outlined in the previous chapter, he is in a position to apply this information to the actual adjustment of brakes.

The brake that he will most frequently encounter is the external contracting band type. The external contracting band brake operates on the wrapping principle as illustrated in Fig. B1. In this type of brake the rotary motion of the drum tends to drag a portion of the band along with it and thus automatically increases the contact pressure. As will be seen by reference to Fig. B2, some external brakes have the anchor located directly across from the ends of the band. With this construction the brake theoretically has the same wrapping action regardless of the direction of rotation of the drum.

On some cars, however, it will be noticed that the anchor is located more than half way around the band circumference. With this construction, shown in Fig. B3, the brake will have more wrapping action when the car is moving forward than when it is being backed.

Although the degree of wrap or position of the anchor has considerable influence on the amount of pedal pressure required to stop the car, it has little bearing on the lever angle specifications required for best adjustment. The most important thing to remember is that it is difficult to make a three-quarter wrapping type brake top as quickly or as smoothly) in reverse gear as the half wrapping type.

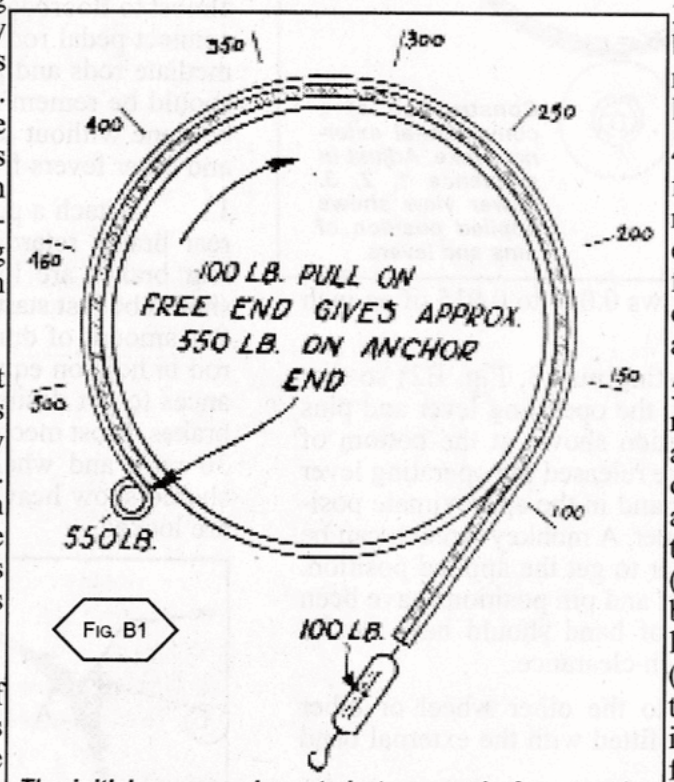


FIG. B1

The initial pressure imparted at one end of a wrapping type band is increased over four times its original value at the anchor end. The figures are for illustration of the theory; they are not exact.

How to Properly Adjust an External Brake

In the later chapters of this book the reader will find specific specifications for adjusting most of the existing four-wheel brake systems. The data contained in these later chapters will prove much more valuable to the mechanic if he will first study and master the principles. of external brake adjustment contained in this chapter.

To properly adjust a conventional external contracting type brake system proceed in this general manner:

1. Raise wheels from floor and put blocks under axles.

2. Snap brake pedal on and off to note whether brake linkage is sluggish and if so apply penetrating oil to all connections, brake linkage bearings and anchor screws.

3. Check wheel bearings for looseness, . If any are loose, adjust them.

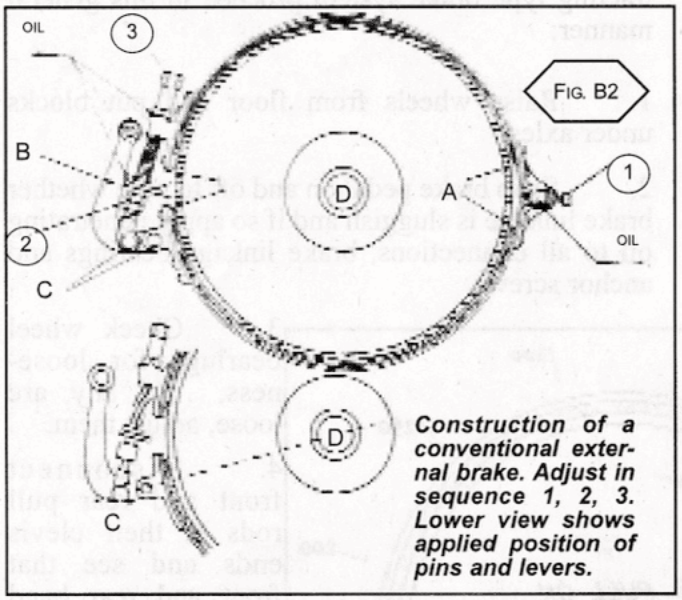
4. Disconnect front and rear pull rods at their clevis ends and see that front and rear band operating levers are against the stops.

5. With pull rods disconnected, adjust the lining to drum clearance first at the anchor, then at the pinned end (which is usually the bottom half) and lastly at the unpinned end (which is usually at the top as illustrated in Fig. B2). On some few brake systems the pinned end of band s at the top as shown in figure B3.

6. Assuming the layout is conventional like the one shown in Fig. B2, turn the anchor adjustment (1, Fig. B2) until lining drags against drum then back off until feeler shows 0.010 inch clearance at 'A,' Fig. B2. Make sure that band is free at anchor bracket. There should be no up and down play of band on anchor and if any exists correct by peening or renewal of the worn parts. Chattering and squealing are oftentimes traceable to a sloppy anchor. Revolve wheel and observe if clearance remains the same. If it varies more than 0.010 while wheel is being turned, it shows an eccentric drum which

should be removed and trued on a drum lathe or grinder. Erratic brake action and squealing are generally caused by eccentric drums.

7. Turn lower adjustment nut (2, Fig. B2) until



Construction of a conventional external brake. Adjust in sequence 1, 2, 3. Lower view shows applied position of pins and levers.

lower half of band shows 0.010 to 0.015 of an inch clearance.

8. Turn top adjusting nut (3, Fig. B2) so that when brake is 'applied the operating lever and pins will stand in the position shown at the bottom of Fig. B2. With the brake released the operating lever and pins "C" should stand in the approximate position shown Fig B2 upper. A monkey wrench can be used on operating lever to get the applied position. When the correct lever and pin positions have been secured the top half of band should have not to exceed 0.045 of an inch clearance.

9. Do the same to the other wheel or other three wheels if all are fitted with the external band type brake.

On those few cars equipped with the reversed band operating linkage as shown in Fig. B3, the procedure for adjusting is the same as outlined above except that the unpinned portion of the band is at the bottom. On this type linkage the sequence of adjustment is as shown in Fig. B3-anchor first, then top nut, and lastly the lower adjusting nut.

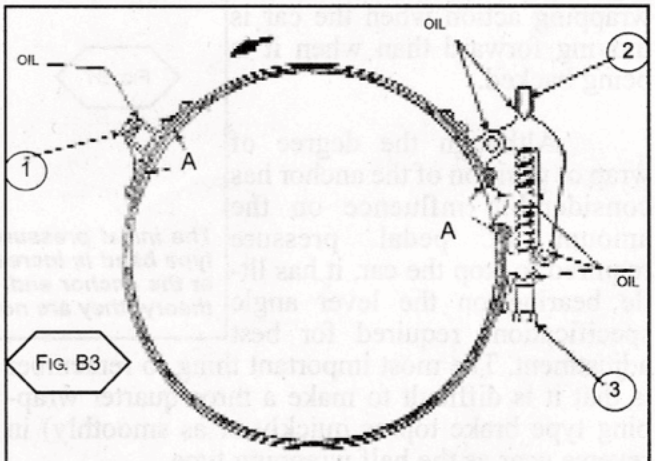
10. Now, with all bands adjusted to the above specifications, proceed to reconnect the pull rods. While doing this note the angle of the levers operating these pull rods. With the brakes in the released position they should stand at about the same angle as shown in the simple hookup in Fig. B4. With these levers at the angle indicated, adjust the pull rod clevises so that rods are of such length as to permit connecting them to the band operating levers without moving the latter from their stops.

Also check position of equalizer bar and if it does not stand square across and parallel, adjust rods lengths at clevises to secure parallel position.

11. Check all other levers in the hookup and see that they are set according to the standards outlined on pages 24-27.

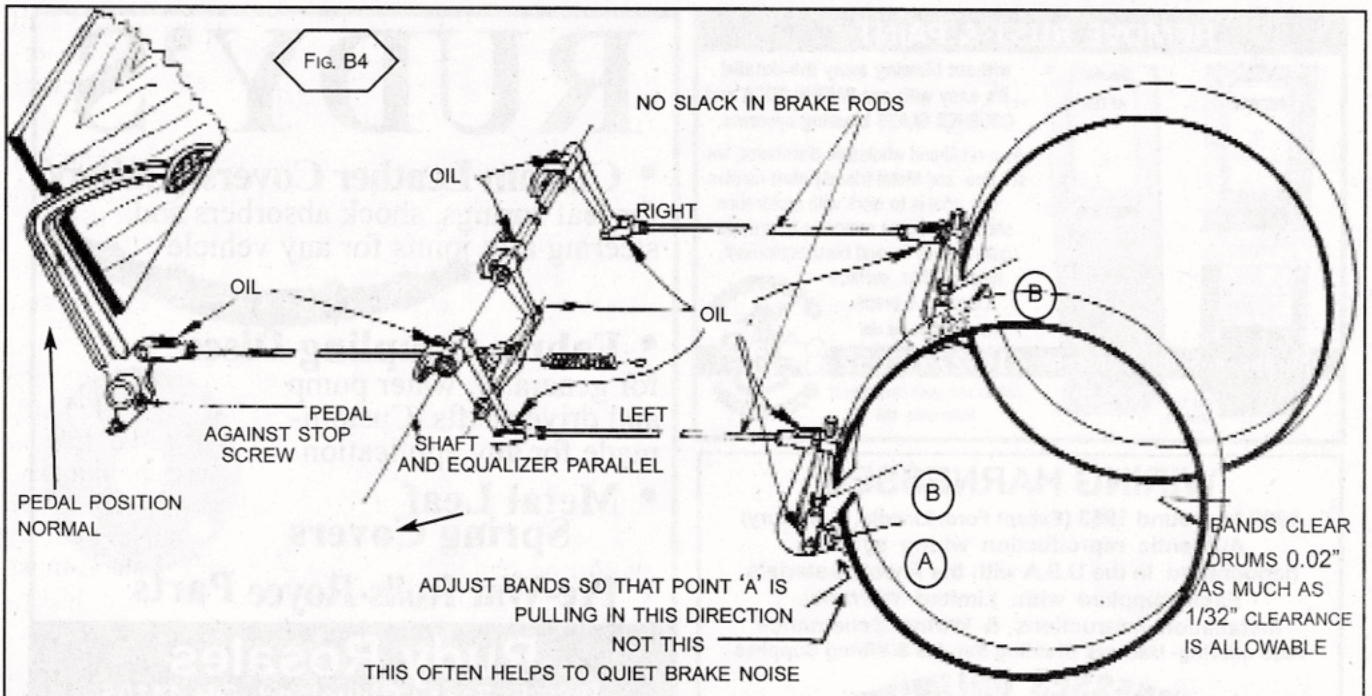
12. Now try pedal travel. Brakes should be fully applied and locked when pedal has traveled not more than ¾ of its total travel. If pedal travels almost to floorboards before brakes are applied, disconnect pedal rod and remove all slack from intermediate rods and pull rods by clevis adjustment. It should be remembered that removal of slack must be done without moving the band operating levers and other levers from their stops.

13. Attach a pedal depressor and check front to rear brake, retarding ratio. Adjust depressor until rear brakes are locked. Now try the fronts. They should be just starting to take hold or should have a fair amount of drag. Change position of pedal pull rod in hole on equalizer bar or readjust band clearances to get desired retarding ratio of front to rear brakes. Most mechanical brakes have a 60-40 or 70-30 ratio and when tried on dry pavement, fronts should show heavy impression on road when rears are locked.



Three-quarter wrapping type brake. Adjust in sequence 1,2,3. Note that pinned end of band is at top.

13. Try car on floor or road for equal braking. If one wheel locks before the other, loosen the top adjusting nut (3, Fig. B2) on the locking-wheel and take up slightly on the opposite wheel.

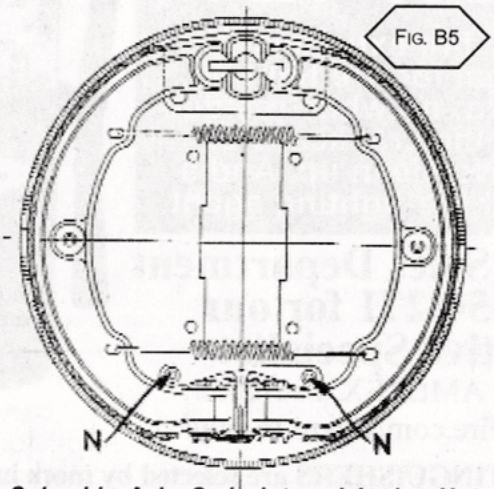


Proper position of mechanism when correctly adjusted, brakes released. If equalizer bar is not parallel with shaft lengthen right rod, shorten left rod, or vice versa. Change rod lengths by means of clevises. Position of 'A' can be controlled by manipulating nuts 'B.'

For information on brake troubles not corrected after making an ordinary adjustment, see the 'Trouble Shooting Chart' [see next month's installment] or the more specific instructions contained in the chapters devoted to the various makes of brakes and cars as listed in the index on page 24.

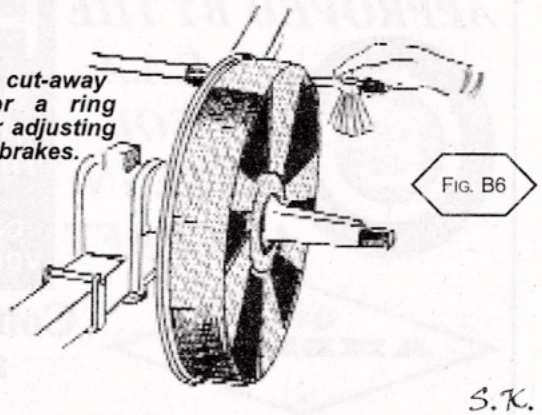
Adjustment of Internal Brakes

The fundamentals governing adjustment of internal brakes are the same as outlined for the external type. On internal brake systems where rigid shoes are utilized the most important adjustment is centering the shoes to the drum. The most popular constructions for centering adjustment are the use of slotted holes in the brake mounting or the utilization of eccentric type anchors. Centering of shoes on the rigid shoe brake correspond to anchor adjustment on the external type. Accurate centering usually requires the use of a cut away drum or ring gage with adapters as shown in Fig. B6. Ring gages are a necessity for the shop specializing in brake maintenance



Columbia Axle Co.'s internal brake. Note shoe centering facilities at 'N.'

Use of a cut-away drum or a ring gage for adjusting internal brakes.



S.K.

Next month: Troubleshooting Brakes & Lockheed Brake Systems