June 3, 1930. H. C. OLIVIER 1,761,933

INTERNAL BRAKE

Filed Jan. 6, 1928 3 Sheets-Sheet 1

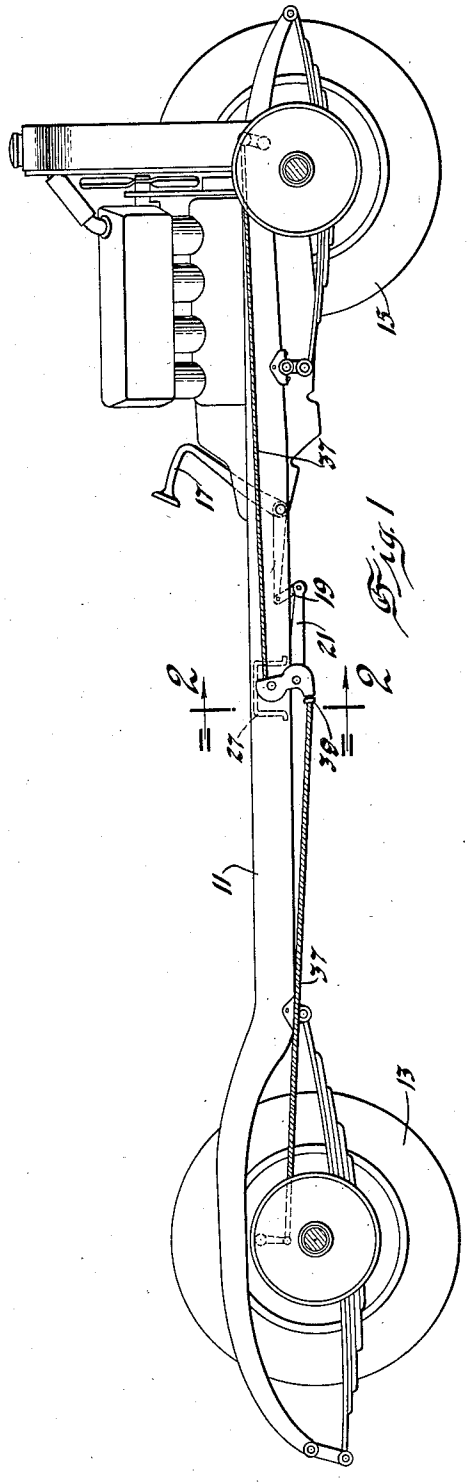


Fig. 1

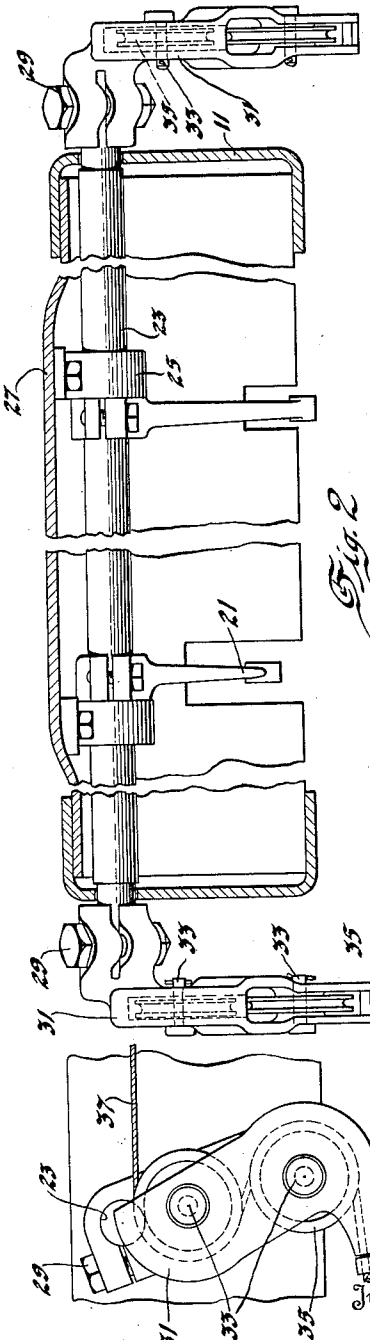


Fig. 2

Fig. 3

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INTERNAL BRAKE

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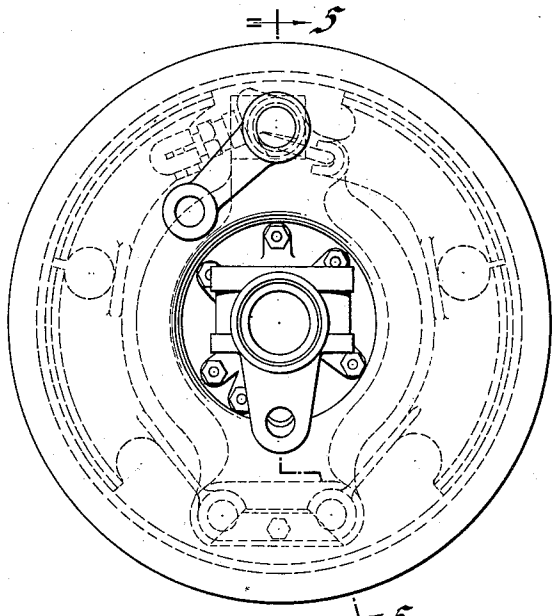


Fig. 4

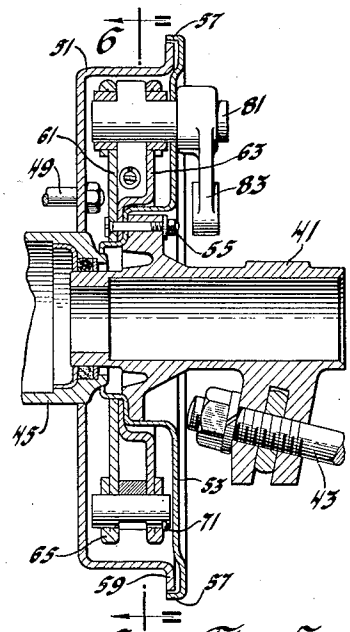


Fig. 5

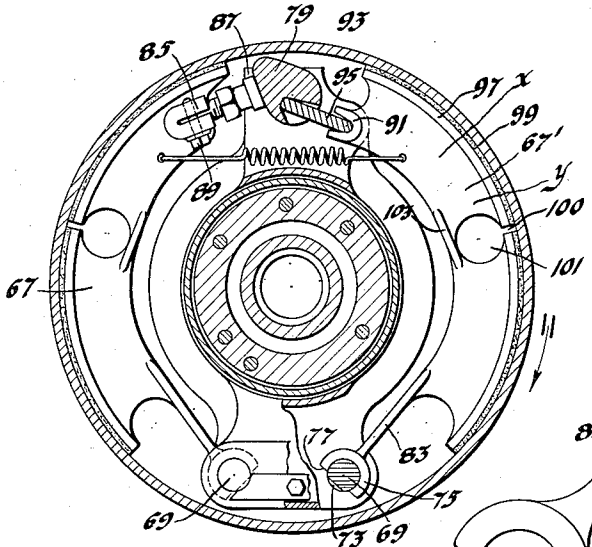


Fig. 6

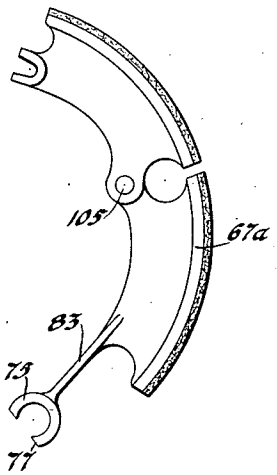


Fig. 7

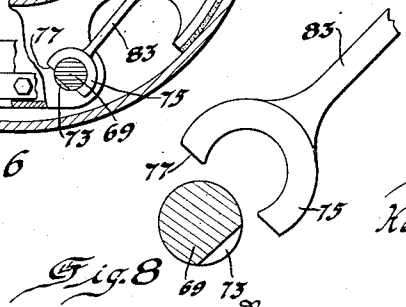


Fig. 8

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June 3, 1930. H. C. OLIVIER 1,761,933

INTERNAL BRAKE

Filed Jan. 6, 1928 3 Sheets-Sheet 3

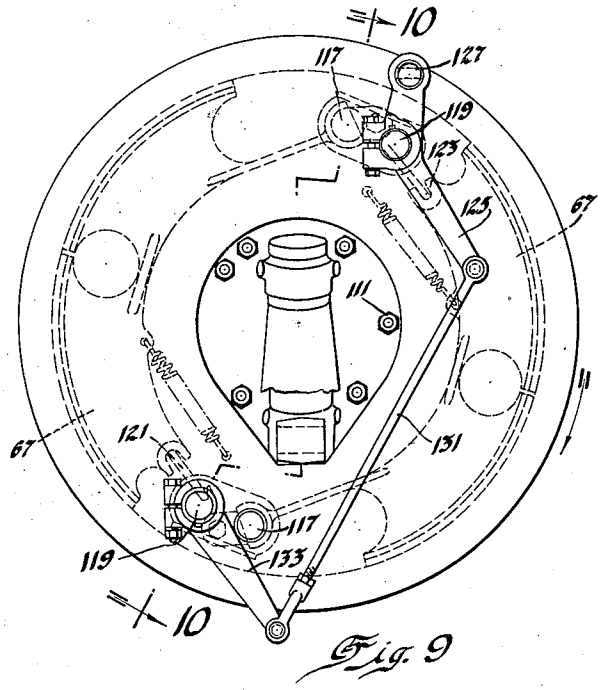


Fig. 9

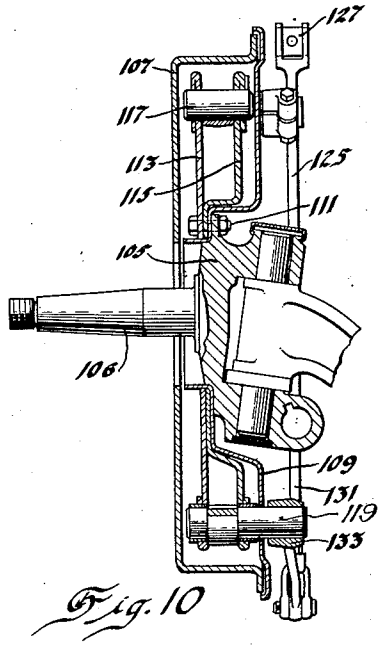


Fig. 10

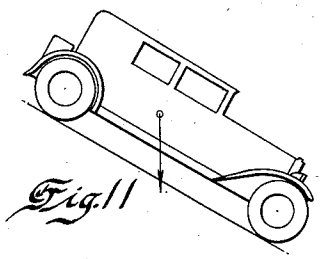


Fig. 11

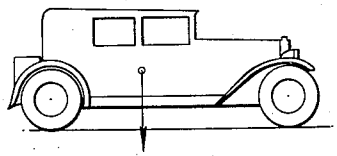


Fig. 12

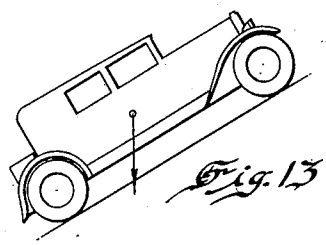


Fig. 13

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1,761,933

UNITED STATES PATENT OFFICE

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INTERNAL BRAKE

Application filed January 6, 1928. Serial No. 244,886.

This invention relates to brakes, and more particularly to internal shoe brakes for use on vehicles.

The advantages of internal brakes as compared with external brakes are well-known. Among such advantages is the protection from dust, from rain and snow. External bands can be effectively wrapped about the drum to produce the retarding resistance but the use of expanding internal bands has been more or less unsatisfactory and if a rigid shoe can be made to operate satisfactorily it is believed that it will be generally preferred.

One of the objects which has stood in the way of the more general adoption of the internal shoe is the difficulty encountered in securing uniform drum engagement at all points along the peripheral surface of the shoe. It is almost impossible to make the drum absolutely true and to so anchor the shoe that it shall simultaneously engage the drum at all points. Added to this mechanical difficulty is a further difficulty resulting from the change in the curvature of a shoe and drum under the influence of heat. It has been found that when the brakes are applied the outer portion of the shoe becomes hotter than the inner portion. This results in the curling of the shoe away from the drum so that its heel portion only offers frictional resistance. The brake then becomes hard to operate and the lining at the heel becomes worn down. The shoe is restored to its normal temperature and with the lining at the heel worn down the toe of the shoe comes first in contact with the drum when the brake is subsequently applied and the brake is grabby. So bad are these defects that internal shoes have been to some extent in disfavor. Associated with this difficulty is the further difficulty owing to the variability in the coefficient of friction between the lining and the drum. If the coefficient is too low there is a lack of breaking resistance while if it is too high the least tendency to grab is exaggerated. The manufacturer of brakes is therefore limited in his selection of linings. Furthermore, the temperature changes produce great differences in the coefficient of friction for any selected lining material with the result that with temperature changes a brake operating perfectly at one temperature may become exceedingly unsatisfactory when the drum becomes heated through frequent brake application. Upon subsequent cooling the coefficient may be so high that jolting movements of the car without pedal pressure will lock the brakes.

It is to overcome the above and other faults in a brake of the internal shoe type that this invention has been made.

It has for its object to make an internal brake shoe of a semi rigid construction wherein the shoe, though sufficiently rigid to be called a rigid shoe, is nevertheless to some extent yieldable to conform to the contour of the drum and does so in spite of irregularities in its own shape and in spite of an out of round condition in the drum. A shoe as herein described is almost perfectly free from the noted bad effects of heat. As a second object the invention takes advantage of drum rotation to secure the most effective action in checking both forward and reverse motion and in checking such motion both on level roads and on grades. To this end it makes use of both shoes on the forward wheels as self actuating members to check forward motion of the vehicle.

As another object the invention provides for a simple relation between the shoe and its anchor pin which is intended to facilitate assembly and removal of the shoe for replacement or renewal of its lining.

The invention also makes use of a novel hook-up including details related to equalization.

For a full understanding of the invention reference is made to the accompanying drawing, in which

Figure 1 is a side elevation showing a motor vehicle with my novel brake applied thereto.

Figure 2 is a transverse section on line 2—2 of Figure 1.

Figure 3 is a view in elevation of a detail illustrating the equalizing instrumentality.

Figure 4 is a view in elevation of the brake mechanism as used on the rear axle.

Figure 5 is a section on line 5—5 of Figure 4.

Figure 6 is a section on line 6—6 of Figure 5.

Figure 7 is a detail illustrating a modified form of the shoe in side elevation.

Figure 8 is a diagrammatic view showing the method of assembly and removal of the shoe from its anchor.

Figure 9 is a side elevation of the brake mechanism as used on the front axle.

Figure 10 is a section substantially on the line 10—10 of Figure 9.

Figures 11, 12 and 13 are diagrammatic views to illustrate the distribution of the mass of the vehicle relative to the wheels in several positions.

Referring by reference characters to the drawing, numeral 11 represents a side frame member of the motor vehicle supported by rear wheels 13 and front steering wheels 15. The chassis is for the most part conventional and unnecessary description will be omitted. At 17 is shown in a conventional way a brake pedal which may be pivoted to any convenient part of the chassis. One arm of the pedal is connected by a link 19 with an arm 21 rigidly carried by a rock shaft 23 extending transversely of the frame and journalled in suitable bearings 25 carried by a cross frame member 27 of channel shape which is supported by the chassis side frame member 11. The shaft arm 21 is preferably curved in a forward direction rather than being extended directly downwardly. It will be understood that the cross frame member is better able to offer resistance vertically than lengthwise of the vehicle and by extending the arm 21 and connecting it to the pedal as explained the reaction upon the cross member has practically only a vertical pull and the cross member is able to afford suitable support for the rock shaft 23 without distortion. The cross shaft 23 extends through the side frame members and to its ends outside the frame there are clamped by means of bolts 29 suitable brackets 31. These brackets 31 are in the form of housings having pivot pins 33 upon which are rotatably mounted pulleys 35. The flexible cable 37 traverses the pulleys 35, engages opposite faces of the pulleys as shown and extends from one pulley to the forward brake and from the other pulley to the rear brake. This construction is provided on each side of the vehicle, the cable and pulley functioning in a well-known way to equalize between the front and rear brakes. When the pedal is depressed shaft 23 is rocked in a counter-clockwise direction, the pulleys similarly rocking about the center of shaft 23. It will be understood that if the cable were fixed to housing 31 the rotation of the shaft would increase the distance between the center of the lower pulley and the rear brake thereby applying the brake. Since, however, the cable is free to move over the pulleys when the shaft is rocked the rear brake is applied and when the housing 31 moves beyond a position where the rear brake is applied the cable will be pulled rearwardly and apply the front brake, the free movement of the cable over the pulleys ensuring equalized action between the two brakes. When the pedal is released the brakes return to their disengaged condition. Should one of the releasing springs for example, the front spring be comparatively strong, it might operate to release its brake and also operate through the cable to hold the other, the rear, brake applied. To prevent this action the cable is provided with a stop device 39 which engages a bracket abutment after which the decreasing distance between the rear brake and lower pulley must introduce slack in this part of the cable and permit the release of the rear brake.

Referring next to Figures 4, 5 and 6, which show the brake as used with a rear vehicle wheel, numeral 41 is used to designate a tubular member which is to be secured to the end of the rear axle housing, not shown. A brace rod 43 is illustrated merely to show its relation to other parts. A part of the wheel hub is shown at 45.

To the wheel, fastening means 49 secure a drum 51 and at 53 is a backing plate or dust guard secured to the part 41 by bolts, one of which is shown at 55. The backing plate 53 and the drum 51 are provided with angular flanges at 57 and 59 to protect the enclosure between the backing plate and drum from the admission of moisture or dirt. Bolts 55 serve further to hold to the dust plate and part 41 two supporting plates 61 and 63. These plates, although in contact where held by the bolts, are elsewhere spaced and serve as anchors for the shoes and also to journal the actuating cam or its equivalent. At their outer portions they are bent back as shown at 65 in Figure 5 to afford greater stiffness for the shoe anchors and for the cam shaft. The shoes 67 are preferably two in number and are anchored on pins 69 carried in spaced position between extremities of plates 61 and 63. Each anchor pin 69 is received within registering openings in plates 61 and 63 in the double thickness part as shown. The pins are held from removal by any suitable fastening means such as 71. Between plates 61 and 63 the pins are made with flat portions as at 73. The shoes are formed with eyes 75 which are milled off as at 77 so that when properly positioned relative to the flat on the anchor pin they may be assembled and then rotated to operative position. To remove a shoe it is only necessary to swing it through a predetermined angle and then slide it off the anchor pin. This facilitates the work of renewing brake lining or making of other repairs.

The actuating cam 79 is carried on the cam shaft 81 similarly journalled in plates 61 and

63. The straddle bearing here and at the anchor affords a very substantial support, much better than in the case of a pin projecting inward from the backing plate and supported wholly thereby. The cam is positioned between plates 61 and 63. Outside the enclosure defined by the drum and backing plate the shaft 81 has an operating arm 83 for connection with the operating cable 37.

Into the end of one shoe adjacent the cam is threaded the shank 85 of a cam abutment 87, suitable fastening means 89 being used to clamp the abutment means in the shoe. By loosening the fastening means 89 it will be seen that adjustment can be easily made. The other shoe 67' has a tapered slot 91 which is axially in alignment with a similar tapered slot eccentrically located in the cam 79. A flat steel plate 95 is received in the aligned slots and when the cam is rotated it, by direct contact with the shoe abutment 87, expands shoe 67 and through the agency of plate 95 it expands shoe 67'.

The structure of the shoes constitutes an important part of the invention. The shoe is formed with a circumferential flange 97 to which a lining 99 of any preferred kind may be secured by riveting as usual. At one end the shoe is formed with a somewhat elongated thin arm 83. This arm 83 ends in the eye 75 for engagement with the anchor pin as explained above. At the other end of the shoe there is either the adjustable abutment 87 or the tapered slot as described above. Between the ends of the shoe the flange is saw cut forming a slot as at 100, and the web of the shoe is formed with a somewhat circular shaped opening 101 communicating with the slot 100. Adjacent the opening 101 and along the inner arc of the beam of the shoe there is a narrow wall or bridge 103. This part 103, although narrow, is laterally thickened to add strength to thereby resist forces exerted lengthwise of the bridge when the brake is applied, but the strength thus given still leaves a certain degree of yieldable quality afforded the shoe at this point by the removal of material at 100 and 101. It should also be noted that the part 83 is similarly thin and somewhat longer than the thin part 103 whereby yieldability is afforded between the anchor and the shoe proper. The action of the several forces applied to the shoe, the thrust of the cam through the abutment or through plate 95, the reaction upon the shoe from the anchor pin 69 through yielding part 83 and the reaction of the forces caused by the pressure between the shoe and the drum produce a resultant pressure acting substantially lengthwise through the bridge 103 and the thickening of the bridge at this point, as noted above, affords the strength to resist this resultant pressure. The yieldability of the shoe owing to its flexibility both at the bridge 103 and at the arm 83 permits it to bend sufficiently to conform to any irregularities in the face of the drum. Should the shoe become unduly heated and tend to expand along the outer edge the slot 100 affords an expansion region and there is no occasion for the curling action which occurs frequently in shoes of the rigid type. Each shoe may be thought of as more or less like two yieldingly connected shoes, one of which is an applied shoe and the other an anchored shoe, there being a yielding connection at 103 between the two shoes. If a single rigid shoe of a length corresponding to the double shoe be compared with the double shoe it may be said of the single shoe that if, owing to its failure to conform to the shape of the drum, it contacts at a point adjacent its heel a hard operating brake results. If this double shoe should tend to contact at the heel portion, the flexible parts yield and permit contact of the other parts to make the action of the shoe as a whole more effective. Similarly any tendency to a grabbing action such as is caused by a contact at the toe portion makes a very bad brake in the case of a rigid shoe, but in the case of a shoe of this kind the tendency to grab exerts a force through the bridge such as to enable other points along the shoe to engage the drum and the grabbing tendency is overcome.

The flexibility of the shoe as described above is of great value when the effects of changing coefficients of friction are taken into consideration. As is well known a rigid shoe which operated to advantage with a lining having a known coefficient of friction may not operate at all well with a lining having a lower or higher coefficient of friction. A lining with a lower coefficient may make the brake hard in its operation. A lining with a higher coefficient will tend to lock the wheels if there is a least tendency to grab. When it is considered that even the best linings have considerable variations in their coefficients of friction at different temperatures it will be appreciated that even a shoe which may operate well at one temperature may be very touchy at another temperature. This difficulty has been a serious problem with the manufacturers of rigid shoes. With the present shoe the resultant of the several forces acting on the shoe normally lies in the long axis of the bridge, the long axis of the bridge being determined for selected lining coefficient. If a lining of higher coefficient is used or if, as a result of temperature changes, the coefficient of friction of a given lining, is considerably increased the resultant force passes through the bridge at an angle with its longitudinal axis and tends to release the highly self-actuated part of the shoe. If, for example, the highly self-actuated part of the shoe should be actuated with greater force owing to an unduly high lining coefficient and tend therefore to grip the drum and lock the wheel the angular relation of the resultant of

the several forces through the bridge tends to relieve the pressure in the highly self-actuating region, as at x—y, and prevent the grabbing. Simultaneously the portion of the shoe nearer the heel is given additional pressure. This is the region where self-actuation is low. By these combined actions the brake as a whole operates well with variation in coefficient of friction. By means of a shoe built as this is it is possible to secure maximum deceleration without grabbing and it is also possible to use linings of a higher coefficient of friction than is the case with the more conventional rigid shoe.

In Figure 7 is illustrated a modified form of brake shoe. This shoe 67ª resembles shoe 67′ shown in Figure 6 differing only in that instead of the flexible bridge 103 the shoe is made of two parts pivoted together at 105 which point corresponds with the yieldable portion 103 of shoe 67′. In this form the forces act ordinarily through the pivot along such a line that there is no tendency to collapse the shoe about the pivot 105. When, however, the shoe fails to conform to the drum or under the influence of temperature changes as explained above the line of action of the several forces is at a slightly different angle there may be a slight pivotal action at 105 and a bending at portion 83 such as to enable the shoe to properly conform to the drum and compensate for temperature changes.

In Figures 9 and 10 there is illustrated an embodiment of the invention which will be used in the case of a front wheel brake. This front wheel brake resembles in general the brake for the rear wheel but differs in that one of the two shoes of the front wheel brake is reversed in position so that each shoe has an anchor adjacent the application end of the other shoe and two simultaneously operable actuating means are used, one for each shoe. By this means each shoe is made self actuating for forward driving with the result that the front wheel brake is the more effective for forward driving.

In this connection it seems best to state briefly the problems encountered in checking a moving vehicle with brakes. It should be noted that the center of gravity is usually nearer the rear of the vehicle than the front, the rear wheels commonly carrying two thirds the weight of the vehicle and the front wheels one third. This has been illustrated in a diagrammatic view, Figure 12. When the wheels are checked inertia tends to continue the movement of the supported chassis parts and body. If the body is moving forward this, in effect, is as if a part of the rear wheel load were transferred to the front wheels. The front wheels are therefore the logical places for applying at least the greater part of the brake effort for forward driving. So, when driving in reverse the rear brakes should be the more effective.

This braking arrangement, whereby forward travel is checked mostly by front brakes and rearward travel mostly by rear brakes operates just as it should in the case of travel on grades. The remarks above apply in these cases also. Furthermore, the direction of the pull of gravity is directed, as shown in Figures 11 and 13, toward the lower wheels in proportion as the grade is steep, the lower wheels supporting the great part of the load. The braking resistance is therefore, according to the plan herein described, where it should be, on the front wheels when driving forward on a level road or downhill and on the rear wheels when driving backward on a level stretch or coasting backward downhill.

Referring now particularly to Figures 9 and 10 for a description of the structure of the front wheel brakes, reference character 105 represents the steering knuckle which is provided with a spindle 106 for carrying the wheel. This wheel is provided as usual with a drum 107 and the backing plate 109 is secured to the knuckle in a suitable or preferred manner, preferably by fastening means 111. Also secured to the knuckle are plates 113 and 115 corresponding to plates 61 and 63 as used with the rear wheel brake. At diametrically opposite points these plates 113 and 115 support side by side the brake anchor pin 117 and an actuating shaft 119. Associated with each shaft 119 is a cam carrying an eccentrically mounted steel plate 121 corresponding to the steel plate 95 of the rear wheel brake. This steel plate enters an eccentrically located slot 123 in the shoe and a corresponding slot in the cam as in the case of the rear wheel brake. The milled eye at the anchor end of the shoe may be used as before. The two shoe anchors and operating means are so positioned that the rotating drum as the wheel turns forwardly supplements the actuating force. In other words, both shoes are self actuating for forward vehicle travel. Both are simultaneously operated. To that end, on one shaft 119, the upper one as shown in Figure 10, there is clamped an actuating lever 125. Its upper end is provided with suitable means 127 for connection with the operating cable 37 extending from the pulley toward the front end of the vehicle. The lever 125 also extends downwardly from its connection with shaft 119 and between its lower end and an arm 133 extending from the lower shaft 119 is a link 131. It will be understood from this description that when the cable pulls upon lever 125 it turns the upper shaft 119 exerting a thrust upon the shoe 67 at the right of Figure 9. The lever 125 simultaneously through the link 131 and the arm 133 exerts a thrust upon the other shoe 67. It may be added to avoid any misunderstanding that the wheel shown in Figure 9 is rotating clockwise so that its drum tends to

carry both shoes around clockwise and thus adds the self-actuating effect to the force applied by the operator in pulling on lever 125 through the cable 37.

The accomplishment of the desired result whereby the front brake is rendered more effective for forward driving is thus very simple. It amounts really to the reversing of one of the shoes together with its anchor, utilizing a second operating means and connecting the operating means for the two shoes. With this arrangement if the vehicle is going forward and is to be stopped both shoes in the forward wheel are mechanically applied by the operator and both are self actuating to give a maximum retarding effect at the front wheel. At the same time, at the rear wheel one shoe only, as is the usual arrangement with rigid shoes, is self actuating and its self-actuation is neutralized by the opposite effect of the drum upon the other shoe. When, however, the vehicle is moving backwardly and is to be checked there is no self actuating effect added to the applied force at the front wheel as there is when forward motion is checked. On the contrary both shoes tend to be rotated away from the drum by the rotary movement of the drum. Both are therefore non-self actuating. While in the case of the rear wheel one of the shoes is self actuating and the other is non-self actuating. It therefore follows that with this arrangement the front wheel brakes are more effective to stop forward motion; and for checking rearward motion the rear wheel brakes are most effective because at the front wheel both shoes become non-self actuating while at the rear there is a merely neutral condition, one shoe being self actuating and the other non-self actuating.

I claim:

1. A shoe for brakes comprising a lining carrying flange, an arc shaped web supporting said flange, said lining carrying flange formed at an intermediate point with a radial slot and the said web having an opening into which the slot gives access, there being a bridge portion relatively thin radially and wide axially inwardly of the opening in the web.

2. The invention defined by claim 1, the longitudinal axis of the web formed to substantially coincide with the resultant of the several forces acting through the bridge when the brake is applied.

3. The invention defined by claim 1, said shoe being yieldable at said bridge portion to enable the shoe to conform to the drum.

4. The invention defined by claim 1, the longitudinal axis of the bridge formed to substantially coincide with the resultant of the several forces acting through the bridge for a lining of predetermined coefficient of friction, said bridge portion being yieldable whereby changed lining coefficients operate to cause the resultant line of force to cross the bridge angularly and effect a yielding action.

5. Brake mechanism comprising an anchored shoe having a lining carrying part and an arc shaped radially extending web, said web having flexible portions along its inner wall including a flexible portion adjacent the anchor to permit the shoe to conform to the drum when the brake is applied and to reduce the self actuation of the highly self actuated part when the lining coefficient is abnormally high.

6. A brake shoe comprising two shoe parts integrally united by a yielding bridge, each part consisting of a lining carrying portion and an arc shaped web, one web terminating in an actuating abutment and the other web having at its outer web an anchor pin abutment.

7. The invention defined by claim 6, said last named web being yieldable adjacent said anchor pin abutment.

8. The invention defined by claim 6, the inner adjacent ends of the webs being integrally united to constitute the said yielding bridge.

9. A brake shoe comprising a lining carrying flange and an arc shaped web, an anchor and an actuating means, said shoe including integral yielding parts adjacent the anchor and also at an intermediate point along the shoe.

10. In a brake, a shoe, an anchor pin for said shoe, said pin having at least one flat surface, said shoe having an eye for engaging said anchor pin, said eye being milled off to slidingly engage said pin in the act of assembling and removal.

In testimony whereof I affix my signature.

HERMAN C. OLIVIER.