

Aug. 10, 1937.

H. L. BONE

2,089,823

RAILWAY BRAKING APPARATUS

Filed Nov. 15, 1934

6 Sheets-Sheet 1

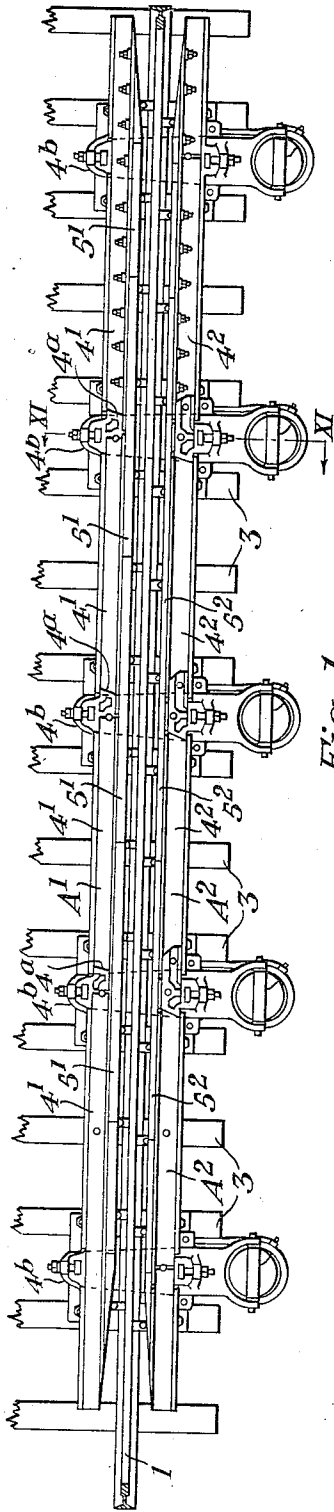


Fig. 1.

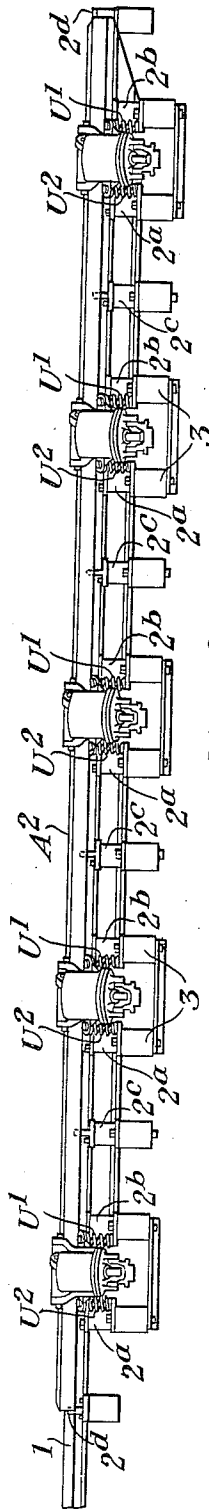


Fig. 2.

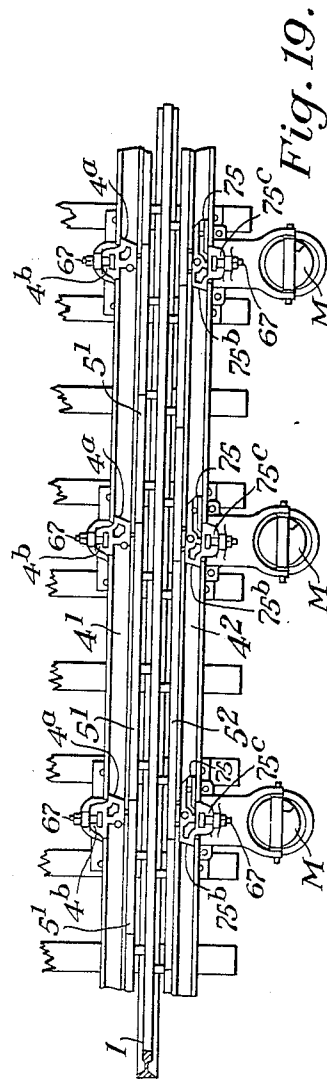


Fig. 19.

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RAILWAY BRAKING APPARATUS

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6 Sheets-Sheet 2

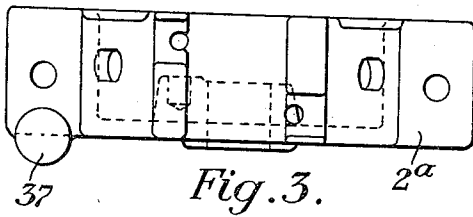


Fig. 3.

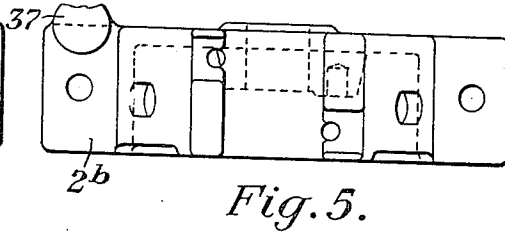


Fig. 5.

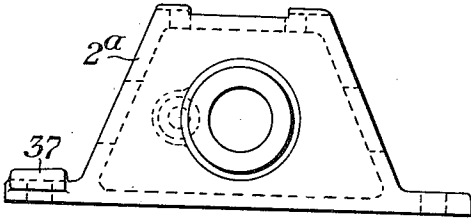


Fig. 4.

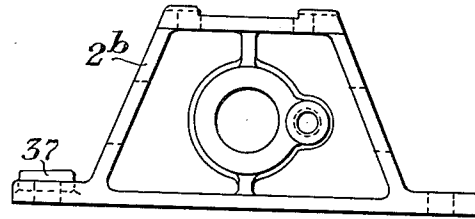


Fig. 6.

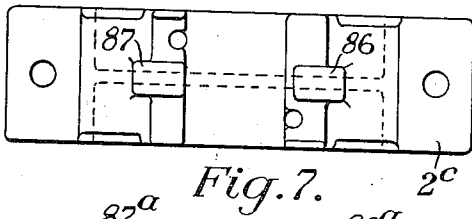


Fig. 7.

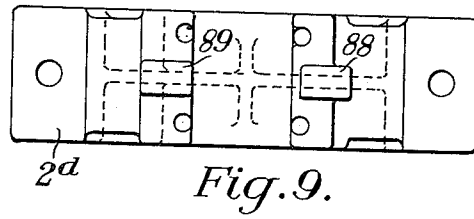


Fig. 9.

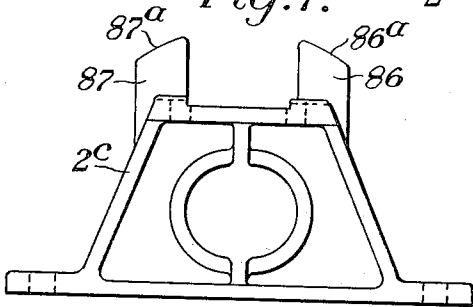


Fig. 8.

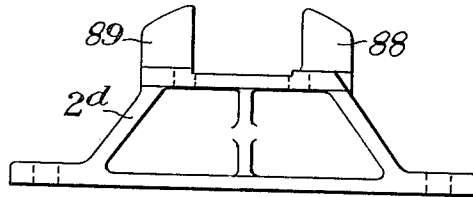


Fig. 10.

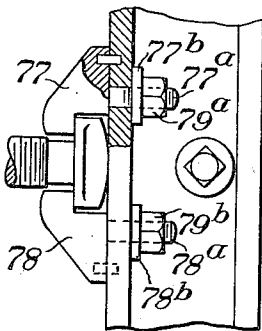


Fig. 18.

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RAILWAY BRAKING APPARATUS

Filed Nov. 15, 1934

6 Sheets-Sheet 3

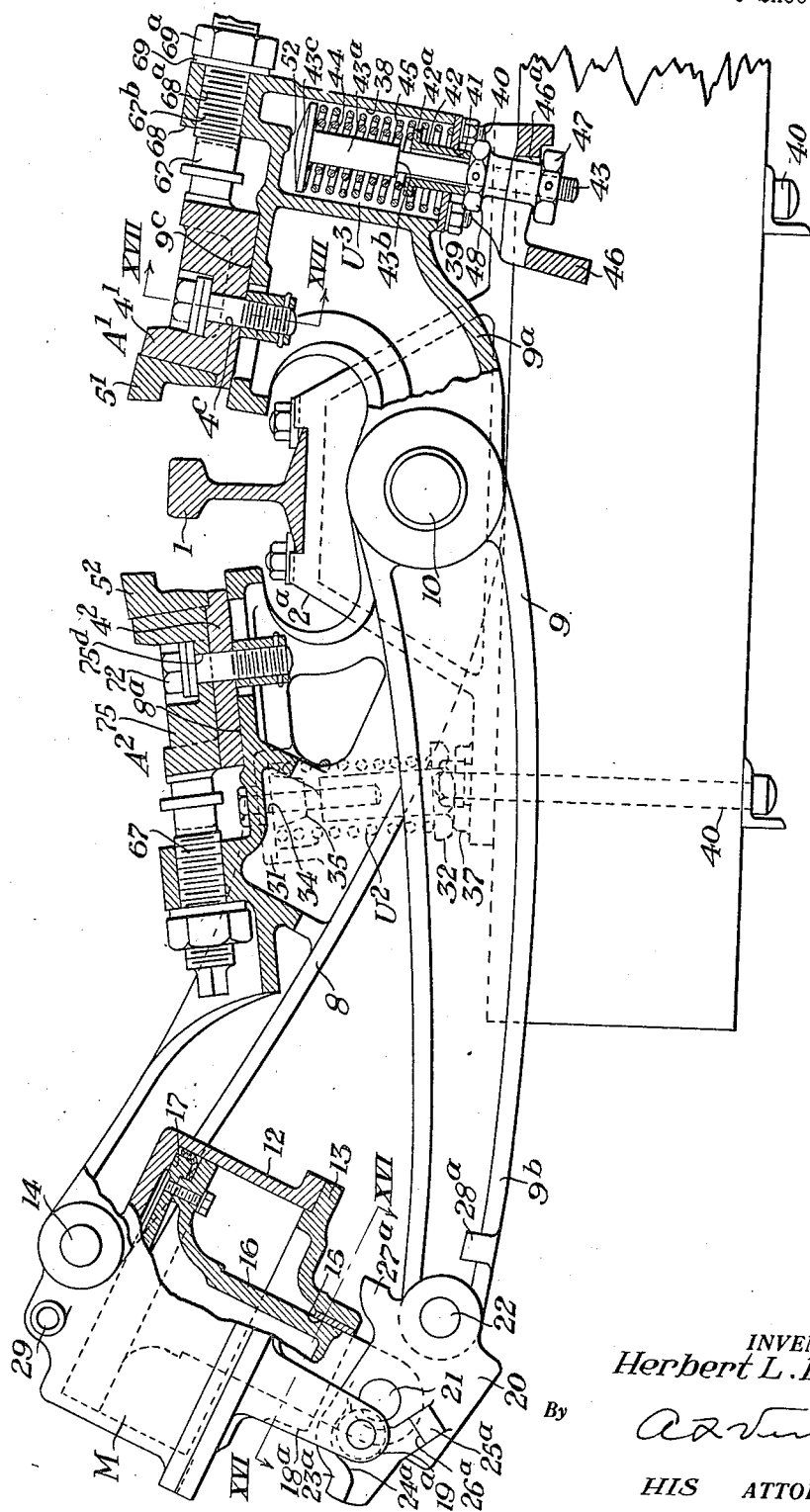


Fig. II.

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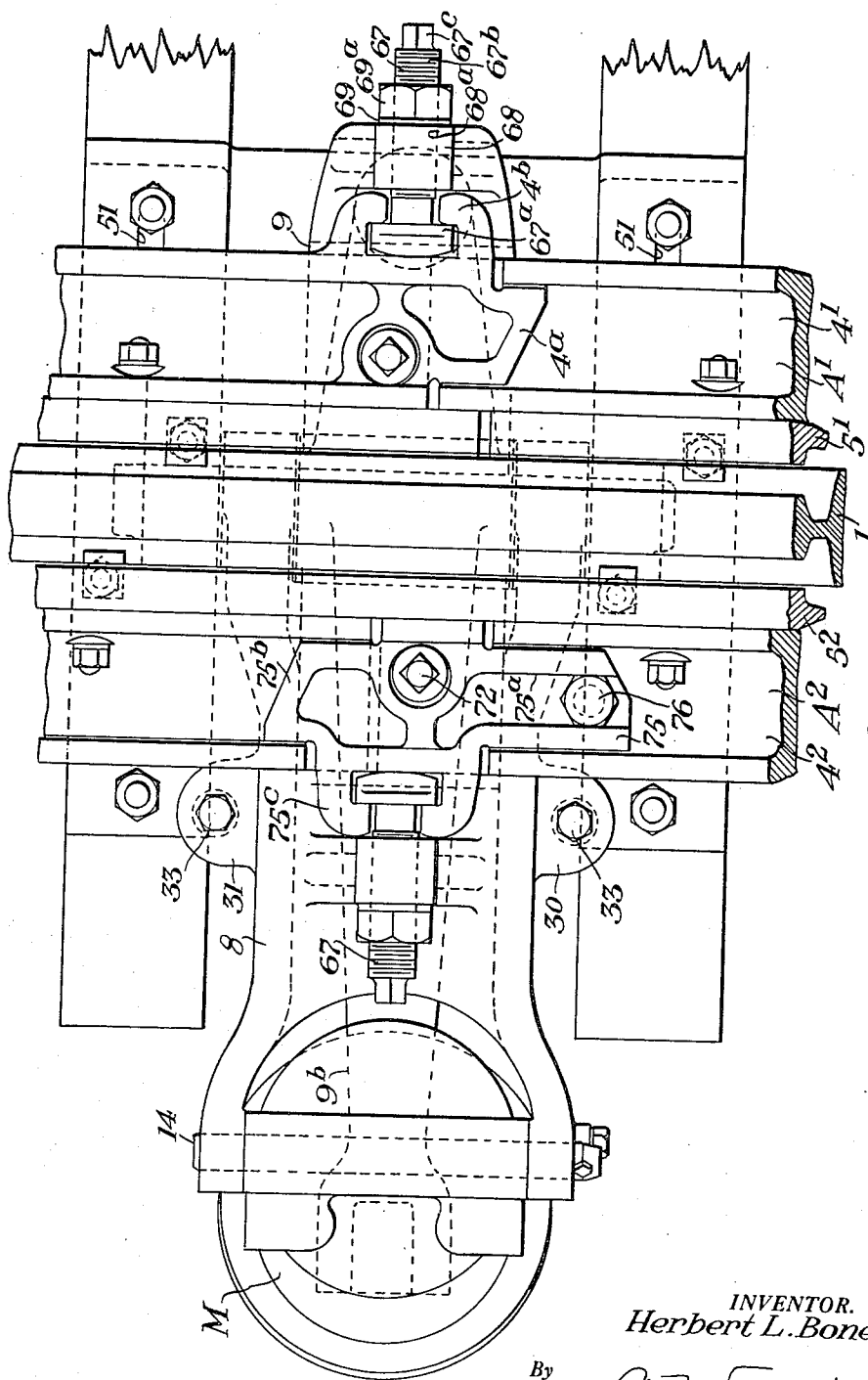
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RAILWAY BRAKING APPARATUS

Filed Nov. 15, 1934

6 Sheets-Sheet 4



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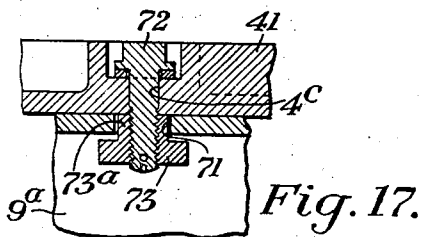
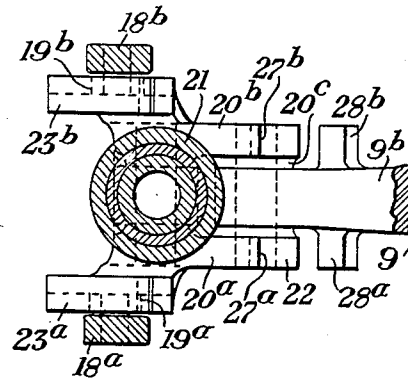
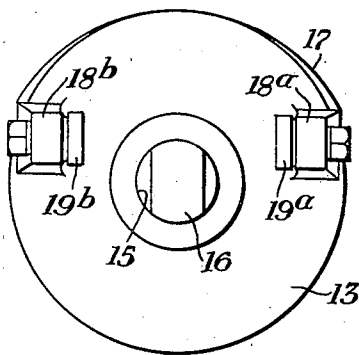
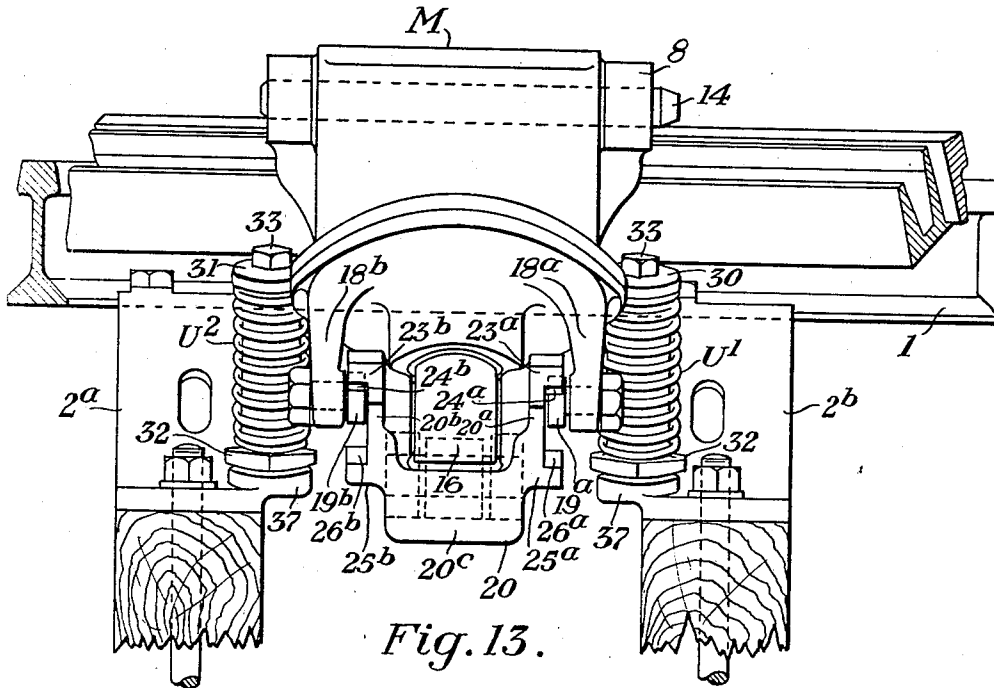
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RAILWAY BRAKING APPARATUS

Filed Nov. 15, 1934

6 Sheets-Sheet 5



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RAILWAY BRAKING APPARATUS

Filed Nov. 15, 1934

6 Sheets-Sheet 6

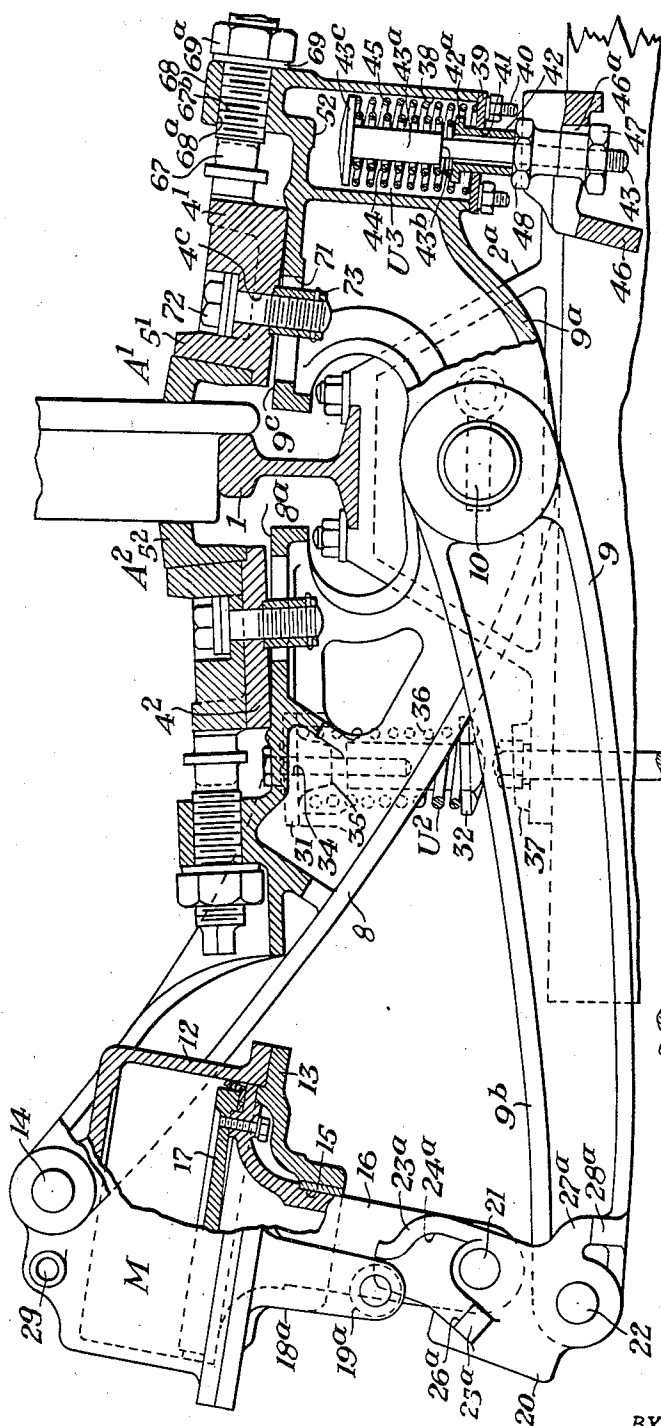


Fig. 14.

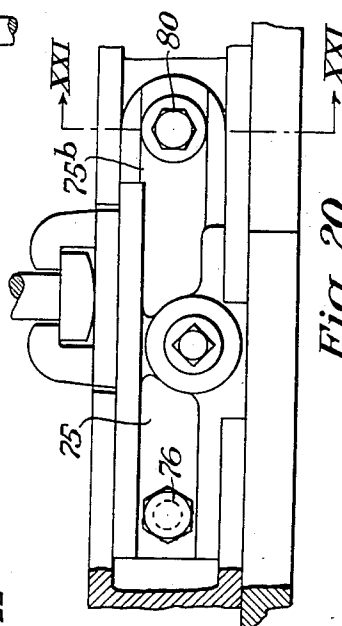


Fig. 20.

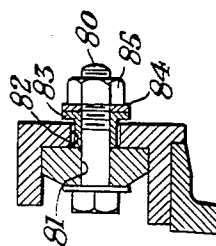


Fig. 21.

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UNITED STATES PATENT OFFICE

2,089,823

RAILWAY BRAKING APPARATUS

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Application November 15, 1934, Serial No. 753,184

31 Claims. (Cl. 188—62)

My invention relates to railway braking apparatus, and particularly to braking apparatus of the type comprising wheel engaging braking bars extending parallel to a track rail on opposite sides of the rail, and movable toward and away from the rail into braking and non-braking positions. More particularly, my invention relates to apparatus of the type described in which the braking bars are arranged to be moved to their braking positions by a fluid pressure operated motor or motors, and to be restored to their non-braking positions by suitable biasing means.

Specifically, my invention relates to improvements in apparatus of the type described and claimed in Letters Patent of the United States, No. 1,927,201, granted to me on September 19, 1933, for Railway braking apparatus.

One object of my invention is the provision, in apparatus of the type described, of means for reducing the amount of fluid required to operate the apparatus.

Another object of my invention is the provision, in apparatus of the type described, of novel means for adjusting the positions of the braking bars with respect to the track rails to compensate for brake shoe wear.

Other objects of my invention will appear as the description proceeds.

I will describe one form of apparatus embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawings, Fig. 1 is a top plan view showing one form of braking apparatus embodying my invention. Fig. 2 is a side view of the apparatus shown in Fig. 1. Figs. 3 and 4 are enlarged top plan and side views, respectively, of one of the rail supports 2^a shown in Fig. 2. Figs. 5 and 6 are enlarged top plan and side views, respectively, of one of the rail supports 2^b shown in Fig. 2. Figs. 7 and 8 are enlarged top plan and side views, respectively, of one of the rail supports 2^c shown in Fig. 2. Figs. 9 and 10 are top plan and side views, respectively, of one of the rail supports 2^d shown in Fig. 2. Fig. 11 is an enlarged vertical sectional view taken substantially on the line XI—XI of Fig. 1, and showing the details of construction of one of the operating units for the car retarder shown in Fig. 1. Figs. 12 and 13 are top plan and side views, respectively, of the operating unit shown in Fig. 11. Fig. 14 is a view similar to Fig. 11 but showing the parts in the positions which they occupy when the braking bars are engaging a car wheel. Fig. 15 is a bottom view of the fluid pressure motor M of the operating unit shown in Figs. 11 to 14, in-

clusive. Fig. 16 is a view taken on the line XVI—XVI of Fig. 11. Fig. 17 is a detail sectional view when taken on the line XVII—XVII of Fig. 11. Fig. 18 is a detail view of a portion of the apparatus shown in Fig. 11. Fig. 19 is a fragmentary top plan view showing the manner in which the brake shoes are arranged when two retarders similar to the retarder illustrated in Fig. 1 are joined together. Fig. 20 is an enlarged detail view showing a modified form of a portion of the apparatus illustrated in Figs. 1 and 12, and Fig. 21 is a sectional view on the line XXI—XXI of Fig. 20.

Similar reference characters refer to similar parts in each of the several views.

Referring first to Figs. 1 and 2, the reference character 1 designates one track rail of a stretch of railway track which track rail, as here shown, is secured to a plurality of rail supports 2 mounted on the usual crossties 3. The rail supports 2 are of four different types for reasons which will be made clear as the description proceeds, and the type to which each support belongs is indicated in the drawing by the addition of the exponent *a*, *b*, *c* or *d* to the reference character for the support. In actual practice, the supports 2^a are usually referred to as left-hand supports, the supports 2^b as right-hand supports, the supports 2^c as intermediate supports, and supports 2^d as end supports, and for convenience, I shall hereinafter refer to the different supports in the manner in which they are referred to in actual practice. A left-hand support 2^a is shown in detail in Figs. 3 and 4 of the drawings, a right-hand support 2^b in Figs. 5 and 6, an intermediate support 2^c in Figs. 7 and 8, and an end support 2^d in Figs. 9 and 10. It will be noted from an inspection of Fig. 2 that the left-hand and right-hand supports are disposed in pairs and are mounted on adjacent crossties 3, while an intermediate support is disposed between each two adjacent pairs of right and left-hand supports. It will also be noted that the end supports 2^d are disposed at the extreme ends of the braking apparatus.

Extending parallel to rail 1 on the gauge side of the rail is a braking bar A¹ comprising a plurality of brake beams 4¹, secured together by means of replaceable brake shoes 5¹, and extending parallel to the rail 1 on the other side of the rail is a braking bar A² comprising a plurality of brake beams 4² secured together by means of replaceable brake shoes 5². The braking bars A¹ and A² are adapted to be moved toward and away from rail 1 into braking and non-braking

positions, and for this purpose a plurality of independent operating units are provided, one of which is associated with each pair of right and left-hand rail supports 2^a and 2^b. These operating units are all alike and a description of one will therefore suffice for all.

Referring particularly to the operating unit shown on an enlarged scale in Figs. 11, 12, 13 and 14, this operating unit comprises a lever 8 pivotally mounted at one end on a pivot pin 10 carried by the associated rail supports 2^a and 2^b, and a lever 9 pivotally mounted intermediate its ends on the pivot pin 10. The lever 8 is inclined upwardly and extends away from the rail 1, and is provided adjacent the rail with a flat upper surface 8^a which supports the braking bar A². The one end 9^a of the lever 9 is likewise inclined upwardly and extends away from the rail 1 at the opposite side of the rail from the lever 8, and the other end 9^b of the lever 9 is inclined downwardly and extends away from the rail 1 below the lever 8. The end 9^a of the lever 9 is provided adjacent the rail with a flat upper surface 9^c similar to the surface 8^a, which latter surface supports the braking bar A¹. The braking bars are fastened to the associated levers in a manner which I will describe in detail hereinafter. The parts are so arranged and so proportioned that if the outer or free ends of the levers 8 and 9 are moved apart, the braking bars will be moved toward the rail to their effective or braking positions in which they will engage the opposite side faces of the wheel of a car traversing rail 1 and will retard the speed of the car. The center of gravity of the lever 8 and the braking bar A² is considerably to the left of the pivot pin 10, as will be seen from an inspection of Fig. 11, so that this lever will normally tend to rotate in a counter-clockwise direction about the pivot pin. Similarly, the center of gravity of the lever 9 and braking bar A¹ is to the right of the pivot pin 10, as viewed in Fig. 11, so that this lever will normally tend to rotate in a clockwise direction about the pivot pin. It will be apparent, therefore, that when no force is applied to the free ends of the levers 8 and 9 to move them apart, the free ends of these levers will move toward each other, thereby moving the braking bars away from the rail to their open or ineffective positions in which they are shown in Fig. 11.

Each operating unit also comprises apparatus embodying my present invention for moving the levers apart. As here shown, this apparatus comprises a fluid pressure motor M consisting of a cylinder 12 partly closed at its lower end by a cylinder head 13, and pivotally connected at its upper end to the free end of the lever 8 by means of a pivot pin 14. The cylinder head 13 is provided with a relatively large centrally located bushed bearing 15, and extending into the cylinder 12 through this bearing is a piston rod 16 that is driven by a piston 17, a part of which piston is formed integrally with the piston rod as clearly shown in Fig. 11. The cylinder head is also provided with two laterally spaced depending brackets 13^a and 13^b which support rollers 19^a and 19^b, respectively. A link 20 comprising two parallel side members 20^a and 20^b connected together by a web 20^c (see Figs. 13 and 16) is pivotally connected intermediate its ends to the lower end of the piston rod 16 by means of a pin 21, and is pivotally connected at one end to the end 9^b of the lever 9 by a pin 22, thus operatively connecting the piston rod 16 with the lever 9. The side members 20^a and 20^b of the

link 20 at the end opposite to that which is pivotally connected to the lever 9 are provided, respectively, with integral laterally projecting cams 23^a and 23^b having cam surfaces 24^a and 24^b, and with laterally projecting cams 25^a and 25^b having cam surfaces 26^a and 26^b. The cam surfaces 24^a and 26^a cooperate with the roller 19^a, and the cam surfaces 24^b and 26^b cooperate with the roller 19^b. The side members 20^a and 20^b of the link 20 are further provided with bosses 27^a and 27^b which cooperate with stop lugs 28^a and 28^b provided on the end 9^b of the lever 9.

Fluid pressure may be admitted to the cylinder 12 through an opening 29 which is threaded to receive a pipe not shown. When fluid pressure is admitted to the cylinder, the piston 17 is forced downwardly within the cylinder from its retracted position in which it is shown in Fig. 11 to its projected position in which it is shown in Fig. 14. As the piston moves downwardly, the cam surfaces 24^a and 24^b engage the rollers 19^a and 19^b, respectively, and these cams are so shaped that this engagement will cause the cylinder 12 to rotate in a counter-clockwise direction about the pivot pin 14, and the link 20 to rotate in a clockwise direction about the pivot pin 22, until the link 20 has been rotated to the position in which the bosses 27^a and 27^b on the link 20 engage the stop lugs 28^a and 28^b on the lever 9, as shown in Fig. 4. The parts are so proportioned that the link 20 will be rotated to the position in which the bosses 27^a and 27^b engage the stop lugs when the piston has moved downwardly from one-half to two-thirds of its total stroke, and that when the link 20 occupies this latter position, the toggle formed by the cylinder and link will be moved past its dead-center position a small amount. It is obvious that as the toggle formed by the cylinder and link moves toward its dead-center position, the associated ends of the levers 8 and 9 are moved apart, but that the force available for moving the lever apart is only a component of the total force exerted by the piston, whereas, as soon as the toggle reaches its dead-center position, the full force exerted by the piston is then available for moving the levers apart. The parts are further so proportioned that when the toggle formed by the link 20 and cylinder 12 has been moved to its dead-center position, the braking bars will just be moved to the positions in which they are engaging the opposite side faces of a car wheel traversing rail 1, and it follows, therefore, that while the full force of the piston is not available for moving the braking bars from their open positions to the positions where the braking bars just engage the car wheels, the force which is available under these conditions is more than adequate since the only force which has to be overcome is that due to the bias of the levers and friction. It also follows that when the braking bars are engaging the car wheels the full force exerted by the piston is then available to produce retardation of the car. In actual practice, the portion of the stroke of the piston required to move the braking bars to the positions where they just engage the car wheels is usually referred to as the clearance stroke, while the remainder of the stroke of the piston is usually referred to as the working stroke. For convenience, I will hereinafter refer to these portions of the stroke of the piston in this manner. When the levers 8 and 9 have been moved apart by admitting pressure to the motor M in the manner just described, and the cylinder 12 is subsequently

disconnected from the source of pressure and is vented to atmosphere, the free ends of the levers 8 and 9 will move toward each other under the influence of gravity in the manner previously described. During this movement, the toggle formed by the cylinder and link will remain in the position in which the bosses 27^a and 27^b on the link engage the stop lugs 28^a and 28^b on the lever 9 until the piston has moved upwardly far enough to cause the cam surfaces 26^a and 26^b to engage the rollers 19^a and 19^b, whereupon continued movement of the levers will cause the link 20 to rotate in a counter-clockwise direction about the pin 22 past the dead-center position of the toggle formed by the lever and the motor M. As soon as the link has been rotated past the dead-center position of the toggle, the toggle is, of course, broken and as the free ends of the levers 8 and 9 complete their return movement, the parts gradually return to their normal positions in which they are shown in Fig. 11.

It should be pointed out that with the parts arranged in the manner just described the portion of the return stroke of the piston necessary to move the toggle formed by the cylinder and link past its dead-center position is somewhat greater than the length of the working stroke of the piston. One advantage of this arrangement of the parts is that it insures that the toggle formed by the cylinder and link will not be broken in the event that the piston is forced back a distance greater than the length of the working stroke for any reason by a car wheel while the car is being retarded, thus providing some extra margin to the working stroke which becomes effective after the retarder has once been closed. Inasmuch as the braking bars will, during a large percentage of the times when the retarder is being operated, be in their braking positions before a car enters the retarder, this extra margin is available in practically all cases.

It should also be pointed out that when the link 20 is rotated to the position in which the bosses 27^a and 27^b engage the stop lugs 28^a and 28^b, as shown in Fig. 14, the rollers 19^a and 19^b are spaced a slight distance from the cam surfaces 24^a and 24^b. It will be apparent, therefore, that when the piston 17 is pushed back from its projected position in the cylinder by a car, as is usually the case when the braking bars have been moved to their braking positions and a car enters the retarder, there will be no wear between the cam surfaces 24^a and 24^b and the rollers 19^a and 19^b.

One advantage of the means just described for moving the levers apart is that it enables the braking bars to be moved from their non-braking positions in which they are spaced from the rails far enough to clear wide locomotive wheels to their braking positions in which they engage the wheels of a car and retard the speed of the car, with a considerably shorter piston stroke than would otherwise be possible, thus decreasing the amount of fluid required to operate the retarder. According to actual tests, this decrease in fluid consumption amounts to from 40% to 50% of that which would be required to produce equivalent operation of the braking bars by means of a fluid pressure motor, the cylinder of which was connected directly to the one lever and the piston of which was connected directly to the other lever.

Another advantage of the means just described for moving the levers apart is that it permits the overall height of the retarder, when the braking

bars are in their open positions, to be lower than would otherwise be the case. This is desirable because it lessens the danger of damage to the retarder due to dragging railway equipment.

It will be readily understood that it is desirable to have the braking bars A¹ and A² accurately positioned with respect to the rail 1 when the braking bars are in their open or ineffective positions, in order to insure that the brake shoes 5 will not engage the wheels of cars or locomotives which should not be retarded while passing through the braking apparatus, and it will also be readily understood that it is likewise desirable to have the braking bars accurately positioned with respect to the rail 1 when the braking bars are moved to their ineffective or braking positions, so that cars which are to be retarded may enter the braking apparatus smoothly and without danger of derailment. For accomplishing the desirable results just pointed out positioning means are provided which, in addition to positioning the braking bars, performs the further function of assisting the force of gravity in returning the braking bar A¹ to its open position after it has been moved to its closed position.

Referring now again to the drawings, these positioning means include two resilient stop units U¹ and U² which are associated with each lever 8, and a spring unit U³ which is associated with each lever 9. The stop units U¹ and U² are all similar, and are secured to lugs 30 and 31 formed on opposite sides of the associated lever 8, as best seen in Figs. 12 and 13. Each stop unit comprises a nut 32 screwed onto the lower end of a bolt 33 which extends downwardly with some clearance through a hole 34 provided in the associated lug 30 or 31, and through a boss 35 which surrounds the lower end of the hole, and a spring 36 which surrounds the upper end of the nut 32 and the lower end of the bolt 33, and which engages at one end the underside of the associated lug 30 or 31, and at the other end a flange forming part of the associated nut 32.

The stop units U¹ and U² cooperate at their lower ends with fixed stops 37 provided on the associated right and left-hand supports 2^a and 2^b. The springs 36 of the units U¹ and U² are so designed, and these units are so adjusted, that when the lever 8 has been rotated in a counter-clockwise direction, due to its bias, to the position in which the braking bar A² occupies the desired non-braking position with respect to the rail 1, these units will engage the associated fixed stops and prevent further rotation of the lever 8. The springs of these units are further so proportioned that, if a car becomes derailed for any reason so that its wheels ride up onto the braking bar A², the springs of these units will not deflect any appreciable amount, but that, if when the braking bar A² occupies its non-braking position, a locomotive having unusually wide gauge wheels enters the retarder, these springs will deflect and permit sufficient additional movement of the braking bar A² to prevent damage to the braking apparatus.

The spring unit U³ associated with each lever 9 is housed in a cylinder 38 which is cast integrally with the associated lever 9 on the underside of the arm 9^a, and which is partially closed at its lower end by an end plate 39 which is bolted to the cylinder 38 by means of bolts 40. The end plate 39 has formed therein a hole 41 which is in axial alignment with the cylinder 38, and slidably mounted in this hole is a sleeve

42 provided at its upper end with an annular flange 42^a which cooperates with the end plate 39 in a manner which will be made clear hereinafter. A spring bolt 43 extends into the cylinder 38 through the sleeve 42 with sufficient clearance to permit the bolt to slide freely in the sleeve, and this bolt is provided on the inside of the cylinder with an enlarged shank portion 43^a the lower end of which forms a shoulder 43^b which cooperates with the flange 42^a on the sleeve 42 for a purpose which will also be made clear hereinafter. The spring bolt is further provided on the inside of the cylinder 38 with a circular head 43^c having a diameter which is just a little smaller than the diameter of the cylinder 38, and surrounding the spring bolt between the head 43^c and the flange 42^a on the sleeve 42, and between the head 43^c and the end plate 39, respectively, are two concentric coil springs 44 and 45. The lower end of the spring bolt 43 extends downwardly through a lateral slot 46^a formed in an angle bracket 46, and is secured to the angle bracket in such manner that the bolt is free to move along the slot 46^a in response to rotation of lever 9, and that a limited amount of vertical movement with respect to the angle bracket is permitted. As here illustrated, the means for securing the bolt to the angle bracket comprises two nuts 47 and 48 which are screwed onto the screw threaded lower end of the bolt, and which have abutting portions of reduced diameter which extend into the slot 46^a with sufficient clearance to permit the desired movement of the bolt. The nuts 47 and 48 are locked in place on the bolt by means of cotter keys (not shown) in the usual and well known manner. The angle bracket 46 spans the space between an adjacent pair of the ties 3 directly below the cylinder 38, and rests at its ends on the adjacent feet of the right and left-hand rail supports 2^a and 2^b. It is secured to the rail supports by means of the bolts which secure the rail supports to the ties and, in order to facilitate the ready removal of the angle bracket, the angle bracket is provided with laterally extending slots 51 (see Fig. 12) which receive the bolts. The underside of the angle bracket adjacent the slot 46^a is in the form of an arc to facilitate the movement of the spring bolt 43 in response to rotation of the lever 9 without excessive friction between the nut 47 and the angle bracket.

The spring 45 is assembled in the cylinder 38 with an initial compression and the nuts 47 and 48 on the bolt 43 are so adjusted that, when the lever 9 is rotated to the position in which the braking bar A¹ occupies the desired non-braking position, the head 43^c of the bolt 43 will be spaced a short distance from a depending stop 52 which is provided on the arm 9^a of lever 9 at the upper end of the cylinder 38. It will be apparent therefore that the spring 45 constantly biases the lever 9 toward the position in which the head of the bolt 43 engages the stop 52, and that any movement of the lever 9 in the direction to move the braking bar A¹ from its non-braking position to its braking position will act through the end plate 39 to compress the spring 45. The spring 44 is also assembled into the cylinder 38 with an initial compression, and the sleeve 42 with which the lower end of this spring cooperates, is so designed that the end plate 39 will move into engagement with the flange 42^a of this sleeve and compress the spring 44 beyond its initial compression when and only when the

braking bar A² is moved closer to the rail 1 than the desired braking position. The springs 44 and 45 are so proportioned that when the braking bars have been rotated to their desired braking positions, the force due to the amount of compression which then exists in the spring 45 plus that due to the initial compression of the spring 44 will be sufficient to overcome the counter-clockwise rotational tendency of the complete lever assembly. The extreme position toward the rail to which the braking bar A¹ can be moved in response to rotation of the lever 9 is limited by the flange 42^a of the sleeve 42 moving into engagement with the shoulder 43^b formed on the bolt 43.

The positioning means just described forms no part of my present invention, except in so far as it is used in combination with the other apparatus, and is claimed in Letters Patent of the United States, No. 2,014,551, granted to myself and H. C. 20 Clausen on September 17, 1935.

The operation, as a whole, of the braking apparatus thus far described is as follows:

When it is desired to move the braking bars A¹ and A² to their braking positions, fluid pressure is simultaneously admitted to the motors M through suitable piping not shown in the drawings. When fluid pressure is admitted to the motors, the piston 17 of each motor will move downwardly in the associated cylinder 12, and as the piston moves downwardly the associated lever 9 will be rotated in a counter-clockwise direction until the associated end plate 39 has moved into engagement with the flange 42^a on the sleeve 42, after which further rotation of the lever 9 will be prevented by the springs 44 and 45, and the associated lever 9 will then rotate in a clockwise direction until the motor pistons have completed their strokes. The parts are so proportioned that when the levers 8 and 9 have been rotated to the positions just described, the braking bars A¹ and A² will then occupy the desired braking positions with respect to the rail 1.

If after the braking bars have been moved to their braking positions in the manner just described, it is desired to move them to their non-braking positions, the fluid which was previously supplied to the motors is exhausted from the motors. Under these conditions, the levers 9 will each first rotate in a counter-clockwise direction in the manner previously described until the stop units U¹ and U² move into engagement with the associated fixed stops 37, after which the levers 9 will each rotate about the associated pivot pin 10 until the associated piston 17 moves into engagement with the upper end of cylinder 12 of the associated motor M. When in this position, the head 43^c of each bolt 43 will be spaced a short distance from stop 52. As was previously pointed out, the stop units U¹ and U² are so adjusted and so designed that when these stop units are in engagement with the associated fixed stops 37, the braking bar A² will occupy the desired non-braking position with respect to the rail 1; and the parts of the apparatus are so proportioned that when the stop units U¹ and U² are engaging the associated fixed stops and the piston 17 of each motor M is engaging the upper end of associated cylinder 12, the braking bar A¹ will occupy the desired non-braking position with respect to the rail 1.

The braking bars A¹ and A² may be constructed in either one of two ways, and the manner in which the braking bars are fastened to the associated levers varies somewhat with the way in

which the braking bars are constructed. In order to illustrate both types of braking bars and the manner in which each type is fastened to the associated levers without unnecessarily increasing the number of drawings required, I have shown the braking bar A¹ constructed in one way and the braking bar A² constructed in the other way. It will be understood, however, that in actual practice, both braking bars of the car retarder will usually be alike. Referring first to the braking bar A¹, each brake beam 4¹ of this braking bar is channel shaped and is constructed of cast steel. The intermediate beams are all similar and each intermediate beam spans the space between two adjacent operating units, and is disposed with its opposite ends resting on the flat upper surfaces 9^a of the levers 9 of the adjacent operating units in such manner that the beam is free to slide toward and away from the rail on these surfaces. Provided on one end of each intermediate beam is an integral tongue 4^a which extends with a small amount of clearance into the channel in the next adjacent beam, as shown in Figs. 1 and 12. Also provided on each intermediate beam adjacent the tongue 4^a is a jaw 4^b, and extending downwardly through each intermediate beam substantially in front of the associated jaw is a vertical hole 4^c (see Figs. 11 and 17). Each jaw 4^b receives the head 67^a of a T-shaped adjusting bolt 67, the screw threaded shank 67^b of which is screwed through a tapped hole 68^a provided in an upstanding lug 68 formed on the upper end 9^a of the adjacent lever 9. The outer end 67^c of each bolt 67 is made square to facilitate turning the bolt by means of a wrench or other suitable tool, and the heads of the bolts and jaws in which they fit are so designed that when a bolt is turned, the head of the bolt will rotate freely within the jaw and will remain in engagement with the jaw in all positions of the bolt. A lock washer 69 and a nut 69^a is provided on the outer end of each bolt to lock the bolt in an adjusted position.

The vertical hole 4^c in each intermediate beam aligns with an elongated slot 71 which extends at right angles to the rail 1 through the upper part 9^a of the lever 9 upon which the associated end of the beam rests. A hold-down bolt 72 passes downwardly through each hole 4^c and the associated aligned slot 71, and is provided on its lower end with a nut 73. As shown in Fig. 17, each nut 73 is T-shaped, and is provided with a square upper shank portion 73^a which extends into the associated slot in such manner that the nut is free to slide along the slot but that it is held in such a position with respect to the associated lever by the slot that the opposite ends of the nut extend away from the sides of the slot in opposite directions. The length of the shank of each nut is made somewhat longer than the depth of the associated slot 71, and it will be apparent, therefore, that when the bolt 72 is tightened, the shank of the associated nut will move into engagement with the underside of the associated beam, and there will be a certain amount of clearance between the upper surfaces of the opposite ends of the nut and the underside of the associated lever 9.

The two end beams 4¹ are somewhat longer than the intermediate beams, and each end beam is slidably supported at one end on a flat upper surface 9^c of the lever 9 of the operating unit next to the associated end operating unit, while intermediate its ends each end beam is slidably supported on the flat upper surface 9^c of the

lever 9 of the associated end operating unit. The right-hand end beam receives at its left-hand ends the tongue 4^a which is provided on the contiguous end of the adjacent intermediate beam and is provided directly above the surface 9^c of the lever 9 of the end operating unit upon which the beam rests with a jaw 4^b which cooperates with a T-headed bolt in the same manner that the jaws on each of the intermediate beams cooperate with the associated bolts 67. The right-hand end beam 4¹ is also provided in front of the jaw 4^b with a hole 4^c which aligns with and elongated slot 71 in the end 9^a of the lever 9 of the end operating unit, and which receives a hold-down bolt 72 provided on its lower end with a T-shaped nut 73. The left-hand end beam is slidably supported at its right-hand end on the flat upper surfaces 9^c of the lever 9 of the operating unit next to the associated end operating unit, and is slidably supported intermediate its ends on the flat upper surface 9^c of the lever 9 of the associated end unit. The right-hand end of the left-hand end beam 4¹ is provided with a tongue 4^a which extend into the channel in the adjacent intermediate beam, and this beam is further provided with two jaws 4^b which cooperate with T-headed bolts secured to the associated levers 9, and with two vertical holes 4^c which align, respectively, with elongated slots 71 provided in the associated supporting levers 9. The holes 4^c and aligned slots 71 cooperate with hold-down bolts 72 and nuts 73 in the same manner that the holes 4^c in the intermediate beams and associated aligned slots 71 cooperate with the associated hold-down bolts 72 and nuts 73.

The brake shoes 5¹ of the braking bar A¹ are constructed in sections and, with the exception of two flared sections which are secured to the two end beams, respectively, to facilitate the smooth entry of cars into the retarder and two other short shoe sections, the functions of which will be made clear hereinafter, the shoe sections are securely bolted to the beams at short intervals in such manner that the ends of the shoes are disposed near the centers of the brake beams. One advantage of this construction is that there is no chance of misalignment of the brake beams which would result in shock to the retarder or to a car as the car wheels pass from one brake shoe section to the next.

It should be pointed out that with the braking bars A¹ constructed in the manner described when pressure is exerted against the wheels of a car by this braking bar, the manner in which the thrust due to the wheels is transmitted to the levers 9 of the operating units will vary as the position of the wheels with respect to the levers varies. For example, when a wheel is directly opposite an operating unit, the direct thrust of the wheels will be transmitted through the associated shoe to the two beams whose ends are supported by the lever 9 of this unit. The one beam, in turn, will transmit the thrust directly to the associated lever 9 through engagement of the beam at the inner end of the jaw 4^b with the head of the associated adjusting screw, and the other beam will transmit the thrust to said one beam by engagement of the inner edge of the channel which is nearest the rail with the side nearest the rail of the tongue of said one beam (see Fig. 12). When a car wheel is between two operating units, the greater part of the thrust will be transmitted through the brake shoe which the wheel is engaging to the beam which is op-

posite the wheel, and from thence to the two operating units which support the beam which is opposite the wheel in a manner which will be apparent from the foregoing and from an inspection of the drawings. A part of the thrust, however, may also be transmitted to the other beam to which the braking shoe which the wheel is engaging is attached, and from this beam to the lever 9 of the same operating unit which jointly supports this beam which is opposite the wheel.

When the braking bar A¹ is being moved away from the rail by the levers 9 substantially no force is exerted on the beam by the levers other than that which is transmitted directly to the beams by the engagement of the underside of the beams with the flat surface upon which the beams rest, but a small amount of force may be transmitted to each beam through the associated adjusting bolt 67 engaging the associated jaw 4^b and through the outer edge of the tongue of each beam engaging the channel of the next adjacent beam at the side of the beam which is farthest away from the rail.

It should also be pointed out that when the braking bar A¹ is engaging a car wheel there is an overturning force which tends to raise the braking bar at the side where the brake shoes engage the car wheels as shown in Fig. 14. A certain amount of this raising or tipping is desirable because it permits the brake shoes to engage the car wheels at a higher point and therefore a more effective point, than would otherwise be the case and it is for the purpose of permitting the desired amount of this tipping that the previously described clearance between the ends of the nuts 73 and the underside of the associated levers 9 is provided.

It should be further pointed out that with the braking bar A¹ constructed in the manner described when it is desired to move the braking bar closer to, or further away from, the rail to compensate for brake shoe wear, this may be conveniently done by loosening the lock nuts 69^a and turning the adjusting bolts in the proper directions, thus causing the beams to slide on the flat upper surfaces 9^c upon which the beams rest. After this adjustment has been completed, the nut 69^a may again be tightened and the braking bar will be securely held in its adjusted position.

It should still further be pointed out that when the braking bar is in its braking position and a car wheel is about to pass from a given beam section to the beam section next in advance, the entering end of the beam section next in advance will not only be forced away from the rail the same distance as the leaving end of the given section, but will also be tipped or raised approximately the same amount as the given beam section is tipped or raised by engagement with the car wheel. As a result, when the car wheels pass from one beam section to the next, a more efficient braking action takes place, and the life of the braking apparatus is greatly lengthened due to the decreased strains.

Referring now to the braking bar A², the chief difference between this braking bar and the braking bar A¹ is that the beam sections 4² of this braking bar are rolled instead of cast, thus making it necessary to utilize joint bars 75 at the junctions of the brake beams to facilitate fastening the beams to the levers 9 of the operating units in the desired manner, and to perform the functions which are performed by the tongues

4^a and 4^b which are cast integrally with the cast steel beam 4¹. As best seen in Fig. 12, each joint bar is provided with a tongue 75^a which extends into the channel of the one contiguous beam and is securely bolted to this beam by means of a bolt 76 so that this beam and joint bar are, in effect, a rigid unit. Each joint bar is also provided with a tongue 75^b which extends into the channel of the other contiguous beam and cooperates with this beam in the same manner that the tongues 4^a on the brake beams 4¹ of the braking bar A¹ extend into the channel of the contiguous beam 4¹ and cooperate with the contiguous beam. Each joint bar is further provided with a jaw 75^c which cooperates with an adjusting bolt 67 secured to the associated lever 9, and with a vertical hole 75^d which cooperates with a hold-down bolt 72. The jaws on the two end beams are formed by means of two hook-shaped members 77 and 78 (see Fig. 18), having extended threaded shanks 77^a and 78^a which project through holes provided in the side of the beam and carry on their inner ends lock washers 77^b and 78^b and nuts 79^a and 79^b. These jaws cooperate with adjusting bolts in the same manner that the other jaws cooperate with adjusting bolts.

The brake shoes 5² of the braking bar A² are similar to the brake shoes 4² of the braking bar A¹ but are turned end for end.

The operation of the braking bar A² when a car is passing through the retarder, and the manner of adjusting this braking bar for brake shoe wear is the same as the operation and manner of adjusting the braking bar A¹, and will be understood from the foregoing without further description.

Under some conditions, two car retarders similar to that just described are joined together in such manner that the operating units of either retarder may at times be operated simultaneously with those of the other retarder, and at other times without simultaneously operating those of the other retarder, and when this is done, it is desirable that the centrally located brake beams which are operated at one end by an operating unit of the one retarder and at the other end by the next adjacent operating unit of the other retarder, should be free to move independently of the adjacent beams without causing shock to the car wheels or the retarder as the wheels move past the ends of the centrally located beams. To accomplish the desired operation, the brake shoes in the vicinity of the centrally located beam are preferably arranged in the manner shown in Fig. 19 from which it will be seen that a brake shoe section 5¹ or 5² of standard length is secured to the centrally located beams 4¹ or 4² in such manner that one end of each shoe extends past the one end of the associated beam a short distance, and that two short shoe sections similar to those shown next to the flared end sections in Fig. 1 are secured to the adjacent beams so that one end of each short shoe section abuts each end of the standard shoe section which is attached to the centrally located beam.

With the brake shoes arranged in the manner just described, when the braking bars have been moved to their braking positions, and fluid pressure is vented from the motors M to cause the braking bars to return to their non-braking positions, the centrally located brake beam 4¹ at its right-hand end will be retracted by the engagement of the adjusting bolt 67 with the associated jaw 4^b, and the shoe section 5¹ of standard length which is attached to this centrally located beam

will be retracted with the beam. As this shoe section is retracted, the portion of the shoe section which overlaps the beam on the right will engage the inner flange of this right-hand beam, and will retract the left-hand end of this last mentioned beam, thus causing the shoe sections which are attached to this last mentioned beam to be retracted. The right-hand end of the beam to the left of the centrally located beam 4¹ will be retracted in the same manner that the right-hand end of the centrally located beam is retracted, and will cause the short shoe section 5¹ which is attached to this beam to engage the inner flange of the centrally located beam at its left-hand end and thereby retract the left-hand end of the centrally located beam. If the short shoe section which is attached to the beam to the left of the centrally located beam should break at the joint between the adjacent beams, the outer side of the tongue 4^a on the left-hand beam will engage the outer flange of the centrally located beam, and will thus retract the left-hand end of the centrally located beam. This will not give as smooth an alignment of the brake shoes as results when the brake shoes are intact, but will give a sufficiently smooth alignment to prevent damage to the retarder or to a car as the car wheel moves past the junction of the beams. A similar action will take place if the shoe section 5¹ which is attached to the centrally located beam 4¹ should break at the joint between this beam and the beam to the right of this beam.

When a car wheel is moving through the retarder in the direction of the tongues 4^a, the brake shoe section 5¹ which is attached to the brake beam in advance of the beam which is opposite the car wheel will be both raised and pushed back before the car wheel reaches the advanced shoe section by the engagement of the overlapping end of the shoe section attached to the beam which is opposite the car wheel with the inner flange of the advance beam 4¹, and thus a smooth alignment of the shoe sections 5¹ will be obtained. If the overlapping end of a shoe section 5¹ should break off, the advance beam 4¹ will be pushed back prior to the time the car wheel reaches the advance beam by engagement of the outer surface of the tongue 4^a on the beam which is opposite the car wheel with the outer flange on the advance beam. The alignment of brake shoes thus obtained will not be as good as in the first mentioned instance, but will be good enough to prevent damage.

When a car wheel is moving through the retarder in a direction opposite to the direction of the tongues 4^a, the brake beam next in advance of the beam which is opposite the car wheel will be pushed back by engagement of the inner flange of the beam which is opposite the car wheel with the inner surface of the tongue 4^a on the advance beam. The advance beam under these conditions will be raised by the engagement of the underside of the ledge on the beam which is opposite the wheel with the overlapping portion of the shoe on the advance beam. If the overlapping portion of the shoe on the advance beam should break off, the advance beam will then be pushed back in the same manner as before, but will now be raised by engagement of the upper surface of the beam which is opposite the car wheel with the underside of the tongue on the advance beam. This again will not provide as smooth an alignment as when the brake shoes are intact, but will give an alignment of

the shoes which is sufficiently smooth to prevent damage.

The manner in which the brake beams 4² and associated shoes 5² are retracted when the retarder is being opened, and the manner in which the brake beams 4² and the associated brake shoes 5² are raised and pushed back prior to the passage of a car wheel from one beam section to the next will be obvious from the foregoing description and from an inspection of the drawings without further description.

Referring now again to Fig. 1, it will be noted that the flared shoe section at the left-hand end of the braking bar A¹ is somewhat longer than the flared shoe section at the other end of the braking bar A¹, and that the flared shoe sections at the right and left-hand ends of the braking bar A² are similar to those at the opposite ends of the braking bar A¹. The reason for making these flared sections in this manner and for providing the short shoe sections next to these flared shoe sections in the manner previously described is to permit the same type of brake shoes to be used on both braking bars A¹ and A² and at the same time permit the shoes to be arranged in the manner just described when two retarders are joined together.

When two retarders are joined together in the manner shown in Fig. 19 and rolled steel beams are used, the tongue 75^b of each joint bar which is associated with, or is adjacent to, the centrally located beam may, if desired, be fastened to the associated brake beam 4 by means of a hold-up bolt 80 (see Figs. 20 and 21) which extends downwardly through a hole 81 provided in the tongue, and through an aligned hole 82 provided in the associated beam, and which carries at its lower end a sleeve 83, a lock washer 84 and a nut 85. The sleeve 83 extends with clearance through the hole 82, and is provided with a flange 83^a at its lower end. The parts are so proportioned that when the nut 85 is tightened, there will be a certain amount of clearance between the top of the flange and the underside of the associated brake beam. The primary purpose of the hold-up bolts 80 is to prevent relative longitudinal displacement of the brake beams, but these hold-up bolts also assist in raising or tilting the brake beams prior to the time a car wheel moves to the position where it is opposite a beam.

Hold-up bolts similar to those just described may also be used at the junction of two retarders when cast steel beams are used and the brake shoes are arranged in the manner shown in Fig. 19, for the same reasons that the hold-up bolts are provided in connection with the rolled steel beams.

It will be remembered that an intermediate rail support 2^c is located between each pair of rail supports 2^a and 2^b, and it will be seen from an inspection of Figs. 7 and 8, that each of these supports is provided with two upstanding lugs 86 and 87 having rounded upper surfaces 86^a and 87^a. These lugs are disposed directly below the associated brake beams A¹ and A² and are of such lengths that if a car becomes derailed and rides up onto either one of the beams A¹ or A², the lugs will limit the deflection of the beams to an amount which is insufficient to cause damage to the beams.

As shown in Figs. 9 and 10, the end rail supports 2^d are provided with upstanding lugs 88 and 89 similar to the lugs 86 and 87 on the intermediate beams, which lugs are provided for the

same purpose that the lugs 86 and 87 are provided on the intermediate supports.

Although I have herein shown and described only one form of railway braking apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

10 Having thus described my invention, what I claim is:

1. Railway braking apparatus comprising two braking bars located on opposite sides of a track rail, two pivoted levers for supporting said braking bars, a link pivotally connected at one end with one of said levers, a motor device operatively connected with said link and with the remaining lever for at times operating said levers, and means responsive to operation of said motor device for rotating said link about its pivotal connection with said one lever to different positions.

2. Railway braking apparatus comprising two braking bars located on opposite sides of a track rail, two pivoted levers for supporting said braking bars, a link pivotally connected at one end with one of said levers, a motor device operatively connected with said link and with the remaining lever for at times operating said levers, and means responsive to operation of said motor device for rotating the toggle formed by said lever and said motor device to different positions.

3. Railway braking apparatus comprising two braking bars located on opposite sides of a track rail, two pivoted levers for supporting said braking bars, a link pivotally connected at one end with one of said levers, a motor device operatively connected with said link and with the remaining lever for at times operating said levers, and cam means controlled by said motor device for rotating said link about its pivotal connection with said one lever to different positions.

4. Railway braking apparatus comprising two braking bars located on opposite sides of a track rail, two pivoted levers for supporting said braking bars, a link pivotally connected at one end with one of said levers, a motor device operatively connected with said link and with the remaining lever for at times operating said levers, a roller attached to said motor device, and cam means on said lever cooperating with said roller for rotating the toggle formed by said lever and said motor device to different positions in response to operation of said motor device.

5. Railway braking apparatus comprising two braking bars located on opposite sides of a track rail, two pivoted levers for supporting said braking bars, a link pivotally connected at one end with one of said levers, a fluid pressure motor having its cylinder operatively connected with the remaining lever and its piston operatively connected with said link, and means on said link cooperating with means on said motor for rotating the toggle formed by said link and said motor to different positions in response to operation of said piston.

6. Railway braking apparatus comprising two braking bars located on opposite sides of a track rail and adapted to be moved toward and away from the rail into braking and non-braking positions, two levers one for supporting each of said braking bars, said levers being pivotally mounted for rotation about a common axis in such manner that said braking bars are biased by gravity to their non-braking positions, a link pivotally connected with one lever, a fluid pressure motor

having a cylinder pivotally connected with the other lever, a piston in said cylinder operatively connected with said link, and means on said link cooperating with means on said motor to rotate the toggle formed by said motor and said link to different positions, the parts being so proportioned that when said piston occupies its retracted position said toggle will occupy a collapsed position in which the axis of the motor is disposed at an angle to the axis of the link, and that during movement of said piston from its retracted to its projected position said toggle will be moved to and stopped in a position just past its dead center position.

7. Railway braking apparatus comprising two braking bars located on opposite sides of a track rail and adapted to be moved toward and away from the rail into braking and non-braking positions, two levers one for supporting each of said braking bars, said levers being pivotally mounted for rotation about a common axis in such manner that said braking bars are biased by gravity to their non-braking positions, a link pivotally connected with one lever, a fluid pressure motor having a cylinder pivotally connected with the other lever, a piston in said cylinder operatively connected with said link, and means on said link cooperating with means on said motor to rotate the toggle formed by said motor and said link to different positions, the parts being so proportioned that when said piston occupies its retracted position said toggle will occupy a collapsed position in which the axis of the motor is disposed at an angle to the axis of the link, and that during movement of said piston from its retracted to its projected position said toggle will be moved to and stopped in a position just past its dead center position, the parts being further so proportioned that when said toggle occupies its collapsed position the braking bars will occupy their non-braking positions and that when said toggle occupies its dead center position the braking bars will be moved toward their braking positions to positions where they will just engage the wheels of a car traversing the track rail.

8. Railway braking apparatus comprising two braking bars located on opposite sides of a track rail and adapted to be moved toward and away from the rail into braking and non-braking positions, two levers one for supporting each of said braking bars, said levers being pivotally mounted in such manner that said braking bars are biased by gravity to their non-braking positions, a link pivotally connected with one lever, a fluid pressure motor having its cylinder pivotally connected with the other lever, a piston in said cylinder operatively connected with said link, and means on said link cooperating with means on said motor for rotating the toggle formed by said motor and said link from a collapsed position in which the axis of the motor is disposed at an angle to the axis of the link to a position just past the dead center position during a part of the stroke of said piston from its retracted to its projected position and for retaining the toggle in the position just past its dead center position during the remainder of the stroke of the piston from its retracted to its projected position.

9. Railway braking apparatus comprising two braking bars located on opposite sides of a track rail and adapted to be moved toward and away from the rail into braking and non-braking positions, two levers one for supporting each of said braking bars, said levers being pivotally mounted in such manner that said braking bars are biased

by gravity to their non-braking positions, a link pivotally connected with one lever, a fluid pressure motor having a cylinder pivotally connected with the other lever, a piston in said cylinder operatively connected with said link, and means on said link cooperating with means on said motor for rotating the toggle formed by said motor and said link from a collapsed position in which the axis of the motor is disposed at an angle to the axis of the link to a position just past the dead center position during a part of the stroke of said piston from its retracted to its projected position and for subsequently retaining the toggle in the position just past its dead center position until the piston has been moved toward its retracted position some distance beyond the position where the toggle was moved to the position just past its dead center position.

10. Railway braking apparatus comprising two braking bars located on opposite sides of a track rail and adapted to be moved toward and away from the rail into braking and non-braking positions, two levers one for supporting each of said braking bars, said levers being pivotally mounted in such manner that said braking bars are biased by gravity to their non-braking positions, a link pivotally connected with one lever, a fluid pressure motor having a cylinder pivotally connected with the other lever, a piston in said cylinder operatively connected with said link, and means on said link cooperating with means on said motor for rotating the toggle formed by said motor and said link from a collapsed position in which the axis of the motor is disposed at an angle to the axis of the link to a position just past the dead center position during the first part of the stroke of said piston from its retracted to its projected position and for subsequently retaining the toggle in the position just past its dead center position until the piston has been moved toward its retracted position some distance beyond the position where the toggle was moved to the position just past its dead center position, the parts being so proportioned that when said toggle occupies its collapsed position said braking bars will just occupy their non-braking positions, that when said toggle occupies its dead center position said braking bars will be moved toward their braking positions to positions where they will just engage the side faces of the wheels of a car traversing the track rail, and that when said piston is moved to its full projected position said braking bars will be moved to their full braking positions.

11. In combination, a fluid pressure motor including a cylinder containing a piston which drives a piston rod, a link pivotally attached to said piston rod, and means on said link cooperating with means on said motor for rotating said link from a position in which its axis is disposed at one angle to the axis of said motor past a position in which its axis aligns with the axis of the motor to a position in which its axis is disposed at another angle to the axis of the motor during a part of the stroke of said piston from its retracted to its projected position.

12. In combination, a fluid pressure motor including a cylinder containing a piston which drives a piston rod, a link pivotally attached to said piston rod, and means on said link cooperating with means on said motor for rotating said link from a position in which its axis is disposed at one angle to the axis of said motor past a position in which its axis aligns with the axis of the motor to a position in which its axis is disposed

at another angle to the axis of the motor during the first part of the stroke of said piston from its retracted to its projected position, and for subsequently retaining said link in the position in which its axis is disposed at said other angle to the axis of the motor until said piston has been moved toward its retracted position some distance beyond the position where the link was originally moved to its last-mentioned position.

13. In combination, a fluid pressure motor including a cylinder containing a piston which drives a piston rod, a link pivotally attached to said piston rod, a roller attached to said motor, and cams attached to said link and cooperating with said roller for rotating said link from a position in which its axis is disposed at one angle to the axis of said motor past a position in which its axis aligns with the axis of the motor to a position in which its axis is disposed at another angle to the axis of the motor during the first part of the stroke of said piston from its retracted to its projected position and for subsequently retaining said link in the position in which its axis is disposed at said other angle to the axis of the motor until said piston has been moved toward its retracted position some distance beyond the position where the link was originally moved to its last mentioned position.

14. As a new article of manufacture a beam section for a car retarder, said beam section being channel-shaped and being provided at one end with a tongue which is adapted to fit into the channel on the end of a similar beam section and with a jaw adjacent said tongue which jaw is adapted to cooperate with means for moving the beam to an adjusted position with respect to the operating mechanism of the car retarder.

15. Railway braking apparatus comprising a plurality of operating units disposed at intervals along a track rail, each said operating unit comprising a first lever pivotally mounted at one end on a fixed pivot pin and having its free end inclined upwardly and extending away from said rail, a second lever pivotally supported intermediate its ends on said pivot pin and having one end inclined upwardly and extending away from said rail opposite said first lever and having its other end inclined downwardly and extending away from the rail below the free end of said first lever, and a fluid pressure motor for operating said levers; each said first lever and said one end of each of said second levers being provided adjacent said rail with a flat upper surface, two braking bars one supported on the flat upper surfaces of said first levers in such manner that said one braking bar is free to slide toward and away from the rail on the associated surfaces, and the other supported on the flat upper surfaces of said second levers in such manner that said other braking bar is free to slide toward and away from the rail on the associated surfaces, and means for adjustably fastening the associated braking bars to the levers in such manner that when a braking bar is engaging a car wheel the braking bar is free to tip upwardly at the side nearest the rail a limited amount.

16. Railway braking apparatus comprising a plurality of operating units disposed at intervals along a track rail, each said operating unit comprising a first lever pivotally mounted at one end on a fixed pivot pin and having its free end inclined upwardly and extending away from said rail, a second lever pivotally supported intermediate its ends on said pivot pin, and having one

end inclined upwardly and extending away from said rail opposite said first lever and having its other end inclined downwardly and extending away from the rail below the free end of said first lever, and a fluid pressure motor for operating said levers; each said first lever and said one end of each said second levers being provided adjacent said rail with a flat upper surface, a plurality of aligned brake beams disposed on each side of said track rail and each having its opposite ends resting on the flat upper surfaces of the levers of two adjacent operating units, each said brake beam being channel-shaped and being provided at one end with a tongue which extends into the channel in the next adjacent beam, means for fastening the brake beams to the levers in such manner that the beams can be moved toward and away from the rails on the levers to adjusted positions and that the sides of the beams which are nearest the rails are free to tip upwardly a limited amount, and brake shoes attached to said brake beams.

17. Railway braking apparatus comprising a plurality of operating units disposed at intervals along a track rail, each said operating unit comprising a first lever pivotally mounted at one end on a fixed pivot pin and having its free end inclined upwardly and extending away from said rail, a second lever pivotally supported intermediate its ends on said pivot pin and having one end inclined upwardly and extending away from said rail opposite said first lever and having its other end inclined downwardly and extending away from the rail below the free end of said first lever, and a fluid pressure motor for operating said levers; each said first lever and said one end of each of said second levers being provided adjacent said rail with a flat upper surface, a plurality of aligned brake beams disposed on each side of said track rail and each having its opposite ends resting on the flat upper surfaces of the levers of two adjacent operating units, each said brake beam being channel-shaped and being provided at one end with a tongue which extends into the channel in the next adjacent beam, means for fastening the brake beams to the levers in such manner that the beams can be moved toward and away from the rails on the levers to adjusted positions and that the sides of the beams which are nearest the rails are free to tip upwardly a limited amount, and brake shoes attached to said brake beams and spanning the junction between adjacent beams.

18. Railway braking apparatus comprising a plurality of operating units disposed at intervals along a track rail, each said operating unit comprising a first lever pivotally mounted at one end on a fixed pivot pin and having its free end inclined upwardly and extending away from said rail, a second lever pivotally supported intermediate its ends on said pivot pin and having one end inclined upwardly and extending away from said rail opposite said first lever and having its other end inclined downwardly and extending away from the rail below the free end of said first lever, and a fluid pressure motor for operating said levers; each said first lever and said one end of each of said second levers being provided adjacent said rail with a flat upper surface, a plurality of aligned brake beams disposed on each side of said track rail and each having its opposite ends resting on the flat upper surfaces of the levers of two adjacent operating units, each said brake beam being chan-

nel-shaped and being provided at one end with a tongue which extends into the channel in the next adjacent beam and with a jaw adjacent said tongue and with a vertical hole, a lug on each lever provided with a tapped hole, a T-headed bolt associated with each lug and having its head disposed in said jaw and its shank screwed through the tapped hole in the associated lug, a lock nut on each bolt, a slot formed in each lever below the hole in the associated beam, a hold-down bolt extending downwardly through the hole in each beam and through the associated aligned slot, and a T-shaped nut screwed onto the lever end of each bolt, each said T-shaped nut being a square shank portion which extends through the associated slot with some clearance and which is somewhat longer than the depth of the slot and which holds the nut in the position in which its ends extend away from the sides of the slot.

19. Railway braking apparatus comprising a plurality of operating units disposed at intervals along a track rail, each said operating unit comprising a first lever pivotally mounted at one end on a fixed pivot and having its free end inclined upwardly and extending away from said rail, a second lever pivotally supported intermediate its ends on said pivot pin and having one end inclined upwardly and extending away from said rail opposite said first lever and having its other end inclined downwardly and extending away from the rail below the free end of said first lever, and a fluid pressure motor for operating said levers; each said first lever and said one end of each of said second levers being provided adjacent said rail with a flat upper surface, a plurality of aligned brake beams disposed on each side of said track rail and each having its opposite ends resting on the flat upper surfaces of the levers of two adjacent operating units, each said brake beam being channel-shaped; a joint bar disposed at the junction of each two adjacent brake beams; each said joint bar being provided with a first tongue which extends into the channel in the one adjacent beam, with a second tongue which extends into the channel in the other adjacent beam, with an integral laterally extending jaw, and with a hole; means for securely fastening the one tongue of each joint bar to the adjacent lever, a lug on each lever provided with a tapped hole, a T-headed bolt associated with each lug and having its shank screwed through the hole in the associated lug and its head disposed in the jaw of the associated joint bar, means on each bolt for locking the bolt in an adjusted position, an elongated slot formed in each lever at right angles to the rail directly below the hole in each joint bar, a hold-down bolt extending downwardly through the hole in each joint bar and the aligned slot in the associated lever, and a T-headed nut screwed onto the lower end of each hold-down bolt and having a square shank which is somewhat longer than the slot in the associated lever and which extends into the slot in the associated lever with some clearance in such manner that the nut is held in the relative position with respect to the associated lever in which the ends of the nut extend away from the sides of the slot.

20. Railway braking apparatus comprising a plurality of operating units disposed at intervals along a track rail, each said operating unit comprising a first lever pivotally mounted at one end on a fixed pivot pin and having its free end

inclined upwardly and extending away from said rail, a second lever pivotally supported intermediate its ends on said pivot pin and having one end inclined upwardly and extending away from said rail opposite said first lever and having its other end inclined downwardly and extending away from the rail below the free end of said first lever, and a fluid pressure motor for operating said levers; each said first levers and said one end of each of said second levers being provided adjacent said rail with a flat upper surface, a plurality of aligned brake beams disposed on each side of said track rail and each having its opposite ends resting on the flat upper surfaces of the levers of two adjacent operating units, each said brake beam being channel-shaped; a joint bar disposed at the junction of each two adjacent brake beams, each said joint bar being provided with a first tongue which extends into the channel in the one adjacent beam, with a second tongue which extends into the channel in the other adjacent beam, with an integral laterally extending jaw, and with a hole; means for securely fastening the one tongue of each joint bar to the adjacent lever, means for loosely fastening the other tongue of each joint bar to the associated lever, a lug on each lever provided with a tapped hole, a T-headed bolt associated with each lug and having its shank screwed through the hole in the associated lug and its head disposed in the jaw of the associated joint bar, means on each bolt for locking the bolt in an adjusted position, an elongated slot formed in each lever at right angles to the rail directly below the hole in the associated joint bar, a hold-down bolt extending downwardly through the hole in each joint bar and the aligned slot in the associated lever, and a T-headed nut screwed onto the lower end of each hold-down bolt and having a shank which is somewhat longer than the slot in the associated lever and which extends into the slot in the associated lever with some clearance in such manner that the nut is held in the relative position with respect to the associated lever in which the ends of the nut extend away from the sides of the slot.

21. In combination, a track rail supported on a plurality of rail supports, two braking bars extending parallel to the rail on opposite sides of the rail and movable toward and away from the rail into braking and non-braking positions, a plurality of operating units supported by certain ones of said rail supports and effective for moving the braking bars toward and away from the rail, and two upstanding lugs disposed on certain ones of the remaining supports, said lugs being located directly below the two braking bars and being of such length that these lugs will limit the distance which the braking bars can deflect downwardly between the operating units due to a derailed car to an amount which is insufficient to damage the braking bars.

22. In combination, a track rail, a braking bar extending parallel to said track rail and movable toward the rail into engagement with a part of a car traversing said rail for retarding the speed of the car, a plurality of operating units supporting said bar at intervals and attached to the bar for moving the bar toward and away from the rail, and means disposed below said bar at a point between said units for limiting the downward deflection of said braking bar caused by a derailed car to an amount which is insufficient to damage the braking bar.

23. In combination, a track rail supported at intervals by a plurality of pairs of rail supports disposed on adjacent ties at spaced intervals along the rail, two braking bars extending parallel to the rail on opposite sides of the rail and movable toward the rail into engagement with a part of a car traversing the rail to retard the speed of the car, a plurality of operating units for moving the braking bars toward and away from the rail, one such operating unit being supported by each pair of rail supports, a plurality of intermediate rail supports one disposed between each pair of supports, and two end rail supports disposed respectively at the opposite ends of the braking bars, each said intermediate and end rail supports being provided with two upstanding lugs which are disposed below said two braking bars respectively and which are of such lengths that these lugs will limit the distance which the braking bars can deflect downwardly due to the wheels of a derailed car riding on the braking bars at a point adjacent to the lugs.

24. Railway braking apparatus comprising a plurality of operating units disposed at intervals along a track rail, each said operating unit comprising two pivotally mounted levers each having a flat upper surface disposed on the opposite side of the track rail from the surface on the other lever, a plurality of fluid pressure motors one for operating the levers of each operating unit, two braking bars extending parallel to the track on opposite sides of the rail, said braking bars being supported on the flat upper surfaces of said levers in such manner that said braking bars are each free to slide toward and away from the rail on said surfaces, and means for adjustably fastening the braking bars to the associated levers in such manner that movement of the levers will move the braking bars toward and away from the rail into braking and non-braking positions.

25. Railway braking apparatus comprising a plurality of operating units disposed at intervals along a track rail, each said operating unit comprising two pivotally mounted levers each having a flat upper surface disposed on the opposite side of the track rail from the surface on the other lever, a plurality of fluid pressure motors one for operating the levers of each operating unit, two braking bars extending parallel to the track on opposite sides of the rail, said braking bars being supported on the flat upper surfaces of said levers in such manner that said braking bars are each free to slide toward and away from the rail on said levers, and means for adjustably fastening the braking bars to the associated levers in such manner that movement of the levers will move the braking bars toward and away from the rail into braking and non-braking positions and that when a braking bar is engaging a car wheel a limited amount of tipping of such braking bar is permitted.

26. Railway braking apparatus comprising a plurality of operating units disposed at intervals along a track rail; each said operating unit comprising two pivotally mounted levers having flat surfaces disposed on opposite sides of the rail, and means for operating said levers; a plurality of aligned brake beams disposed on each side of said track rail and each having its opposite ends resting on the flat upper surfaces of the levers of two adjacent operating units, each said brake beam being channel shaped and being provided with a tongue which extends into the channel in the next adjacent beam, brake shoes attached to

said brake beams, and means for fastening said brake beams to the levers in such manner that the beams may be moved toward and away from the rail to adjusted positions relative to the levers and that movement of the levers will move the beams toward and away from the rail into braking and non-braking positions.

27. Railway braking apparatus comprising a plurality of operating units disposed at intervals along a track rail; each said operating unit comprising two pivotally mounted levers having flat surfaces disposed on opposite sides of the rail, and means for operating said levers; a plurality of aligned brake beams disposed on each side of said track rail and each having its opposite ends resting on the flat upper surfaces of the levers of two adjacent operating units, each said brake beam being channel shaped and being provided with a tongue which extends into the channel in the next adjacent beam, brake shoes attached to said brake beams, and means for fastening the brake beams to the levers in such manner that the beams may be moved toward and away from the rail to adjusted positions relative to the levers and that movement of the levers will move the beams toward and away from the rail into braking and non-braking positions and that when a brake shoe is engaging a car wheel a limited amount of tipping of the associated brake beam is permitted.

28. In combination, two pivoted brake controlling levers, a link pivotally connected with one lever, a motor device operatively connected with said link and with the remaining lever in such manner that said link and said motor device form a toggle, and means responsive to operation of

said motor device for rotating the toggle formed by said motor device and said link to different positions.

29. In combination, two pivoted brake controlling levers, a link pivotally connected with one lever, a motor device operatively connected with said link and with the remaining lever in such manner that said link and said motor device form a toggle, and means attached to said motor device and cooperating with means on said link for rotating the toggle formed by said link and said motor device to different positions in response to operation of said motor device.

30. In combination, two pivoted brake controlling levers, a link pivotally connected with one lever, a motor device operatively connected with said link and with the remaining lever in such manner that said link and said motor device form a toggle, a roller attached to said motor device, and cam means on said link cooperating with said roller for rotating the toggle formed by said link and said motor device to different positions in response to operation of said motor device.

31. In combination, two relatively movable brake controlling members, a link operatively connected with one member, a motor device operatively connected with said link and with said other member in such manner that said link and said motor device form a toggle, and means responsive to operation of said motor device for rotating the toggle formed by said motor device and said link to different positions to move said brake controlling members to different positions.

HERBERT L. BONE. 35