April 16, 1935. E. E. GREVE 1,997,727

HOIST BRAKING MECHANISM

Filed Sept. 15, 1930 4 Sheets-Sheet 1

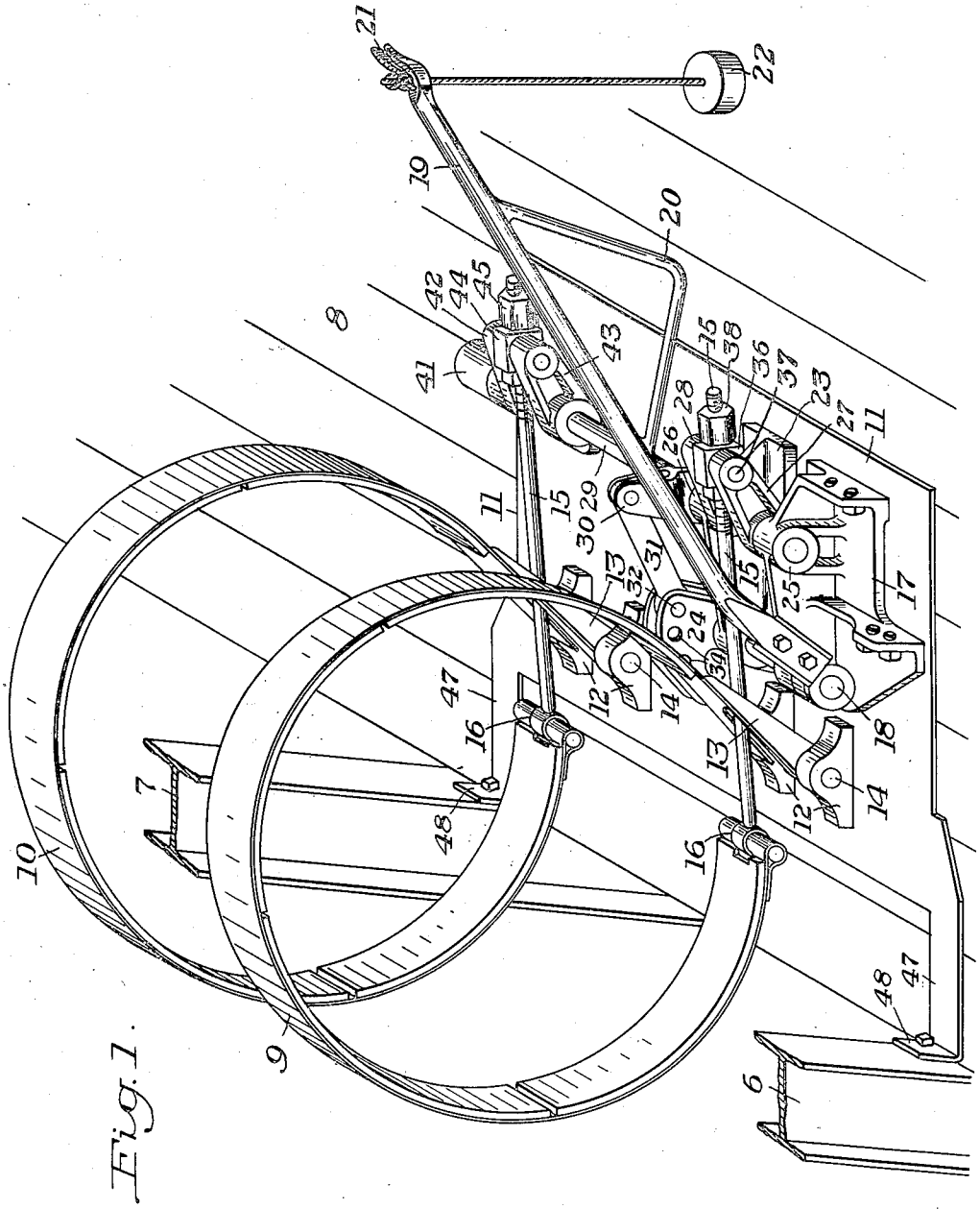


Fig. 1.

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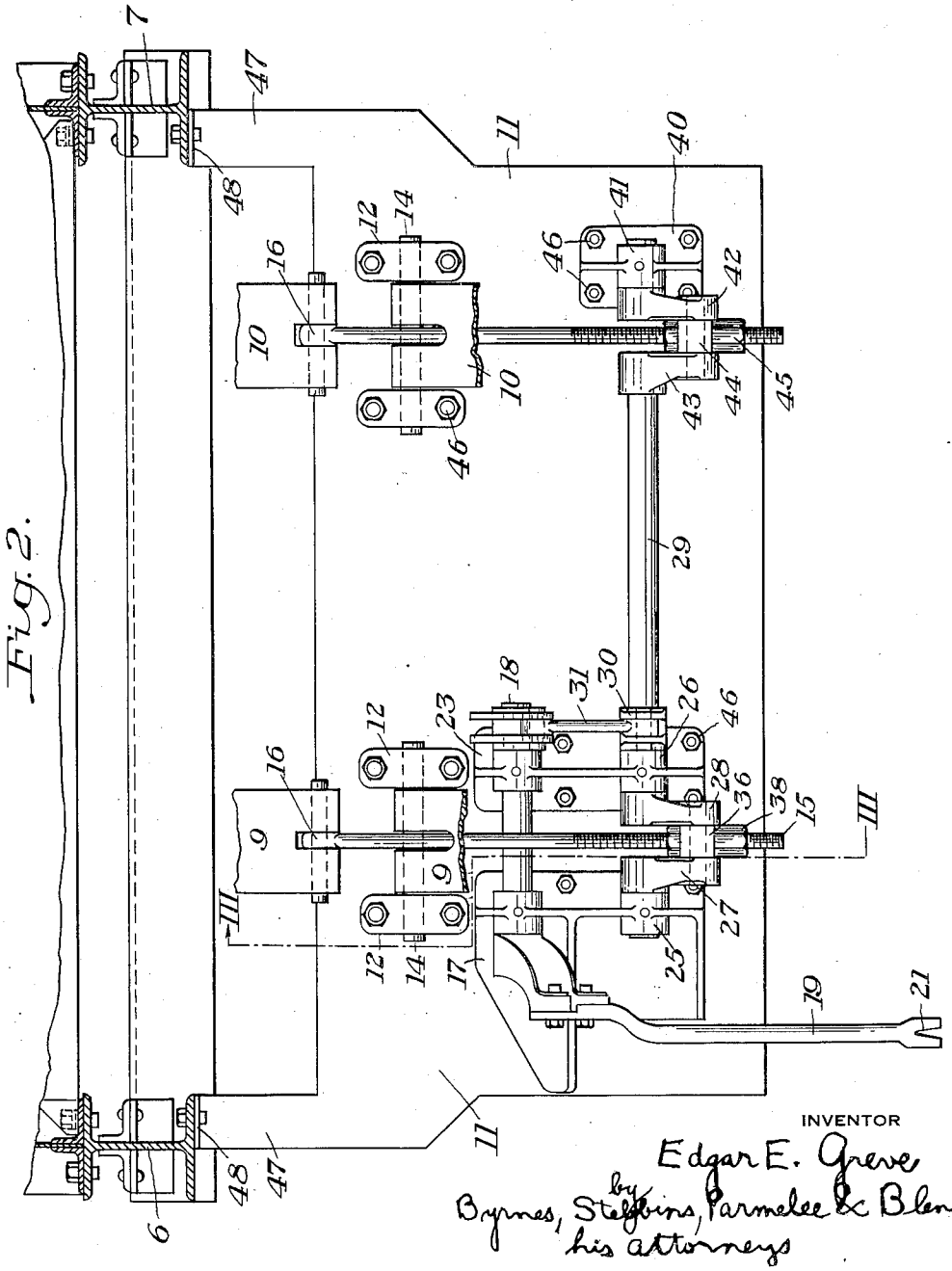


Fig. 2.

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HOIST BRAKING MECHANISM

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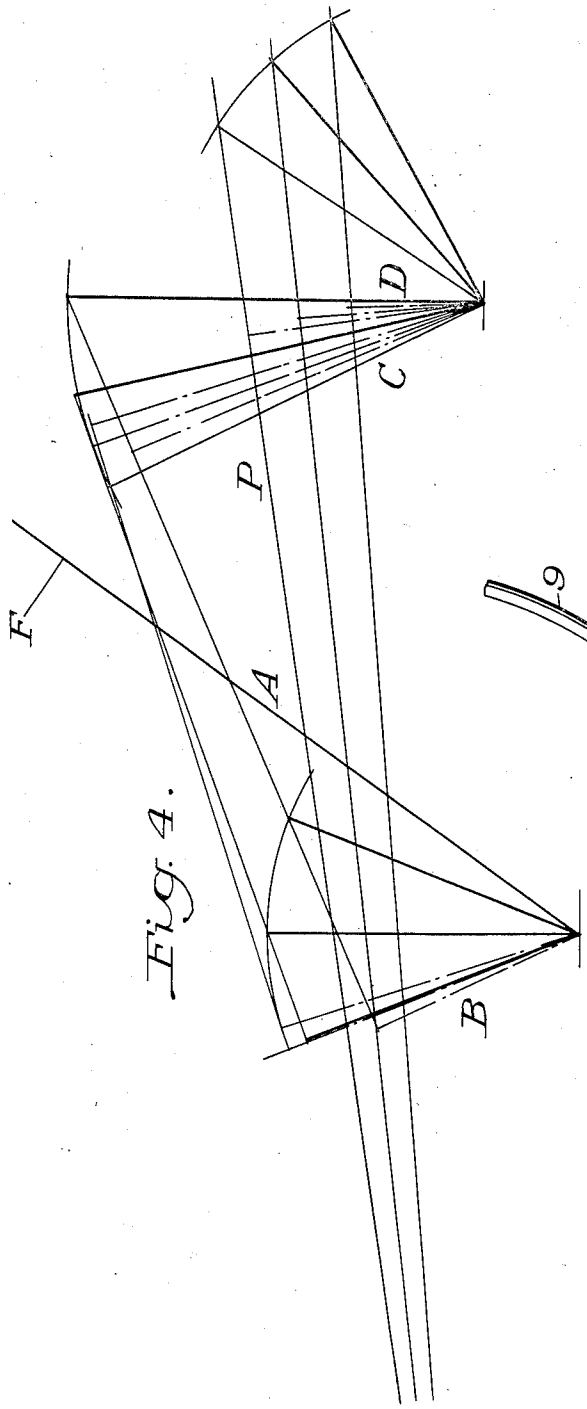


Fig. 4.

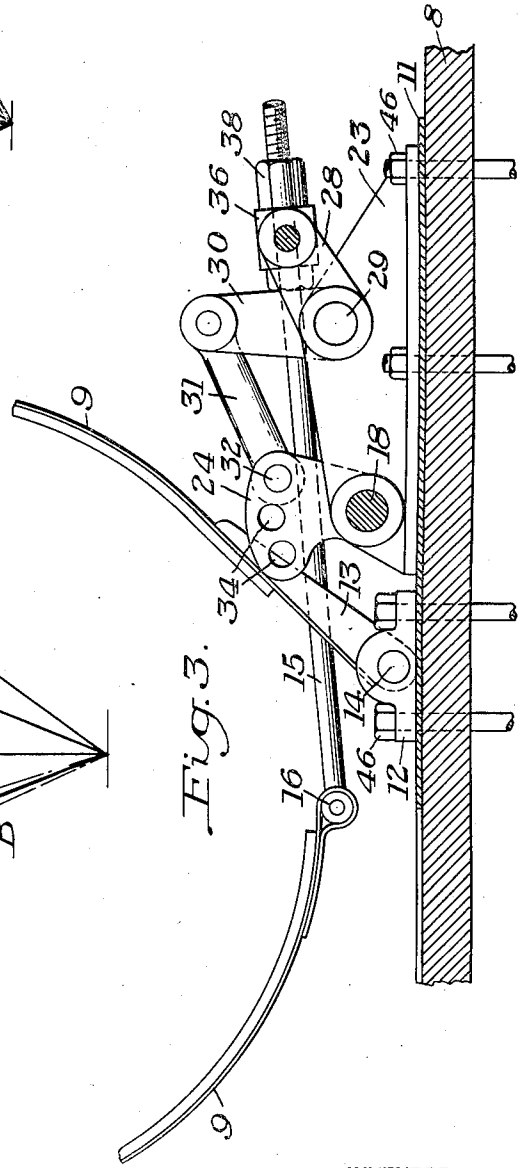


Fig. 3.

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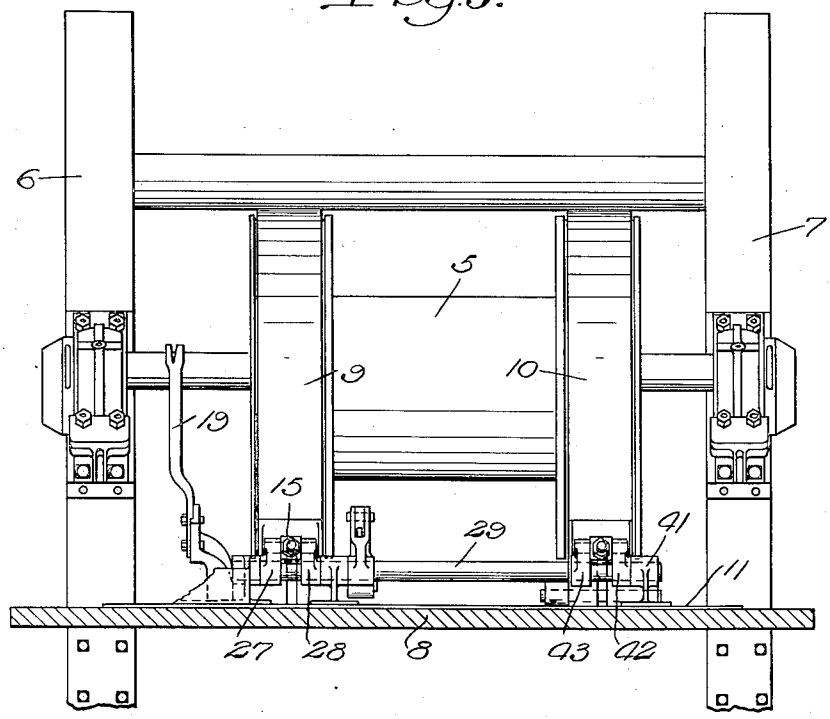
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HOIST BRAKING MECHANISM

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Fig. 5.



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HOIST BRAKING MECHANISM

Edgar E. Greve, Bellevue, Pa., assignor, by mesne assignments, to Oil Well Supply Company, Oil City, Pa., a corporation of New Jersey

Application September 15, 1930, Serial No. 481,998

2 Claims. (Cl. 188—77)

This application relates to braking mechanism of the type which is employed for controlling the paying out of cable or the like from a hoist drum. This invention deals particularly with the adjustment of the means for applying a friction brake to the brake drum, this adjustment varying the braking effect produced by the application of a force which may be constant. This invention had its origin in the solution of a problem in controlling a hoisting mechanism used in well drilling, and although the invention is applicable broadly to many types of hoisting mechanisms it is believed that it will facilitate understanding of the invention to describe it in connection with its use in well drilling.

The weights which are involved in hoisting and lowering strings of drill tubes in a well which may reach to as great a depth as eight or nine thousand feet are very great; and great difficulty has been experienced in succeeding in making the brake hold in a satisfactory and safe manner when cable is being unwound from the hoisting drum. It is obvious that when the first few lengths of tubing are suspended and are being lowered in the well, the braking effect need not be nearly as great as when additional lengths of tubing have been added to the string so as to reach to a much greater depth in the well. It is, moreover, desirable that the mechanism for applying the brake be so arranged that a weight may be hung from the lever applying the brake, this weight being just sufficient to permit the hoist drum to slowly revolve, thereby lowering the drill string in the well. It is clear, therefore, that if the brake applying mechanism is to operate automatically, this weight must have a greater effective braking action as the weight of the drill pipes suspended in the well increases.

One object of my invention is to provide in combination with a friction brake, means for applying the brake connected thereto by a member, the applying means including a crank adjustably connected to the member so that the angle between the crank and the member may be varied. A further object of my invention is to provide a common support for the anchor for the brake band of braking means for a hoist drum, and also the operating mechanism for the brake band, this supporting means being provided with spacing means engaging the drum support to properly position one support relative to the other. Further objects of my invention will become apparent in the course of the following description and will be more particularly pointed out in the accompanying claims.

As above explained, I wish to describe my invention as applied to a hoisting drum used in well drilling; and I have therefore shown in the drawings, not as limiting my invention but for the purpose of illustrating the same, one embodiment which the same may assume; and accordingly

Fig. 1 shows in perspective a pair of friction brake bands for a hoist drum, the supports for the drum, and operating mechanism for the friction bands;

Fig. 2 shows in plan the operating mechanism for the brake bands, the latter being broken away to facilitate illustration;

Fig. 3 shows in section and partially in side elevation, a portion of the operating mechanism for one brake band, this view being a vertical section taken on the line 3—3 of Fig. 2;

Fig. 4 shows a force diagram of the braking effect with the operating mechanism in three different positions;

Fig. 5 is a view in side elevation of the hoisting mechanism, the derrick floor being shown in section.

In the illustrative embodiment shown in the drawings, the hoisting drum 5 is supported on two vertical posts 6 and 7 which extend upwardly at the side of the derrick floor 8. A pair of friction brake bands 9 and 10 are provided for controlling the rotation of the hoisting drum so as to pay out the cable when the string of drill tubing is being lowered in the well. A supporting base such as the plate 11 is secured to the derrick floor 8. A pair of spaced lugs 12 are provided for anchoring the end of each brake band, these lugs being fixed to the support plate 11 in spaced position so that the anchor members 13 of the brake bands may be inserted between the same and pivoted thereto as at 14. To the free end of each brake band is attached a connecting member, such as the tension rod 15 which is pivoted to the brake band as at 16. While I have illustrated a braking mechanism in which the brake bands are applied by a tension rod, it is to be understood that my invention is applicable to other types of friction brakes such, for example, as a brake in which a rod is pushed instead of pulled; and it will become apparent during the course of the ensuing description that the same principles apply in the case where the rod is to be pushed as apply in the embodiment illustrated in which the rod 15 is to be pulled.

The brake applying mechanism includes a frame member 17 in which is pivoted a jack shaft 18. A lever 19 is fixed to the shaft 18 so that when the lever 19 is forced downwardly, torque

is applied to the shaft 18. An angle 20 may be secured to the lever 19 as by welding to enable the operator to use his foot in pressing down on this lever. The outer end of the lever 19 is forked as at 21 to permit a weight 22 to be hung therefrom.

The other end of the jack shaft 18 extends through and is pivoted in a second frame member 23. The projecting end of the shaft carries a sector member 24, which normally extends vertically from the jack shaft. The frame members 17 and 23 are also provided with bearings 25 and 26 respectively; and a crank 27 is mounted in the bearing 25 and a crank 28 is mounted in the bearing 26. The shaft 29 to which the crank 28 is secured extends through the bearing 26; and on the other side of this bearing a crank 30 is secured. To its upper end is pivoted a link 31. The other end of the link 31 carries a pin 32 which may be selectively inserted in any one of the holes 34, a plurality of which are provided in sector member 24. As illustrated, these holes are all at the same radial distance from the axis of the jack shaft 18; but it is to be understood that this is not necessary, since the braking effect may be further varied by changing the distance of these perforations from the axis of the jack shaft 18. A yoke 36 is slidable on the outer end of the tension rod 15, this yoke being provided with trunnions 37 which extend through the ends of the cranks 27 and 28. An adjusting nut 38 is threaded on the end of the tension rod 15 so as to adjust the yoke 36 longitudinally thereof.

The shaft 29 extends to another crank mechanism similar to the one just described. This crank mechanism includes but a single frame member 40 having a bearing 41 in which is pivotally mounted the stub shaft of a crank 42. A companion crank 43 is secured to the end of shaft 29; and the trunnions of a yoke 44 are mounted in the ends of the cranks 42 and 43. The yoke 44 is slidable longitudinally of the tension rod 15 which is connected to the brake band 10 and a nut 45 determines the position of the yoke 44 relative to the tension rod 15 similarly as in the crank mechanism first described.

The frame members 17, 23 and 40 are all secured to the plate 11 as by bolts 46. The plate 11 is provided with spacing means 47 which, in the embodiment illustrated herein are formed integrally with the plate. The upturned ends 48 of the spacing means are secured as by bolts to flanges of the posts 6 and 7 thereby anchoring the plate 11 in proper position relative to the hoisting mechanism.

It will be understood that other securing means than bolts may be employed but, in any event, the upturned ends 48 are to be positioned only at fixed stations on the posts 6 and 7 so that the relative position of the plate 11 to the posts and thus to the drum and its brake flanges is accurately fixed. For example, the bolt holes and their position on the flanges of the posts 6 and 7 form fixed stations on these flanges on which the upturned ends 48 must rest when secured by bolts passing through the bolt holes.

In Fig. 4 there is shown a force diagram which illustrates how adjustment of the nuts 38 and 45 along the rods 15 causes the effective action of the bands 9 and 10 to be changed. F may be taken as the pressure on the lever 19 including the weight of the lever itself. A may be taken as the length of the lever arm 19. B may be taken as the perpendicular distance from the axis of the jack shaft 18 to the center line of the link 31, this center line being the one passing through the centers of its two pivots. C may be taken as the vertical distance from the axis of the bearings 25 and 26 to the center line of the link 31. D may be taken as the vertical distance from the axis of the bearings 25 and 26 to the center line of the rod 15, this center line being taken as extending through the two pivots of the rod 15. P may be taken as the pull on the brake band.

As three different holes 34 are shown in the sector member 24, three examples will be given as illustrating how the pull on the brake band may vary. P, in each case, will equal the product of F times A times C divided by the product of B times D. In each case, F will be taken as 75 pounds and A will be taken as 52 inches. With the crank mechanism in the position shown in Fig. 3, and B taken as $4\frac{3}{16}$ inches, C taken as $7\frac{5}{16}$ inches and D taken as $2\frac{9}{16}$ inches, P (pull on brake band) will be 1092 pounds. In the middle position, with B equal to $5\frac{5}{16}$ inches, C equal to $7\frac{1}{16}$ inches, and D equal to $3\frac{5}{16}$ inches, the calculation of P (pull on brake band) works out as 1518 pounds. With the pin 32 in the third hole and B equal to 6 inches, C equal to $7\frac{7}{8}$ inches and D equal to $4\frac{1}{16}$ inches, P is calculated to be 2658 pounds.

It is obvious that various factors contribute towards the above calculated increase in pull on the brake band. It is clear that the change in the angle of the cranks 27 and 28 relative to the rod 15 cause a change in the pull on the brake band if the weight 22 be kept the same. This change may, therefore, be the only one relied on to cause the change in the pull on the brake band. The change in the perpendicular distance B and the change in the perpendicular distance C also contribute, and it is to be understood that these, as contributing further to the desired purpose, are to be understood as forming a part of more specific features of my invention.

It is moreover clear that by incorporating these principles in my improved brake operating mechanism I have provided a mechanism which, while keeping the lever 19 in the same angular position and retaining the same weight 22, provides different braking effects. It should be noted at this point that the angle of the lever 19 is not altered by the adjustments above described since at the same time that the nut 38 is adjusted along the tension rod 15, the pin 32 is inserted in a different hole 34, these two changes compensating each other so that the rod 19 maintains its same relative angular position.

It is furthermore apparent that by mounting the various parts of the brake operating mechanism, together with the anchors for the brake bands on the same plate 11, the assembling of the hoisting mechanism in proper position on the derrick floor is facilitated. The spacing means 47 engage the supports 6 and 7 for the hoisting drum and, therefore, the plate with the parts supported thereby are properly positioned relative to the hoisting drum. Since these parts are not being assembled in the factory but are being erected out in the field with rough equipment, the advantage of the provision of the spacing means 47 is obvious.

While I have illustrated and described one specific form of brake applying mechanism, it will be understood that the invention is not restricted to the particular construction and arrangement shown, but may be variously modified within the contemplation of the invention and under the scope of the following claims.

I claim:

1. In combination with a friction brake and an operating member therefor, means for applying force to said member comprising a crank, adjustable means for connecting the crank to said member at various points along the same whereby the angle between the crank and the adjustable means may be varied, a lever, an actuating weight suspended from the lever, and operative connections between the lever and the crank for transmitting actuating torque from the lever to the crank including an adjustable connection for compensating for adjustments between the crank and the operating member whereby the lever may be maintained at the same angle relative to the horizontal.

2. In combination with a friction brake and an operating member therefor, means for applying force to said member comprising a crank, adjustable means for connecting the crank to said member at various points along the same whereby the angle between the crank and the adjustable means may be varied, a lever, an actuating weight suspended from the lever, and operative connections between the lever and the crank for transmitting actuating torque from the lever to the crank including a link, and a sector member provided with a plurality of perforations to which the link may be pivoted whereby adjustments between the crank and the operating member may be compensated for so as to maintain the lever at the same angle relative to the horizontal.

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