March 22, 1932. J. R. McGIFFERT ET AL 1,850,116

HOISTING MECHANISM

Filed Nov. 20, 1929 4 Sheets-Sheet 1

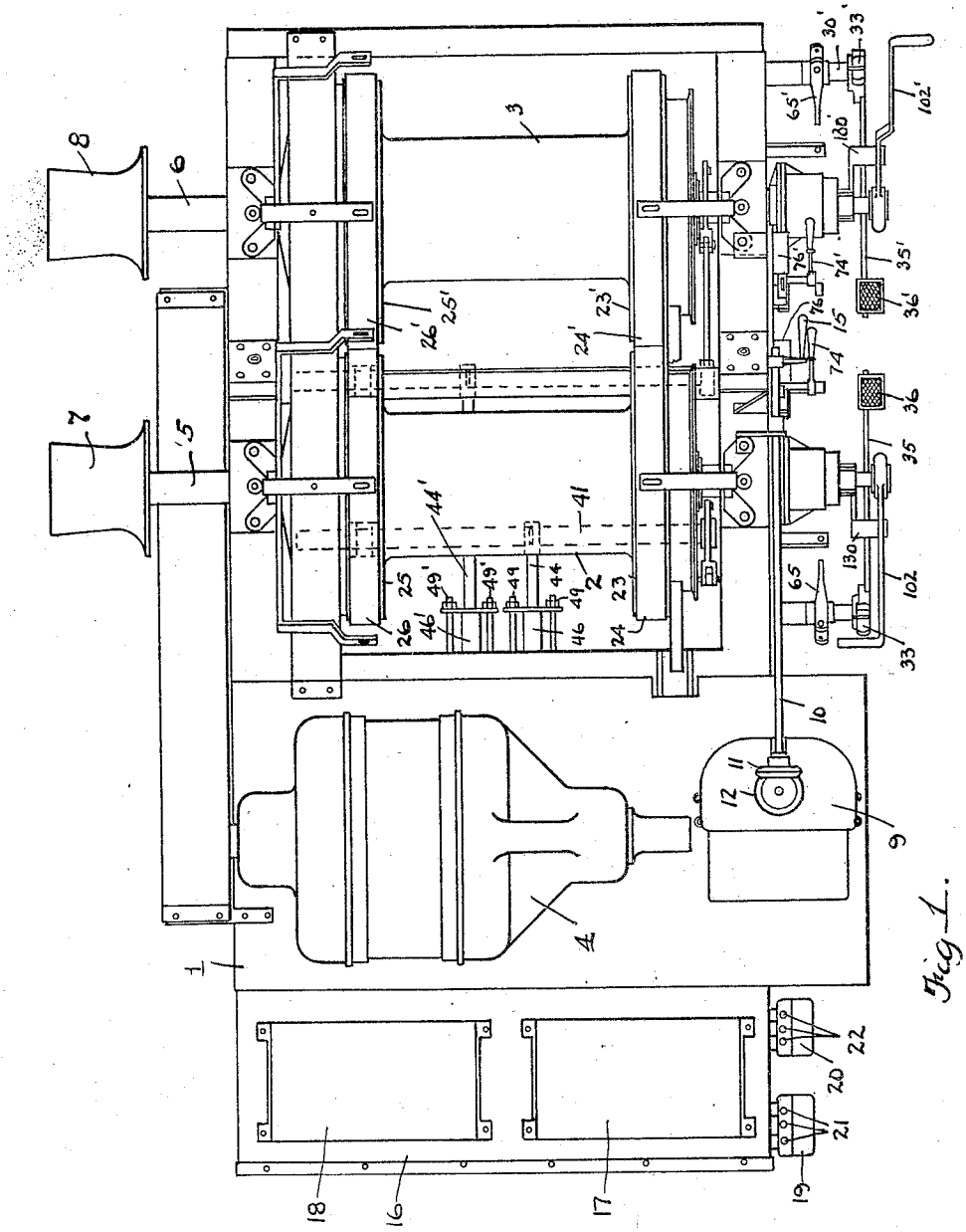

Fig. 1.

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HOISTING MECHANISM

Filed Nov. 20, 1929 4 Sheets-Sheet 2

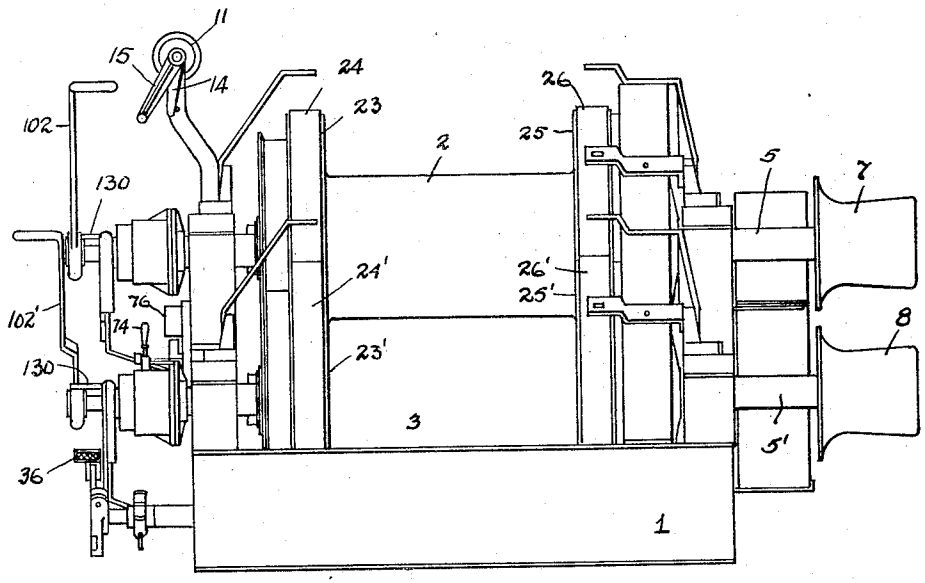

Fig. 2

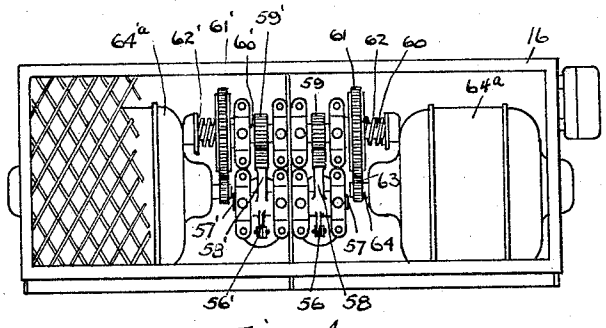

Fig. 4

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HOISTING MECHANISM

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Fig. 5

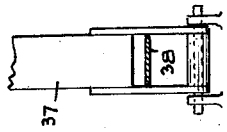


Fig. 6

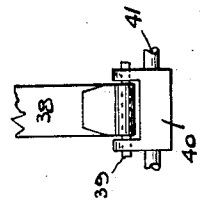


Fig. 3

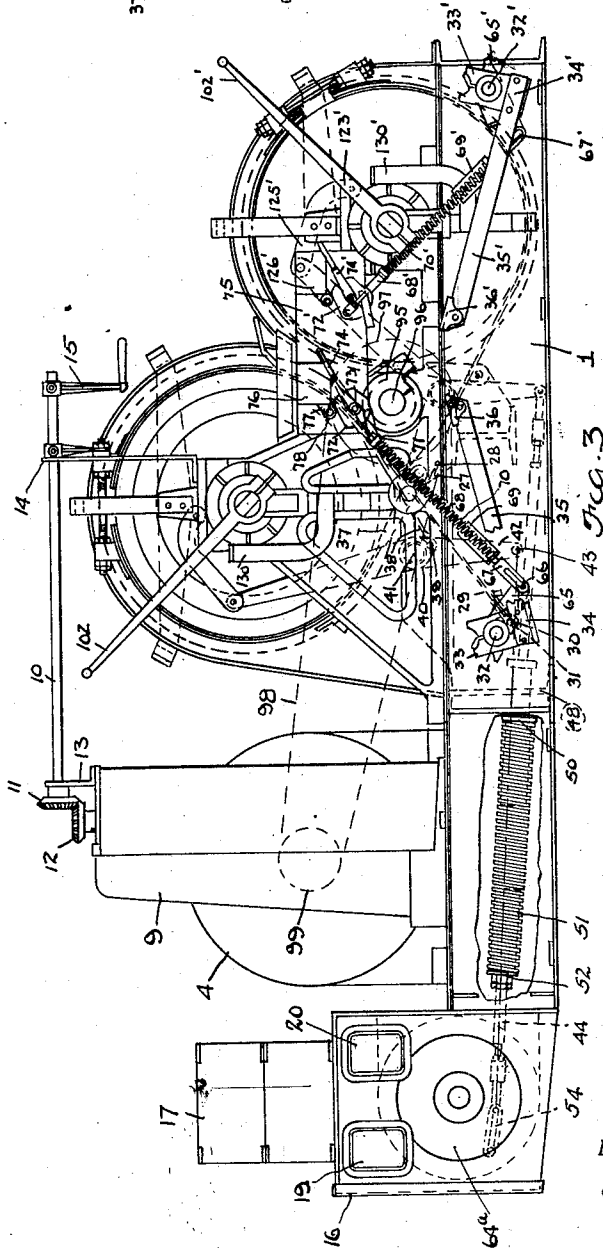
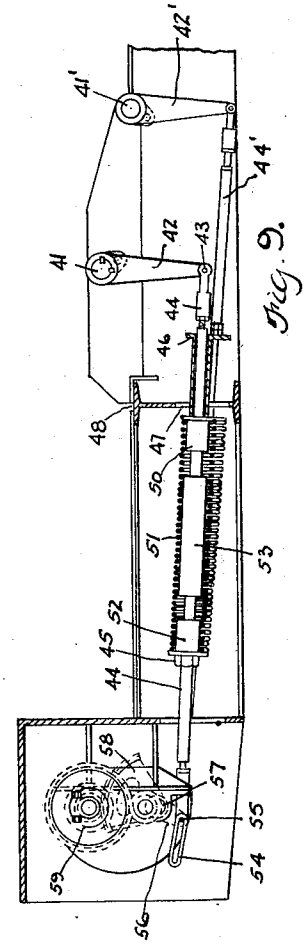


Fig. 9.



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HOISTING MECHANISM

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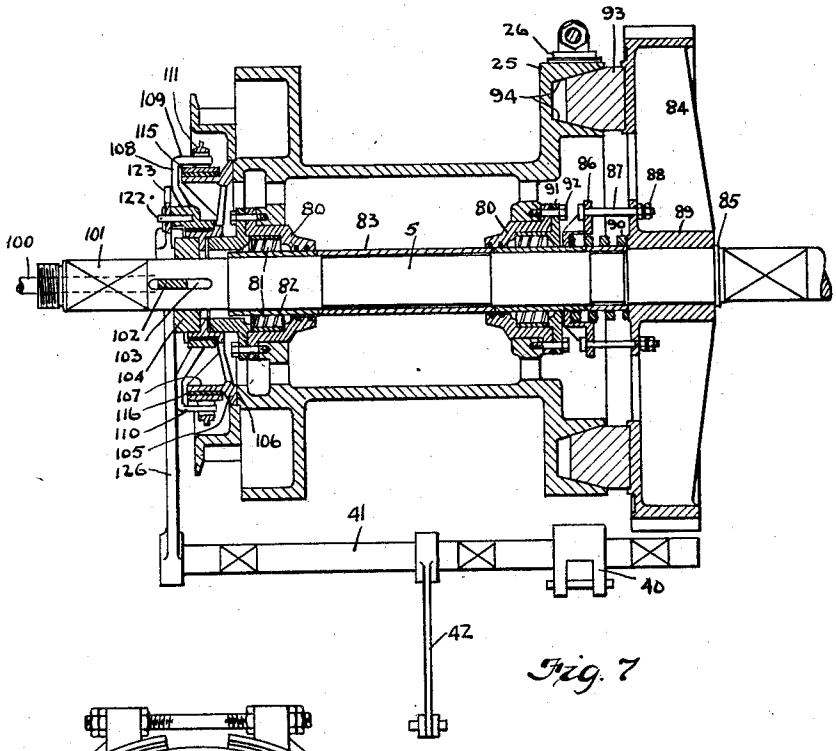

Fig. 7

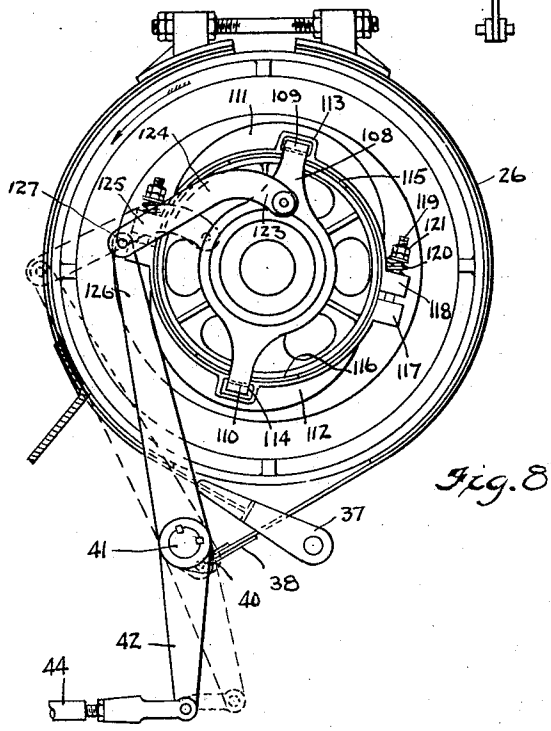

Fig. 8

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UNITED STATES PATENT OFFICE

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HOISTING MECHANISM

Application filed November 20, 1929. Serial No. 408,482.

This invention, as indicated, relates to hoisting mechanism and has particular reference to a mechanism whereby hoisting machinery of the common type is provided with a safety means for the prevention of the accidental dropping of the hoisted load.

Hoisting mechanisms as commonly employed, for example, in hoisting building material from the ground level to the upper levels of a building in the course of construction, are provided with no means other than the manual control of the operator for preventing the accidental falling of the suspended load, whether such load be an elevator carriage or a heavy structural steel member. In the construction of the hoisting mechanism of the type commonly employed, the winding spool upon which the hoisting cable is wound is provided with a brake drum, on which is mounted the common type of brake band. This brake is actuated and controlled by a foot or hand lever which is manipulated by the operator of the hoist. After the driving means has been disconnected from the winding spool the load is held in elevated position by the application of the above mentioned brake and the load, consequently, is held suspended only so long as the operator maintains the application of the brake. The brake by which the load or elevator carriage is held in position is usually the same brake by which the descent of the carriage or hoisted material is regulated.

With the confusion necessarily incident to building construction and the many distractions which are present in the neighborhood of the hoisting mechanism operator there are numerous possibilities for such operator becoming confused and releasing the brake with the resulting precipitation of the suspended load and injury to persons in the vicinity where the load is dropped. A further source of danger is the element of carelessness present in the manner in which the hoisting mechanism is controlled by certain types of operators.

It is the purpose of our invention to provide a safety means for hoisting mechanism whereby any accidental dropping of the suspended load is entirely obviated. It is a further object of our invention to provide a safety device for hoisting mechanism which shall be operable at all times and can in no way be impaired by any careless or unpremeditated act on the part of the operator. Other objects of our invention will be apparent as the description proceeds.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims; the annexed drawings and the following description setting forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:—

Fig. 1 is a plan view of a hoisting mechanism embodying the principles of our invention; Figs. 2 and 3 are respectively end and side elevations of the mechanism shown in Fig. 1; Fig. 4 is a plan view of a portion of the mechanism shown in the previous figures comprising the torque motors and associated mechanism; Figs. 5 and 6 show the manner in which the ends of the safety brake are secured; Fig. 7 is a fragmentary part section part elevation of a winding spool and associated parts as illustrated in Fig. 1; Fig. 8 is a fragmentary part section part side elevation of the mechanism shown in Fig. 7; and Fig. 9 is an enlarged part section part elevation of the safety brake actuating mechanism.

Referring more specifically to the drawings, and more especially to Fig. 1, the hoisting mechanism here shown for the purpose of illustration is of the common type, in which the base frame 1 supports plural winding spools 2 and 3, which spools are revolubly driven by means of the prime mover 4, here shown in the form of an electric motor. The spools 2 and 3 are respectively mounted on transverse shafts 5 and 6, to the terminal portions of which are secured the winch heads 7 and 8. Mounted on the base frame 1 is an electric controller unit 9 whereby the flow of electric current to the motor 4 is regulated by

means of the shaft 10 acting through gears 11 and 12, which shaft is journaled in brackets 13 and 14 and has secured to its terminal portion a crank handle 15 by which the shaft 10 is rotated and the controller 9 properly actuated. Positioned adjacent one end of the base frame 1 and rigidly secured thereto is a motor housing frame structure 16, upon which is mounted the resistor units 17 and 18, and to the sides of which are secured the starter boxes 19 and 20, which are here shown provided with three-phase A. C. binding posts 21 and 22, respectively.

For the purpose of the following description the winding spool 2, which is considered as the rear spool, and its associated parts and the operating mechanism therefor, will only be described. The operating mechanism and associated parts of the forward winding spool 3 is identical with that of the rear spool 2 and therefore the ordinals employed to designate the various parts of the mechanism associated with spool 2 will be given prime marks and applied to the corresponding elements of the mechanism associated with spool 3. The spool 2 has one terminal portion thereof formed into a brake drum 23, upon which is mounted the brake band 24, and this brake band with its associated drum will throughout the description be referred to as the service brake. The other terminal portion of the spool 2 is provided with a brake drum 25 which has suitably mounted thereon a brake band 26 and this brake with its associated drum will hereinafter be referred to as the safety brake.

Referring now to Fig. 3, one end 27 of the service brake band 24 is secured by the pin 28 rigidly mounted in the base 1 and the other end 29 thereof is supported by the pin 30 rigidly mounted in the member 31 which is secured to the revoluble shaft 32, which is journaled in the side of the base 1. Rigidly secured to the shaft 32 is a member 33 which has rigidly united therewith the end 34 of the foot lever 35, which carries the foot pad 36. The safety brake band 26 is rigidly secured at one end 37 thereof, and the other end 38 of the band 26 is secured by means of the pin 39 to the member 40 which is secured to the shaft 41. The end 37 of the brake band 26 is bifurcated, as shown in Fig. 5, in order to permit the other end 38 to pass therethrough, thereby effecting a greater contact area between the band 26 and the drum 25.

Rigidly mounted on the shaft 41 is a crank arm 42 which, at its lower end, is adapted to receive the pin 43 by which the rod 44 is attached thereto. The rod 44, shown more clearly in Fig. 9, passes through a sleeve 46, which in turn projects through the aperture 47 formed therefor in the sill 48 on the base 1 and which is secured to the sill 48 more or less loosely by means of the bolts 49. Coaxially mounted with the rod 44 is a thimble 50 which is held against the end of the sleeve 46 by means of the spring 51, which at its other end is axially restrained by a thimble 52 secured to the shaft 44 by means of the nut 45. Intermediately of the thimbles 50 and 52 and coaxially mounted on the rod 44 is a spring bushing 53. The rod 44 is provided with a slotted end 54 which is adapted to engage the pin 55 carried by the member 56, which is oscillatorily mounted on the shaft 57. The member 56 has integrally united therewith a toothed segment 58 which is adapted to engage the gear 59, which is more clearly shown in Fig. 4 mounted on the shaft 60. The shaft 60 has frictionally mounted thereon a gear 61 by means of a spring 62, which gear 61 intermeshes with the pinion 63 which is mounted on the motor shaft 64.

The shaft 32 has rigidly mounted thereon the arm 65 which carries a pin 66 engaged by the slotted end 67 of the rod 68. The rod 68 passes through an aperture formed in the bracket 69 and has coaxially mounted thereon a spring 70, which at one end rests against the bracket 69 and at the other end is axially restrained by the nut 71 carried by the rod 68. The other end of the rod 68 is pivotally mounted on the cam element 72. The cam element 72 is pivotally supported at 73 and has rigidly secured thereto the actuating lever 74. Secured to the rigidly mounted plate 75 is a switch 76 of the common type, by means of which the current to the torque motor 64^a is controlled. The switch 76 has a control lever 77 extending therefrom which carries a frictionless roller 78, which roller is held in contact with the surface of the cam 72 by means of a spring (not shown) in the switch 76.

The spool 2, as shown in Fig. 1 is revolubly mounted on the shaft 5 by means of the journal boxes 80 which carry the friction reducing bearings 81 which run on the hardened sleeves 82, which sleeves are spaced apart by means of the sleeve 83 carried by the medial portion of the shaft 5. Coaxially mounted on the shaft 5 is a gear wheel 84 which is positioned adjacent the collar 85 formed integrally with the shaft 5. The gear wheel 84 has secured thereto a member 86 by means of the bolts 87, which loosely pass through apertures formed therefor in the web of the gear wheel 84 and which carry locked nuts 88. Positioned intermediately of the member 86 and the hub 89 of the gear wheel 84 is a spring 90. The right-hand journal box 80 is provided with a thrust plate 91 secured thereto by means of the bolts 92, and which is adapted to contact with the member 86. The gear wheel 84 carries friction blocks 93 which are adapted to engage with the complementary beveled faces 94 formed on the spool 2. Frictional driving communication between the spool 2 and driving gear wheel 84, which receives its rotation from the pinion 95

mounted on the shaft 96, and which in turn receives its power from the driven means 97 through the resilient driving means 98 passing over the sprocket or pulley 99 of the motor 4, is effected in the manner now to be explained.

Thrust pin 100, which is free to move in the aperture 101 formed therefor centrally of the shaft 5, is forced axially of the shaft 5 by means of the lever 102 acting through suitable thrust screws (not shown). The thrust pin 100, in being forced to the right, as illustrated in Fig. 7, bears against the cross key 102 which is free to slide in the slot 103 provided therefor in the shaft 5, and which in turn bears against the thrust collar 104. The thrust collar 104 bears against the disk 105, which in turn bears against the spool 2 on the surface 106. This pressure forces the spool 2 axially of the shaft 5, compresses the spring 90 and effects frictional engagement between the friction blocks 93 and the complementary beveled faces 94 of the spool 2, which causes the spool to rotate with the gear wheel 84.

The disk 105 has a circumferential flange 107 extending axially thereof. Revolubly mounted on the disk 105 is a spider 108 which has arms 109 and 110 formed integrally therewith and extending axially therefrom toward the spool 2. These arms 109 and 110 secure the brake shoes 111 and 112 by engagement with the apertures 113 and 114, respectively. The shoes 111 and 112 are lined with the brake linings 115 and 116, respectively, and have lugs 117 and 118 adapted to receive the securing bolt 119. The securing bolt 119 has coaxially mounted therewith a spring 120 which is secured thereto by means of the nuts 121, and by means of which the tension of the brake shoes 111 and 112 may suitably be regulated. The spider 108 carires a pin 122 which revolubly secures the end 123 of the arm 124. The arm 124 is, at its other end 125, fastened to the crank arm 126 by means of the pin 127 and the crank arm 126 is in turn keyed to the shaft 41.

Rigidly secured to the standard which carries the shaft 5 is a bracket 130, which is adapted to present a stop for the lever 102 and prevent such lever from excessively retracting the thrust screws, by means of which frictional engagement between the spool 2 and the driving gear wheel 84 is effected.

It will be noted that for the purpose of clarifying the various drawings some of the commonly known parts have been omitted to more clearly bring out those which are new and which are vital in the description of the operating mechanism.

The operation of the mechanism will now be briefly described. The service brake 24 is actuated by depressing the lever 35 which causes a clockwise rotation of the shaft 32 and, which similarly rotates the member 31, to which is secured the end 29 of the service brake. The safety brake 26 is normally maintained in communication with the brake drum 25 by means of the spring 51, which forces the rod 44 to the left and, through the intervening connecting links causes a clockwise rotation of the shaft 41. It will be seen, therefore, that the engagement of the safety brake depends solely upon the compression spring and is uneffected by any other variables which may fail, or over which the operator has any control. The switch 76, which controls the current to the torque motor 64^a when closed, causes current to flow to this motor which then will rotate in a clockwise direction until restrained by means of the spring 51. The rotation of the shaft 64 of the motor, through the intervening gears 63, 61 and 59, causes a counter-clockwise rotation of the toothed segment 58 on the shaft 57. The member 56, which is formed integral with the toothed segment 58, will also rotate in a counter-clockwise direction and, through the pin 55, force the rod 44 to the right, compressing the spring 51 and imparting counter-clockwise rotation to the shaft 41 through the crank lever 42, thus releasing the safety brake. Should the current to the torque motor 64^a fail at any time during the operation of the hoisting mechanism, such failure will in no way impair the operation of the safety brake since as soon as the current to the torque motor does fail the spring 51 will immediately move the rod 44 to the left and effect an engagement of the safety brake.

The member 65, which is keyed to the shaft 32, this shaft being the one carrying the service brake actuating lever, through the pin 66, which engages the slotted end 67 of the rod 68, will cause a rotation of the cam 72 when the service brake lever is depressed and the service brake actuated. The rotation of the cam 72 will cause a clockwise movement of the switch lever 77 and close the circuit through switch 76 to the torque motor 64^a which then, as before explained, releases the safety brake. When the roller 78 of the switch lever 77 rests upon either of the side faces of the cam 72 the switch 76 will be opened. Therefore, by rotating the cam 72 in a counter-clockwise direction by means of the lever 74, which is made possible by means of the slotted end 67 of the rod 68, the cam 72 may be rotated sufficiently so that the roller 78 will rest upon the straight face of the cam opposite to the one shown in Fig. 3. This position of the cam 72 permits the application of the safety brake coincidental with the application of the service brake if this condition should be desired in sustaining the hoisted load.

For the proper functioning of the safety brake means must also be provided for the release of this brake when driving communi-

cation is established between the driving wheel 84 and the spool 2, and such release of the safety brake must, for the proper functioning of the hoisting device, be in no way dependable upon the actuation of the service brake. The release of the safety brake upon the establishment of driving communication with the spool 2 is effected by the mechanism clearly illustrated in Figs. 7 and 8. When the thrust pin 100 is moved axially of the shaft 5 in the hole 101 provided therefor, the end of the thrust pin forces the cross key 102 against the thrust collar 104, which bears against the disk 105, which in turn bears against the surface 106 of the spool 2. The disk 105 is free to move relatively, both to the thrust collar 104 and the spool 2, except when frictionally engaged by these members as a result of pressure on thrust pin 100. When, therefore, the friction thrust mechanism is operated, as is the case when a load is being raised by the spool 2, disk 105 will turn with the spool 2. At any time other than when the spool 2 is driven for hoisting the load the disk 105 is stationary upon the shaft 5. On the disk 105 an axially extending circumferential flange 107 is provided and on this flange are mounted the brake shoes 111 and 112, to which are secured the brake lining 115 and 116. The proper adjustment of the brake shoes 111 and 112 is obtained by means of the lock nuts 121 and the springs 120 which are coaxially mounted on the bolts 119. The spider 108, which engages the brake shoes 111 and 112 in the apertures 113 and 114, respectively, by means of the arm 109 and 110, is loosely mounted with respect to the shaft 5 and rotates with the disk 105 through the frictional engagement of the brake shoes 111 and 112 with the flange 107.

When driving communication has been established between the driving wheel 84 and spool 2 in the manner just described the spider 108 will be rotated and will carry therewith the associated links 124 and 126, and which in turn cause a rotation of the shaft 41. The counter-clockwise rotation of the spool 2, as indicated by the arrow in Fig. 8, and which is the rotation necessary to wind the hoisting cable on the drum as the load suspended thereby is being elevated, will cause the links 124 and 126 to assume the position shown in dotted lines in Fig. 8. In moving from the full line position to the dotted line position in this figure the shaft 41 will be rotated in a counter-clockwise direction and the rod 44, which is associated with the shaft 41 by means of the lever arm 42, will be moved to the right and the safety brake thereby released in the manner hereinbefore described.

The tension of the springs 120 will be so adjusted that the brake shoes 111 and 112 will have sufficient frictional engagement with the surface of the flange 107 to cause the lever arm 126 to rotate the shaft 21 against the resistance of the spring 51. The slot in the rear end of the rod 44, that is, the slotted end which has heretofore been designated by the ordinal 54, permits the mechanism just described to release the safety brake without having to move the torque motor and also permits the spring 51 to reset the safety brake when the friction mechanism is released without the drag of the torque motor. This construction reduces the necessary friction between the brake shoes 111 and 112 and the flange 107 and also greatly expedites the setting of the safety brake when the spool friction lever 102 is disengaged.

It will be seen from the above description that we have provided a safety brake for a hoisting mechanism or the like which is positive in its operation at all times and cannot be disturbed by any accidental or unpremeditated act of the operator. The safety brake which we have provided further is operable at all times and is absolutely independent in its effectiveness from the current by which the hoisting mechanism is actuated. The construction as described permits a flexibility of operation of the various parts which has not been possible with mechanisms of like character previously employed.

Other modes of applying the principle of our invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

We therefore particularly point out and distinctly claim as our invention:—

1. In a hoisting machine having a winding spool, means for driving said spool, operable means for effecting driving communication between said spool and said driving means, a brake associated with said spool and operable means for applying said brake, the combination of a second brake associated with said spool, resilient means for normally applying said second named brake, and means functionally responsive to manipulation of said first named brake for releasing such last named brake.

2. In a hoisting machine having a winding spool, means for driving said spool, operable means for effecting driving communication between said spool and said driving means, a brake associated with said spool and operable means for applying said brake, the combination of a second brake associated with said spool, resilient means for normally applying said second named brake, and electrically actuated means functionally responsive to manipulation of said first named brake for releasing such last named brake.

3. In a hoisting machine having a winding spool, means for driving said spool, operable means for effecting driving communi-

cation between said spool and said driving means, a brake associated with said spool and operable means for applying said brake, the combination of a second brake associated with said spool, resilient means for normally applying said second named brake, and an electric motor intergeared with said last named brake and functionally responsive to manipulation of said first named brake for releasing such last named brake.

4. In a hoisting machine having a winding spool, means for driving said spool, operable means for effecting driving communication between said spool and said driving means, a brake associated with said spool and operable means for applying said brake, the combination of a second brake associated with said spool, resilient means for normally applying said second named brake, and means functionally responsive to rotation of said spool in a single direction for releasing said second named brake.

5. In a hoisting machine having a winding spool, means for driving said spool, operable means for effecting driving communication between said spool and said driving means, a brake associated with said spool and operable means for applying said brake, the combination of a second brake associated with said spool, resilient means for normally applying said second named brake, means functionally responsive to rotation of said spool in a single direction for releasing said second named brake, and means functionally responsive to manipulation of said first named brake for releasing said second named brake.

6. In a hoisting machine having a winding spool, means for driving said spool, operable means for effecting driving communication between said spool and said driving means, a brake associated with said spool and operable means for applying said brake, the combination of a second brake associated with said spool, resilient means for normally applying said second named brake, means functionally responsive to rotation of said spool in a single direction for releasing said second named brake, and electrically actuated means functionally responsive to manipulation of said first named brake for releasing said second named brake.

7. In a hoisting machine having a winding spool, means for driving said spool, operable means for effecting driving communication between said spool and said driving means, a brake associated with said spool and operable means for applying said brake, the combination of a second brake associated with said spool, resilient means for normally applying said second named brake, means functionally responsive to rotation of said spool in a single direction for releasing said second named brake, and an electric motor intergeared with said second named brake and functionally responsive to manipulation of said first named brake for releasing said second named brake.

8. In a hoisting machine having a winding spool, means for driving said spool, operable means for effecting driving communication between said spool and said driving means, a brake associated with said spool and operable means for applying said brake, the combination of a second brake associated with said spool, resilient means for normally applying said second named brake, and means frictionally driven from said spool for releasing said second named brake.

9. In a hoisting machine having a winding spool, means for driving said spool, operable means for effecting driving communication between said spool and said driving means, a brake associated with said spool and operable means for applying said brake, the combination of a second brake associated with said spool, resilient means for normally applying said second named brake, and means frictionally driven from said spool for releasing said second named brake upon unidirectional rotation of said spool.

10. In a hoisting machine having a winding spool, means for driving said spool, operable means for effecting driving communication between said spool and said driving means, a service brake associated with said spool, and operable means for applying said service brake, the combination of a safety brake associated with said spool, resilient means for normally applying said safety brake, means frictionally driven by said spool for releasing said safety brake as said spool rotates in a single direction, and means responsive to the manipulation of said service brake for releasing said safety brake.

11. In a hoisting machine having a winding spool, means for driving said spool, operable means for effecting driving communication between said spool and said driving means, a service brake associated with said spool, and operable means for applying said service brake, the combination of a safety brake associated with said spool, resilient means for normally applying said safety brake, means frictionally driven by said spool for releasing said safety brake as said spool rotates in a single direction, and electrically actuated means functionally responsive upon application for said service brake for releasing said safety brake.

12. In a hoisting machine having a winding spool, means for driving said spool, operable means for effecting driving communication between said spool and said driving means, a service brake associated with said spool, and operable means for applying said service brake, the combination of a safety brake associated with said spool, resilient means for normally applying said safety brake, means frictionally driven by said spool

for releasing said safety brake as said spool rotates in a single direction, and an electric motor intergeared with said safety brake and functionally responsive to the application of said service brake for releasing said safety brake.

13. In a hoisting machine having a winding spool, means for driving said spool, operable means for effecting driving communication between said spool and said driving means, a service brake associated with said spool, and operable means for applying said service brake, the combination of a safety brake associated with said spool, resilient means for normally applying said safety brake, power means for releasing said safety brake, and control means for said power means responsive to the application of said service brake.

14. In a hoisting machine having a winding spool, means for driving said spool, operable means for effecting driving communication between said spool and said driving means, a service brake associated with said spool, and operable means for applying said service brake, the combination of a safety brake associated with said spool, resilient means for normally applying said safety brake, power means for releasing said safety brake, and control means for said power means functionally responsive to the application of said service brake for effecting release of said safety brake and manually operable during the application of said service brake for permitting application of said safety brake by said resilient means.

Signed by us, this 15th day of November, 1929.

JOHN R. McGIFFERT.
OLA L. BERBY.