

Sept. 1, 1936.

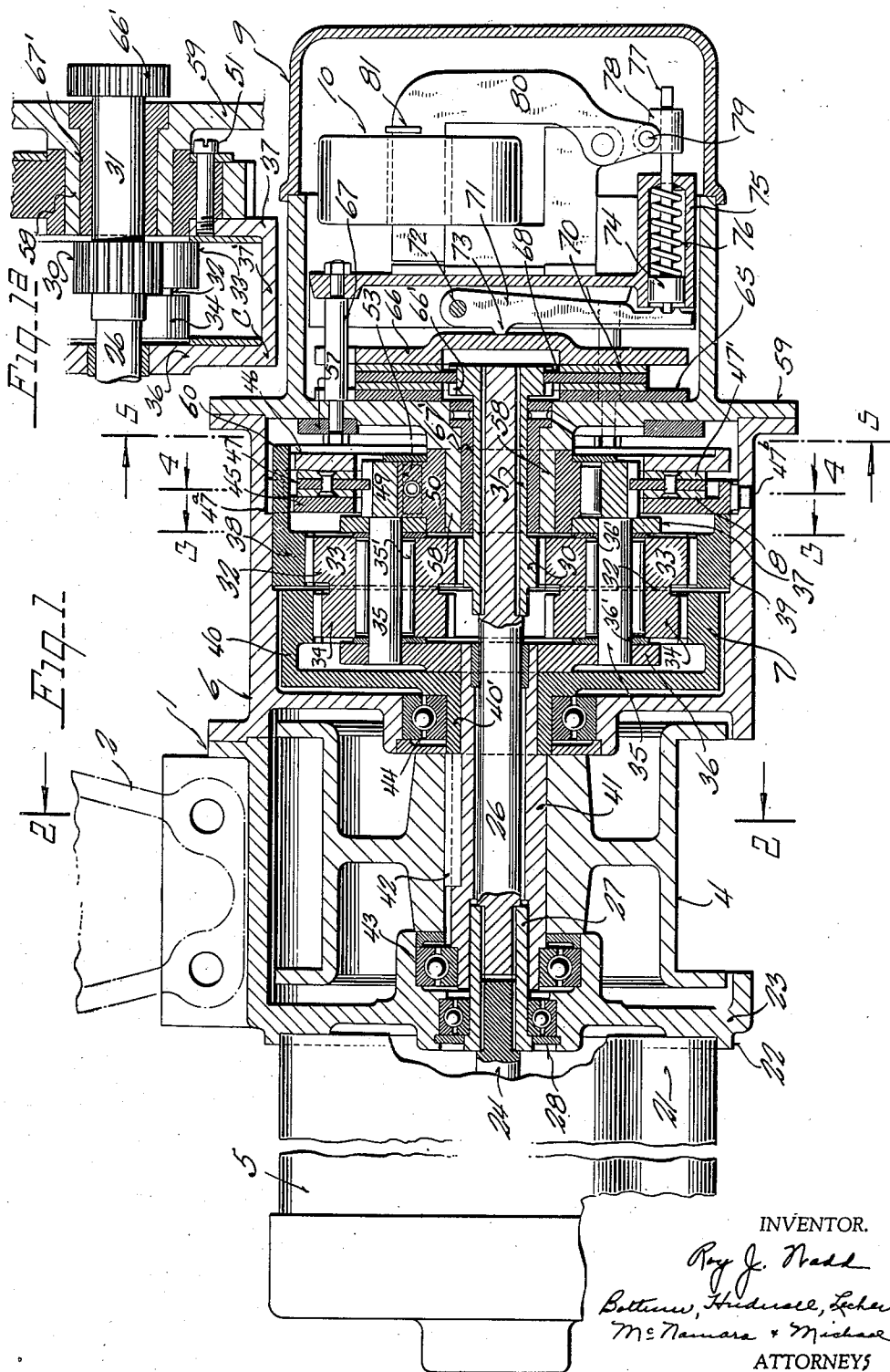
R. J. WADD

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HOIST

Filed Aug. 1, 1934

4 Sheets-Sheet 1



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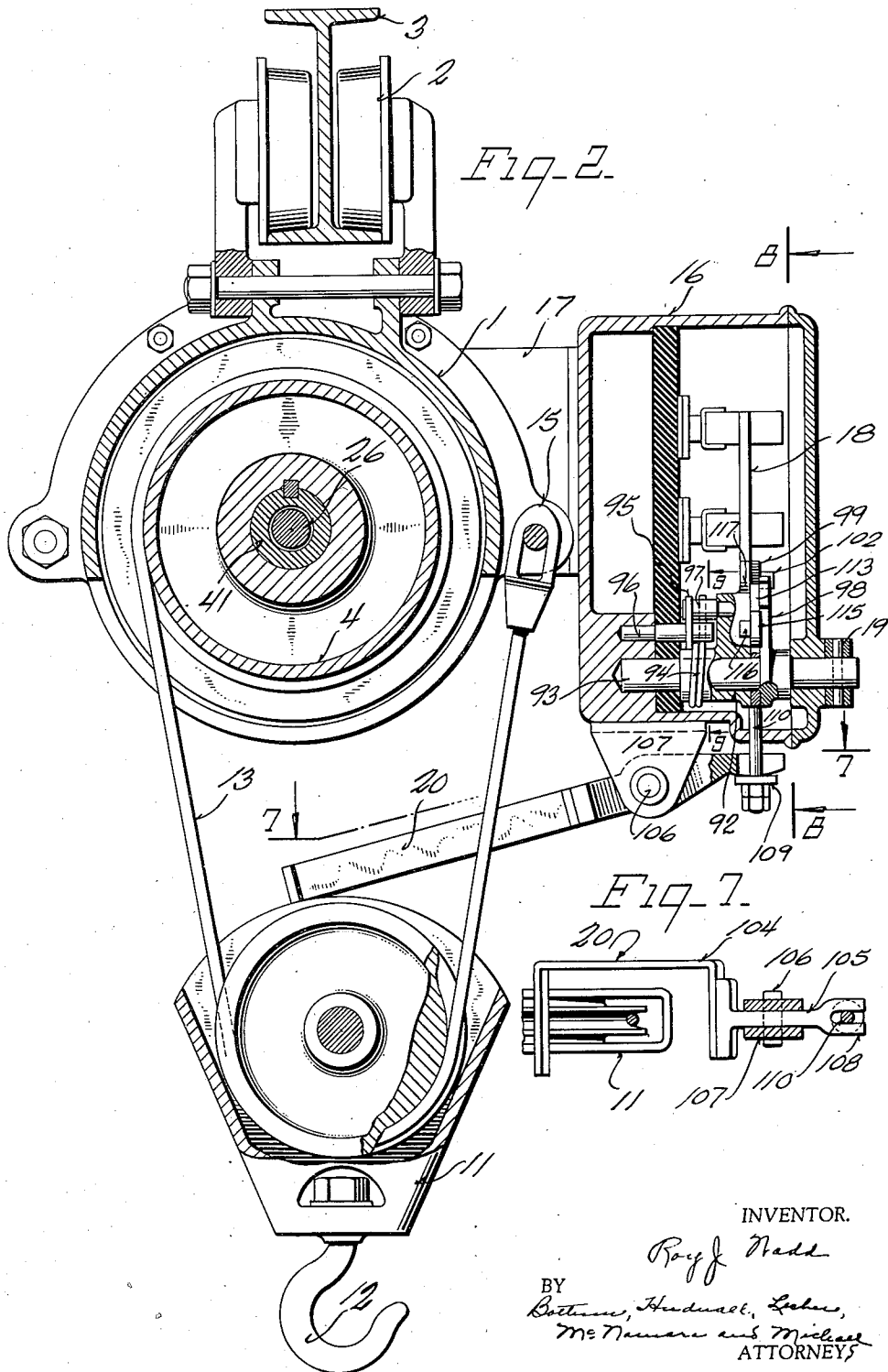
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HOIST

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Fig. 3

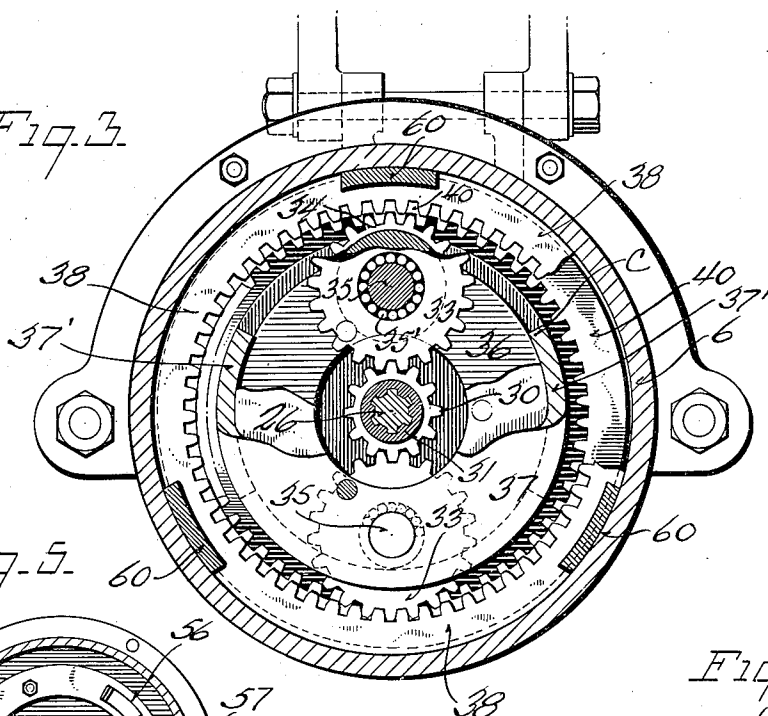


Fig. 5

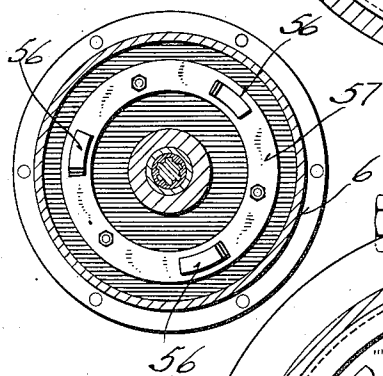


Fig. 6

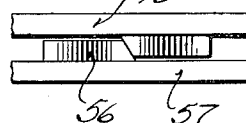
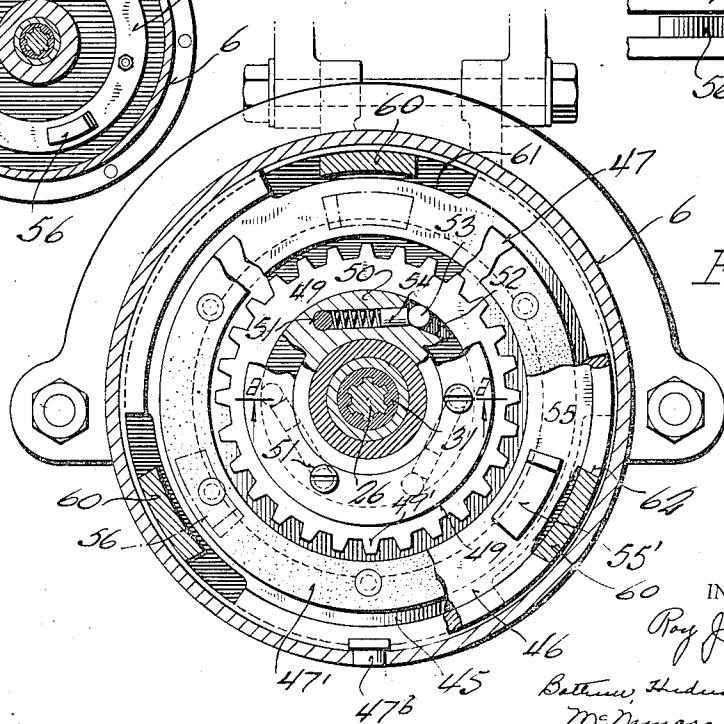


Fig. 4



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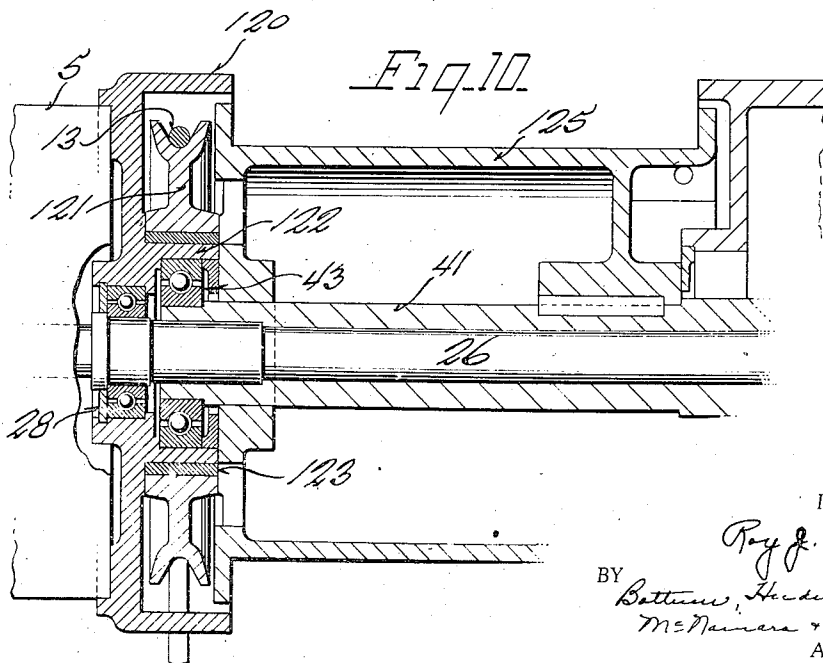
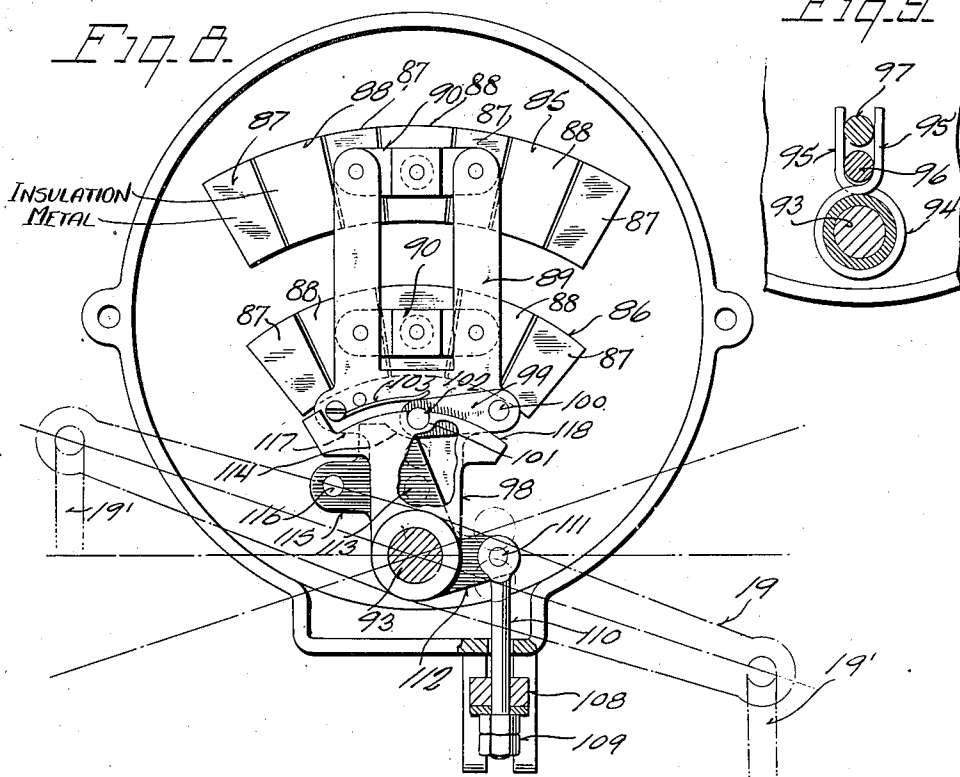
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HOIST

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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,053,055

HOIST

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Application August 1, 1934, Serial No. 737,920

9 Claims. (Cl. 254-168)

This invention relates in general to hoists and more particularly to electric hoists of the type wherein the hoisting mechanism or hoisting drum, the driving motor and the gearing between the driving motor and the drum, as well as the braking mechanism employed, are all compactly organized in a single unitary structure. In fact, with hoists of this type it is important that the assembly be as compact as practical in order to use the hoist in crowded quarters as well as for other reasons. Heretofore, one of the deficiencies of this type of hoist has been the lack of flexibility of the gearing employed in respect of variations in speed and power ratios. With the prior constructions a maximum ratio range has not been available in a compact unit which adequately meets the requirements of industry and certainly this is particularly true in any construction which is adaptable to the other requirements of hoists of this character and which operates with efficiency.

One of the objects of the present invention is to provide a hoisting mechanism so constructed and organized as to render available a wide range of gear ratios and to accomplish this while rendering the structure even more compact and more efficient. Combined with these advantageous features is a novel load brake which precludes the load overrunning the motor when lowering while avoiding any lateral sliding action in the operating gears, thus affording a free braking action directly in proportion to the applied load.

Another object of the invention is to provide a hoist having these advantages and capacities and which has incorporated in its structure an advantageous form of stopping brake which is capable of functioning as a holding brake in instances where the automatic load brake is not used.

Still another object of the invention is to provide a hoist mechanism of this character which is simple and durable in its construction, reliable and efficient in its operation, and easy and comparatively inexpensive to manufacture and maintain.

A further object of the invention is to provide a hoist of this character which is so constituted as to provide an enclosure for the gearing and the load brake mechanism so that the gearing may be immersed in a bath of lubricant.

Another object is to provide a hoist having these advantages and which embodies in its construction a novel means for limiting the approach of the load block to the winding drum, such means providing for the automatic movement of the

motor controlling switch first to "off" position and in the event of continued drift or approach of the load block to the hoisting drum, then reversal of the driving motor for a short period, whereupon the switch returns to "off" position.

Other objects and advantages reside in certain novel features of the construction, arrangement and combination of parts which will be hereinafter more fully described, and particularly pointed out in the appended claims, reference being had to the accompanying drawings, forming a part of this specification, and in which:

Figure 1 is a view partly in elevation and partly in central vertical longitudinal section showing a hoist constructed in accordance with the present invention, parts being broken away for the sake of illustration;

Figure 1a is a fragmentary view in vertical section but taken on the plane of line a-a of Figure 4;

Figure 2 is a view in transverse vertical section taken on line 2-2 of Figure 1, and also showing in addition one type of suspension of the hoist, the load block and one manner of suspending the same and an automatic limit switch arrangement;

Figures 3, 4 and 5 are views in transverse vertical section taken on lines 3-3, 4-4 and 5-5, respectively, of Figure 1, Figure 5 being on a somewhat smaller scale;

Figure 6 is a fragmentary view in elevation illustrating one set of camming lugs employed for applying braking pressure between the braking members of the automatic load brake;

Figure 7 is a fragmentary view in section taken on line 7-7 of Figure 2;

Figure 8 is a view in vertical section taken on line 8-8 of Figure 2;

Figure 9 is a fragmentary sectional view taken on line 9-9 of Figure 2; and

Figure 10 is a fragmentary view in central vertical longitudinal section illustrating a modification of the hoisting drum to provide for a multiple reeving of the hoist line.

Referring to the drawings, and more particularly to Figures 1 and 2, it will be seen that the hoist embodying the present invention comprises generally a main frame member 1 suspended by means of a trolley 2 from a monorail 3. However, the invention is adaptable to any suitable suspension means, as, for instance, a hook suspension, a motor driven or other trolley suspension, or any of the various types of fixed suspensions or supports. Within the main frame member a hoisting drum 4 is supported for rotation. On one

end of the main frame member 1 an electric motor 5 is securely mounted. On the opposite end thereof a gear casing 6 is secured and houses the gearing designated generally at 7 which serves to transmit the drive from the motor 5 to the hoist drum 4. An automatic load brake designated generally at 8 is also provided within the gear casing 6. A housing 9 is securely fastened to the outboard end of the gear casing 6 and encloses a holding brake designated generally at 10. A load block 11 (see Figure 2) having a hoisting hook 12 is suspended from the hoisting drum 4 by means of a hoisting line 13, one end of which may be anchored or dead-ended as at 15 and the other end portion of which is secured to and coiled about the hoisting drum 4.

A switch box 16 is fastened to a bracket 17 carried in the main frame and contains a switch 18 which controls the supply of current to the motor 5. The switch 18 is normally operated from a control lever 19, the ends of which are equipped with pull cords 19', which the operator manipulates, but in the event the load block 11 approaches too close to the hoist drum 4, the switch 18 is properly manipulated automatically from a stop lever 20 actuated by the load block 11.

As shown in Figure 1, the electric motor 5 has one end of its casing 21 fitted in a flanged seat 22 provided on one end wall 23 of the main frame 1 and is securely bolted or fastened in position against such seat in any suitable manner. The armature shaft 24 of the motor 5 is connected to a drive shaft 26 by means of a coupling sleeve 27, the coupling sleeve 27 being splined or keyed to the armature and drive shafts. A roller bearing assembly 28 suitably fitted and secured in the end wall 23 of the main frame supports the coupling sleeve 27 for rotation.

The gearing 7 may be characterized broadly as a planetary gear set of the differential epicyclic type and comprises a driving pinion 30, the teeth of which are formed on one end of a sleeve-like hub 31 splined to the drive shaft 26, as illustrated in Figures 1, 1a and 4. A plurality of sets of planet pinions designated generally at 32 is provided, each set of planet pinions being double, that is, consisting of two pinions, one designated at 33 and the other at 34, the pinions 33 and 34 of each set being integral or else otherwise rigidly fastened together. Each set of pinions is rotatably supported on a pinion shaft 35, the shafts 35 having their ends mounted in the plates 36 and 37 of a carrier designated generally at C. The construction of the carrier is completed by arcuate webs 37' (see Figure 3) which connect portions of the peripheral edges of the plates 36 and 37 and may be integral with said plates or else welded or otherwise fixed thereto. If desirable, suitable roller bearings, such as are designated at 35', may be provided between each set of pinions and their pinion shafts and washers or wear plates 36' may be provided between the side faces of the pinions and the carrier plates. The carrier plates are mounted for rotation in a manner which will be hereinafter pointed out. The pinions 33 mesh with an internal gear ring 38 fitted in a shouldered seat 39 provided therefor in the gear casing and although free for a limited rotary movement the ring gear 38 is effectually fixed or stationary in the operation of the hoist. The pinions 34 mesh with an internal ring gear 40 supported for rotation on the reduced end of a bushing 41, which is telescoped over the drive shaft 26 and mounted for rotation in ball bearings 43 and 44, the bushing having direct mount-

ing in the ball bearing assembly 43 and being indirectly supported for rotation in the ball bearing assembly 44 due to the interpositioning between the bushing and such bearing 44 of the hub flange 40' of the second internal ring gear 40. This flange 40' of the ring gear 40 is firmly secured or keyed to the bushing 41 and since the bushing 41 is keyed as at 42 to the hub of the hoist drum 4, the motion of the internal ring gear 40 is transmitted directly to the hoist drum. It will be noted that the inner end of the bushing 41 projects beyond the body of the ring gear 40 and thus provides a bearing for the carrier plate 36 of the planetary gear set.

By varying the number of teeth in the driving pinion, the planet pinions and the ring gears, a wide range of gear ratios are available and the proper hoist line speed developed to suit the variable conditions met in the industries and this while employing a very compact and efficient structure and while utilizing a high speed rotary or electric motor.

The automatic load brake 8 comprises a pair of braking elements or discs 45 and 46 disposed on the opposed sides of an interposed braking element or disc 47, the latter being provided with facings or brake lining 47' on the surfaces that are engaged by the braking discs 45 and 46. The braking disc 45 has its flanged periphery engaged on a shouldered seat 47^a provided therefor on the gear casing 6 and it is fixed in position by means of a key 47^b. Its cooperable braking disc 46 is, however, supported for rotary and slight axial movement in the housing as will hereinafter more clearly appear.

The braking disc 47 is connected to the carrier plate 37 by means of a one-way clutch or ratchet device so that the load brake will be operative only when lowering and when the hoist is stationary, the one-way clutch automatically disconnecting or freeing the hoist of the action of the load brake when hoisting.

As shown in Figures 1 and 4, the one-way clutch 48 comprises an outer clutch member 49 which has ribs or teeth 49' on its periphery interfitting with a corresponding formation on the inner periphery of the brake disc 47. The outer clutch member 49 is of ring-like form and it is rotatably fitted on an inner collar-like clutch member 50 fastened by means of screws 51 to the carrier plate 37 of the gear set. The inner clutch member 50 is supported for rotation on a hub-like annular flange 58 which is preferably an integral extension of the end wall 59 of the housing 9. At angularly spaced points in the periphery of the inner clutch member 50, notches 52 are machined and these notches have the bottoms or floors thereof inclined as shown in Figure 4. Rollers 53 are positioned in the notches 52 and are urged outwardly into engagement with the inner periphery of the outer clutch member 49 by means of spring pressed followers 54. With a construction of this character, when the carrier plate 37 of the planetary gear set rotates the inner clutch member 50 in a clockwise direction, as viewed in Figure 4, and with the outer clutch member 49 retarded under the action of the brake discs 45, 46 and 47, the rollers 53 will drift down into the deeper portions of the notches 52 and there will be no effective connection between the clutch members 49 and 50. On reverse rotation of the inner clutch member 50, that is, rotation thereof in a counter-clockwise direction and with the rotation of the clutch member 49 restrained, the rollers 53 will be

brought into wedging engagement between the inclined floors of their notches 52 and the inner periphery of the outer clutch member 49 so that these clutch members will be effectually connected together with the consequence that the planetary gear set will operate against the resistance of the braking discs 45, 46 and 47.

For the purpose of varying the braking pressure of the discs 45 and 46 on the interposed braking disc 47, motion is taken from the internal ring gear 38 and is transmitted through the braking disc 46 to bring into action a plurality of cooperable cams or helical surfaces, designated at 55 and 56, the cams 55 being provided on one face of the braking disc 46 and the cams 56 on a stationary disc 57 fastened to the end wall 59 of the housing 9. As shown in Figures 1, 3 and 4, the ring gear 38 has projecting from one side thereof at angularly spaced points integral arms 60, the arms extending through arcuate slots 61 and 62 formed in the periphery of the discs 45 and 46, respectively, and being located beyond the periphery of the braking disc 47. As will be understood from the drawings, the discs 45 and 46 have their peripheries flanged to strengthen them. These flanges, however, are cut away at the points where the slots 61 and 62 are formed. The slots in the periphery of the brake disc 45 are sufficiently large to allow free movement of the arms 60 therein. However, the slots 62 in the brake disc 46 are smaller and, as shown in Figure 4, are designed to be engaged at all times with portions of the arms 60 to provide for support of the brake disc 46 on these arms 60 and for the transmission of motion from the arms 60 to the brake disc 46.

The motor 5 is started and the shaft 26 is rotated, the pinion 30 will rotate the planetary gear set 32, and the pinions 33 thereof will first cause the ring gear 38 to rotate. Such rotation of the ring gear will be transmitted through the arms 60 to the brake disc 46. When this rotation is in such direction as to cause the camming lugs 55 to move to the left as viewed in Figure 6, their inclined surfaces will ride along the inclined surfaces of the camming lugs 56 and force the clutch disc 46 to the left as viewed in Figure 1, thereby causing it to press with greater force against the clutch disc 47 and the latter in turn to press harder against the clutch disc 45. As a consequence, the rotation of the clutch disc 47 is more firmly retarded and the braking effect exerted is directly in accordance with the load applied to the hoist.

The stopping brake 10 is preferably of the disc type and of a character which is biased to braking position by a spring or the like and released by means of an electromagnet so connected up in the motor circuit as to be automatically energized whenever current is supplied to the motor. Thus, as illustrated, the stopping brake consists of a pair of brake discs 65 and 66, brake disc 65 being stationary and abutting against one side of the end wall 59 of the housing 9, whereas the brake disc 66 is movable and is supported for shifting movement on supporting elements or bolts 67. Interposed between the discs 65 and 66 is a brake disc 68 having brake lining or surfacing 70 on the faces thereof with which the brake discs 65 and 66 are engageable. The inner periphery of the brake disc 68 is toothed to interfit with a toothed or ribbed formation 66' provided on the adjacent end of the sleeve-like hub 31 of the driving pinion 30 of the gear set. It will be noted that this sleeve-like hub 31 inter-

mediate the pinion 30 and the toothed or ribbed formation 66' is rotatable in a bushed bearing 67' provided therefor in the annular flange 58 of the end wall 59 of the housing 9.

An operating lever 71 is provided for the stopping brake, the operating lever being fulcrumed within the housing 9, as indicated at 72, and having a boss 73 intermediate its ends which bears against a raised portion of the brake disc 66. The end of the lever 71 opposite its fulcrum is engaged by a plunger which slides in a sleeve-like bracket 75 provided therefor and which is urged against the lever by a coil spring 76. The rod 77 of the plunger projects beyond the bracket 75 and has a collar 79 fixed thereto which is pivotally or otherwise appropriately connected as at 79 to the armature 80 of an electromagnet 81. It is obvious that spring 76 applies the stopping brake and that electromagnet 81, when energized, releases it. It is conventional to have such a magnet so connected in the motor circuit that it is automatically engaged when the motor is running and disengaged when the motor stops.

The switch which controls the energization of the motor 5 is illustrated in Figures 2, 8 and 9, and, as shown, comprises fixed contact segments 85 and 86 made up of a sufficient number of angularly spaced metal contacts 87 separated by insulation 88 to provide for the rotation of the motor in one direction or the other to take care of hoisting and lowering. A movable contact arm 89 is mounted to sweep back and forth across the contact segments 85 and 86 and has bridging contacts 90 and 91 which, in one position, bridge the contacts 87 which run the motor forward, in another position bridge the contacts which reverse the motor 5 and in the third position, that shown in Figure 8, break the motor circuit. The details of the switch per se form no part of the invention and hence will not be further described. Such switches are well known to those skilled in the art.

The hub 92 of the contact arm 89 is rotatably mounted on a supporting shaft 93 which is, in turn, mounted for rotation in bearings provided therefor in the switch box 16. In order to bias the switch arm 89 to the position shown in Figure 8, in which position the motor circuit is broken, a spring 94 is coiled about the hub 92 and has its ends 95 extending vertically and embracing or straddling pins 96 and 97, the pin 96 being fixed to the structure of the gear box and projecting forwardly between the terminals 95 of the spring, whereas the pin 97 is fixed to the hub 92 of the movable switch arm and projects rearwardly between the spring ends 95. It will be understood from this that the movable switch arm 89, when moved either to the right or to the left from the position shown in Figure 8, partakes of such movement against the action of the spring 94 so that the spring 94 is constantly exerting a force on the movable switch arm tending to return it to open position (see Figure 8).

The central portion of the operating lever 19 is fixed to the shaft 93. Normally there is a mechanical connection between this shaft 93 and the switch arm 89, which connection, however, is made releasable under the action of the stop lever 20 to prevent the load block from approaching too close to the hoisting drum. This releasable mechanical connection may be provided by fixing a segment-like arm 98 to the shaft 93 and releasably connecting the arm 98 with one end of a link 99, the other end of the link being pivotally con-

connected as at 100 to the movable switch arm 89. The releasable connection between the link 99 and the arm 98 may be afforded by providing a U-shaped or semi-circular notch 101 in the upper edge of the arm 98 and equipping the link 99 with a laterally extending stud or pin 102 which ordinarily is seated in the notch 101 and is releasably held therein by a blade spring 103 fixed on the switch arm 89 and bearing down on the link 99.

The stop lever 20 has a bail-like portion 104 which lies in the path of movement of the load block 11, as will be understood from Figures 2 and 7. This bail-like portion is connected to a T-shaped portion 105, the latter being fulcrumed as at 106 on a bracket 107 carried by a switch box 16. The outer end of portion 105 is bifurcated as at 108 and straddles a nut and washer assembly 109 carried by the lower end of a connecting rod 110 which extends into the switch box and is pivotally connected as at 111 to a crank arm 112 pivotally or rockably fitted on the shaft 93. Integral with the crank arm 112 is a camming arm 113, the camming arm 113 having a camming surface 114 underlying the link 99 and cooperable with the adjacent curved end of the link to lift the link and disengage its stud 102 from the notch 101 under certain conditions, as will be hereinafter more fully described. The camming arm 113 also has an integral extension 115 provided with a laterally extending stud 116 which is, under certain circumstances, engageable with the shoulder-like formation 117 provided on the switch arm, as will also be hereinafter fully pointed out.

When the operator desires to hoist or raise the load block he pulls downwardly on the left hand pull cord 19' (as viewed in Figure 8) to cause the bridging contacts 90 and 91 thereof to bridge such fixed contacts 87 as to cause the motor to drive the hoisting drum in such direction as to reel up on the hoist line and raise the load block. If the operator continues to hold the pull cord down while the load block approaches too close to the hoisting drum, the block will strike the stop lever 20 thereby pulling down on the connecting rod 110 and rocking the crank lever 112 and its camming arm 113 in a clockwise direction as viewed in Figure 8 to cause the camming surface 114 to wipe against the adjacent curved end of the link 99 thereby lifting the pin 102 on the link 99 out of the notch 101. The movable switch arm 89 is now free to rock on the shaft 93 under the influence of its spring 94 and it is at once returned to the position shown in Figure 8, wherein the circuit to the motor is broken. Should the block 11 continue to drift or approach toward the hoisting drum the stop lever 20 will be further rocked and consequently the camming arm 113 will be rocked still further in a clockwise direction so that eventually its pin 116 will engage the shoulder formation 117 on the switch arm 89 to swing this switch arm from the position shown in Figure 8 in a clockwise direction, as viewed in such figure, until its contacts 91 bridge such of the fixed contacts 87 as will bring about a reversal of the motor. When the motor reverses the load block is lowered and consequently the stop lever 20 under the influence of its own weight swings downwardly. This correspondingly moves the cam arm 113 and its pin 116. The movement of the cam arm 113 and pin 116 is now in a counter-clockwise direction, as viewed in Figure 8. The switch arm 89 under the influence of its spring 94 follows the pin 116 in such movement until the switch arm returns to its "off" position. During this time the pin 102 of the link

99 has been riding on the curved surface 118 of the sector-shaped arm 98 and it will remain on some portion of this surface 118 until the operator moves the lever 19 back to its horizontal position whereupon the pin 102 will snap into the notch 101 and the device will be reset.

In Figure 10 of the drawings there is shown a modified type of drum and a slight modification in the structure of the main frame member, all for the purpose of providing for a multiple reeving of the hoist line. As therein illustrated, 5 designates the motor and 26 the drive shaft, both of which may be constructed as previously described. The main frame member is designated at 120 and has an outer peripheral flange to enclose an idler pulley 121 over which the hoist line 13 is reeved, in addition to being coiled about the drum and dead-ended. The pulley 121 rotates on an annular flange 122 integral with the main frame member, a bushing 123 being interposed between the flange 122 and the hub of the pulley. The hoisting drum is designated at 125 and is keyed to the bushing 41 as before, although its structure from the point of view of design is somewhat modified as will be understood from the drawings.

It will be understood from the foregoing that a hoist embodying the invention disclosed may be constructed to provide practically any desirable gear ratio. This flexibility in the gear train flows from the capacity of the differential epicyclic planetary gear set in its adaptability to provide in a practical way a maximum gear ratio of range. This variability or flexibility in the gear ratio range is had merely by varying the movement of teeth in the driving pinions, the planet pinion and the ring gear. And this advantage is had while enhancing the desirable feature of compactness. In other words, the overall dimensions of the hoist embodying this invention occupies a minimum of space. In fact, a hoist desired to handle loads up to one ton occupies just about one-half the space as previous hoists of this type. Furthermore, the efficiency of the hoist and its durability are enhanced and the cost of producing the hoist and of operating and maintaining it are materially reduced.

Then again, the automatic mechanical load brake combined with the hoist provides a braking effect directly in accordance with the applied load, either when the hoist is stationary or when lowering, and yet when hoisting the mechanism is freed automatically of the restraining influence of the brake.

While I have shown and described typical embodiments of the invention, it is to be understood that the constructions shown have been selected merely for the purpose of illustration or example, and that various changes in the size, shape and arrangement of the parts may be made, as will be apparent to those skilled in the art, without departing from the spirit of the invention or the scope of the subjoined claims.

The invention claimed is:

1. A hoist comprising a rotatable hoisting drum, a driving motor therefor, and a planetary gear set providing a driving connection between said motor and said drum and comprising a driving pinion actuated by the motor, a plurality of pairs of planet pinions, a carrier for said planet pinions, one pinion of each of said pairs meshing with said driving pinion, two internal ring gears meshing with said planet pinions, means for constraining one of said ring gears to a limited amount of rotation and thereafter holding it against further rotary movement, and 75

means for connecting the other of said ring gears to said hoisting drum, the driving pinion, planet pinions and ring gears having an unequal number of teeth so as to provide the desirable speed and power ratio, in combination with an automatic load brake having a plurality of braking elements, one of which is connected to the carrier of said gear set and another of said braking elements being secured in fixed position, camming means coacting with still another of said braking elements for applying braking pressure therebetween, and means utilizing the limited rotation of the one of said ring gears for actuating said camming means.

2. A hoist comprising a hoisting drum, a driving motor therefor, a gear set actuated by said motor and connected to said drum to provide a driving connection for the motor and drum, and an automatic load brake for said hoisting drum comprising a braking disc connected to said gear set, a fixed braking disc engageable with one face of said first-named disc, an axially shiftable disc engageable with the other face thereof, cooperable cams for shifting said last-named disc axially to apply said brake and means actuated by said gear set for actuating the cams.

3. A hoist comprising a hoisting drum, a driving motor therefor, a gear set actuated by said motor and connected to said drum to provide a driving connection between the motor and the drum, said gear set having one ring gear constrained to a limited amount of rotary movement, a gear casing enclosing said gear set, and an automatic load brake for said hoisting drum, also mounted in said gear casing and comprising a braking disc connected to said gear set, a fixed braking disc engageable with one face of said first-named disc, an axially shiftable braking disc engageable with the other face thereof, cooperable camming means between said last-named disc and said gear casing for shifting said last-named disc axially to apply said brake, and means actuated by said gear set for actuating the cams.

4. A hoist comprising a hoisting drum, a driving motor therefor, a gear set actuated by said motor and connected to said drum to provide a driving connection between the motor and the drum, said gear set having one ring gear constrained to a limited amount of rotary movement, a gear casing enclosing said gear set, and an automatic load brake for said hoisting drum, also mounted in said gear casing and comprising a braking disc connected to said gear set, a fixed braking disc engageable with one face of said first-named disc, an axially shiftable braking disc engageable with the other face thereof, cooperable camming means between said last-named disc axially to apply said brake, and arms carried by said ring gear and engageable with said last-named disc for moving the same to cause the cams to engage and shift said last-named disc axially.

5. In combination with a hoist having a hoisting drum, a hoisting line actuated by the drum, a load block raised and lowered by said hoisting line, and an electric motor for driving said drum, of means for limiting the approach of the load block toward the hoisting drum and comprising a switch for controlling the supply of current to the motor and having a swingable switch arm and stationary contacts with which said switch arm is engageable, manually controllable means for swinging said arm including a lever and a releasable connection between

the lever and the arm, and means for disconnecting said releasable connection including a stop lever adapted to be engaged by the load block and a trip for said releasable connection actuated by said stop lever when the same is shifted by the load block.

6. In combination with a hoist having a hoisting drum, a hoisting line actuated by the drum, a load block raised and lowered by said hoisting line, an electric motor for driving said drum, of means for limiting the approach of the load block toward the hoisting drum and comprising a switch for controlling the supply of current to the motor and having a movable switch arm, means for biasing the switch arm to "off" position, manually controllable means for swinging the same arm to "on" position and including a lever and a releasable connection between the lever and said arm, and means for disconnecting said releasable connection including a stop lever adapted to be engaged by the load block and a trip for said releasable connection actuated by said stop lever when the latter is shifted by the load block.

7. In combination with a hoist having a hoisting drum, a hoisting line actuated by the drum, a load block raised and lowered by said hoisting line, an electric motor for driving said drum, of means for limiting the approach of the load block toward the hoisting drum and comprising a switch for controlling the supply of current to the motor and having a movable switch arm, means for biasing the switch arm to "off" position, manually controllable means for swinging the said arm to "on" position and including a lever and a releasable connection between the lever and said arm, and means for disconnecting said releasable connection including a stop lever adapted to be engaged by the load block and a trip for said releasable connection actuated by said stop lever when the latter is shifted by the load block, said trip having means for engaging the arm and shifting the same to "reverse" position upon continued drift of the load block toward the drum after said releasable connection has been disconnected.

8. In combination with a hoist having a hoisting drum, a hoisting line actuated by the drum, a load block raised and lowered by said hoisting line, an electric motor for driving said drum, of means for limiting the approach of the load block toward the hoisting drum and comprising a switch for controlling the supply of current to the motor and having a movable switch arm, means for biasing the switch arm to "off" position, manually controllable means for swinging the said arm to "on" position and including a lever and a releasable connection between the lever and said arm, and means for disconnecting said releasable connection including a stop lever adapted to be engaged by the load block and a trip for said releasable connection actuated by said stop lever when the latter is shifted by the load block, said releasable connection being automatically reset upon return of said manually controlled means to the position which it normally occupies when the switch is in open position.

9. A hoist comprising a hoisting drum, a driving motor therefor, a gear set actuated by said motor and connected to said drum to provide a driving connection between the motor and the drum, said gear set having one ring gear constrained to a limited amount of rotary movement, a gear casing enclosing said gear set,

and an automatic load brake for said hoisting drum, also mounted in said gear casing and comprising a braking disc, a one-way clutch between said braking disc and said gear set, a fixed braking disc engageable with one face of said first-named disc, an axially shiftable braking disc engageable with the other face thereof, cooperable

camming means between said last-named disc axially to apply said brake, and arms carried by said ring gear and engageable with said last-named disc for moving the same to cause the cams to engage and shift said last-named disc axially.

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