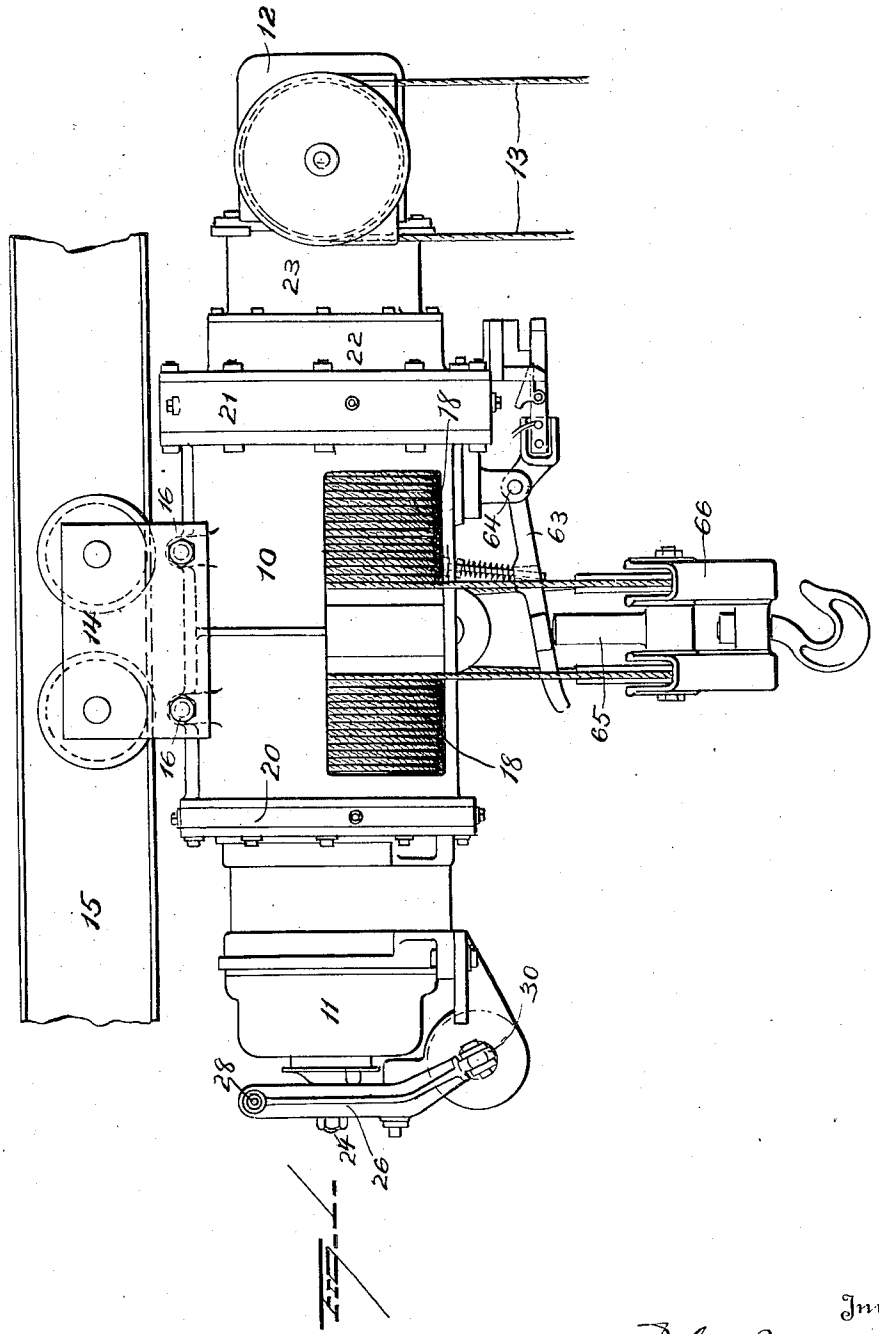
March 25, 1924. 1,488,286

P. C. RICHTER

ELECTRIC HOIST

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By Seymour & Bright

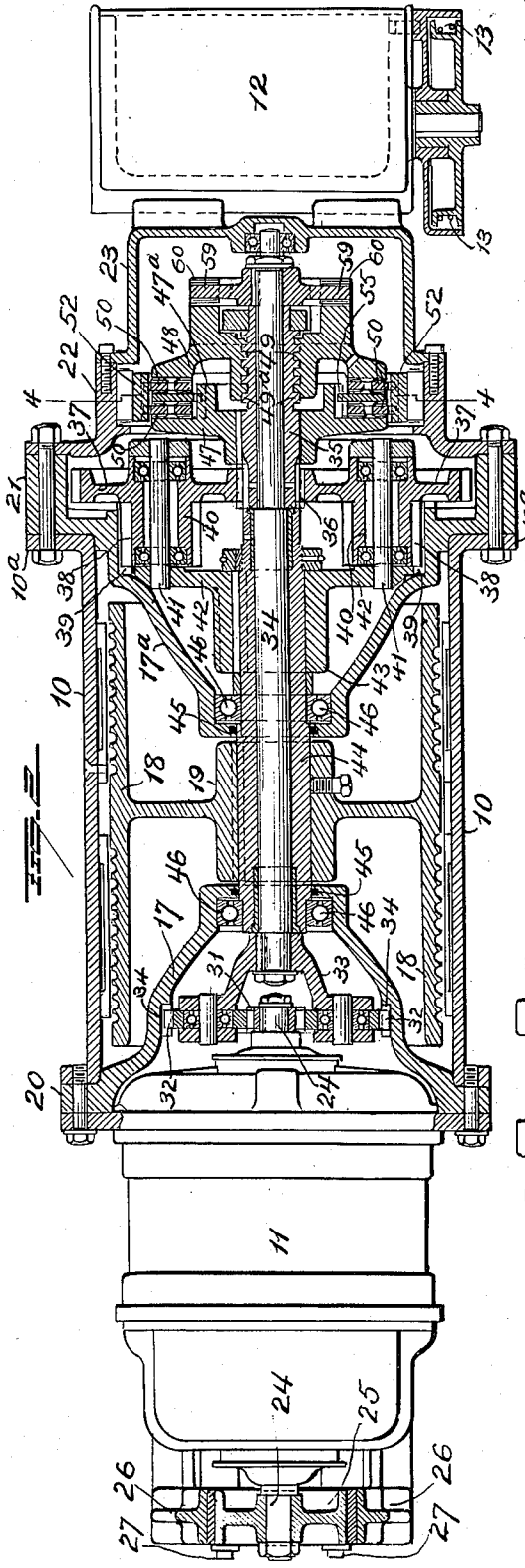
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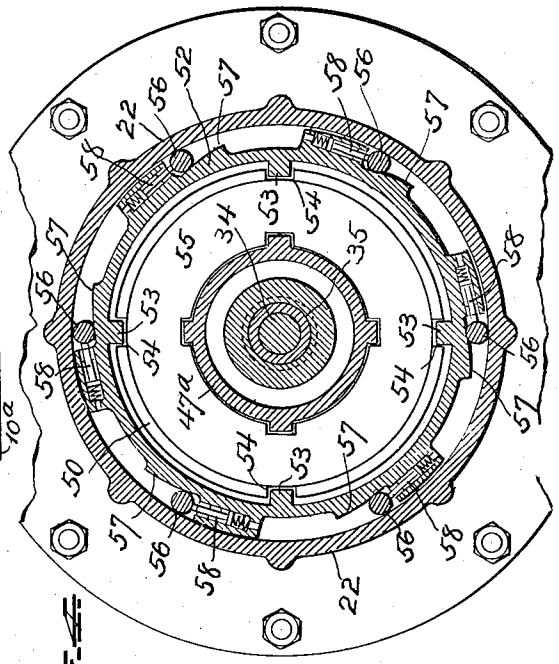
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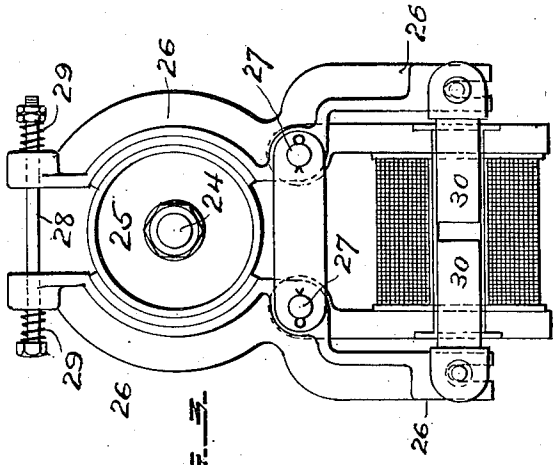
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ELECTRIC HOIST

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FIG. 5.

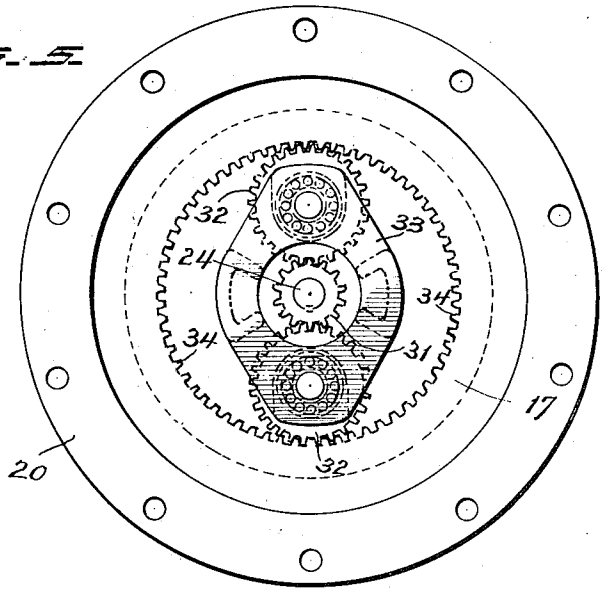
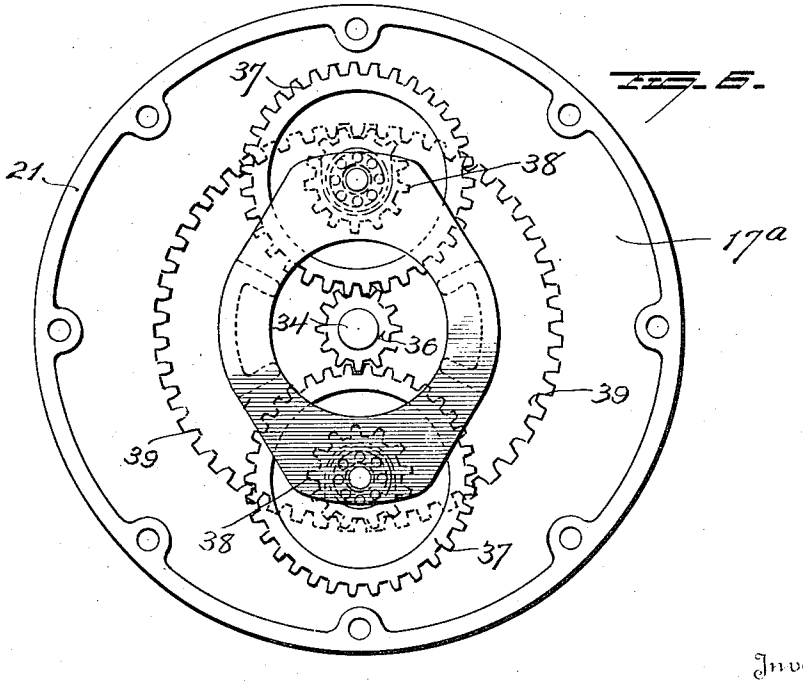


FIG. 6.



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Fig. 7.

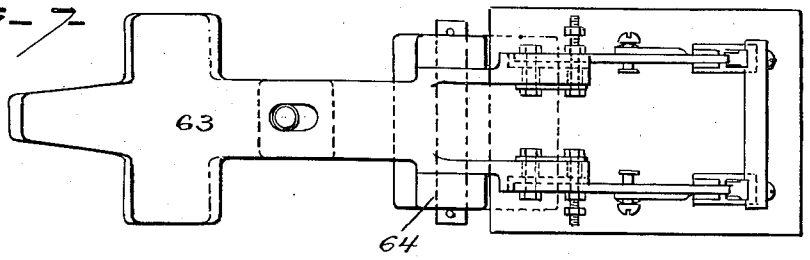


Fig. 2.

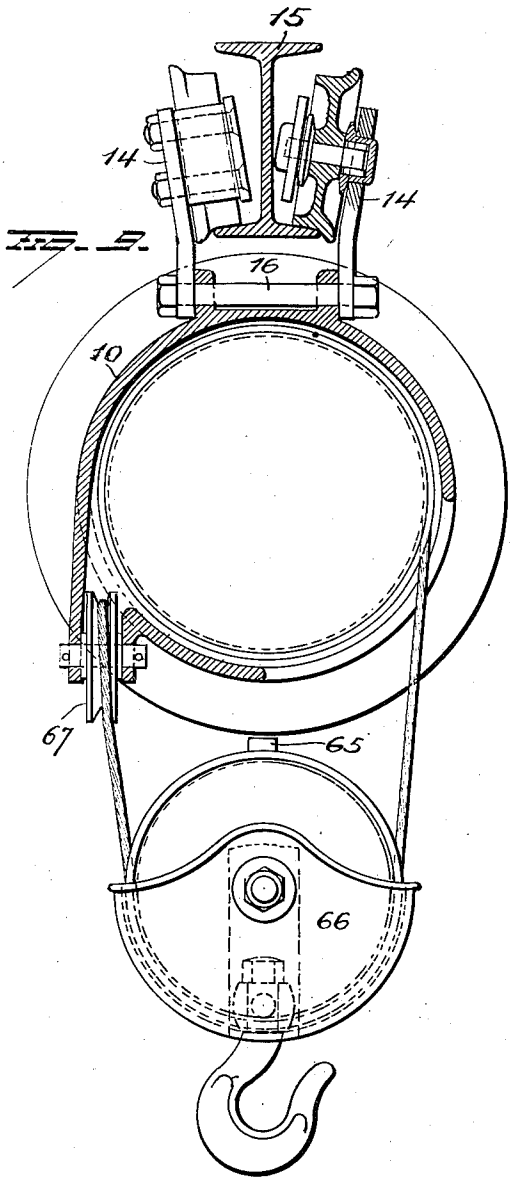
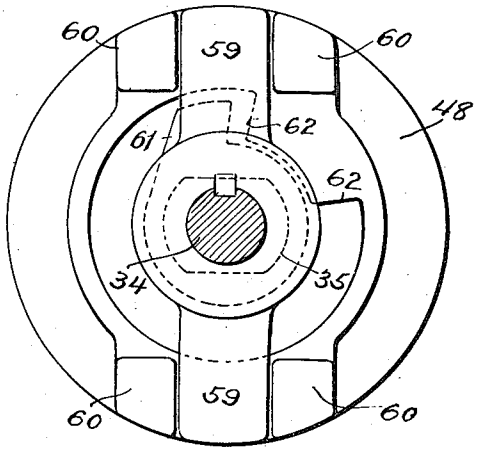


Fig. 5.



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FIG. 10.

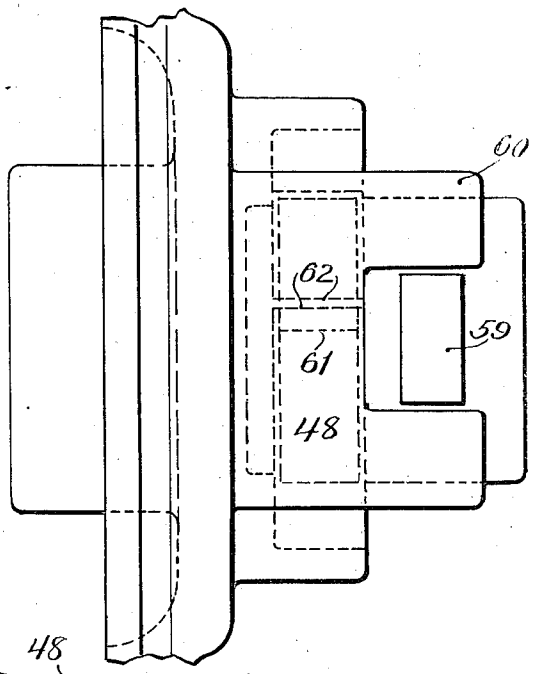
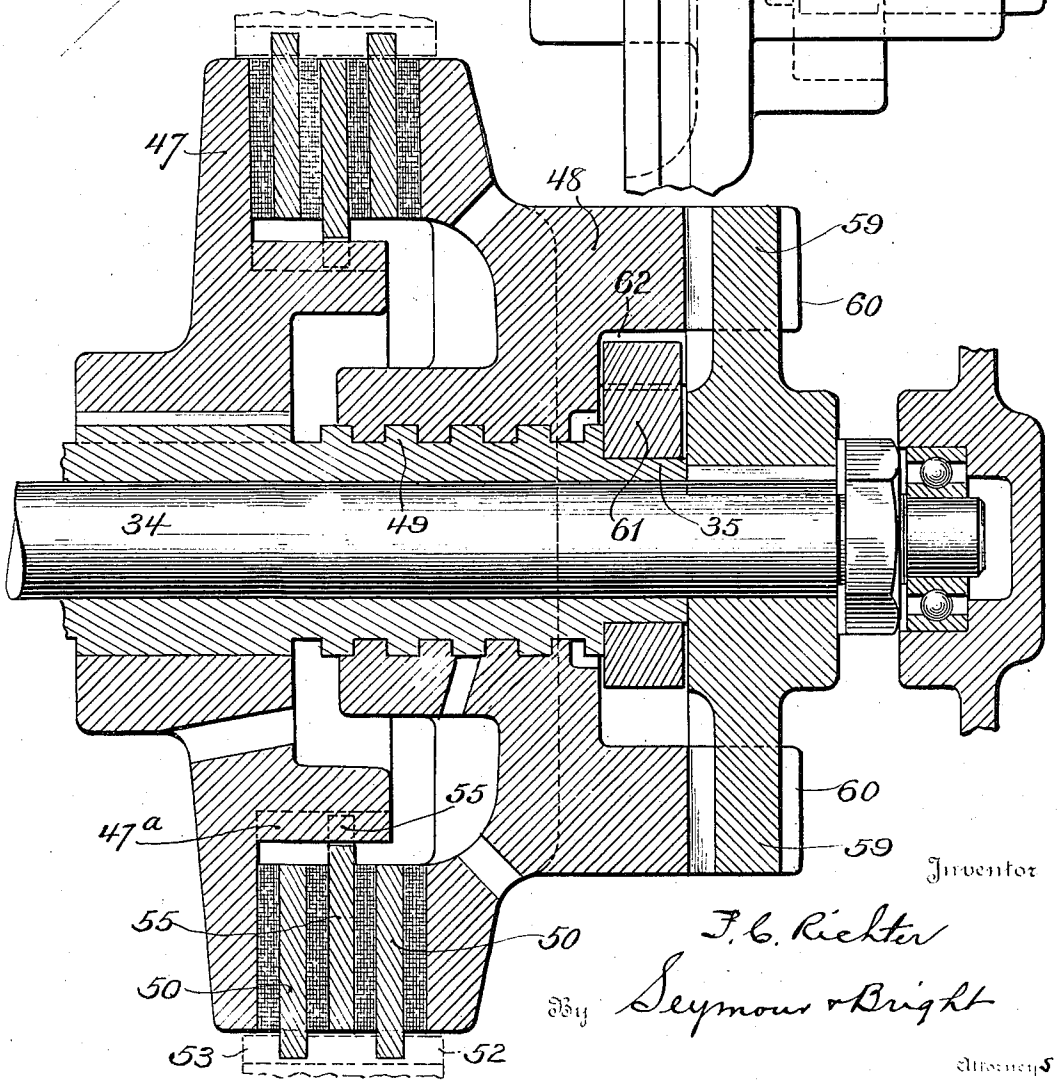


FIG. 11.



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Patented Mar. 25, 1924. 1,488,286

UNITED STATES PATENT OFFICE.

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ELECTRIC HOIST.

Application filed May 27, 1921. Serial No. 473,019.

To all whom it may concern:

Be it known that I, PAUL C. RICHTER, a citizen of the United States, and a resident of Stamford, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Electric Hoists; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to an improvement in electric hoists and it consists primarily in a drum driven by two sets or systems of planetary speed reducing gearing, the driven shaft connecting the two sets of gearing being located centrally within the hoist drum.

It further consists of two sets of planetary gearing, one set at each end of the drum, a shaft connecting the two sets of gearing, a motor the armature shaft of which is connected with one set of gearing, and connection between the other set of gearing and the drum.

It further consists in a drum driven by a single motor through two sets of speed reducing gears located respectively at the ends of the drum and partly within the latter.

It further consists in enclosing the operating parts in oil chambers whereby they are lubricated and at the same time protected from dirt, suitable filling and draining openings being provided for draining and refilling when necessary.

It further consists in providing a brake for the motor, and also one for the drum whereby the parts will be locked when the current is off and the drum prevented from racing while lowering the load.

It further consists in the parts and combinations of parts and in details of construction as will be more fully explained and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in side elevation of my improved rope hoist; Figure 2 is a view in vertical longitudinal section, the motor and controller being shown diagrammatically and in elevation; Figure 3 is an end view partly in section of the magnetic or electric brake; Figure 4 is a view in section on the line 4—4 through the mechanical brake or clutch; Figure 5 is a view of the planetary gearing at the motor end of the hoist drum; Figure 6 is a similar view of the gearing at the opposite end of the drum; Figure 7 is a view in plan of the automatically operated cut out switch; Figure 8 is a view in elevation showing the connection between the mechanical clutch or brake and the shaft connecting the two sets of driving and reducing gears; Figure 9 is a view in section through the trolley and drum casing and showing the hook block in elevation, the cut out switch being omitted. Figure 10 is a view in plan of the connection between the mechanical clutch and the shaft and Figure 11 is an enlarged view in section through the clutch or brake, sleeve and shaft.

10 represents the casing enclosing the hoist drum and gearing and carrying at one end the motor 11 and at the other end the controller 12 the latter being actuated to start, stop and reverse the motor by the ropes 13 or by any other well known means.

The unit comprising the drum casing and its enclosed parts, the motor and controller, is suspended from a trolley 14 mounted to travel on the lower flange of the I-shaped track or girder 15 as shown, the trolley being connected to the hoist mechanism by the bolts 16.

It is clearly evident however that instead of suspending the hoist mechanism from a trolley as shown, a suspension hook unit may be substituted therefor, the hook carrier being secured by the bolts 16.

The casing 10 (see Figure 2) is closed at its ends by the conical heads 17, and 17^a, the smaller ends of which project into the open ends of the hoist drum 18 and terminate adjacent the hub 19 of the said drum. The head 17 is provided with peripheral flange 20 which forms a bearing or support for the motor 11, one end of which forms a closure for the said conical head 17. The head 17^a at the opposite end of the casing is closed by the ring member 22, which constitutes a part of the mechanical clutch or brake to be hereinafter referred to, which ring member is secured to the flange 21, and this ring member 22 constitutes a support for the end cap 23 to which the controller 12 is secured, the end cap 23, ring 22 and adjacent head 17^a forming a closed chamber containing one set of planetary or sun and planet gearing and the mechanical brake or clutch.

The armature shaft 24 of the motor 11

projects through the outer end of the motor casing and is provided with a brake drum 25, engaged by the brake levers 26 pivoted at 27, and connected at their upper free ends by the rod 28 carrying the springs 29, and carry at their lower ends the solenoid cores or plungers 30. When the circuit is closed the cores or plungers 30 of the solenoid will be drawn inwardly into the magnet thus turning the levers on their pivots 27 and moving the brake lever away from the brake drum 25. When however the circuit is opened and the solenoid or magnet de-energized, the spring 29 on rod 28 acting against the ends of the brake levers, force the brake linings into contact with the drum 25, and hold the latter and the armature shaft to which it is connected against any movement.

The armature shaft 24 of the motor 11 is provided at its other or inner end with a pinion 31 which is in mesh with the two pinions 32, mounted on the carrier 33, the two pinions 32 meshing with the internal gear 34 formed on the conical head 17. The frame 33 which is connected with and carries the pinions 32 of the sun and planet gearing above referred to and shown in Figure 5, is keyed to the shaft 34 which extends lengthwise the casing and carries at its opposite end the sleeve 35. This sleeve is provided at its inner end with an integral pinion 36 which drives the second system of sun and planet gearing shown in elevation in Figure 6. Pinion 36 meshes with the two gear wheels 37, the hubs of which are provided with pinions 38 meshing with the integral gear 39 formed on the conical head 17ª, within which the sun and planet gearing last above described is located, the said conical member 17ª forming a closure for the end of casing 10 adjacent the controller.

The hubs 40 of the gear wheels 37 are mounted on the stub axles 41 carried by the disk shaped carrying frame 42, the hub 43 of which latter is keyed to the sleeve 44 mounted on and closely embracing the shaft 34.

The inner ends of the conical heads 17 and 17ª form bearings for the sleeve 44 and are each provided with felt washers 45 for preventing the leakage of oil, and each head or housing member 17 and 17ª has ball bearing 46 in which the sleeve 44 is mounted to rotate. The outer edges or peripheries of the heads or housings 17 and 17ª are securely bolted to the end flanges 10ª of casing 10 and constitute in effect end closures for the latter.

The hoisting drum 18 is keyed to the sleeve 44, and rotary motion is transmitted to same through the gear carrying frame 42, which as previously explained is keyed to sleeve 44.

Pinion 36 which as before explained is formed on the end of sleeve 35, constitutes the operating or driving member for the drum. Mounted on sleeve 35 are the brake or clutch operating members 47—48, the member 47 being keyed to the sleeve 35 so as to turn therewith, while member 48 is connected to it by a right hand screw 49. Each member 47 and 48 is provided adjacent its periphery with a friction surface, and located between the friction surface of the two members are the friction plates 50 and 55. The two outside plates 50 are connected to the ring 52 by tongues 53 on ring 52 entering slots 54 in the two plates 50, and the intermediate plate 55 is similarly connected by tongues and slots as shown in Figures 4 and 10 with the flange 47ª on brake member 47 which latter as previously explained is rigidly keyed to sleeve 35.

A series of friction rollers 56 are located between the periphery of the ring 52, to which the friction plates 50 are connected, and the ring 22 constituting a part of the casing, the outer surface or periphery of said ring 52 being provided with a series of inclined surfaces 57, (see Figure 4) one for each friction roller 56, the construction being such that when the friction rollers 56 are at the bases of the incline as shown in Figure 4, the ring 52 will be free to revolve in one direction, but upon the reversal of direction of rotation, the friction rollers will be forced by frictional contact and also by the spring acuated plungers 58 against the inclined surfaces 57 and thus positively clamp or lock the ring 52 to the fixed ring or casing member 22.

When the drum 18 is hoisting, the two brake or clutch members 47—48, the friction plates 50 and 55, ring 52 and rollers 56, all move or revolve as a single unit, but when the shaft 34 is revolved in the opposite direction, as in lowering the load, the rollers 56 move and are forced onto the inclines 57, thus clamping and locking the ring 52 to the fixed ring or casing member 22, and preventing the friction plates 50 from revolving.

A dog 59 (see Figure 8) is keyed to shaft 34 at the end thereof farthest removed from the motor, with its ends located between lugs 60 integral with the hub of brake or clutch member 48 hence the latter necessarily turns with shaft 34. Upon starting the motor to hoist, the brake or clutch member 48 turns with the shaft 34 and as the said brake or clutch member is provided with internal threads 49 engaging external threads 49ª on the sleeve 35, it will be moved forwardly on the screw and clamp the friction plates 50 and 55 between the friction faces of the brake or clutch members 47 and 48 and create friction sufficient to drive the brake or clutch member 47, and as the latter is keyed to sleeve 35, the latter turns with

said member. As previously explained sleeve 35 has an integral pinion 36 in mesh with the planetary gears 37 carried by the frame 42 and as the latter is keyed to sleeve 44 carrying the drum 18, the latter will be rotated in a direction to hoist the load.

As the motor stops, after hoisting, the weight of the load tends to revolve the drum and with it the threaded sleeve 35 and friction plate 47, thus continuing to hold 47 and 48 clamped to the stationary friction rings 50, 50 and retaining the load in suspension.

When the motor is started to lower, the friction plate or member 48 is driven by the shaft 34 in the direction to unscrew from the threaded sleeve 35 thus reducing the amount of friction on the stationary plate 50 sufficient to allow 47 to slip on the plate 50 and revolve under the pull of the load. Any tendency of the drum to race, however, would at once result in screwing 47 and 48 together and increasing the friction sufficient to hold the load.

In lowering a heavy load, a greater amount of friction is required than with a light one but in each case 48 turns back on the screw thread of 35 more or less until, according to the weight of the load, the friction is reduced sufficiently to allow 47 to slip on the stationary plate 50. In the case of a very light load or when lowering the empty hook there is not weight enough to revolve the drum, so at such times 47 together with the drum must be driven by the motor through the shaft 34. This is accomplished by the lug 62 on 48 coming in contact with the driving cam 61 secured to the sleeve 35 as shown in Fig. 8.

The engagement of the parts 61 and 62 prevents the friction member 48 from backing off and releasing the brake more than a small part of a revolution. These parts 61 and 62 function only when lowering the empty hook. In this lowering action, the friction member 48 revolves counter clockwise, and can only turn the distance between the lug 62 and the face of the driving cam 61. When these parts come together, the part 61 becomes the driver of the hollow sleeve 35, which then revolves gears 36—37 and 38, frame 42, shaft 44 and the drum 18 which in turn lowers the empty hook. Parts 61 and 62 have nothing whatever to do when hoisting or lowering a load, nor when hoisting the empty hook, but come into action only when lowering the empty hook, at which time the part 61 becomes the driver for the unloaded gearing.

When lowering a load the action of the brake is as follows:—the shaft 34 and the dog 59 turn counterclockwise and revolve the clutch or brake member 48 in the same direction, and this movement, acting through threads 49 unscrews brake member 48 and moves it away from the friction plates, thus releasing the friction and permitting the load on the hook, due to its weight to lower. In the lowering action two of the friction washers are held from revolving by the means described, while the other brake or clutch members 47 and 48 and the central friction plate 55 revolve and rub with pressure against the two non-revolving friction plates thus providing the necessary friction or braking action to lower the load gradually.

When hoisting with or without a load the action of the parts is as follows: shaft 34 and dog 59 turn clockwise, and the latter and the lugs on brake or clutch member 48 turn the latter, screwing it up on threads 49 thereby clamping the friction plates tightly together, so that the mechanism then acts as a clutch and drives the clutch member 47 and the other parts in the direction to hoist.

In hoisting, the brake or clutch ring 52 turns with the other part and the screw connection between the clutch member 48 and sleeve 35 forces the former toward the other clutch member 47 thus locking them together and transmitting the movement of shaft 34 through pinion 36 to the adjacent planetary gearing and from the latter to the sleeve 44 carrying the drum.

The planetary system at the motor end of the hoist reduces the speed of the driven shaft, and the planetary system at the opposite end of the hoist causes a further reduction in speed. The two speed reducing systems are located within enclosed chambers at the opposite ends of the drum, which chambers are designed to contain oil or other lubricant in which the gearing is partly immersed and which also protects them from dust and dirt. Each oil holding chamber is provided with inlet and outlet openings closed by screws or plugs thus permitting the chamber to be drained or refilled whenever it may be necessary to do so.

Sleeve 35 is provided in advance of the dog 59 with a driving cam 61 adapted to be engaged by a shoulder 62 on the brake or clutch member 48, so that when turning the motor to lower the hook without any load thereon, the sleeve 35 will be turned by the driving cam 61 and operate the drum through the planetary gearing geared up to the sleeve.

A well known form of safety switch 63 is pivoted to bracket 64 carried by the casing 10 and is so arranged as to be hit by the plunger 65 on the hoist block 66 and open the circuit to prevent a collision between the block and casing in the event the operator through inattention or otherwise should fail to stop the motor when the block reaches the limit of its upward movement.

In the operation of the improvement the motor is started and stopped by the ropes

13 or equivalent means which actuate the controller. When the circuit is closed, the armature shaft of the motor drives the first set of planetary gearing which latter forms the first speed reduction system. The frame 33 carrying said planetary gearing being keyed to the shaft 34 drives it at the reduced speed, and this shaft is connected as explained to the second set of planetary gearing which constitutes the second speed reduction system and drives the drum. The cable is preferably secured at its ends to the hoist drum 18 and passes out through an opening in the casing as shown in Figure 9, around the sheaves on the hook or hoist block with its center supported on the equalizing sheave 67.

The arrangement of gearing is such that the shaft 34 is free from strains arising from any slight defect in the alignment of motor shaft 24, and therefore if the motor shaft be slightly out of line with the hoist shaft the second reduction gearing and parts operated thereby will still retain their efficiency. This is true from the fact that if the motor shaft is slightly out of alignment with shaft 34, due to any defect in the motor or the part to which it is connected that will prevent perfect alignment of shaft 24 with shaft 34, but hold the former at a slight angle to it, the efficiency of the second reduction gearing and parts connected with it will not be impaired. In other words if the motor shaft be slightly out of alignment, it would simply bring the gear teeth 31 into mesh with the other teeth on a slight angle but would not cause any additional strain or friction on shaft 34 or on any of the other shafts or bearings nor on any of the reduction gears at the rear of the first reduction mechanism, consequently the efficiency of the machine as a hoist would not be impaired because of the slight tilt of the motor. Again with the arrangement shown the central shaft 34 which connects the two gearing systems, is not in any way held in fixed axial position by the motor shaft, nor by the gears but may float and assume its own axis.

It is evident that many slight changes might be resorted to in the relative arrangement of parts shown and described without departing from the spirit and scope of my invention hence I would have it understood that I do not wish to confine myself to the exact construction and arrangement of parts shown and described but,

Having fully described my invention what I claim as new and desire to secure by Letters-Patent, is:—

1. The combination of a drum, a motor at one end of the latter, two sets of speed reducing gearing, one set located at one end of the drum and geared up to the motor, and the other set located at the opposite end of the drum and connected with the latter, means connecting the two sets of gearing including a shaft and a mechanical brake and clutch mechanism actuated by the shaft for transmitting motion to the second set of speed reducing gearing and also for retarding the rotation of the drum, during the lowering movement of the latter.

2. The combination of a hoist drum having open ends and a central hub, a motor, two sets of planetary gearing located at opposite ends of the drum and partly within the same, one set of which is driven by the motor and the other connected to the drum, and means including a mechanical brake connecting said sets of gearing.

3. The combination of a hoist drum, a motor, two sets of speed reducing gearing located at opposite ends of the drum one of which is driven directly by the motor, and the other geared to the drum, and means including a mechanical brake connecting the two sets of gearing.

4. The combination of a hoist drum, a motor located adjacent one end of the drum, a magnetic brake located in the motor circuit for braking the latter when the circuit is open, speed reducing gearing actuated by said motor and located adjacent the motor and at one end of the drum, a second system of speed reducing gearing located at the opposite end of the drum and connected with the latter, and means connecting said speed reducing gearings for actuating the drum.

5. The combination of a hoist drum, a motor for actuating the same, a magnetic brake in the motor circuit for breaking the motor when the circuit is open, speed reducing gearing actuated by said motor and located at one end of the drum, a second system of speed reducing gearing located adjacent the opposite end of the drum, a mechancial brake and clutch mechanism connected with said last mentioned system of gears, and means connecting said two systems of gears whereby they will be driven in unison.

6. The combination of a drum, a motor, speed reducing gearing connected with the motor, a second set of speed reducing gearing, a shaft driven by said first set of gears and mechanical clutch mechanism actuated by said shaft and connected with said second set of gearing, the said shaft passing centrally through the drum.

7. The combination of a drum, a motor, speed reducing gearing located adjacent one end of the drum and connected with the motor, mechanical brake mechanism, a shaft connecting said speed reducing gearing and the brake mechanism, and a second system of speed reducing gearing located adjacent the opposite end of the drum, actuated by the brake mechanism and geared up to the drum.

8. The combination of a drum, a motor, planetary gearing actuated by the motor, a shaft connected with said gearing, a clutch mechanism actuated by the shaft, and a second system of planetary gearing actuated by said clutch mechanism and geared to the drum for rotating the latter.

9. The combination of a motor, speed reducing gearing actuated by the motor, a shaft connected with said gearing, a mechanical clutch actuated by the shaft, a second system of speed reducing gearing actuated by the clutch, a sleeve connected with said second system of speed reducing gearing, and a hoist drum rigidly secured to said sleeve intermediate the two systems of speed reducing gearings.

10. The combination of a casing, a head secured to each end thereof, a sleeve mounted to rotate in said heads, a drum within the casing and secured to the sleeve so as to rotate with the latter, a motor adjacent one head of the casing, a shaft geared to said motor and passing through the sleeve, speed reducing gearing located at the outer side of the head at the end of the latter farthest removed from the motor and geared up to the sleeve, and a combined clutch and brake mechanism interposed between the shaft and said speed reducing gearing for actuating the drum and for retarding the rotation of the latter during the lowering operation.

11. The combination of a casing, conical heads secured to the ends thereof with their smaller ends projecting inwardly, a sleeve mounted in the inner ends of the heads, a motor secured to one of said heads, speed reducing gearing located within said head and actuated by the motor, a second system of speed reducing gears within the other conical head, a mechanical clutch connected with said second system of speed reducing gears, and a shaft connecting the gears actuated by the motor with the mechanical clutch, the said shaft passing through the sleeve carrying the drum.

12. The combination of a casing, conical heads secured to the ends thereof, a sleeve mounted in the inner ends of the heads, a motor secured to and closing the outer end of one of said heads, speed reducing gears located within said head and actuated by the motor, a closure for the other head speed reducing gears located within said other head, a mechanical clutch connected with said second system of speed reducing gears, a housing for the clutch, and a shaft passing through the sleeve and connected at one end with the gearing actuated by the motor and at its other end with the clutch, the said heads and the closures therefor forming lubricating chambers in which the gearings are located.

13. The combination of a drum mounted on a sleeve, bearings for the latter, a motor, sun and planet gearing actuated by the motor, a second system of sun and planet gearing carried by the sleeve, a shaft connected with the first sun and planet gearing system, a sleeve mounted to turn on said shaft and provided with external threads, a two part mechanical clutch one part provided with internal threads engaging the threads on the sleeve and the other part keyed to the sleeve, means connecting the threaded member of the clutch with the shaft and a gear on the threaded sleeve meshing with the second system of sun and planet gearing, whereby motion is transmitted to the drum through said second system of gearing.

14. The combination of a drum having a centrally located hub and open ends, a drum casing having inwardly projecting conical ends, a gear casing forming a closure for one conical end of the casing, a motor casing forming a closure for the other of said conical ends, gearing within the gear casing and connected with the drum, a motor and means connecting the motor and gearing.

15. The combination of a drum having open ends and a centrally located hub, a drum casing having inwardly projecting conical ends, a motor casing forming a closure for one of said conical ends, a gear casing forming a closure for the other conical end, gearing located within both of said conical ends, a motor and means connecting the motor with both sets of gearing.

16. The combination of a drum having open ends, a drum casing having inwardly projecting conical ends, a motor casing forming a closure for one of said conical ends, a gear casing forming a closure for the other conical end, a shaft passing through both conical ends, gearing within the conical ends of the casing and having connection with the said shaft, and a motor having direct connection with the gearing at one end of said shaft, and imparting motion through said shaft to the gearing at the other end of the shaft and means connecting the gearing in the gear case to the drum.

17. The combination of a drum, a casing having inwardly projecting conical ends, a sleeve mounted to rotate in said conical ends, a drum secured to the sleeve, a shaft passing through the sleeve, gearing at each end of the shaft, the gearing at one end being connected with the sleeve and a motor connected with the gearing at the other end of said shaft.

In testimony whereof, I have signed this specification in the presence of two subscribing witnesses.

PAUL C. RICHTER.

Witnesses:
WM. R. HOYT,
CHAS. A. BERRY.