May 22, 1928. 1,670,734

G. E. MOORE

ELECTRIC HOIST

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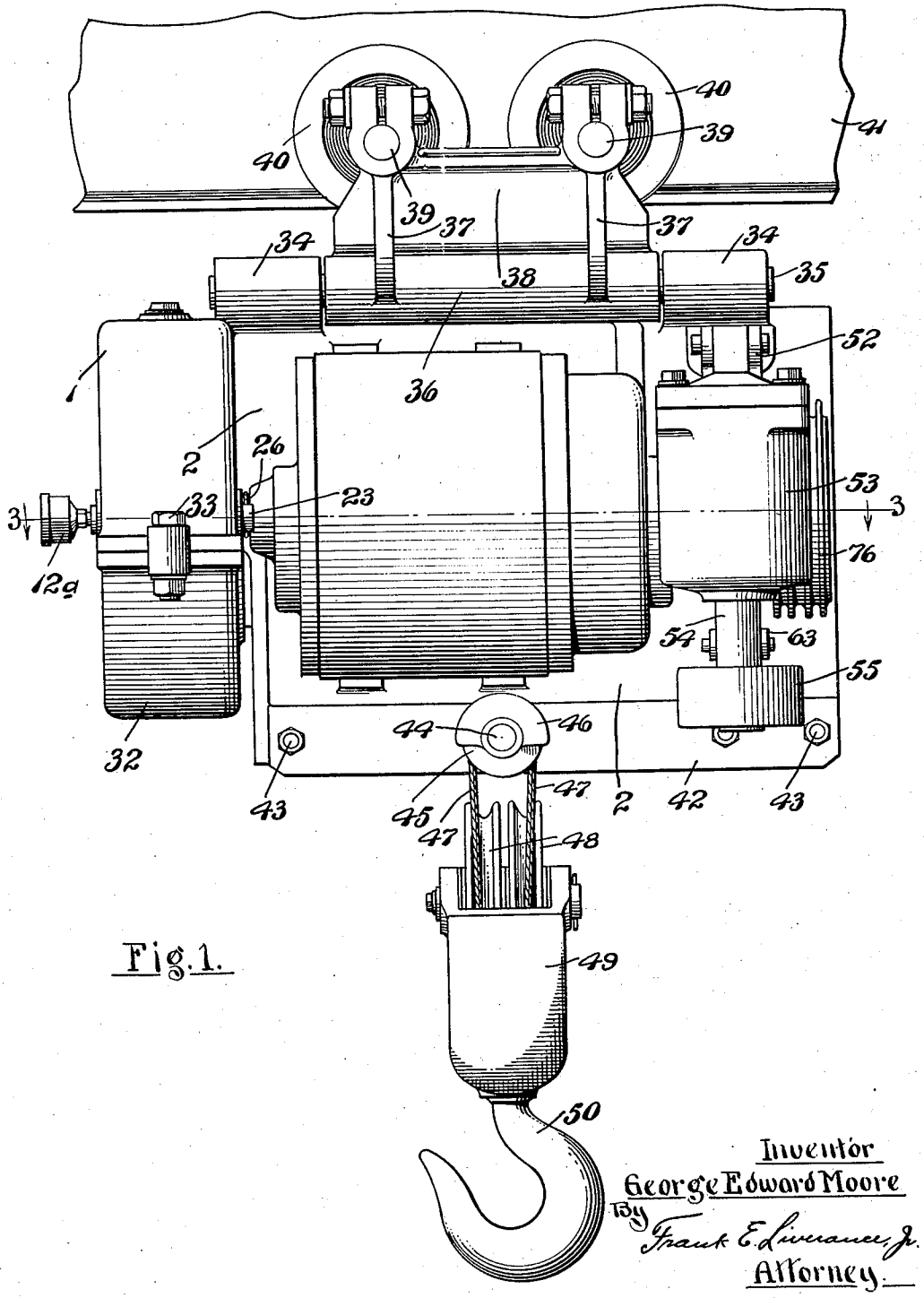


Fig. 1.

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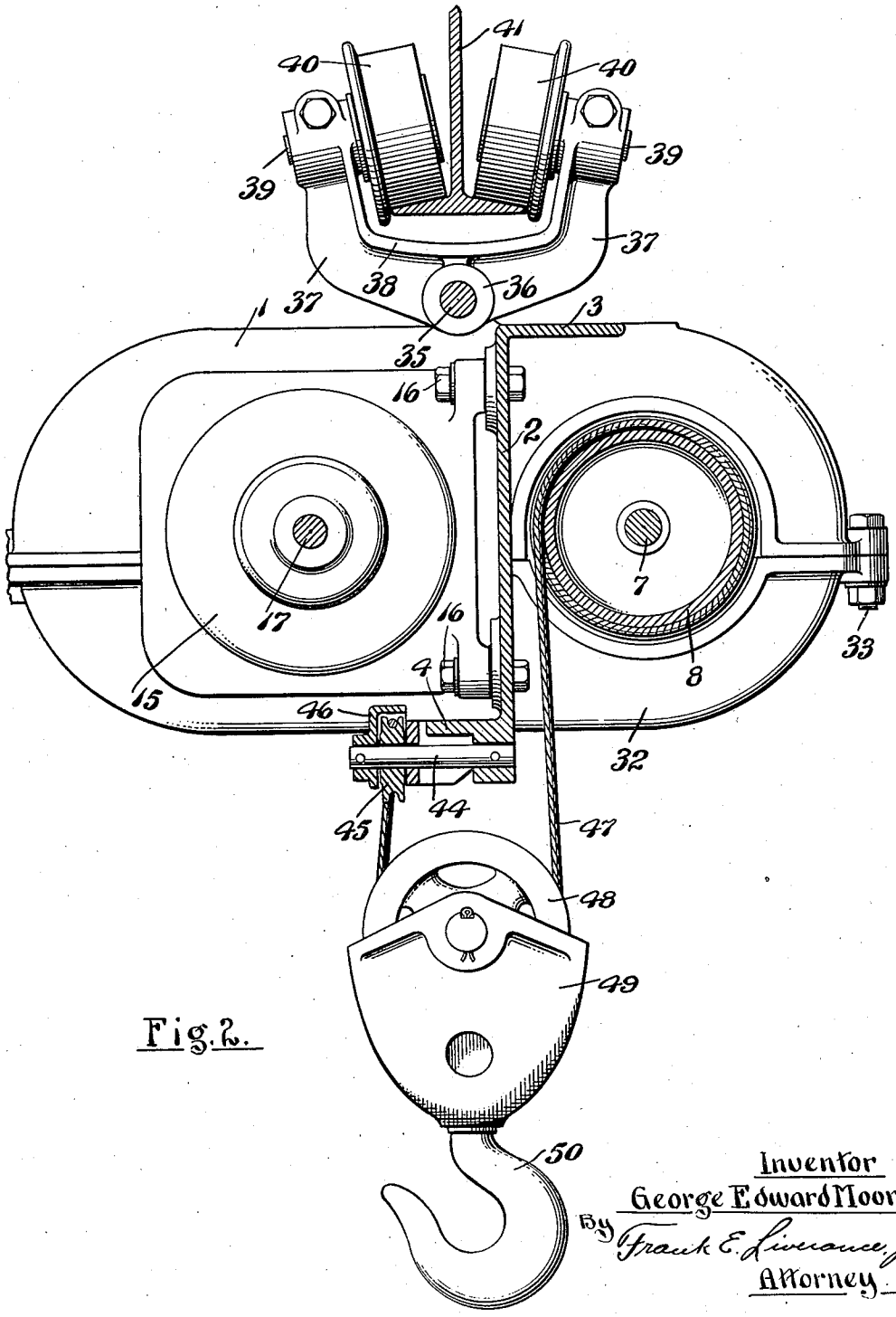


Fig. 2.

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ELECTRIC HOIST

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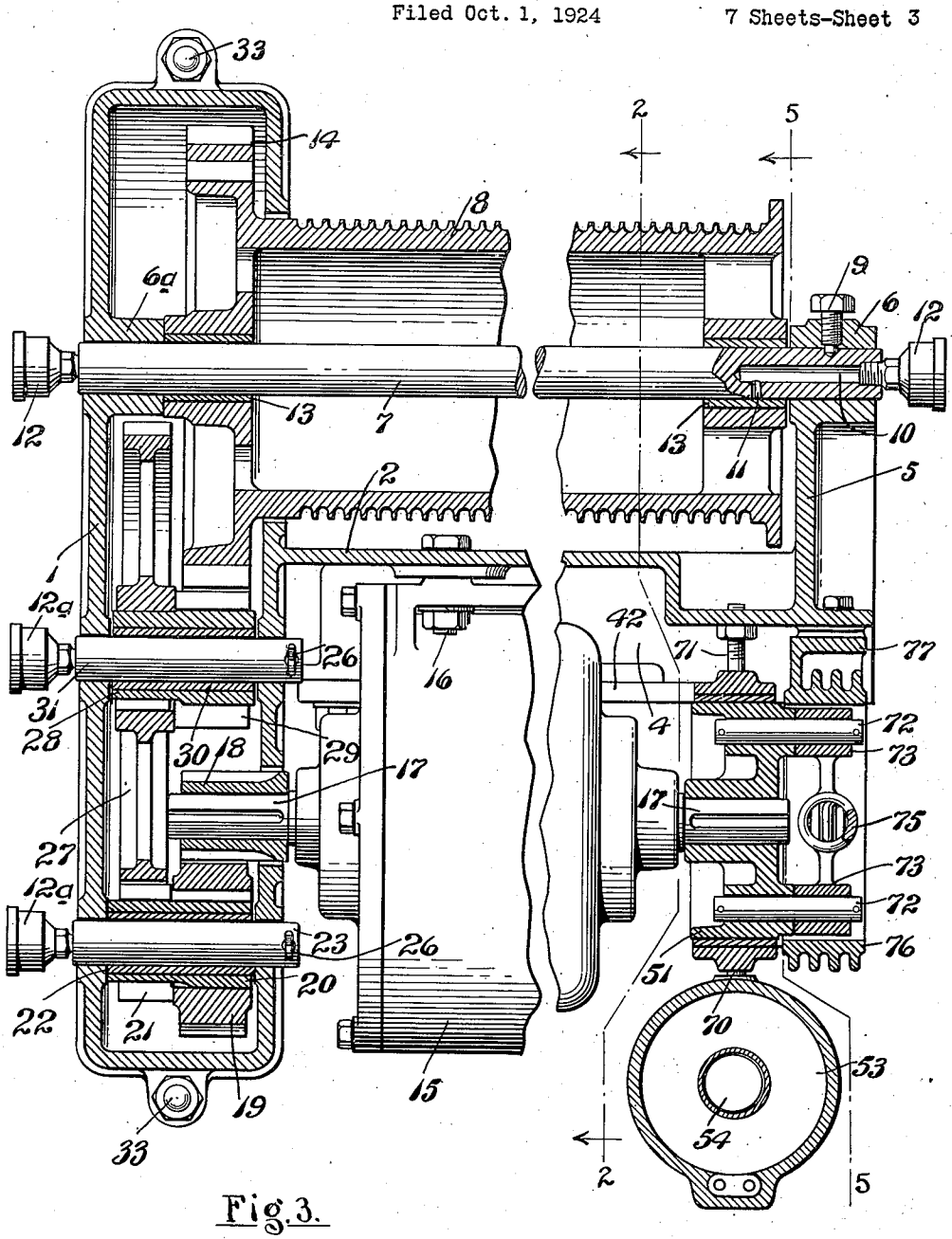


Fig. 3.

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ELECTRIC HOIST

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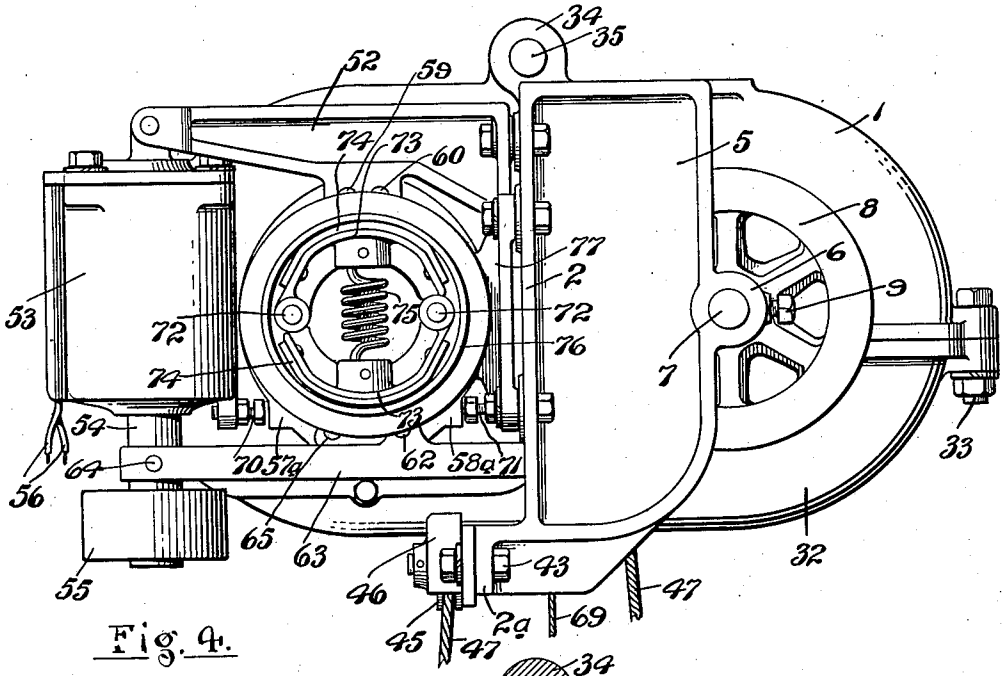


Fig. 4.

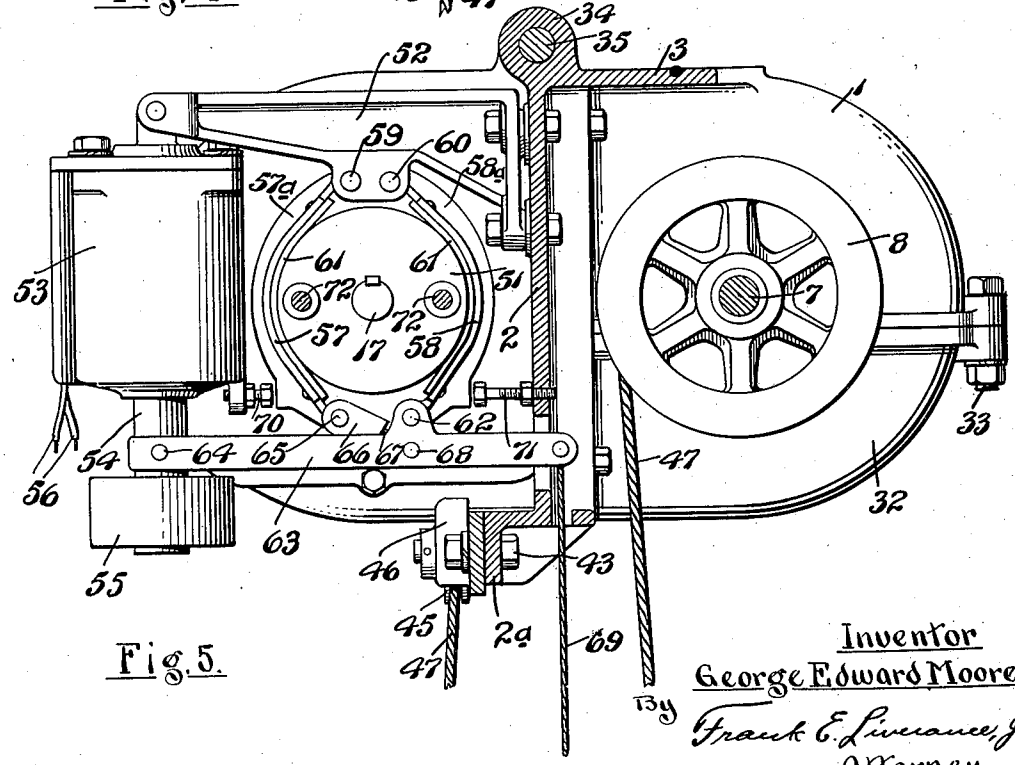


Fig. 5.

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ELECTRIC HOIST

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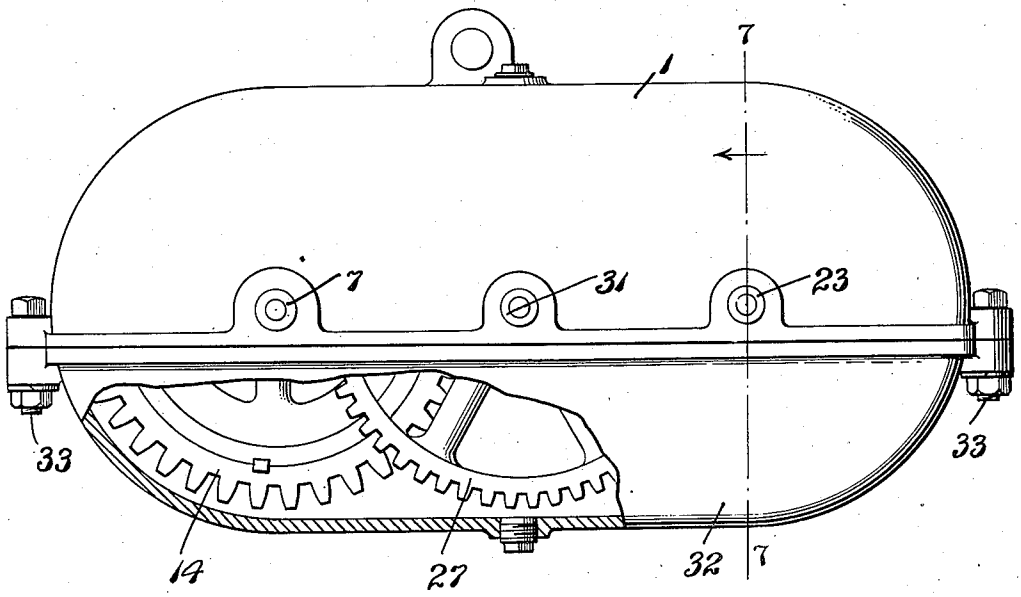


Fig. 6.

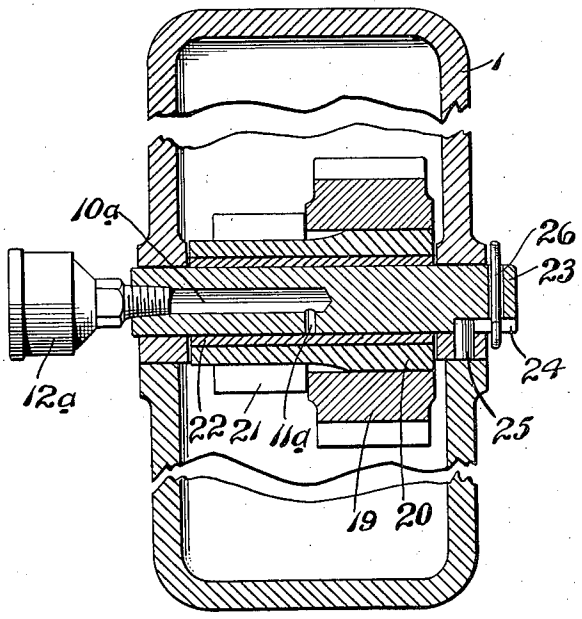


Fig. 7.

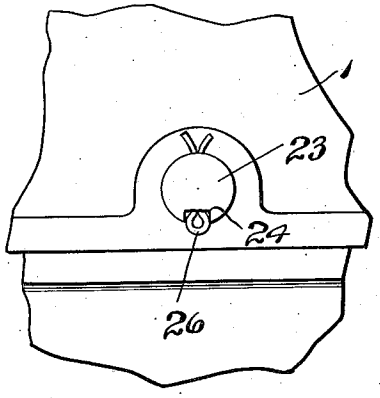


Fig. 8.

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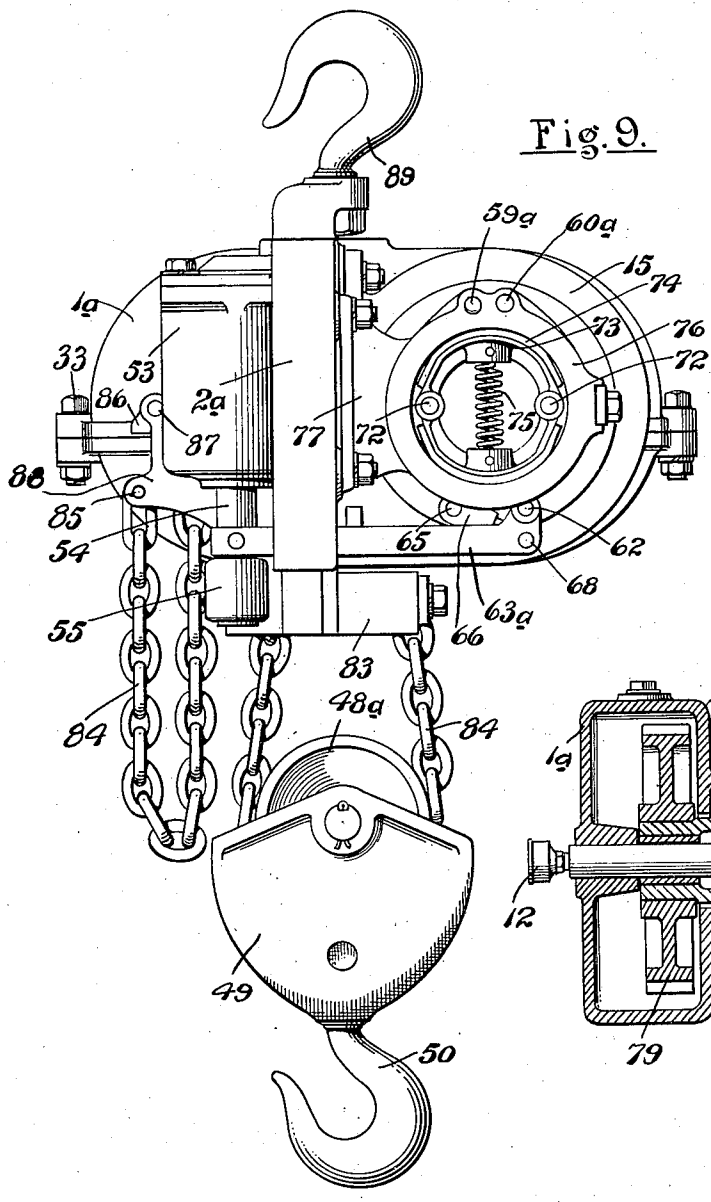
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G. E. MOORE

ELECTRIC HOIST

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Fig. 9.



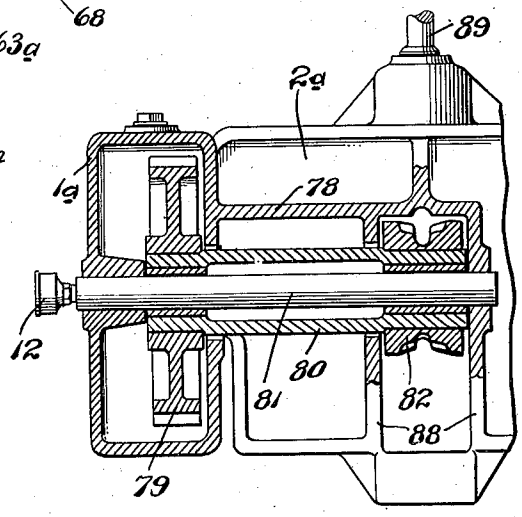


Fig. 10.

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May 22, 1928. 1,670,734

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ELECTRIC HOIST

Filed Oct. 1, 1924 7 Sheets-Sheet 7

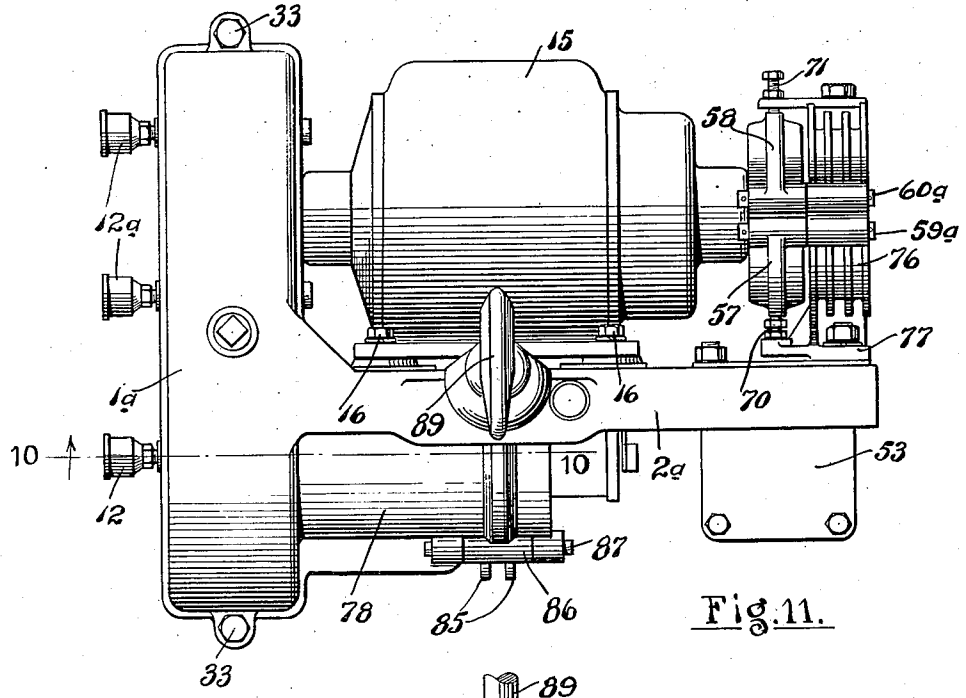


Fig. 11.

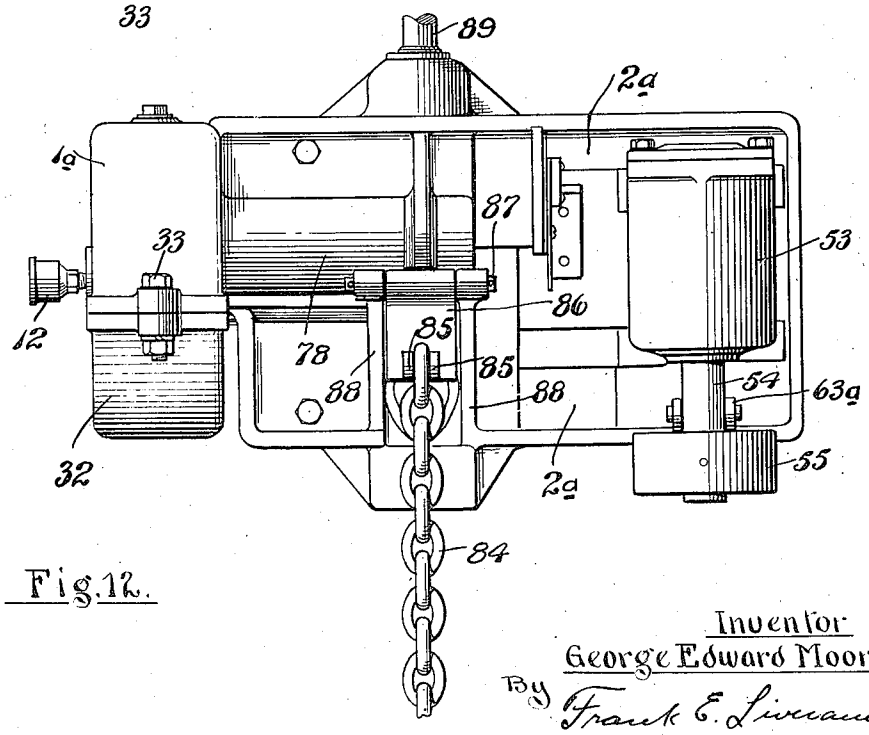


Fig. 12.

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UNITED STATES PATENT OFFICE.

GEORGE EDWARD MOORE, OF MUSKEGON, MICHIGAN, ASSIGNOR TO MANNING, MAXWELL & MOORE, INC., OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

ELECTRIC HOIST.

Application filed October 1, 1924. Serial No. 741,093.

This invention relates to an electric hoist, of the type which may be either attached to an overhead beam or other support or equipped with a trolley to run on the lower flanges of an I-beam, or similar support.

In hoists of this character, it is an accepted feature of their design that they must occupy as little height as possible and, for service, under the conditions to which they are subjected it is desirable that the diameter of the hoisting drum over which the hoisting ropes or cables are wound should be at least twenty-four to thirty times the diameter of the cable. Also the hoist should be as compact as possible and at the same time the parts thereof be readily accessible for inspection or repair. Hoists have been made in which the drum over which the cables are wound is in alinement with the motor and a gear reduction box is located adjacent the end of the drum away from the motor and, while this construction reduces the height of the hoist, it results in an abnormally long hoist and at the same time it is necessary to thread the motor shaft through the drum shaft in order to drive the gearing from the motor. The machinery in such case is not very accessible and it is very poor engineering practice to thread one shaft through another. Other hoists have been made in which, through an attempt to reduce dimensions to a minimum, constructions have been made which set up, in service, extremely high strains in the parts so that gears and shafts must be made of high priced alloy steels, specially heat treated, in order to enable them to stand up when in service. Others reduce the diameter of the drums to such an extent that while in usual crane practice the diameter should, as before stated, be twenty-four to thirty times the rope or cable diameter, they use drums in many instances as low as twelve times the rope diameter, such a construction resulting in speedy destruction of the rope due to the high bending stresses and destructive forces occurring in the rope or cable by the short bending made by a small diameter drum. Still others make a drum of short length and coil the rope or cable in overlapping coils on the drum. This is very objectionable as ropes or cables subject to tension are easily weakened on account of the stresses set up when so wound on the drum.

It is desirable and in fact practically necessary that hoists of this character be equipped with a brake of some sort to control the rotation of the drum and this brake should be subject to control at a distance from the hoist.

It is a primary object and purpose of the present invention to provide a novel construction and design of hoist operated by an electric motor wherein minimum height, the most compact assembly of parts possible, a drum of proper diameter with respect to the rope or cable used thereon, machinery easily accessible for inspection or repair, a novel form of brake control for the hoist and one readily controlled at a distance from the hoist, and a hoist which is capable of manufacture in any of the various sizes desired from smallest to largest with no changes except dimensional changes for the different sizes is produced; and this in a practical and economical manner in accordance with the best of engineering practice, with gears and shafts and other parts made of ordinary commercial forged and cast steels not requiring any special high-priced material or special treatment whereby the cost of manufacture is increased or factors are introduced which, if not correct in all respects, are a source of weakness rather than strength in the design. It has been the controlling thought in the construction of this electric hoist to produce one which in its simplicity and soundness of design is as near perfect as possible and a classic in its field.

For an understanding of the invention and the constructions embodying the same reference may be had to the following description taken in conjunction with the accompanying drawings in which,

Fig. 1 is a side elevation of the hoist of my invention, showing the same mounted for movement on an overhead supporting I-beam.

Fig. 2 is a vertical section taken substantially on the plane of line 2—2 of Fig. 3.

Fig. 3 is a horizontal section substantially on the plane of line 3—3 of Fig. 1.

Fig. 4 is an end elevation of the hoist looking at the right hand end of the same as it appears in Fig. 3.

Fig. 5 is a vertical section on the plane of line 5—5 of Fig. 3.

Fig. 6 is an end elevation with parts

broken away and shown in section looking at the end of the machine opposite to that shown in Fig. 4.

Fig. 7 is a vertical section on the plane of line 7—7 of Fig. 6.

Fig. 8 is a fragmentary elevation of the construction shown in Fig. 7 looking at the right hand side thereof.

Fig. 9 is an end elevation similar to that shown in Fig. 4, showing a different form of construction wherein a chain is used in place of a rope or cable.

Fig. 10 is a vertical section on the plane of line 10—10 of Fig. 11.

Fig. 11 is a plan of the different form of hoist, and

Fig. 12 is an elevation of the different form of hoist similar to that shown in Fig. 1 of the first hoist described.

Like reference character refer to like parts in the different figures of the drawings.

In the construction of this hoist, a main frame member is provided integral with which is a gear box 1 from which a vertical web 2 extends at right angles the same being reinforced by an upper flange 3 (see Fig. 2) and a lower oppositely extending flange 4, the web at its outer end being formed, as shown in Fig. 3, and terminating in an end portion 5 which is positioned vertically and in substantial parallelism with the sides of the gear box. The gear box 1 is open at its under side but extends down far enough that bearings for the various shafts on which the gearing and the drum are mounted are provided above the lower edges of the gear box, this being best shown in Fig. 6. A bearing 6 is formed at the edge of the end portion 5, a rod or shaft 7 on which the grooved hoisting drum 8 is mounted passing through the bearing 6 and a suitable bearing 6^a (see Fig. 3) in the gear box 1. This rod or shaft is held against rotation by a set screw 9 which passes through the bearing 6 and at its end seats in a recess in the shaft as fully shown in Fig. 3. This shaft is bored at each end for a distance to make a central opening 10 from which a lateral branch 11 is made to the outside of the shaft and to the bushings 13 around the shaft, which are carried in the hubs at the ends of the cable drum 8. Any usual form of grease cup 12 is screwed in each end of the shaft 7 so that the grease may be forced through the passages 10 and 11 to the bushings for proper lubrication. It will be noted that the shaft 7 is a plain cylindrical rod and in practice it is cut from the proper stock of cold rolled steel rod, requiring no outside machining.

At the end of the drum 8 within the gear box 1, a gear 14 is secured being keyed onto the end of the drum. An electric motor 15 is located on the side of the web 2 opposite the drum 8 and is secured by bolts 16, as shown in Fig. 2, the drum and the motor being positioned as closely to each other as possible with web 2 between. The front armature shaft 17 of the motor extends through the adjacent side of the gear box and is equipped with a pinion 18 which in turn meshes with a somewhat larger gear 19 keyed to an extension 20 of the hub of a pinion 21 which lies alongside of the gear 19, this extension of hub 20 of the pinion being mounted on a bushing 22 around a shaft 23 passing through the opposite sides of the gear box. As shown in Figs. 7 and 8, the inner end of the rod or shaft 23 has a short key-way 24 cut therein into which a pin 25 passes, the same extending upwardly from the lower edge of the lower side of the gear box to the key-way slot 24. A cotter pin 26 is then passed through the projecting end of the shaft 23 whereby it is evident that this rod or shaft 23 can have no longitudinal movement. The outer front end of the rod or shaft 23 is equipped with identically the same lubricating means heretofore described with reference to the shaft 7, that is, passages 10^a and 11^a leading to the bushing 22 and a grease cup 12^a screwed into the rod or shaft 23. The pinion 21 meshes with a gear 27 of substantially the same diameter as the gear 14 heretofore described. Gear 27 is keyed to a projecting hub 28 extending from a pinion 29 lying alongside the gear 27 and this pinion 29 with its projecting hub is mounted on a bushing 30 through which a shaft 31, similar in all respects to the shaft 23, extends. The pinion 29 meshes with the gear 14. There is thus provided a gear reduction between the motor and the drum 8.

It will be noted that all of the gears, with the exception of the one on the armature shaft 17, are straight spur gears and that all are equipped with bushings turning loose on the shafts 23 and 31. The shafts are fixed and are subject to almost uniformally distributed bending and shear strains only so that their diameter can be at a minimum. The keying of the gears onto extensions of the pinions or drum is an advantage in that the diameter at which the key is placed is large in comparison with what it would be if the gears and pinions were keyed separately to their shafts, this reducing stress on the keys to a comparatively low figure. By this means the pinions can be made of the absolute minimum diameter consistent with ample wearing area and strength and it is evident that a minimum of space is taken up by the gearing as all of the gears and pinions are located closely together, as shown in Fig. 3, and no waste space appears. The reductions are proportioned so as to occupy the minimum length consistent with having the drum as close to the motor as possible, the location of the first reduction back of the motor pinion giving a great latitude in

the selection of gears to give the required reduction to reach the drum in its predetermined location; and with the pinions of a minimum diameter the whole assembly of gears can be made to occupy a minimum space. While the pinions and drums are loose on their shafts it is evident that this construction lends itself to either this method or the alternative method of keying the pinions or drum to the shafts and running the ends of the shafts in bearings. I prefer the method shown and described as both cheaper and better as the strength of a stationary shaft is greater than that of a rotating shaft. The gear case 1 is equipped with a lower cover 32 which may be detachably connected and held in place by bolts 33. But two of these bolts are shown as they have only to carry on the weight of the gear case cover 32. It is evident that the cover may be removed at any time and the hoist operated, this being sometimes convenient during tests or to investigate any suspected faults in the construction.

Two spaced apart bosses 34 are cast integral with the frame at the upper side thereof, as shown in Fig. 1, through which a rod 35 passes. This rod also passes through a sleeve 36 located between the bosses 34 integral with which are opposite, outwardly and upwardly extending arms or ribs 37 connected by an integral web 38. At the upper ends of the ribs 37 bearings are provided for the rigid mounting of shaft pins 39 which extend upwardly and inwardly toward each other. Flanged rollers 40 are rotatably mounted on the free ends of the shaft pins and are adapted to bear against the upper sides of the lower flange of a horizontally mounted over head I-beam 41. This provides a trolley construction for mounting the hoist for movement in a horizontal plane along the I-beam support. The rod 35 is located as closely as possible directly over the center of gravity of the hoist.

At the lower side of the frame and in front of the ledge or flange 4 a bar 42 of metal is secured by bolts 43 to said flange. This bar is of flat rolled steel and is used instead of casting the same integral with the frame because of the superior reliability of rolled as against cast metal under high bending stresses and, further, because of the simplicity of its application in the present construction. A pin 44 is fastened to the frame at its lower side and extends through a boss cast with the flange 4, the pin passing through the bar 42 and at its free end carrying a grooved roller 45, which is guarded at its upper side by a guard 46 of conventional construction to insure the cable staying on the roller. The ropes or cables 47 used pass over the roller 45, the two strands then passing downwardly under two grooved pulleys 48 which are mounted on a fixed shaft similar in construction and mounting to the shafts 23 and 31. This shaft is mounted at the upper end of a housing 49 from which a hook 50 depends. The strands of the cables 47 after passing under the pulleys 48 are thence carried upwardly to the drum 8 and wound around the same in the grooves shown as formed in the drum. It is apparent that the windings of the cable or rope around the drum do not contact with each other, the drum being of sufficient length to carry all windings of the rope for any vertical lifts for which the hoist may be designed.

The rear armature shaft extension 17 has a brake drum 51 keyed or otherwise secured thereto. A bracket 52 is permanently secured to the off-set portion of the vertical web 2, shown in Fig. 3, by bolts and extends outwardly over the brake drum. At its end a solenoid magnet is suspended by a single pin, a core or plunger 54 being disposed within the solenoid coil and extending below the same, at its lower end carrying a weight 55. The wires 56 of the coil are connected in series with the motor so that when the motor is being driven the coil is energized and acts to lift the core or plunger 54 and the weight attached thereto.

Two brake shoes 57 and 58 are pivotally connected at their upper ends, at 59 and 60, respectively, to the bracket 52 and pass downwardly at opposite sides of the drum 51. These shoes are lined with woven asbestos material, indicated at 61, which bears directly against the surface of the drum. At its lower end the shoe 58 is connected, at 62, to an upwardly extending lug formed on a horizontally positioned lever 63 which extends to and at one end is pivotally connected, at 64, to the plunger or core 54. The lower end of the other shoe 57 is pivotally connected, at 65, to a member 66 which in turn is adjustably connected with a pin 67 which is screwed into the member 66 at one end and pivotally connected by pin 68, at its opposite end to the lever 63. It is evident that when no current is passing through the motor and solenoid, the weight 55 serves to draw lever 63 downwardly and tighten the linings of the brake shoes against the drum thereby putting a check on its rotation; and when the motor is started, with a coincident passage of the electric current through the solenoid coil, plunger 54 being elevated releases the brake shoes from bearing engagement with the drum 51. At the free end of lever 63 a rope 69 is attached whereby the brake may be operated manually from below the hoist whenever it is desired. Since the brake shoes when released from the brake drum are free to swing in their upper suspension pins 59 and 60, and one of the shoes might drag on the brake while the other opened to a greater extent than

was needed, easily adjustable stops 70 and 71 are connected to the solenoid casing and the web, 2 respectively, as shown in Fig. 5, which prevent outward movement of either brake shoe beyond a predetermined point, said shoes being provided with reinforced ribs 58ª having shoulders in direct opposition to the stop members 70 and 71. This is desirable and in fact necessary in view of the fact that the length of the stroke of the solenoid magnet is very limited and must be made the most of. As the brake lining wears it is clear that the plunger or core 54 will have to descend lower in order that the shoes grip the drum, this making its stroke longer and the releasing pull of the solenoid when the current is turned on initially weaker, requiring that frequent adjustment of the shoes for wear be made.

With this brake the load suspended from the hook 50 is held against movement when the current is turned off and the motor stopped. The brake is released when the current is turned on with either the hoisting or lowering of the drum by the motor, the brake then offering no impediment to the rotation of the motor armature with its connected train of gears and drum. As there is no middle or intermediate stage between full operation of the brake and full release, the brake alone is not sufficient to give adequate lowering control, for, as soon as the motor is started in the lowering direction with a suspended load carried on the hoist, there is nothing in this construction so far as described to prevent the load from at once starting to fall with great rapidity. And this would, when the speed reached a certain point, act to destroy the motor due to centrifugal force on the armature coils.

To give lowering control and protection against excessive lowering speed a governor is used in conjunction with the brake. From the drum 51 two pins 72, located diametrically opposite each other on the drum, project outwardly on which, beyond the drum, two governor shoes 73 are pivotally mounted being faced on their outer sides by woven asbestos material 74 and normally drawn toward each other by a coiled spring 75, as shown in Fig. 4. A stationary cylindrical housing 76 surrounds the shoes 73 and has an integral bracket extension 77 bolted securely to the web 2 of the hoist frame so that the housing is held rigidly in relation to the frame of the hoist. This housing is provided with radiating fins for the quick disposal of heat caused by friction of the brake shoes against its inner side.

The governor brake shoes with the spring connecting them provide a unit of a very simple construction which can be readily applied to the pins 72 and which is very effective in action. The weight and location of the center of gravity of the shoes is accurately determined so as to be able accurately to figure the centrifugal force that each will have at different speeds; and the spring is then so proportioned that when stretched to hold the two shoes together it will exert a force just sufficient to counteract the force of the shoes when the motor is running to nearly double its normal full load speed. Until that speed is reached the shoes will not act at all to retard rotation with either a hoisting or lowering speed of the motor. However a greater speed will cause the shoes to move outwardly against the tension of spring 75, flying out so as to bring the braking material 74 against the inner sides of the housing 76 and thus put a drag on the motor armature which will prevent the speed thereof from becoming excessive. The manner in which the shoes are pivoted on the brake drum 51 and connected by a single spring makes it impossible for one shoe to have a greater force against the housing 76 than the other, because, as the shoes are duplicate and held back by the same force, the centrifugal force in each available for braking must be the same.

This construction of brake and governor is very simple and effective and in every way practical, combining as it does extreme simplicity with a full measure of everything that could be obtained with much more elaborate apparatus. Since the centrifugal force of the shoes 73 increases as the square of the velocity, by the time the motor is running at two and one-half times its normal full load speed the force exerted by the brake shoes is sufficient to prevent the full load on the hoist from revolving the armature any faster, even if assisted by the current in the motor. Thus the governor absolutely prevents even a momentary excess in lowering speed with possible damage to the motor. Two and one-half times the normal full load speed of the motor is substantially the limit of speed which the motor armature will safely withstand and this may be safely permitted when the motor is direct current and series wound, both when elevating the hoist or when lowering any load.

It will also be noted that when the governor shoes 73 with their lining 74 are bearing against the stationary housing 76, it forms in effect a temporary third bearing for the armature shaft which has a steadying effect and prevents vibration at high speed with consequent wear on the adjoining motor bearing. It will also be noted that if the governor spring should gradually become weaker no detrimental effect will be had, as this will only cause the governor to act earlier than before and check the lowering speed sooner, while if the spring 75 should break, the governor shoes will begin to act at once as soon as the shaft begins to

revolve, resulting in even greater safety as the maximum lowering speed would be considerably diminished with no possible harm resulting; and any such defect can be detected practically instantly and a new spring installed.

By thus limiting the lowering speed to two and one-half times the hoisting speed and equal to the non-load hoisting speed which would be attempted with a direct series wound motor, a large measure of lowering control is secured. The operator with this hoist, to lower, moves the controller either to the full current point on the rheostat, or at any one of the resistance points thereof, thereby releasing the magnetic brake and allowing the load to descend at whatever speed it may attain. This speed will increase until the critical point is reached where it automatically comes under control of the governor, and beyond which speed it cannot go. The load is stopped within an inch or two of the point it is desired to reach and thereafter lowering proceeds by series of momentary current impulses which moves the hook a fraction of an inch at a time.

The hand control operation of the brake by means of the rope 69 is of value where extreme delicacy of control in lowering is required and this, in conjunction with the governor, permits the very nicest lowering control without current on the motor. It is necessary however from the point of safety that the hoist be equipped with the governor as an inexperienced or careless operator, by allowing the lowering speed to become excessive with a load, will destroy the motor armature, but even if such operator should fail in properly hand controlling the brake the governor automatically stops the motor from running beyond a predetermined safe speed of substantially two and one-half times its normal full load speed.

Therefore, with this apparatus of extreme simplicity, the greatest nicety of lowering control can be obtained merely by the attachment of a depending cord or rope; and without the attachment of this cord a measure of lowering control sufficient for all but very exceptionable circumstances is attained. At a considerable extra cost and with serious drawbacks the ordinary dynamic braking used many times with hoists of this character could be used which would give but slightly greater measure of lowering control than can be obtained by this structure without the rope or cord 69 but not nearly as great as can be obtained with it. This is a very important feature of the invention, on account of its practical proved results, its extreme simplicity and economy in manufacture.

The construction of hoist shown in Figs. 1 to 8 inclusive gives all of the advantages and results set forth in the statement of the invention made preliminary to the description of the construction. The frame, as a single casting, is readily produced and requires but little machining. The construction is very compact, the motor and drum being located as closely as possible to each other and the hoisting cables or ropes 47 depend from the drum on the side nearest the vertical web 2 of the casting, passing over the block equipped with the hook 50 and thence coming back over the roller 45 at a point distant from the center of gravity of the hoist substantially equal to the distance of the cables 47 from said center of gravity at the other side thereof. This balances the construction. Assurance is provided against the excessive speed in a very simple and economical manner. The gearing and shafts are of a most economical form but are fully capable of withstanding all stresses to which they may be subjected in service. Every part of the machine is in accordance with the best accepted engineering practice. All parts are easily accessible for inspection and repair. And in every way the construction is designed to combine simplicity, economy and practicability. That this is so has been extensively proved in actual practice.

In Figs. 9 to 12 inclusive, a different design of hoist is shown though it has all of the advantages of the one previously described with reference to Figs. 1 to 8 inclusive. This second hoist, instead of being equipped with wire hoisting ropes or cables, uses ordinary crane chain for the vertical lift apparatus. As a result, the chain passing over a sprocket wheel and playing beyond the sprocket wheel, and not being wound on any drum, a long drum is not needed, whereupon considerable space occupied by the drum in the first construction is made available for other purposes and this results in a somewhat different arrangement of the various parts as to location though in principle the structures are substantially the same.

The frame of the hoist, as before, includes a single casting with a gear case 1^a and a vertical web 2^a extending therefrom which is flanged at its upper and lower sides and free end for strength and reinforcement. In addition a housing 78 is cast integral with the frame on the side thereof opposite where the motor 15 is connected. This housing covers an elongated sleeve 80 mounted on suitable bushings on a shaft 81 which passes through the gear casing, being supported thereby at one end and at the opposite end being supported in the end of the housing 78. A gear 79 is fixed at one end of the sleeve 80 and, to all intents and purposes, is equivalent to the gear 14 fastened on the end of the drum 8 in the first described construction. It is one of the train of gears

interposed between the motor 15 and the sleeve 80 for driving the latter from the motor. At the opposite end of the sleeve a chain sprocket wheel 82 is fixed. A block or projection 83 is cast integral with the vertical web 2^a at its lower portion and extends under the motor 15, one end of a crane chain 84 being fastened to said block thence extending downwardly over the pulley 48^a mounted, as are the pulleys 48 in the first described construction, at the upper end of a housing 49 from which hook 50 depends, the chain thence passing upwardly and over the sprocket wheel 82. The end of the chain after passing over sprocket wheel 82 is looped back and the end link thereof is secured between two ears 85 extending outwardly from a block 87 which is positioned vertically and at its upper end is mounted on a rod 87 passing through bosses formed at the upper ends of spaced apart vertical webs 88 cast integral with the frame of the hoist under the housing 78, serving to reinforce the vertical web 2^a of the hoist frame against any eccentric stresses which may arise in service. An upper hook support 89 is shown attached at the upper side of the vertical web 2^a, as near as possible over the center of gravity of the hoist and practically directly over the lower load carrying hook 50. Of course, this hoist could be made to traverse a horizontal beam like the I-beam 41 quite as well as the first described hoist, and such first hoist can be equipped with a hook like that at 89 if it is not desired that the hoist shall have horizontal movement.

In this design of hoist, the solenoid magnet 53 is placed on the side of the web opposite to the side at which the motor is attached, there being space for its reception due to the elimination of the long drum. The housing 76 for the governor brake shoes is mounted directly opposite the solenoid magnet, being fixed to the web 2^a near its outer end. The brake shoes 57 and 58, instead of being suspended from an over head bracket as in the first described structure, are suspended from pins 59^a and 60^a which in turn are connected to the upper side of the housing 76 and extend inwardly toward the motor. The supports for the adjustable stops 70 and 71 are conveniently cast with or attached to the relatively stationary motor housing 76. Lever 63^a connected at one end to the solenoid core or plunger 54 is similar in most respects to the lever 63. It does not show an extension for the attachment of a depending cord or rope for manual control of the brake though it is obvious that this extension and the cord attached thereto can be used if desired.

This construction is simple, economical to produce, well balanced and in every way capable of the same advantageous results as those described with reference to the first described hoist. The vertical web 2^a is reinforced by ribs such as indicated at 88, this permitting the integral casting of the block or projection 83 to which the end link of the chain 84 is secured whereby the load reacts directly on the frame. The manner of attachment of the chain, which is by recessing the projecting block 83 to snugly accommodate the end link of the chain and a portion of the second link and attach the same by the plate shown which may be slotted to receive and accommodate the top of the second link, is of advantage because it enables the user to fit a new chain on his hoist without having to forge end links for connection. For different classes of service one of the hoists may be preferred over the other the chain type being useful where rough usage occurs which would be fatal to the much more delicate wire rope or cable. The chain hoist has a further advantage in that there is no space limit to the vertical lift, such lift being available to any height so long as sufficient chain is provided for it; while with the wire cable hoist the limit of vertical lift is governed by the length and diameter of the drum, this governing the amount of rope or cable that can be carried on the drum.

The constructions described are both very simple, practical, durable and efficient. Their production has been the result of an intensive study of the conditions and the problems coming therefrom which confront makers of hoists of this character. With either type of hoist described all of the functions required of an electric hoist are present combined with a practical structure which can be produced in any desired sizes without change of design, there being only changes of dimensions of parts for different sizes. The invention is defined in the claims and is to be considered as comprehensive of all forms of structure coming within their scope.

I claim:

1. In an electric hoist, a supporting frame including a vertical web, an electric motor located at one side and fixed to the web, a hoisting drum rotatably mounted at the opposite side of the web on said frame, gearing between the motor shaft and drum for driving the drum at a reduced speed, hoisting ropes wound on the drum and depending therefrom, a pulley block through which the ropes pass, a pulley mounted at the lower part of said vertical web over which the rope passes and a bar fastened to and paralleling the lower edge of the web on which said pulley is mounted, substantially as described.

2. In an electric hoist, in combination, a supporting frame including an integrally cast gear box and a vertical web extending to one side thereof, an electric motor fixed to the web at one side and having its armature

shaft extending into the gear box, a pair of shafts mounted in and extending between the sides of the gear box, means for holding said shafts against rotative movement, one of said shafts being located at one side of the armature shaft and the other at the other side of said shaft, a rotatably mounted hoisting member carried by the web and outer side of the gear box on the side of the web opposite the motor, said hoisting member having a gear at one end located within the gear box and extending toward the last mentioned shaft, and reduction gearing interposed between the motor armature shaft and the gear on the hoisting member for driving said hoisting member from the electric motor.

3. In an electric hoist, a frame including a gear box and a vertical web extending therefrom, an electric motor fixed to the web at one side thereof having one end of its armature shaft extended into the gear box, a pinion on the end of the armature shaft, a shaft mounted on and extending between the sides of the gear box a distance from the armature shaft, a second pinion having an extended hub loosely mounted for rotation on the shaft, a gear keyed to said hub extension of the pinion and meshing with the armature shaft pinion, a second shaft at the opposite side of the motor armature shaft mounted on and extending between the sides of the gear box, a third pinion having an extended sleeve rotatably mounted on the second shaft, a large gear keyed to said hub extension of the third pinion meshing with the second mentioned pinion, a rotatably mounted hoisting member carried by the frame on the side of the web opposite the electric motor, and a gear secured to the end of the hoisting member within the gear box said gear being in mesh with the third pinion, substantially as described.

4. In an electric hoist, a frame comprising a vertical web and a gear box integrally cast therewith at one end of the web, said gear box comprising inner and outer sides spaced apart and connected by an integral cross portion at their upper edges, the lower side of the gear box being open, an electric motor mounted at one side and fixed to the web, said motor having its armature shaft extending through the inner side of the gear box above the lower edge thereof, a rotatably mounted hoisting member located at the opposite side of the web said hoisting member having one end passing through the inner side of the gear box and equipped with a gear, a pinion on said end of the motor shaft, and reduction gearing between said pinion and gear mounted on two shafts carried by the gear box, one at each side of the motor shaft, and adapted to connect said armature shaft pinion with the rotary hoisting member gear, substantially as described.

5. A construction containing the elements in combination defined in claim 4, combined with an under closure member for the gear box including spaced apart sides and an integral bottom, complementary lugs cast on said closure member and the upper gear box, and bolts passing through said lugs for detachably securing said under member to the gear box, substantially as described.

6. In an electric hoist, a vertical web and a gear box cast integral therewith at one end of the web, said gear box comprising spaced apart sides connected by an integral upper cross portion, the lower side of said gear box being open, an electric motor attached to the web at one side thereof having an armature shaft extending through the inner side of the gear box, two short shafts one located at each side of the armature shaft in substantially the same horizontal plane therewith, a rotatably mounted hoisting member carried by the frame on the side thereof opposite the motor having one end extending into the gear box, a gear fastened to said end of the hoisting member, means for holding said shafts against rotary movement, and reduction gearing mounted on said shafts and interposed between the gear on said hoisting member and the pinion on the armature shaft for driving the hoisting member from the motor, substantially as described.

7. In an electric hoist, a frame comprising a hollow gear box and a vertical web extending to one side therefrom, a motor fixed to the web at one side thereof, a rotatably mounted hoisting member located at the opposite side of the web, one end of the motor shaft and one end of the hoisting member extending into the gear box, a pinion on said end of the motor shaft, a gear on said end of the hoisting member, two stationary shafts located one at each side of the motor shaft extending between the sides of the gear box, a second pinion loosely mounted on one shaft and in engagement with the gear on the hoisting member, said pinion having an extended hub, a second gear fixed to said hub of substantially the same diameter as the gear on the hoisting member, a third pinion loosely mounted on the other shaft and in engagement with the second gear, said third pinion having an extending hub, and a gear keyed to said last mentioned hub and in engagement with the pinion on the motor shaft, substantially as described.

8. In an electric hoist a frame comprising a hollow gear box and a vertical web extending to one side therefrom, said gear box having an open under side, an electric motor fixed to and located at one side of the web, a rotatably mounted hoisting member located at the opposite side of the web, two shafts extending between and passing

through the sides of the gear box, each of said shafts at one end being formed with a short keyway, a pin extending upwardly from the lower edge of the gear box into said keyway, a pin passing through said end of the shaft outside of the gear box, and gearing mounted on said shafts, on the motor shaft and on the hoisting member for driving the hoisting member from the motor at reduced speed, substantially as described.

9. In an electric hoist, an integrally cast frame including a gear box and a vertical web extending therefrom, with upper and lower oppositely extending reinforcing flanges cast integral with the web, a horizontal bar fastened to and at the edge of the lower flange, a rod passing through said lower flange and bar, a pulley mounted at the outer end of the rod, an electric motor fixed at one side of the web above said pulley, a rotary hoisting member mounted at the opposite side of the web, gearing located within the gear box between the motor and hoisting member for driving the later by the former, a flexible cable bent over the pulley, and a lifting block including two grooved wheels located under the web, said flexible member passing under the grooved wheels and thence upwardly around the rotary hoisting member, substantially as described.

In testimony whereof I affix my signature.

GEORGE EDWARD MOORE.