S. H. LIBBY.

ELECTRICALLY CONTROLLED HOIST.

APPLICATION FILED MAY 1, 1914.

1,229,984.

Patented June 12, 1917.

2 SHEETS—SHEET 1.

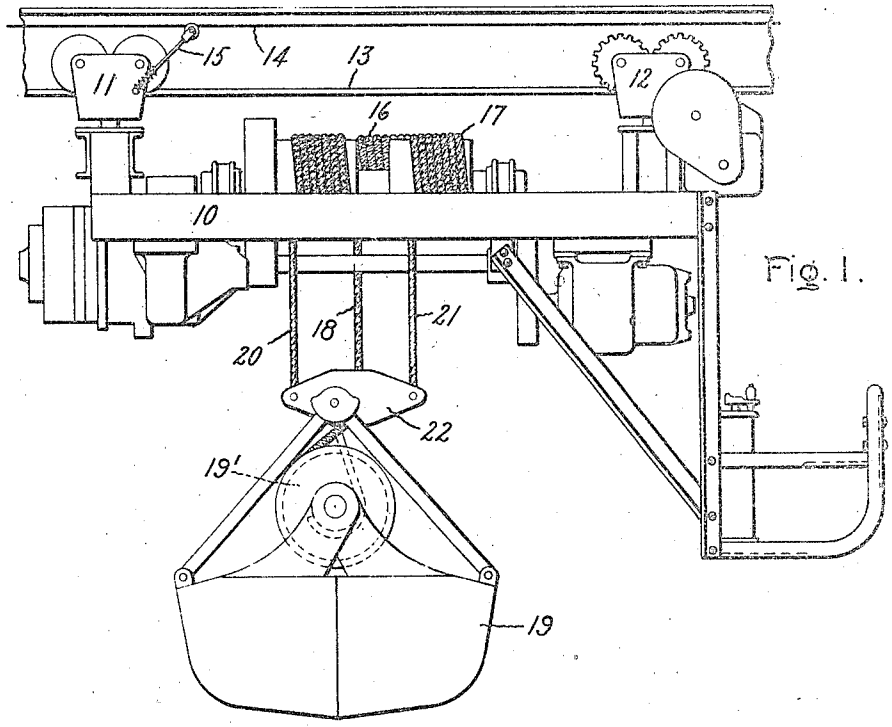


Fig. 1.

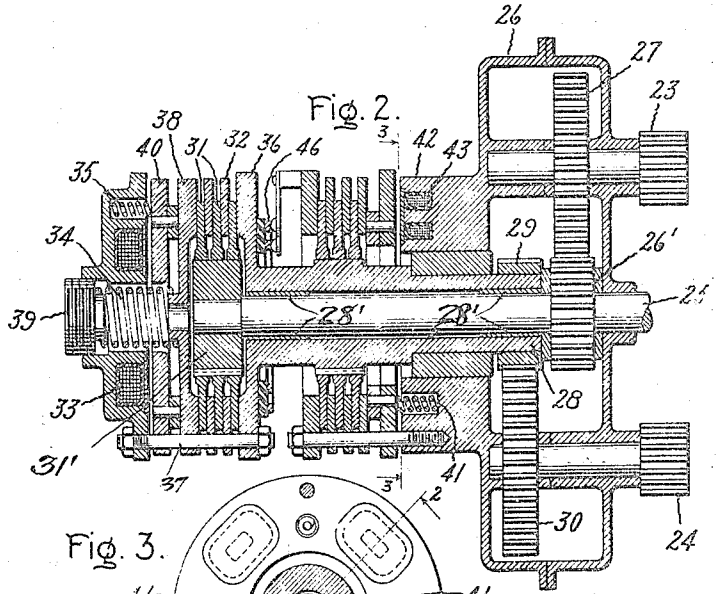


Fig. 2.

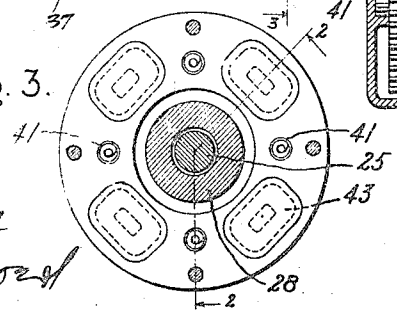


Fig. 3.

Witnesses

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ELECTRICALLY CONTROLLED HOIST.

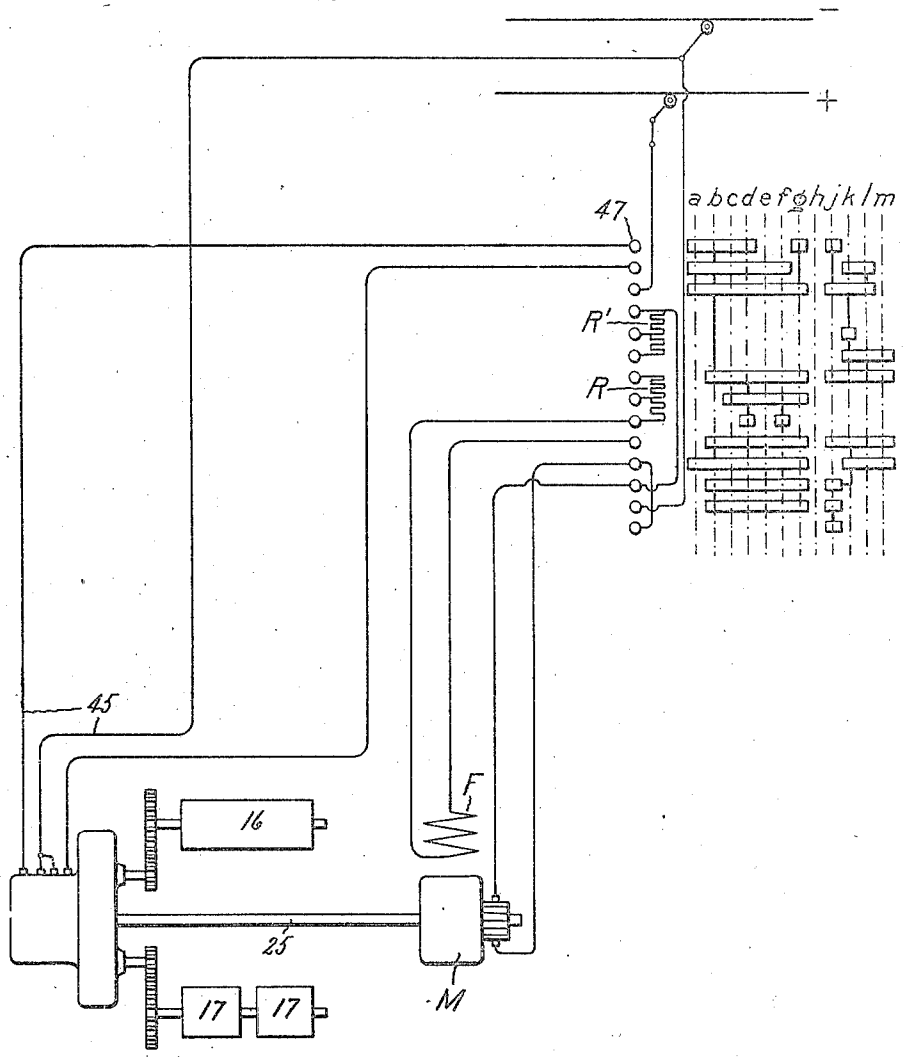
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2 SHEETS—SHEET 2.

Fig. 4.



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ELECTRICALLY-CONTROLLED HOIST.

1,229,984. Specification of Letters Patent. Patented June 12, 1917.

Application filed May 1, 1914. Serial No. 835,680.

To all whom it may concern:

Be it known that I, SAM H. LIBBY, a citizen of the United States, residing at East Orange, county of Essex, State of New Jersey, have invented certain new and useful Improvements in Electrically-Controlled Hoists, of which the following is a specification.

This invention relates to hoisting mechanism or the like, and has for its object the provision of improved means whereby certain loading and conveying operations may be performed in a reliable and efficient manner with a minimum amount of apparatus.

My invention relates more specifically to hoisting mechanism of the type known as "grab bucket" hoists, although my invention is not necessarily limited to this specific type of apparatus. In the construction of grab bucket hoists, two winding drums are necessary, one for closing or "lacing" the bucket and the other for holding the bucket while the opening (and under some circumstances the closing) operation is going on. Heretofore where these grab bucket hoists were operated electrically two motors have been generally required, one for operating each drum. One of the objects of my invention is to provide means whereby the two drums may be operated by a single motor and controller to perform all the necessary operations connected with the use of a grab bucket hoist without the use of manually operated clutching brakes. In one specific embodiment of my invention the lacing drum is geared to the motor so as to be positively driven whenever the motor operates. The holding drum is driven by the motor through electromagnetic friction clutch mechanism under the control of the operator. The arrangement is such that the power transmitted through the friction clutch will depend upon whether or not the electromagnetic mechanism is energized. Under one condition, say for instance when the mechanism is energized, a light friction clutch will be on, whereby a small amount of power will be transmitted to the holding drum—enough to keep the cables taut, but when the mechanism is deënergized a heavy friction clutch will be on which will transmit to the holding drum all the power received from the motor. A friction brake is also applied to the holding drum so that the bucket will not overhaul the drum during the opening or closing in air operations. Since the lacing drum is operated for every movement of the hoist, and the holding drum is only operated during hoisting and lowering, the single motor arranged as described performs all the necessary functions. Other objects and purposes of my invention will appear in the course of the following specification in which I have shown my invention embodied in concrete form for purposes of illustration.

In the accompanying drawing showing one embodiment of my invention, Figure 1 is an outline view in elevation of a grab bucket hoist; Fig. 2 is a sectional view through the gear casing and the friction clutch and brake mechanism; Fig. 3 is a sectional view on line 3—3 of Fig. 2; and Fig. 4 is a diagram of the circuit connections.

Referring first to Fig. 1, it will be seen that I have shown an ordinary grab bucket hoist consisting of a conveyer housing 10 carried by two trucks 11 and 12 mounted upon the track 13 and getting power for operating the same from two trolley wires, only one of which, 14, and one trolley 15 is shown. This conveyer carries the two drums, that is, the lacing drum 16 and the holding drum 17. The lacing drum has a single cable 18 which runs downward to the grab bucket 19 and closes the bucket as the cable, on being drawn upward, turns the power wheel 19′ in a clockwise direction and allows it to open, as the cable is lowered. The holding drum has two cables, 20, 21, which are attached to the cross arm or upper center casting 22 on the grab bucket. These cables 20 and 21 support the bucket while certain operations are taking place as hereinafter described, and coöperate with the cable 18 to lift the bucket.

Referring now to Fig. 2, the pinion 23 is for driving the lacing drum 16, and the pinion 24 drives the holding drum 17. These pinions are geared to their respective drums as shown in Fig. 4. The motor shaft 25 is located between these two gears. The gear case 26 forms a bearing for the shafts upon which the gears 23 and 24 are mounted and also for the motor shaft 25. The motor shaft drives the lacing drum directly and positively through the gears 26′, 27 and 23, so that the lacing drum is always operated whenever the motor is operated. The hold-

ing drum, however, is not positively geared to the motor, but is driven from the motor shaft through a friction clutch. This is accomplished through a sleeve 28 carrying a pinion 29 which meshes with the gear 30 which in turn drives the pinion 24 and drum 17. This sleeve is driven from the motor shaft through a friction clutch mechanism consisting of friction disks 31 on the motor shaft and friction rings 32 carried by the sleeve. These friction surfaces are pressed together either by light or heavy spring pressers depending upon whether or not the electromagnet 33 is energized. In the specific arrangement shown, when the magnet is energized the light spring pressure is applied through spring 34 so that the sleeve is only lightly clutched to the motor shaft, but when the magnet is deënergized the heavy pressure is applied by springs 35 in addition to the light pressure and the sleeve is clutched strongly to the motor shaft. The sleeve 28 is elongated, and the shaft 25 which extends through the sleeve has bearings 28′ at each end thereof. The end of the sleeve is formed into a flange 36 which coöperates with the friction disks 31 splined to a hub 31′ on the motor shaft and the friction rings 32. The friction rings are strung upon bolts 37 passing through the flange 36 so that they may move toward and away from the flange but must turn with it. A plate 38 also mounted upon the bolts 37 receives at its center the pressure of spring 34 which produces the light driving friction. The spring 34 is made adjustable by means of the plug 39. Another plate 40 having a central opening for permitting the spring 34 to pass through it, is pressed against the plate 38 by springs 35. This plate 40 acts as the armature for the electromagnet 33, the arrangement being such that when the magnet is energized, the plate 40 will be attracted and compress the springs 35, thereby relieving the friction surface of the pressure of springs 35. When the magnet is deënergized, the friction surfaces are pressed together by all the springs. The spring 34 presses against the plate 38, and the springs 35 press against the plate 38 through the plate 40. The net result is that when the magnet 33 is deënergized the friction surfaces are pressed strongly together so as to clutch the sleeve tightly to the motor shaft. Under this condition the clutch will transmit to the sleeve and hence to the holding drum all the power received from the motor. But when the magnet is energized the friction surfaces are pressed together less strongly so that the clutch will not transmit all the power received from the motor, but will slip, thereby giving to the sleeve a certain turning tendency which keeps the cables on the holding drum taut. A friction brake consisting of the friction disks and rings pressed together by springs 41 is arranged to apply a brake to the sleeve. This brake operates between the sleeve and the hub 42 of the gear casing, and is similar to that just described. Magnet windings 43 control this brake so that when the windings are energized the brake is released and when the windings are deënergized the brake is applied to the holding drum. It will be seen, therefore, that when the motor operates, it drives the lacing drum positively through gearing, but whether or not it will drive the holding drum will depend upon whether or not the clutch magnet 33 is energized. The holding drum will be braked or free, depending upon whether or not the brake magnet is energized.

In Fig. 4 I have shown a diagrammatic view of the motor connected to the drums and clutch mechanism, and have also shown the circuit connections for the motor clutch, magnetic brake, etc.

The circuit connections will be understood by following through the various steps as they occur in actual practice. Assume that the bucket is open and resting on the pile, say of coal, to be loaded. The first operating position of the controller (position *a*) energizes the brake magnet so as to take the brake off the motor. In this position of the controller the clutch magnet 33 is also energized through wires 45 and slip rings 46 (Fig. 2), thereby taking off the heavy friction clutch between the motor shaft and holding drum. In the next position (*b*) the circuit of the motor M is closed through the resistance sections R and series field F. The motor will now operate the lacing drum to close the bucket in the usual manner, and the holding drum will simply put a tension on the holding cables 20 and 21 and keep them taut. In the next two positions (*c* and *d*) of the controller the resistance sections are cut out of the armature and series field circuit and the motor operates at a greater speed to close the bucket. In the next movement of the controller (position *e*), the clutch magnet 33 is deënergized by the contact finger 47 passing off its segment. This throws on the heavy friction clutch, whereby the motor drives the holding drum, one section of the resistance R being in circuit with the motor. Both drums now start to operate and raise the bucket by the three cables 18, 20 and 21, the latter two cables only being taut enough to keep them from fouling. In the next position (*f*) the resistance R is cut out of the armature and series field circuit and the motor comes up to full hoisting speed. When the hoisting operation is accomplished the operator turns the controller to position (*h*) in which all circuits are opened and the brake is applied to hold the bucket in its upper position by the deënergizing of winding 43. The hoist is

then traversed to the dumping point, wherever it may be, and the operator next turns the controller to position (*j*) to open the bucket. In this position the clutch magnet is energized so that the holding drum will not be operated by the motor. The brake is on, but as it is located on sleeve 28, which is geared to holding drum and is disconnected from motor through the release of clutch it has no effect on the motor and only holds the bucket while it is being opened by the motor through the lacing drum. When the bucket has opened and the load is dumped the operator turns the controller back to position (*h*) and then traverses the hoist back to the loading station, after which he turns the controller to position (*k*) to lower the bucket. In this position the clutch magnet is deënergized so that the holding drum will operate with the motor as well as the lacing drum and lower the bucket, the brake being released. The motor is cut off in this position and connected in a dynamic brake circuit with the resistance R and one section of the resistance R′. In the next position of the controller the remainder of the resistance R′ is connected in circuit so that the bucket descends more rapidly. In the last position (*m*) of the controller, the brake is applied to the motor, causing it to stop in the desired position, this being off and the controller handle having made a complete revolution being now ready to again complete the cycle of operation. In some cases, as, for instance, where there is not room to withdraw the open bucket from a space which it has entered, the bucket must first be closed. Under these circumstances, after the bucket has opened the controller is turned back to position (*g*) in which the bucket is closed. The bucket must afterward be opened and the operation continued as above described. It will thus be seen that with my arrangement a single motor is caused to perform all the operations incident to loading and unloading, hoisting and lowering of a grab bucket or similar hoist, all the operations being performed by a single controller and without the use of foot brakes, hand brakes or manually operated clutches. While I have described my invention as embodied in concrete form and as operating in a specific manner for purposes of illustration, it should be understood that I do not limit my invention thereto, since various modifications thereof will suggest themselves to those skilled in the art without departing from the spirit of my invention, the scope of which is set forth in the annexed claims.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. A grab bucket hoist or the like, comprising a lacing drum, an electric motor having driving connections therewith, a holding drum and means whereby the motor operates the holding drum so as to support the bucket during loading and lift it during hoisting.

2. A grab bucket hoist or the like comprising a lacing drum and a holding drum, an electric motor having a positive driving connection with one of said drums, electromagnetically controlled friction clutch mechanism between the motor and the other drum, and means whereby the friction connection transmits more or less power depending upon whether or not the electromagnetic mechanism is energized.

3. A grab bucket hoist or the like, comprising a lacing drum, an electric motor having a positive driving connection therewith, a holding drum, and an electromagnetically controlled driving connection for transmitting more or less power from the motor to the holding drum at the will of the operator.

4. A grab bucket hoist or the like comprising a lacing drum, an electric motor having a driving connection therewith, a holding drum, and electromagnetically controlled means whereby a greater or less amount of power may be transmitted from the motor to the holding drum at the will of the operator.

5. A grab bucket hoist or the like comprising a lacing drum, an electric motor having a driving connection therewith, a holding drum, and magnetic clutch mechanism provided with means for effecting the transmission of a greater or less amount of power between the motor and the holding drum at the will of the operator.

6. A grab bucket hoist or the like comprising a lacing drum, an electric motor having a positive driving connection therewith, a holding drum, frictional driving connections between the motor and the holding drum, and electromagnetic means under the control of the operator for varying the power transmitted through the friction connection.

7. A grab bucket hoist or the like comprising a lacing drum, an electric motor having a driving connection therewith, a holding drum, means whereby a greater or less amount of power may be transmitted from the motor to the holding drum at the will of the operator, and an electromagnetically actuated brake on the holding drum.

8. A grab bucket hoist or the like comprising a lacing drum, a motor having a driving connection therewith, a holding drum, a friction clutch provided with means for effecting the transmission of a small amount of power between the motor and the holding drum at all times and a greater amount under the control of the operator, and an electromagnetically actuated friction brake on the holding drum.

9. A grab bucket hoist or the like com-

prising a lacing drum, an electric motor having a positive driving connection therewith, a holding drum, electromagnetically controlled friction clutch mechanism between the holding drum and the motor, and means whereby the friction connection transmits more or less power depending upon whether or not the electromagnetic mechanism is energized.

10. A grab bucket hoist or the like comprising a lacing drum, an electric motor having a positive driving connection therewith, a holding drum, electromagnetically controlled friction clutch mechanism between the holding drum and the motor, and means whereby the friction connection transmits more power when the electromagnetic mechanism is deënergized than when it is energized.

11. A grab bucket hoist or the like comprising a lacing drum, an electric motor having its shaft connected to positively drive the same, a holding drum, a sleeve on the motor shaft geared to the holding drum, magnetic clutch mechanism connecting the motor shaft and the sleeve so as to transmit a greater or less amount of power from the motor to the holding drum at the will of the operator, and an electromagnetically controlled friction brake upon the sleeve for braking the holding drum.

12. A grab bucket hoist or the like comprising a lacing drum, an electric motor having a driving connection therewith, a holding drum, a friction clutch connecting the holding drum and the motor shaft, means for exerting a small amount of pressure at all times on the friction clutch, and electromagnetically controlled means for exerting a greater pressure on the friction clutch at the will of the operator.

In witness whereof, I have hereunto set my hand this twenty ninth day of April, 1914.

SAM H. LIBBY.

Witnesses:
ROGER H. BUTTERWORTH,
FREDERICK KEYLER.