

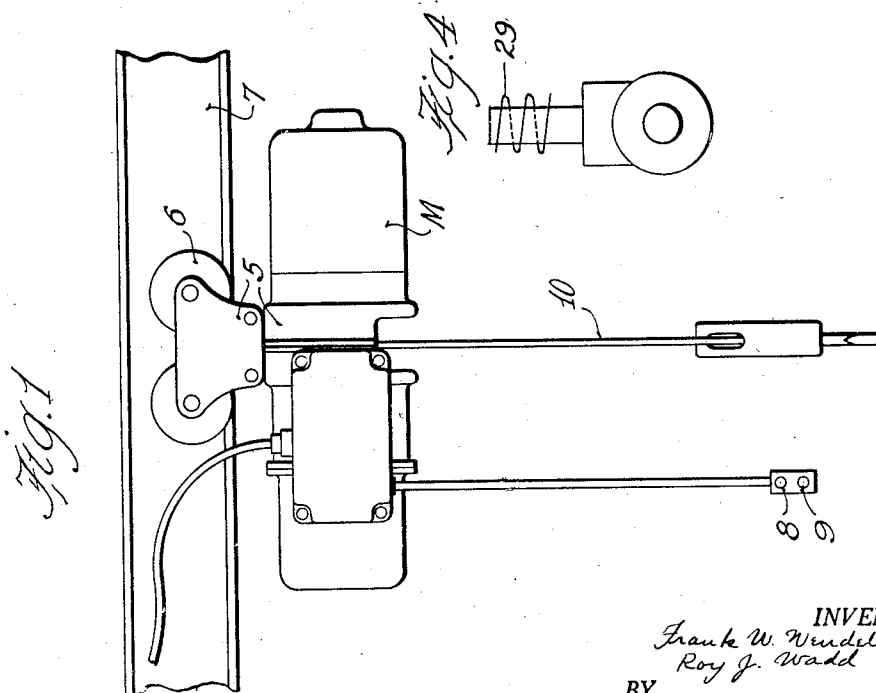
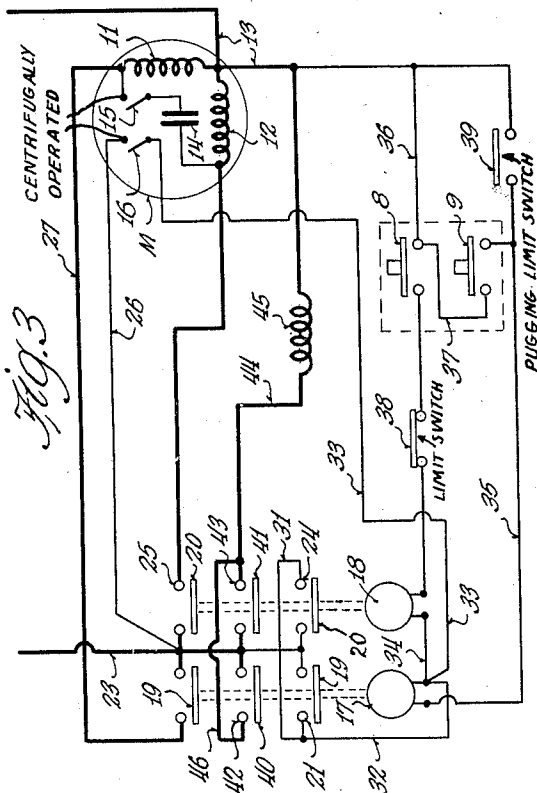
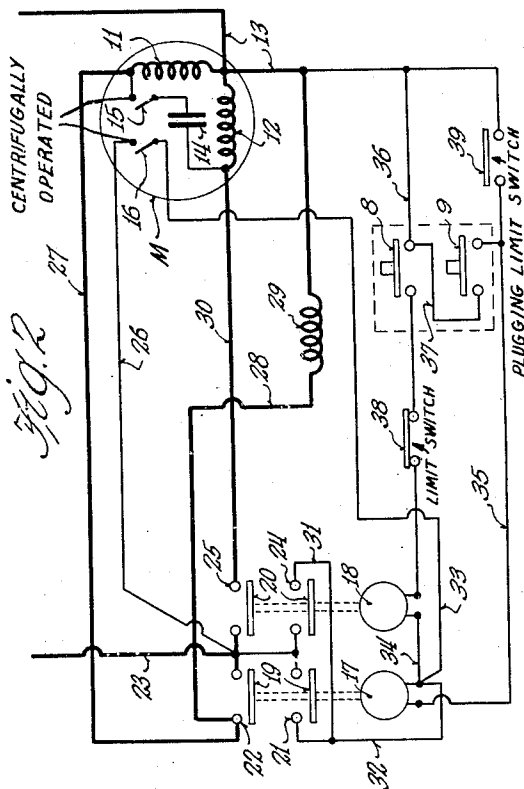
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REVERSIBLE HOIST MOTOR

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REVERSIBLE HOIST MOTOR

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4 Claims. (Cl. 172-279)

The invention relates to electrically operated hoists wherein the drive motor forms an integral part of the hoist and is usually directly reversible.

It is now common practice to use single phase capacitor start induction motors for small hoists, but with their use certain difficulties in the reversing operation may arise.

One of these difficulties is that of effecting the reversal of the motor by reversal of the field winding connections while the motor is operating since under these conditions the motor will continue to operate in the same direction even after reversal of the field connections unless the motor stops or slows down to a speed at which reverse rotation can be effected. The object of the present invention is to provide a novel electrical arrangement for hoist motors of the type above described in which reversal is positively effected even though the reversing operation is initiated while the motor is still revolving in the opposite direction from that desired and at a speed exceeding that at which reversal will occur.

The invention further consists in the several features hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawing:

Fig. 1 is a plan view of a hoist motor equipped with the invention;

Fig. 2 is a diagrammatic view of my improved circuit arrangement;

Fig. 3 is a view similar to Fig. 2 showing certain modifications.

Fig. 4 is a detailed diagrammatic view of the electrically operated brake.

Fig. 1 shows the general arrangement of the hoist wherein the motor M forms a part of the carrier 5 which is provided with wheels 6 running on the track or rail 7, the motor being controlled by the operator's operation of the push buttons 8 and 9 and acting through suitable drive means to wind up or let out the hoist rope 10.

Referring to Fig. 2, the motor M is shown as provided with two windings 11 and 12, either one of which may be the starting winding and the other the running winding, these windings being connected with each other during starting and with the supply conductor 13 at a common junction point. A condenser 14 is in a conductor connected across or in shunt or parallel with both windings as is also a centrifugally operable starting switch 15 of any approved construction. A second centrifugally operable switch 16 is operated by the motor and is connected in the motor control magnetic starting switch circuit. 55

The magnetic starting switch is shown as comprising coils 17 and 18 and pairs of shiftable contact bridging elements 19 and 20. The bridging elements 19 connect the contacts 21 and 22 with contacts connected to the supply conductor 23, and the bridging elements 20 connect the contacts 24 and 25 with contacts connected to said conductor 23. A conductor 26 connects one terminal of the switch 16 with the supply line 23. A conductor 27 connects the contact 22 with the coil 11, and a magnetic brake conductor 28 connects the contact 22 with the conductor 13 and has the brake coil 29 therein. A conductor 30 connects contact 25 with coil 12.

The contacts 21 and 24 are connected together by a conductor 31 which is connected by a conductor 32 with one terminal of the coil 17, and this same terminal is connected by a conductor 33 with the other side of the switch 16 and is also connected by a conductor 34 with one terminal of the coil 18. The other terminal of the coil 17 is connected by a conductor 35 to the line 13, and the other terminal of the coil 18 is also connected by a conductor 36 to the line 13.

The conductor 36 is interrupted by a normally open hoist push button switch 8 and beyond this switch is joined by a conductor 37 which extends through the normally open push button 9 to the conductor 35. The numeral 38 designates a normally closed hoist limit switch and 39 a normally open supplementary plugging limit switch which comes into action to reverse the motor momentarily in case the hoist continues to drift too far in the hoisting direction after power is shut off by the limit switch 38.

The circuit arrangement shown in Fig. 3 is similar in all respects with that shown in Fig. 2 except for the magnetic brake connections which provide direct energization for the brake coil as later described, and similar parts have been similarly numerated. In Fig. 3 an extra set of bridging contacts 40 and 41 connect the line 23 with contacts 42 and 43. A conductor 44 connects the contact 43 with the line 13 and includes the brake coil 45, and conductor 46 connects the contact 42 with the conductor 44.

Referring to Fig. 2, in hoisting the load carried by the hoist rope 10 the operator closes the push button switch 8, and then current flows from supply conductor 13 to 36 through coil 18, conductors 34 and 33 to switch 16 (then closed), through conductor 26 to the supply line 23, thus energizing coil 18 and causing switch elements 20 to be moved to closed position. When this occurs, the coil 18 is maintained energized by current from con-

ductor 36 passing through conductors 34, 32, and 31, contact 24, and switch 20 to supply line 23. At the same time current flows through motor winding 12, conductor 30, and contact 25 to conductor 23 and through a brake release coil 29 and conductors 28 and 27, switch 15 (then closed), condenser 14, conductor 30, contact 25 to conductor 23 while some current also flows through winding 11 (then a starting winding) and switch 15 (then closed) and condenser 14 to conductor 30 and line 23. The brake release coil 29 being energized the brake is released for the motor drive, and the motor M then starts to turn its shaft and the hoist rope 10 operatively connected therewith moves in a direction to hoist the load. As soon as the motor gets up to speed, the switch 15 opens and cuts out winding 11, the brake coil 29, however, remaining excited due to the transformer action between the motor windings 11 and 12, and the motor continues to run on the winding 12 until either the switch 8 is opened or the limit switch 38 opens to interrupt passage of current to the coil 18.

The operation of the circuit shown in Fig. 3 for the hoisting operation is identical with that of Fig. 2 except that instead of an induced voltage through the brake coil 45 this coil is directly energized by current from line 13 passing through conductor 44, contacts 43 and 41 to line conductor 23, thus releasing the brake as the motor is started and keeping it released while the motor is running.

In the case of the circuits shown in Fig. 2 in lowering the load the operator closes the push button switch 9, and then current flows from the line 13 through conductors 36 and 37 to 35, then through switch coil 17, conductor 33, switch 16 (then closed), conductor 26, and supply line 23, thus energizing the coil 17 and causing switch elements 19 to be moved to closed position. When this occurs, the coil 17 is maintained energized by current from conductor 35 passing through conductor 32, contact 21, switch element 19, to supply line 23. At the same time current flows through motor winding 11 and conductor 27, contact 22, element 19 to the supply line 23 while some current also flows through winding 12 (then a starting winding) and switch 15 (then closed) and condenser 14 to conductor 27 and the line 23. Engagement of the element 19 with the contact 22 also causes current to flow through the contact 22 and conductor 28 including coil 29 to the line 13, thus causing said coil 29 to release the brake for the motor drive, and the motor M then starts to turn its shaft and the hoist rope 10 operatively connected therewith moves in a direction to lower the load. As soon as the motor gets up to speed, the switch 15 opens up and cuts out the winding 12, and the motor continues to run on the winding 11 until the switch 9 is opened, the coil being energized as in hoisting by the transformer action of the windings 11 and 12.

The operation of the circuit shown in Fig. 3 for the lowering operation is identical with that of Fig. 2 except that a separate brake contact 42 is relied upon to supply current to the brake coil 45. Thus coil 45 is energized by current from line 13 passing through conductors 44 and 46, contact 42, element 40 to the line conductor 23, which releases the brake as the motor is started and keeps it released while the motor is running.

It is to be noted that the general operation of the arrangement shown in Fig. 3 is the same as that of Fig. 2 and that the only difference is in

the direct or indirect energization of the brake coil 45 to effect release of the brake.

It is to be noted for either the hoist or lowered condition in both arrangements the centrifugal switch 16 must be in a closed position in order for the starting magnets 18 or 17 to be energized to establish the drive connections for the motor. Consequently, if after the motor has been started in one direction, the operator wishes to quickly reverse the direction of rotation of the motor, he releases the switch button then closed and presses the other button to closed position, and this, of course, cuts off the line connection to the motor rotating in its initial direction whose speed then diminishes until the centrifugal switch 16 closes, thus permitting flow of current to that coil of the starting switch which controls the desired direction of rotation of the motor. This operation is positive since the centrifugal switch 16 is designed to close only after motor speed has diminished below that at which reversal is assured. Furthermore, the closing speeds for the switch 16 and the switch 15 may be made to be the same or nearly the same, so that if an effort is made to reverse the motor quickly through the operation of the control buttons, even though it is rotating in the opposite direction from that desired, as soon as it drops to the speed to operate the switch 16, it will also be at a speed to cut in a bucking winding, to wit: the starting winding for the rotation of the motor in the direction desired, with the result that it will slow down the motor and bring about a quicker reversal than could be had if the motor had to be brought to a dead stop before the reversing current could be applied. This property also makes possible the utilization of the extra protection of a plugging limit switch such as the limit switch 39.

We desire it to be understood that this invention is not to be limited to any particular form or arrangement of parts except in so far as such limitations are included in the claims.

What we claim as our invention is:

1. In a hoist having electrical means for driving the same, the combination comprising a single phase capacitor-start reversible induction motor having two stator windings, either of which may be a starting winding and the other a running winding, one end of each of said windings being electrically joined at a common junction point, leaving an outer end on each of said windings, a condenser and circuit connections therefor joining the same to the outer ends of said stator windings, a speed responsive switch contained in said condenser circuit connections adapted to open upon said motor attaining a predetermined speed, means for electrically connecting one side of a single phase power line to the common junction point of said stator windings, electro-magnetically actuated means including a pair of magnet coils and contactors actuated thereby adapted to connect and disconnect the other side of said power line to either of said stator windings outer ends alternatively when said magnet coils are energized respectively, a control current supply for said magnet coils, a pair of manually closeable switches, one for each of said magnets each adapted to connect one side of said control current supply to one end of the magnet coil corresponding thereto, and common return circuit means for connecting the other ends of said magnet coils to the other side of said control current supply, said common return means including a second speed responsive switch associated with said motor and adapted to be

closed when the speed of said motor is below that speed at which reliable reversal may be effected and adapted to be open at motor speeds in excess thereof, said common return means also including maintaining circuit means supplementary to said second speed responsive switch rendered operative upon energization of said magnet coils for maintaining said common return circuit connection so long as either of said magnet coils is energized.

2. In a hoist having electrical means for driving the same, the combination comprising a single phase capacitor-start reversible induction motor having two stator windings, either of which may be a starting winding and the other a running winding, one end of each of said windings being electrically joined at a common junction point, leaving an outer end on each of said windings, a condenser and circuit connections therefor joining the same to the outer ends of said stator windings, a speed responsive switch contained in said condenser circuit connections adapted to open upon said motor attaining a predetermined speed, means for electrically connecting one side of a single phase power line to the common junction point of said stator windings, electro-magnetically actuated means including a pair of magnet coils and contactors actuated thereby adapted to connect and disconnect the other side of said power line to either of said stator windings outer ends alternatively when said magnet coils are energized respectively, a control current supply for said magnet coils, a pair of manually closable switches, one for each of said magnets each adapted to connect one side of said control current supply to one end of the magnet coil corresponding thereto, common return circuit means for connecting the other ends of said magnet coils to the other side of said control current supply, said common return means including a second speed responsive switch associated with said motor and adapted to be closed when the speed of said motor is below that speed at which reliable reversal may be effected and adapted to be open at motor speeds in excess thereof, said common return means also including maintaining circuit means supplementary to said second speed responsive switch rendered operative upon energization of said magnet coils for maintaining said common return circuit connection so long as either of said magnet coils is energized, and a brake releasing magnet coil one end of which is electrically joined to said common junction point of said stator windings and the other end of which is in electrical connection with the outer end of one of said stator windings, whereby said brake release coil receives power line voltage for its energization during driving of said motor in one direction and an induced voltage for its energization due to transformer action between said stator windings when said motor is being driven in the opposite direction.

3. In a hoist having electrical means for driving the same, the combination comprising a single phase capacitor-start reversible induction motor having two stator windings, either of which may be a starting winding and the other a running winding, one end of each of said windings being electrically joined at a common junction point, leaving an outer end on each of said wind-

ings, a condenser and circuit connections therefor joining the same to the outer ends of said stator windings, a speed responsive switch contained in said condenser circuit connections adapted to open upon said motor attaining a predetermined speed, means for electrically connecting one side of a single phase power line to the common junction point of said stator windings, electro-magnetically actuated means including a pair of magnet coils and contactors actuated thereby adapted to connect and disconnect the other side of said power line to either of said stator windings outer ends alternatively when said magnet coils are energized respectively, a control current supply for said magnet coils, a pair of manually closable switches, one for each of said magnets each adapted to connect one side of said control current supply to one end of the magnet coil corresponding thereto, a normally opened plugging limit switch connected in circuit with one of said magnets, and common return circuit means for connecting the other ends of said magnet coils to the other side of said control current supply, said common return means including a second speed responsive switch associated with said motor and adapted to be closed when the speed of said motor is below that speed at which reliable reversal may be effected and adapted to be open at motor speeds in excess thereof, said common return means also including maintaining circuit means supplementary to said second speed responsive switch rendered operative upon energization of said magnet coils for maintaining said common return circuit connection so long as either of said magnet coils is energized.

4. In combination with a single phase induction motor having a starting winding and a running winding, of running circuit connections connected to said running winding and adapted to supply running current thereto, starting current connections connected to said starting winding and adapted to supply starting current thereto, a centrifugally operable normally closed starting switch adapted to be driven by said motor and to open when said motor is running at a speed in excess of a predetermined speed and interposed in said starting circuit connections to interrupt the same, reversible power source connections connected to said starting and running circuit connections including an electro-magnetically actuated reversing switch adapted for admission of current to said starting and running circuit connection for alternative forward and reverse driving of said motor and having a pair of magnetic actuating control coils, control circuit connections for each of said magnetic actuating control coils including manually closable switches for admitting control current to the same selectively, and a second centrifugally operable normally closed switch adapted to be driven by said motor and to open and remain open so long as the speed of said motor exceeds a speed at which it may be reversed, said second centrifugal switch being interposed in said control circuit connections to preclude the admission of control current therethrough to said control coils whenever said second centrifugal switch is open.

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