

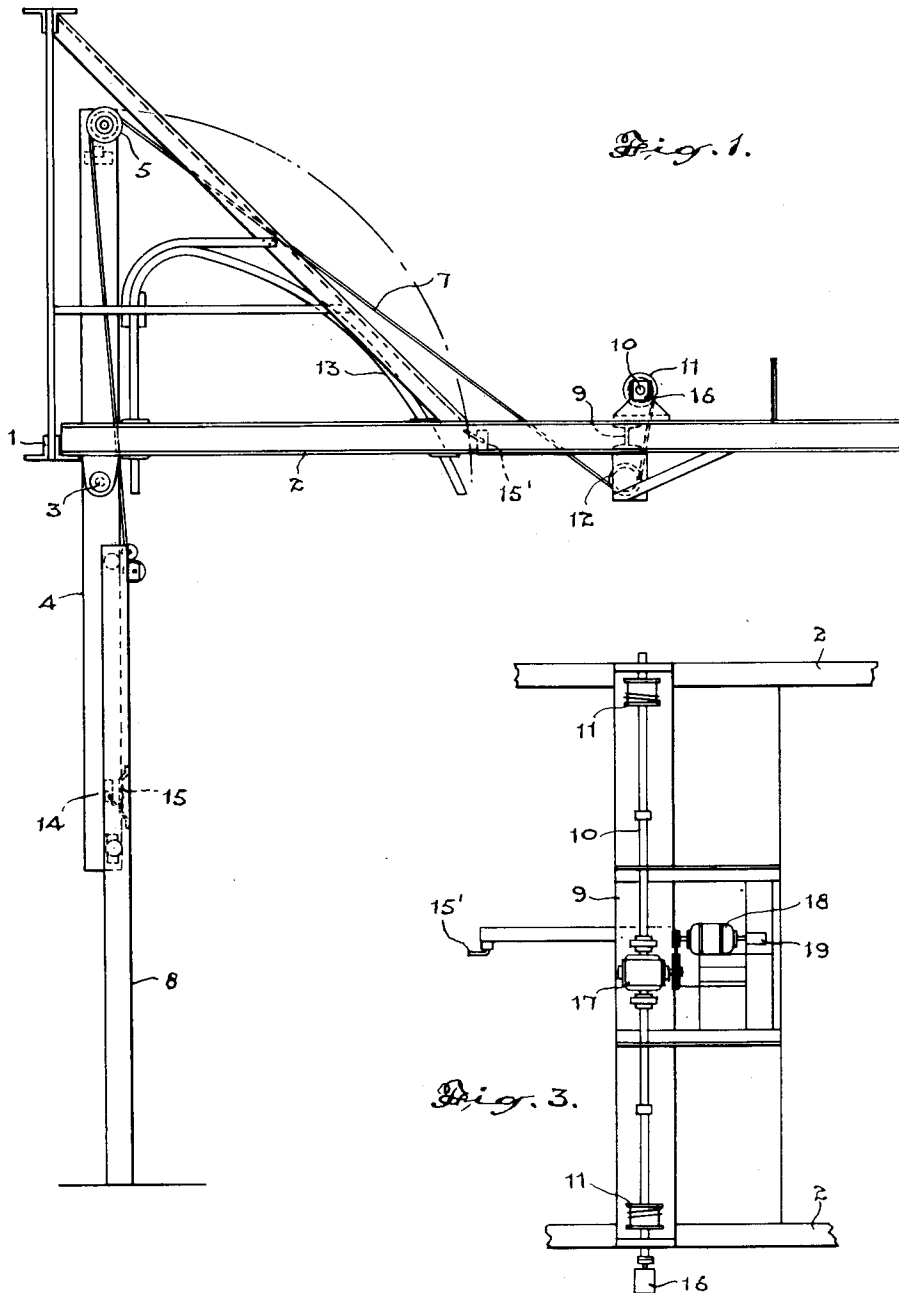
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F. D. NOBLE
ELECTRIC CONTROL FOR HANGAR
TELESCOPIC CANOPY DOORS

2,583,662

Filed July 26, 1945

3 Sheets-Sheet 1



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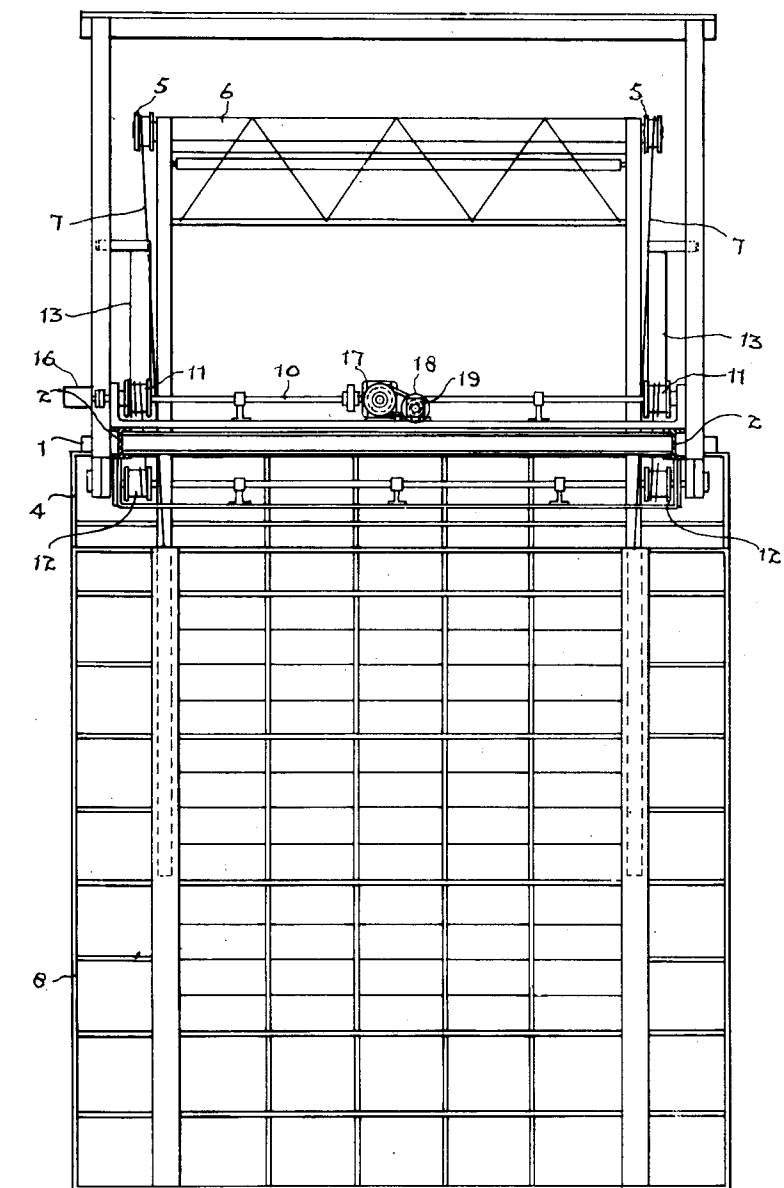


Fig. 2.

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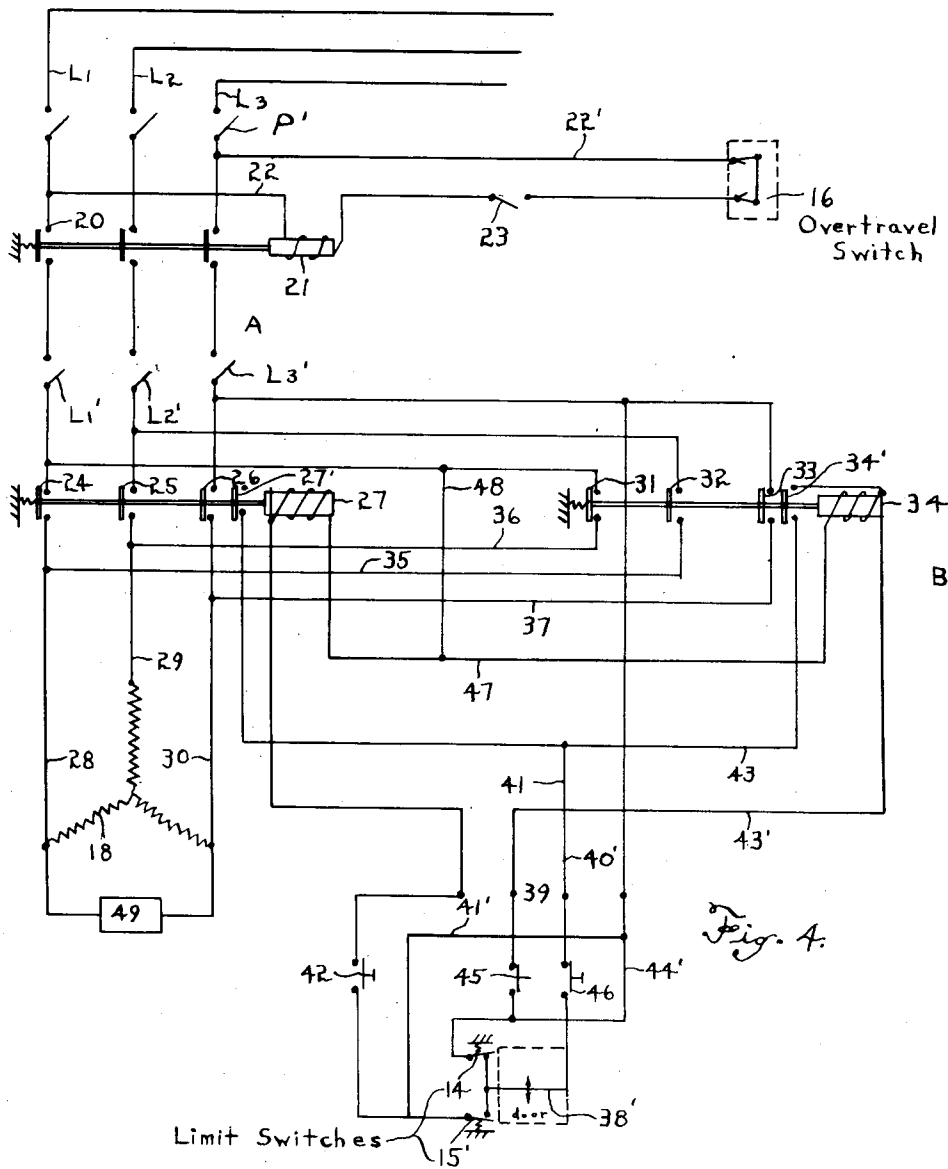
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3 Sheets-Sheet 3



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ELECTRIC CONTROL FOR HANGAR
TELESCOPIC CANOPY DOORS

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4 Claims. (Cl. 318-266)

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This invention relates to improvements in electrical control devices for the raising and lowering mechanism for telescopic hangar doors and the principal objects of the invention are to provide a control which will eliminate the possibility of damage to the doors or planes which might be under them through careless manipulation or through failure of the main operating switch to cut the motor circuit at the required period.

The principal features of the invention consist in the novel arrangement of electrical circuits and controls whereby limit switches are provided to cut the motor circuit and apply a brake when the door reaches its maximum open or closed position or in the event of the motor operating to over or underwind the cables for operating the doors if the limit switches controlled by the movement of the doors fail to operate.

A further important feature of the invention consists in the novel arrangement of circuits and manually controlled switches for starting and stopping the operating motor associated with the aforesaid limit switches.

In the accompanying drawings Figure 1 is a diagrammatic side elevational illustration of a telescopic hangar door to which my improved control equipment is applied.

Figure 2 is a diagrammatic elevational view of the door and its raising and lowering equipment as seen from the inward side.

Figure 3 is a plan view of the motor and cable winding mechanism.

Figure 4 is a wiring diagram of the control equipment.

Referring to the accompanying drawings, in the frame construction of the hangar the overhead arch beam 1 of the door opening is connected with parallel inwardly extending beams 2 from which are supported the main pivots 3 which support the swinging upper door section 4 mid-way of its height.

Cable drums 5 are suitably supported in an overhead frame structure 6 above the door beam 1, over which the cables 7 which support the lower telescopic door section 8 which is slidably mounted between the side beams of the main door section 4.

A cross frame structure 9 is mounted on the parallel beams 2 and on this is mounted on suitable journals a shaft 10 carrying the cable drums 11 to which the cables 7 are secured.

Guide drums or sheaves 12 are mounted below the frame 9 and the cables extending from the

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upper drum 5, pass under these guide drums and extend upward to the shaft drums.

Curved trackways 13 are mounted in the overhead frame to engage rollers mounted on the lower telescopic door section 8 when said section is moved to its raised position and these trackways swing the whole door structure on its pivots 3.

The building frame and door structure is of usual construction and the details of construction are not shown as they do not form a part of the present invention.

Arranged upon the main door section 4 in a suitable position is a limit switch 14 of any suitable design which is engaged by a suitable contact member 15 on the lower or slidable door section 8 so that the switch will be operated to cut the electric circuit to which it is connected as the door 7 reaches the lower limit of its travel.

A similar limit switch 15' is arranged on the cross frame 9 and is engaged by the upper part of the door when it swings on its pivots to the horizontal full open positions to cut the electric circuit.

Connected to the shaft 10 is a suitable form of over and underwind limit switch 16 such as the General Electric "geared-type limit switch CR 9441-LS424" which will cut the electric circuits to which it is connected when the shaft 10 rotates a predetermined number of revolutions either forward or backward.

The shaft 10 is operatively connected by a suitable gear 17 to the reversible motor 18 and the motor shaft is controlled by a suitable form of solenoid operated brake 49.

Referring particularly to the wiring diagram Figure 4, a magnetic contactor A provided with switch contacts 20 is connected with the power lines P through suitable main switches P' connected in lines L₁, L₂, L₃. The contact operating solenoid 21 is connected across one phase L₁, L₃ of the power source by the leads 22 and 22', and in series with this solenoid is the normally closed-over and underwind limit switch 16, and a suitable form of manual foot-operated switch 23.

Connected in series with the contactor A through line switches L₁', L₂', L₃' is a magnetically operated reversing switch B which controls the reversible motor 18. Switch B is provided with switch members 24, 25 and 26 operated by solenoid 27, and with switch members 31, 32 and 33 operated by solenoid 34. The line side of switch member 24 is connected to one side of switch 31, similarly the line side of switch member 25 is connected to one side of switch member

32, and the line side of switch member 26 is connected to one side of switch member 33. The free or motor side of switch member 24 is connected to the free or motor side of switch member 32 by the lead 35 which is connected to one terminal of the motor by the lead 28. Similarly the motor sides of switch members 25 and 31 are connected in parallel by the lead 36 and are connected to the second terminal of the motor by the lead 29. Also the motor sides of switch members 26 and 33 are connected in parallel by lead 37 and to the third terminal of the motor by lead 30.

In the event that switch members 24, 25 and 26 are closed it will be seen that the phase sequence to the motor will be, for example L_1, L_2, L_3 , whereas if switch members 31, 32 and 33 are closed the corresponding phase sequence will be L_2, L_1, L_3 and the rotation of the motor field vector will be reversed.

The solenoids 27 and 34 are connected in parallel with leads 38 and 48 connected with lines L_3 and L_1 respectively. The normal supply circuit to solenoid 27 when it is energized is from the distributor head 39, connected with lead 38, through lead 41', limit switch 15', lead 38' back to distributor lead 39, through lead 41 and contact 27'. Leads 47 and 48 complete the return circuit.

Contact 27' is held closed only by the energized solenoid 27, and therefore a separate circuit comprising push-button 42 and lead 40' connected to lead 40 through distributor head 39 is provided in parallel with limit switch 15' and contact 27' to initially energize this solenoid.

Similarly solenoid 34 is normally energized through lead 44', limit switch 14, lead 38' and 43 and contact 34' which is held closed by the energized solenoid. In parallel with the limit switch 14 and the contact 34' is the initial energizing circuit comprising push button 45, leads 43' and 44.

A suitable normally closed push button stop switch 46 is inserted in line 38'.

In the operation of this control system the foot switch 23, which is normally open, when closed energizes the circuit of the contactor A and supplies power to the reversing switch B which is the main motor control.

Upon the operation of the push button 42 the motor circuit is closed through the switch members 24, 25 and 26 to operate same to open the door and if the door operates the limit switch 15' the circuit is broken and a solenoid brake 49 operates to stop the motor.

To close the door the push button 45 is operated to energize the solenoid 34 thereby closing the motor circuit through the switch members 31, 32 and 33 thus reversing the phase sequence to cause the motor to operate to unwind the cables 7 to lower the door and if the controls are not normally operated before the door reaches its closing limit, the limit switch 14 is operated to break the circuit and cause the motor to be arrested by the solenoid brake 49.

It will also be seen that in the event of the manual controls not being operated at the proper time and if for any reason the limit switches 14 or 15' fail to function the over and under running switch 16 connected with the cable operating shaft will function to break the power circuit through the magnetic contactor A which retains its switches closed only when the circuit to its operating solenoid is closed.

The control device thus has a double automatic safety control in the arrangement of the limit switches 14 and 15' and the over and under wind-

ing switch 16 and it is also capable of manual control to be stopped by the operation of the push button 46 in the power lead 38'.

Suitable thermal overload devices are arranged in the contactor A and reversing switch B.

What I claim as my invention is:

1. Electric control means for controlling the operation of a hangar door comprising a three-phase electrical power source and a reversible electric motor connected with said power source and having an output shaft adapted to be operatively connected with the door to open the door when energized to rotate in one direction and to close the door when energized to rotate in the reverse direction, a magnetically operated multiple contact reversing switch including a magnetic control circuit in series with said motor source for reversing the phase to said motor, limit switches arranged in the magnetic circuit of said reversing switch to open contacts of said switch as the door approaches its operable limits to de-energize said motor, and a geared-type limit switch connected with the shaft of said motor and electrically connected in said power supply circuit connected with said reversing switch to interrupt current flow to said reversing switch and magnetic control circuit to stop said motor upon a predetermined number of revolutions of the motor shaft in either direction in the event of failure of the aforesaid limit switches or the contacts of said reversing switch to open upon the door reaching the limits of its movement.

2. Electric control means for controlling the operation of a hangar door comprising a three-phase reversible motor operatively connected with the door to open the door when energized to rotate in one direction and to close the door when energized to rotate in the reverse direction, a three-phase supply circuit for said motor, a multiple contact phase-reversing switch connected in the supply circuit of said motor, solenoids connected in said supply circuit to operate the contacts of said reversing switch to control the direction of rotation of said motor, manually operable switch means for controlling said solenoids, limit switches connected in series with said solenoids and arranged to be opened by said door reaching the limits of its movement to release the contacts of said reversing switch to de-energize said motor, and an over and underwind limit master control switch geared to said motor and connected to open said supply circuit to said phase-reversing switch to de-energize said motor and solenoids independent of the position of said phase-reversing switch contacts upon rotation of said motor beyond a predetermined number of revolutions in either direction in event the aforesaid limit switches or the contacts of said reversing switch fail to open upon the door reaching the limits of its movement in either direction.

3. A control as claimed in claim 2 in which a magnetically operated switch is included in said supply circuit on the supply side of said reversing switch, and a solenoid is arranged to operate said magnetically operated switch, said over and underwind limit switch being connected to operate said last-mentioned solenoid.

4. Electric control means for controlling the operation of a hangar door comprising a three-phase power source and a three-phase reversible electric motor having an output shaft adapted to be operatively connected with the door to open the door when energized to rotate in one direction and to close the door when energized to

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rotate in the reverse direction, a normally closed magnetic switch connected between said source and said motor, a multiple contact reversing switch connected in series with said magnetic switch and said motor, a pair of solenoids energized from said power source one to close contacts on said reversing switch to give a phase sequence connected to said motor to rotate said motor in one direction, the other to close contacts on said reversing switch to give a phase sequence connected to said motor to rotate said motor in the reverse direction, manual switch means connected in series with said solenoids to operate the contacts of said reversible switch, limit switches connected in series with said solenoids one to open the contacts of said reversing switch as said door approaches the limits of its opening movement the other to open the contacts of said reversing switch as said door approaches the limits of its closing movement, and a gear type limit master control switch connected with the shaft of said motor to open said normally closed magnetic switch to interrupt power to said phase-reversing switch and said pair of solenoids to de-energize said motor upon a predetermined num-

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ber of revolutions of the motor shaft in either direction in event of failure of the aforesaid limit switches or the contacts of said reversing switch to open upon the door reaching the limits of its opening or closing movement.

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