

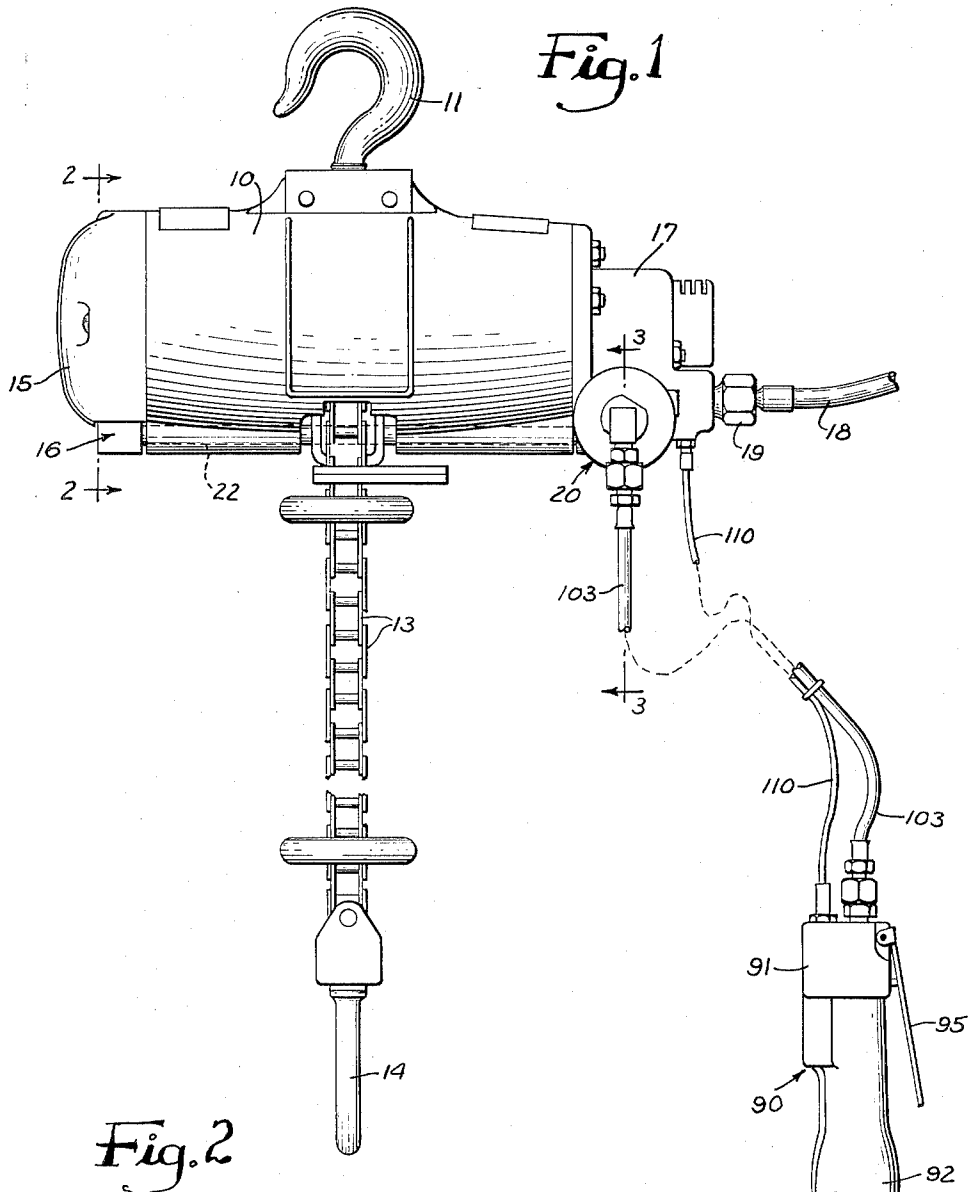
May 1, 1956

J. C. LUNGERHAUSEN
CONTROL FOR PNEUMATIC HOIST

2,743,708

Filed Oct. 5, 1951

2 Sheets-Sheet 1



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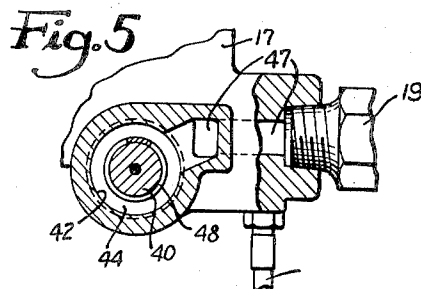
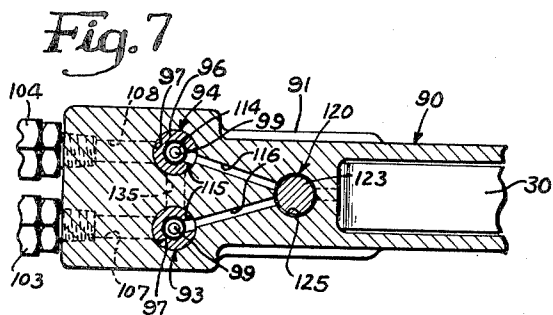
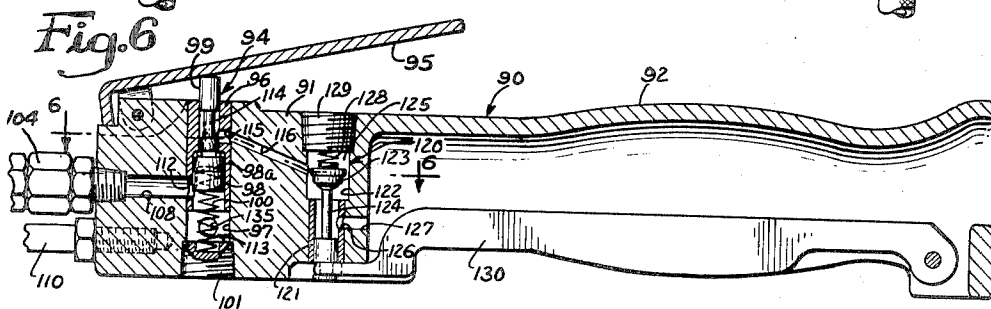
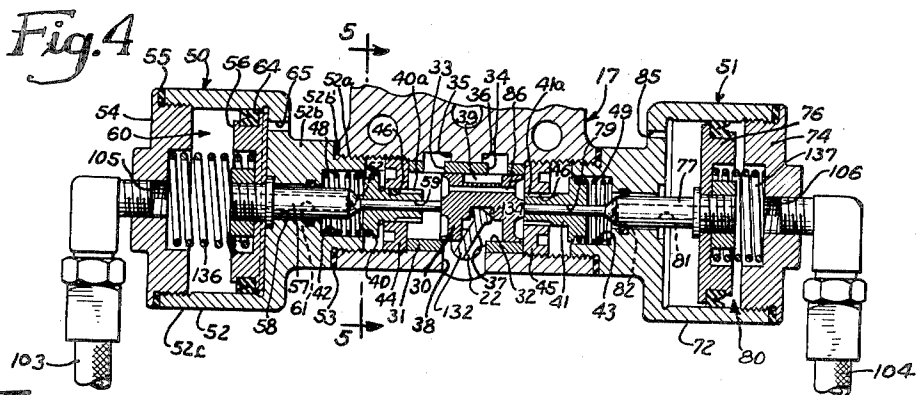
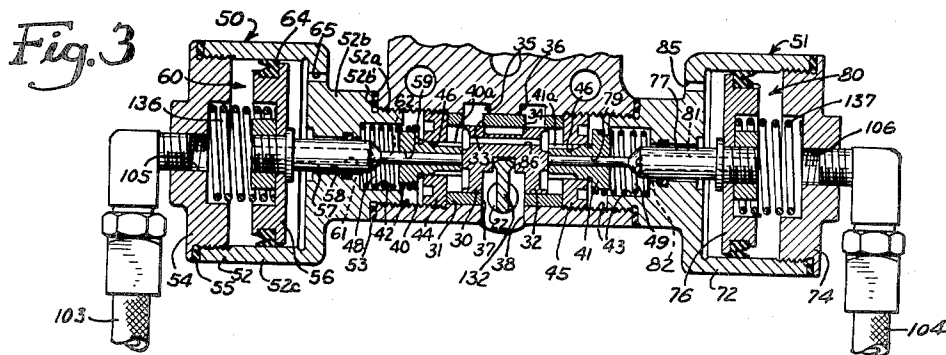
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CONTROL FOR PNEUMATIC HOIST

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2 Sheets-Sheet 2



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2,743,708

CONTROL FOR PNEUMATIC HOIST

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Application October 5, 1951, Serial No. 249,849

5 Claims. (Cl. 121—46.5)

The present invention relates generally to hoists of the type adapted for actuation by a fluid pressure operated motor and more particularly to a new and improved control mechanism for governing the operation of the hoist.

It is a general object of the invention to provide a control mechanism for a pneumatic hoist which is of simple construction, positive in operation, capable of governing effectually both the direction and speed of operation thereof, and permits of economical manufacture.

Another object is to provide in a hoist a control mechanism including independently operable reversing and throttle valves and a brake mechanism with the throttle valve and brake mechanism arranged for operation by the reversing valve so as to insure proper control of the hoist motor both as to direction and as to speed.

A more specific object is to provide a control mechanism for a hoist embodying a combined reversing and throttle valve mechanism in combination with a pressure fluid responsive control device therefor effective to actuate the reversing valve and through the medium of the latter to operate the throttle valve and the hoist brake mechanism.

The objects of the invention thus generally set forth together with other objects and ancillary advantages are shown by way of illustration in the accompanying drawings, in which:

Figure 1 is a side elevational view of a hoist embodying the features of the present invention.

Fig. 2 is a transverse sectional view taken substantially in the plane of line 2—2 in Fig. 1 and illustrating the brake mechanism for the instant hoist.

Figs. 3 and 4 are fragmentary transverse sectional views taken approximately in the plane of line 3—3 in Fig. 1 but on a somewhat enlarged scale and illustrating the improved reversing and throttle valve mechanism.

Fig. 5 is a fragmentary sectional view taken substantially in the plane of line 5—5 in Fig. 4.

Fig. 6 is a vertical sectional view of the pendant control for the reversing and throttle valve mechanism illustrated in Figs. 3 and 4, and

Fig. 7 is a fragmentary transverse section taken in offset planes as indicated by the line 6—6 in Fig. 5.

While the invention is susceptible of various modifications and alternative constructions, there is shown in the drawings and will herein be described in detail the preferred embodiment, but it is to be understood that it is not thereby intended to limit the invention to the form disclosed, but it is intended to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

Referring more particularly to the drawings, there shown for purposes of illustration is a hoist comprising an elongated generally cylindrical housing 10 equipped with a central suspension hook 11 and enclosing a pressure fluid operated motor for actuating a sprocket chain 13 which in turn is equipped with a load supporting hook 14. Enclosed within an end cap 15 at the left hand end of the housing is a brake mechanism, generally desig-

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nated 16, which is adapted to apply a braking force to the motor shaft when the motor is idle.

The motor, which has not been shown in detail, is preferably of the piston and cylinder type and is reversible.

Pressure fluid is supplied thereto under the control of a distributing valve mechanism (not shown) housed within an end cap 17 secured, as shown, to the right hand end of the hoist housing 10. The distributing valve is of conventional construction its function being to cause air to be delivered successively to and from the cylinders of the air motor. A more detailed description of the distributing valve may be had by reference to Patent No. 2,445,585, issued July 20, 1948, to Ernest H. Shaff. Pressure fluid is supplied to the distributing valve from any suitable source (not shown) by way of a hose 18, a fitting 19 rigid with the end cap 17 and a combined reversing and throttle valve mechanism generally designated 20.

A control shaft 22 extends lengthwise of the housing 10 along the lower side thereof. One end of the shaft, herein the left end, is operatively associated with the brake mechanism 16 and the other end of the shaft is operatively associated with the combined throttle and reversing valve mechanism 20 governing the direction of rotation of the hoist motor as well as the speed thereof.

The brake mechanism 16 per se forms no part of the present invention, it being disclosed and claimed in Pat. No. 2,445,585 issued July 20, 1948, to Ernest H. Shaff. Suffice it to say for present purposes, the brake mechanism 16 comprises a sectional drum 23 mounted to rotate with the motor shaft 24 and opposed brake members 25 pressed by means of a leaf spring 26 into engagement with the drum. A cam block 27 fast on the control shaft 22 coacts with depending portions 28 of the brake members 25 so that oscillation of the control shaft from a normal rest position in either direction will release the brake members against the action of the spring 26.

The flow of pressure fluid to and from the distributing valve mechanism housed within the end cap 17, as previously noted, is under the control of the combined reversing and throttle valve mechanism 20. The mechanism includes a reversing valve and a pair of separate throttle valves arranged for actuation selectively in the movement of the reversing valve. As shown (Figs. 3 and 4), the reversing valve comprises an axially reciprocable valve member or spool 30 slidable within a sleeve 31 defining a cylindrical valve chamber 32. The sleeve 31 is provided with axially spaced ports 33 and 34 which communicate with passages 35 and 36, respectively, formed in the motor end cap 17 which are connected to the cylinders of the air motor for supplying live pressure fluid to and exhausting spent fluid from the motor. Additionally the sleeve 31 has an exhaust port 37 registering with a slot 38 formed in the bottom of the end cap 17 and communicating with the atmosphere. The valve member 30 has an annular groove 39 formed intermediate its ends to provide communication alternatively between the motor end cap passages 35 and 36, the valve sleeve ports 33 and 34, and the exhaust port 37 in the valve sleeve 31.

Throttle valves 40 and 41 are positioned at opposite ends of the reversing valve member 30 and are arranged to be alternatively opened thereby when the valve member is shifted in opposite directions. The valve members 40 and 41 constitute in effect tapered poppet valves for controlling the supply of pressure fluid to the central valve chamber 32 defined by the sleeve 31 from either of two supply chambers 42 and 43. The two supply chambers 42 and 43 are separated from the central valve chamber 32 by means of disks 44 and 45 which are centrally apertured at 46 to receive the throttle valves 40 and 41 and serve as seats therefor. Referring particularly to Fig. 5, it will be seen that the supply chambers 42 and

43 are maintained in constant communication with the source of pressure fluid by way of a generally T-shaped passage 47 formed in the end cap 17 and to the outer end of which the fitting 19 and supply hose 18 are connected.

The throttle valves 40 and 41 are axially slidable in the apertures 46 of the disks 44 and 45, respectively, and are normally held seated against the disks by coiled compression springs 48 and 49. The inner end portion of each of the valve members 40 and 41 is cut away to form axially tapered, radial grooves 40a and 41a, respectively. When an opening movement is imparted to one of the throttle valve members, communication is gradually established between the central valve chamber 32 and the corresponding one of the supply chambers 42 and 43.

In carrying out the invention, pressure fluid responsive means is provided for operating the combined reversing and throttle valve mechanism 20 so as to control not only the direction of operation of the hoist but also the speed of operation thereof and the operation of the brake mechanism 16. More particularly, a pair of pressure fluid responsive actuators with control means therefor are provided which are utilized together to maintain the reversing valve 30 in neutral position and are employed alternatively to shift the reversing valve into its two extreme positions so as to control the direction of operation of the hoist and the operation of the brake mechanism 16. Additionally, means operable in conjunction with the actuators is provided to return the reversing valve member 30 to its neutral position after it has been shifted into either of its extreme positions so as to interrupt operation of the hoist and permit operation of the brake mechanism 16.

In the illustrative embodiment of the invention the pressure fluid responsive actuators, generally designated at 50 and 51, each includes a pneumatic cylinder with a piston therein operatively associated with the reversing valve member 30, which together define a pressure fluid chamber having continuous but restricted communication with the pressure fluid supply to the hoist. Control valve means is provided for alternatively exhausting the chambers of the actuators to render one actuator ineffective and to permit the other actuator to positively shift the valve member 30.

As shown, the actuator 50 includes a body portion 52 of stepped cylindrical form which is disposed in coaxial and laterally offset relation with respect to the valve member 30. The actuator body 52 includes an inner end portion 52a which is externally threaded for reception in the outer end of the chamber 42 formed in the hoist end cap 17. The intermediate portion 52b of the actuator body 52 is of slightly larger diameter than the end portion 52a and defines a shoulder 52b' for clamping a gasket 53 against the end cap 17. The outer end portion 52c of the actuator body 52 is of still larger diameter than the intermediate and inner end portions of the actuator body and is of generally annular form having its outer end closed by an end plug 54 and a gasket 55 interposed between the end plug and the outer end of the body portion 52c. The intermediate portion 52b of the actuator body 52, of course, serves to close the forward end of the body portion 52c.

Received within the body portion 52c is a piston 56. The piston 56 is equipped with a stepped rod 57 which is reciprocable in a passage 58 formed coaxially in the central body section 52b. The forward end of the piston rod 57 is adapted to directly engage the end of the reversing valve member 30. For this purpose the piston rod 57 has a reduced inner end portion which extends through and is slidable in a coaxial passage 59 in the throttle valve 40. The inner end of the piston rod bears directly against the left-hand end of the reversing valve member 30. While the rod 57 has been shown as being of one-piece construction, if desired, to alleviate struc-

tural alinement difficulties, its inner end portion can be formed as a separate element.

The body portion 52c and its closure plug 54 together with the piston 56 define a chamber 60 which, as noted above, is in continuous though restricted communication with the pressure fluid supply to the hoist. For this latter purpose, the piston rod 57 is cored to provide a passage 61 therethrough opening at its outer end into the chamber 60 and communicating at its forward end with the pressure fluid supply chamber 42 by way of a small diameter port 62. The piston 56 is equipped with a sealing ring 64 of V-shaped cross section to prevent leakage of pressure fluid from the chamber 60. The interior of the chamber body portion 52c inwardly of the piston 56 is vented to the atmosphere by way of a port 65.

The actuator 51 is identical in form and size with the actuator 50. It includes a body 72 which is closed at its outer end by a plug 74. A piston 76 is reciprocable within the body 72 and is equipped with a rod 77 the inner end of which is engageable with the end of the reversing valve member 30 in opposed relation to the piston rod 57 of the actuator 50. Thus the piston rod 77 is axially slidable in a passage 79 in the throttle valve 41. The body 72, its closure plug 74, together with piston 76 define a pressure fluid chamber 80 which is in continuous but restricted communication with the pressure fluid supplied to the hoist by way of a cored passage 81 and a port 82 in the piston rod 77 opening into the pressure fluid supply chamber 43. As with the actuator 50, the inner end portion of the body 72 is vented to the atmosphere by way of a port 85.

From the foregoing it will be seen that pressure fluid supplied to the hoist from the hose 18 and fitting 19 finds its way by way of the T-shaped passage 47 into the supply chambers 42 and 43. From the supply chambers 42 and 43 pressure fluid is continuously supplied to the actuator chambers 60 and 80 by way of the piston rod passages 62, 61 and 82, 81, respectively. As thus far described, therefore, since the pistons 56 and 76 are of identical areas and the same fluid pressure in the chambers 60 and 80 is exerted on both of them, they exert by way of their rods 57 and 77 equal and opposite forces on the ends of the reversing valve member 30. The reversing valve member 30 is therefore maintained in a neutral position as shown in Fig. 3.

In order to shift the valve into one position or the other, control means is provided so as to quickly exhaust one or the other of the actuator chambers 60 and 80. When one of the actuator chambers is exhausted, that actuator becomes ineffective and permits pressure fluid operating on the piston of the other actuator to shift the reversing valve member 30. It will be apparent, of course, that upon shifting the valve member 30 in one direction or the other the corresponding one of the throttle valves 40 or 41 is positively moved from its seat on its disk 44 or 45 so as to admit pressure fluid from its supply chamber into the reversing valve chamber 32. From the chamber 32 pressure fluid is supplied through a longitudinal passage 86 in the valve member 30 to one or the other of the ports 33 or 34 in the valve sleeve 31 and thence by way of either the passage 35 or the passage 36 to the air motor of the hoist.

For the purpose of relieving fluid pressure in the chambers 60 and 80, exhaust valve means is provided. Preferably, since hoists are normally mounted in an elevated position, the exhaust valves are incorporated in a pendant control. Such a control is generally indicated 90 in the accompanying drawings. It includes a body portion 91 terminating at its outer end in a hollow handle portion 92. A pair of exhaust valves 93 and 94, one for each of the chambers 60 and 80, are disposed adjacent the inner end of the pendant control in side-by-side relation, and the control is equipped with a pair of pivoted levers 95 disposed for convenient manipulation by the hoist opera-

tor's thumb. Each of the valves includes a sleeve 96 which is received in a transverse passage 97 in the body 91 of the control 90, and a head portion 98 axially slidable within the sleeve. The valve head 98 terminates in an outwardly projecting stem 99 and is spring biased outwardly by a suitable coil spring 100 interposed between the inner end of the valve head 98 and a plug 101, the latter serving to close the bottom of the valve passage 97.

Connection is made between the respective ones of the exhaust valves 93 and 94 and the pressure fluid chambers 60 and 80 of the actuators 50 and 51 by way of hoses 103 and 104. The hoses at their upper ends are equipped with fittings which are received in passages 105 and 106 formed in the end plugs 54 and 74 of the actuators 50 and 51, respectively. At their lower ends the hoses are equipped with suitable fittings for reception in the ends of longitudinal passages 107 and 108 formed in parallel, side-by-side relation in the inner end of the pendant control 90. To support the pendant control 90 and relieve strain on the hoses 103 and 104, a cable 110 is provided, the ends of which are suitably secured to the hoist end cap 17 and the pendant control 90, respectively.

Adjacent their lower ends the valve sleeves 96 are provided with ports 112 which register with the inner ends of the passages 107 and 108 in the pendant control so as to admit pressure fluid from the chambers 60 and 80, respectively, into chambers 113 defined by the valve sleeves 96, the lower ends of the transverse passages 97 in the pendant control, and their closure plugs 101.

Intermediate their ends the valve stems 99 are relieved to define with the sleeves 96 annular exhaust chambers 114 which communicate with the atmosphere by way of ports 115 adjacent the upper ends of the sleeves. The ports 115 register with exhaust passages 116 formed in the pendant control 90. It will be seen that upon depressing one of the valve operating levers 95, the corresponding valve stem 99 and head 98 are depressed so as to establish an exhaust path between its port 112 and its exhaust chamber 114 about its valve head. At the same time communication between the port 112 and the valve chamber 113 is interrupted.

In order to provide speed control for the hoist motor, the control device 90 is fashioned to vary the rate at which fluid pressure is relieved in the chambers 60 and 80. Upon reference to Fig. 6, it will be noted that the heads of the exhaust valves 93 and 94 are tapered as at 98a. Thus while full depression of the operating levers 95 completely opens the valves 93 and 94 so that fluid pressure is quickly exhausted from the actuator chambers 60 and 80, partial depression of the levers 95 reduces the rate of fluid pressure relief in view of the continuous, though restricted, supply of pressure fluid to the chambers 60 and 80 by way of the ports 62 and 82. As a result, there is but a partial shifting of the reversing valve member 30 with a corresponding partial opening of the throttle valves 40 and 41 so that the pressure fluid supply to the hoist motor is at a reduced rate by virtue of the restrictive action of the tapered grooves 40a and 41a in the throttle valves.

Because of the pendant character of the control 90, the levers 95 for operating the exhaust valves are likely to be accidentally depressed. This obviously could result in accidental operation of the hoist which might prove to be dangerous, particularly if a load were supported thereon. For purposes of safety, therefore, the pendant control 90 has safety means incorporated therein. As shown, this means comprises a valve 120 interposed between the exhaust valves 93 and 94 and the atmosphere which must be positively operated simultaneously with one or the other of the exhaust valves before communication between such valves and the atmosphere can be established. As shown, the safety valve is of the conventional poppet type including a sleeve 121 fitted within a trans-

verse passage 122 in the pendant control body 91 and a valve head 123 which is adapted to seat against the inner end of the sleeve 121 and is equipped with a stem 124 axially reciprocable within the sleeve. The sleeve 121 and the transverse passage 122 in the body portion 91 of the pendant control define a chamber 125 into which both of the exhaust passages 116 from the exhaust valves 93 and 94 open. The sleeve is ported at 126 for registry with a longitudinal passage 127 which opens directly to the atmosphere through the handle portion 92 of the pendant control 90.

The valve head 123 is normally biased into seating engagement with the inner end of the sleeve 121 by means of an expansion type spring 128 interposed between it and an end plug 129 which closes one end of the safety valve passage 122 in the pendant control body portion 91. The valve is adapted to be opened by means of a pivoted lever 130 extending longitudinally within the hollow handle portion 92 of the pendant control and disposed on the opposite side of the pendant control from the exhaust valve operating levers 95. The lever 130 is arranged for actuation by the fingers of the hoist operator grasping the handle portion 92 of the control 90. It will be seen therefore that even if one or the other or both of the exhaust valve levers 95 are accidentally depressed so as to open the exhaust valves, no resulting actuator operation obtains so as to produce a shifting of the reversing valve member 30 of the hoist control device 20 unless and until the safety valve lever 130 is also depressed so as to open the safety valve 120 and complete the exhaust path.

From the foregoing, the operation of the instant hoist control as thus far described will be apparent. However, it may be summarized as follows: With air supplied to the hoist and thus to the supply chambers 42 and 43 and therefrom to the actuator chambers 60 and 80 and with both of the exhaust valves in the pendant control 90 closed, the same fluid pressure is exerted on both of the actuator pistons 56 and 76. Thus the reversing valve 30 is maintained in its central, neutral position, and both throttle valves 40 and 41 are closed. When it is desired to operate the hoist in either a raising or lowering direction, the hoist operator grasps the pendant control 90 so as to squeeze the safety valve operating lever 130 inwardly to open the safety valve 120 and to depress one of the exhaust valve operating levers 95. Assuming the operator depresses the operating lever for the valve 94 to open the same, then the chamber 80 of the actuator 51 is vented to the atmosphere by way of the hose 104 and its fittings. Even though pressure fluid from the supply chamber 43 continues to be supplied to the chamber 80 by way of the port 82 and the passage 81 in the piston rod stem 77, such pressure fluid can exert no force on the piston 76 as long as the exhaust valve 94 and the safety valve 120 are open. As a result, the actuator 51 is rendered ineffective. Thus the actuator 50 becomes effective by the action of pressure fluid in the chamber 60 on the piston 56 and acting through the piston rod 57 to shift the reversing valve 30 to the right as shown in Fig. 4. Upon so doing, the throttle valve 41 is moved by the valve 30 from its seat so that communication is established between the supply chamber 43 and the supply passage 35 in the motor end cap 17 by way of the central reversing valve chamber 32, passage 36, and through the reversing valve sleeve port 33. Simultaneously, an exhaust path for spent pressure fluid from the air motor of the hoist and the passage 36 in the motor end cap 17 is established to the atmosphere by way of the reversing valve sleeve port 34, the annular channel 39 in the reversing valve, the sleeve slot 37, and the slot 38 in the motor end cap 17.

In order for the brake mechanism to be released at the same time that pressure fluid is supplied to operate the hoist motor, the reversing valve member 30 is also utilized to rotate the rockshaft 22 and its cam block 27 so as to spread apart the depending portions 28 of the brake members 25 to release the latter from engage-

ment with the brake drum 23 which is carried by the hoist motor shaft 24. For this purpose, a crank arm 132 is fixed to the opposite end of the rockshaft 22 and extends upwardly through the end cap slot 38 and the reversing valve sleeve slot 37 for engagement with the reversing valve member 30. For this latter purpose, the reversing valve member 30 is relieved centrally thereof so as to provide a groove 134 for the reception of a ball-like head formed on the outer end of the crank arm 132. It will be apparent from Figs. 3 and 4 that axial movement of the reversing valve member 30 in response to operation of the actuators 50 or 51 produces a corresponding movement of the upper end of the crank arm 132 which results in a corresponding partial rotation or oscillation of the rockshaft 22 and consequently of the cam block 27 on the outer end thereof to release the brake 16.

As previously noted, means operable in conjunction with the actuators 50 and 51 is provided to return the reversing valve member 30 to its neutral position after it has been shifted into either of its extreme positions so as to interrupt operation of the hoist and permit operation of the brake mechanism 16 so as to hold the hoist and any load supported thereby in a particular position. It will be appreciated that upon closing the exhaust valve 94 that fluid pressure again builds up in the chamber 80 of the actuator 51. However, because of the restricted character of the communication afforded between the chamber 80 and the supply chamber 43 afforded by the piston rod passage 31 and port 82, appreciable time will be required for fluid pressure in the chamber 80 to build up to equal that in the chamber 60 of the actuator 50. To avoid this time lag, communication between the two chambers 60 and 80 is provided when both of the exhaust valves 93 and 94 are closed so that fluid pressure in the two chambers can be quickly equalized. In the present instance this is accomplished by interconnecting the lower chambers 113 of the exhaust valves with a lateral passage 135 in the pendant control body portion 91.

It will be further appreciated, however, that even though fluid pressure is quickly equalized in both chambers such equal fluid pressures acting on the pistons 56 and 76, which are of equal areas, merely act in opposition and therefore assert no force to restore the reversing valve 30 to its neutral or central position. Thus means operable in conjunction with the actuators 50 and 51 is provided to insure restoration of the reversing valve member 30 to neutral position and simultaneously to permit operation of the hoist brake mechanism 16. In the present instance this means includes a pair of identical expansion type springs 136 and 137 interposed between the pistons 56 and 76 and the end plugs 54 and 74, respectively, of the actuators 50 and 51 and the spring 26 of the brake mechanism 16. Additionally the spring 26 of the brake mechanism 16 tends to press the brake members together and the depending portions 23 thereof being pressed against the cam block 27 urges the latter toward an upright position. Since the cam block is rigid with the shaft 22, the latter is similarly rotated and the valve member 30 is moved as a result of the action of the brake spring 26 and the return spring 137, toward its neutral position.

It will be seen upon reference to Fig. 4 that when the exhaust valve 94 and the safety valve 120 are operated to exhaust the chamber 80 of the actuator 51 and thus render the actuator 50 effective to shift the reversing valve 30 to the right, the spring 137 interposed between the piston 76 and the end plug 74 of the actuator 51 is compressed by the action of the reversing valve member 30 on the inner end of the piston rod 77. Similarly, the spring 136 interposed between the piston 56 and the plug 54 is permitted to expand as fluid pressure in the chamber 60 moves the piston 56 to the right. When the valves 120 and 94 are closed and upon equaliza-

tion of fluid pressure in the chambers 60 and 80, the spring 137 is then effective to move the piston 76 to the left. This movement continues, the spring 136 being compressed until the two springs exert equal and opposite forces. The springs 136 and 137, being of like character, exert equal forces on the pistons 56 and 76 when the valve member 30 and the pistons 56 and 76 of the actuators 50 and 51 are centered in their neutral positions.

It will be apparent from the foregoing that a control mechanism for a pneumatic hoist made in accordance with the present invention is positive in operation and is capable of governing effectually both the direction and speed of operation of the hoist. The relatively simple character and construction of the device permits it not only to be easily manipulated but also to be economically manufactured.

I claim as my invention:

1. In a hoist having a reversible pressure fluid operated motor and a reversing valve therefor, a control mechanism for the valve comprising, in combination, a pair of pressure fluid responsive actuators each including a cylinder having communication with a source of pressure fluid, and a piston in said cylinder adapted for engagement with the reversing valve, said actuators being disposed in opposed relation with respect to the reversing valve and operative together to hold the reversing valve in neutral position, and a pendant control device for said actuators including an exhaust valve for each of said actuator cylinders alternatively operable to render one of said actuators ineffective to permit the other actuator to shift the reversing valve, and further including a safety valve interposed between said exhaust valves and the atmosphere to prevent operation of the mechanism until said safety valve and one of said exhaust valves are opened.

2. For use with a hoist having a reversible pressure fluid operated motor and reversing valve therefor including a member shiftable between a neutral position and two extreme positions to control the direction of operation of said motor, a control mechanism for the valve comprising, in combination, a pair of pressure fluid responsive actuators and control means for said actuators, each of said actuators including a cylinder having a continuous but restricted communication with a source of pressure fluid, and including a piston in said cylinder and a rod movable with said piston for engagement with the reversing valve member, said actuators being disposed in opposed relation with respect to the reversing valve member and operative together to hold the reversing valve member in neutral position, said control means including an exhaust valve for each of said actuator cylinders alternatively operable to render the corresponding one of said actuators ineffective to permit the other actuator to shift the reversing valve member, means defining a passage substantially free of restriction for interconnecting said cylinders when said exhaust valves are closed to equalize the fluid pressure therein, and means including a spring interposed between the piston and cylinder of each of said actuators for restoring said actuators and the reversing valve to neutral position when said exhaust valves are closed.

3. For use with a hoist having a reversible pressure fluid operated motor and reversing valve therefor including a valving element shiftable between a neutral position and two extreme positions for controlling the direction of operation of the motor, a control mechanism for the valve comprising, in combination, a pair of pressure fluid responsive actuators and a pendant control for said actuators, each of said actuators including a cylinder having continuous but restricted communication with a source of pressure fluid, and including a piston in said cylinder and a rod interposed between said piston and the reversing valve element, said actuators being disposed in opposed relation with respect to the reversing valve element and operative together to hold the reversing valve element in

neutral position, said pendant control including a body, an exhaust valve for each of said actuator cylinders carried by said body, and including hoses respectively connecting said valves to the said actuator cylinders, said exhaust valves being alternatively operable to render the corresponding one of said actuators ineffective to permit the other actuator to shift the reversing valve element, said body having a passage therein interconnecting said cylinders by way of said hoses when said exhaust valves are closed, and means including a spring interposed between the piston and cylinder of each of said actuators for restoring said actuators and the reversing valve element to neutral position when said exhaust valves are closed.

4. For use with a hoist having a reversible pressure fluid operated motor and a reversing valve therefor including a valving element shiftable between a neutral position and two extreme positions to control the direction of operation of the motor; a control mechanism for the valve comprising, in combination, a pair of pressure fluid responsive actuators and a pendant control for said actuators, each of said actuators including the cylinder having continuous but restricted communication with a source of pressure fluid, and including a piston in said cylinder and a rod movable by said piston and adapted for engagement with the reversing valve element, said actuators being adapted to be disposed in opposed relation with respect to the reversing valve element and operative together to hold the reversing valve element in neutral position, said pendant control including a body, an exhaust valve carried by said body for each of said actuator cylinders, and including hoses respectively connecting said exhaust valves to said actuator cylinders, said exhaust valves being alternatively operable to render the corresponding one of said actuators ineffective to permit the other actuator to shift the reversing valve element, said body having a passage therein interconnecting said cylinders by way of said hoses when both of said exhaust valves are closed, and a safety valve interposed between said exhaust valves and the atmosphere to prevent operation of said control mechanism until said safety valve and one of said exhaust valves are opened.

5. For use with a hoist having a pressure fluid oper-

ated reversible motor and a reversing valve therefor including a valve element shiftable between a neutral position and two extreme positions for controlling the direction of operation of the motor, a control mechanism for the valve comprising, in combination, a pair of pressure fluid responsive actuators and a pendant control for said actuators, each of said actuators including a cylinder having continuous but restricted communication with a source of pressure fluid and including a piston in said cylinder, means operatively connecting said piston and the reversing valve element, said actuators being disposed in opposed relation with respect to each other and operable together to hold the reversing valve element in neutral position, said pendant control including a body, an exhaust valve for each of said actuator cylinders carried by said body, said exhaust valves being alternatively operable to render the corresponding one of said actuators ineffective whereby the other actuator is effective to shift the reversing valve element, means interposed between the piston and the cylinder of each of said actuators for restoring said actuators and the reversing valve element to neutral position when said exhaust valves are closed, said restoring means including a passage for interconnecting said cylinders when said exhaust valves are closed to equalize the fluid pressure therein, said pendant control further including a safety valve interposed between said exhaust valves and the atmosphere to prevent operation of the mechanism until said safety valve and one of said exhaust valves are opened.

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