May 1, 1962 R. E. SMITH 3,032,016

HOIST WITH PENDANT CONTROL

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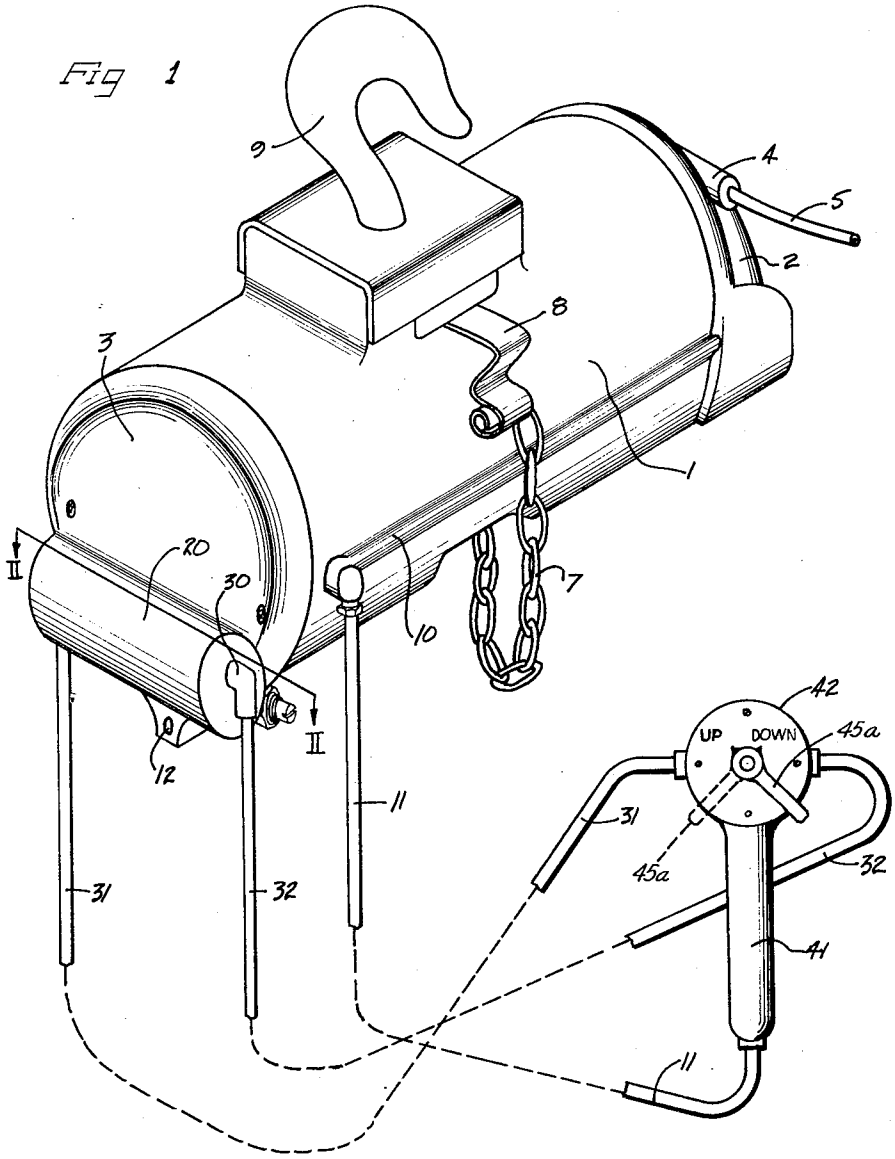
Fig 1



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HOIST WITH PENDANT CONTROL

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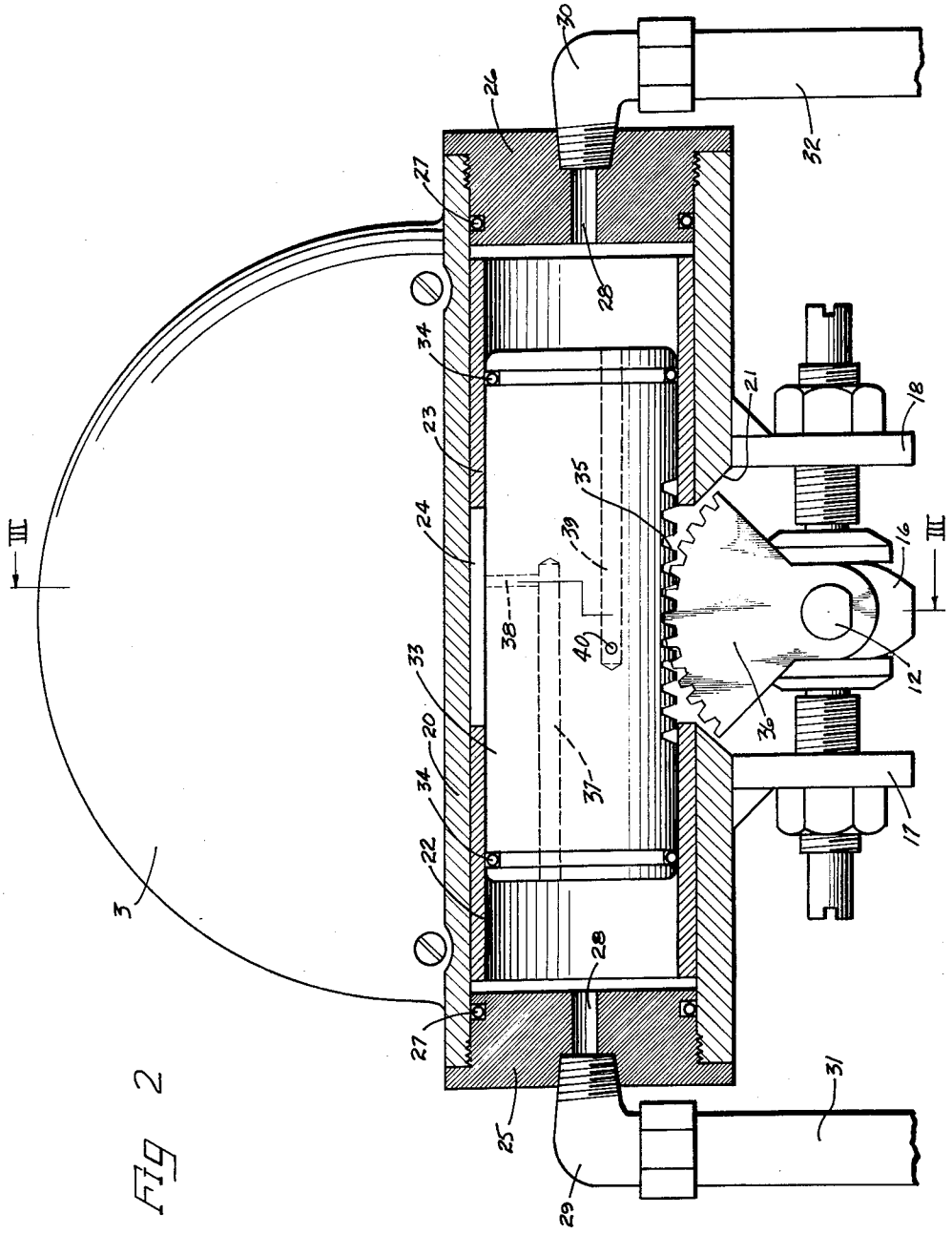

Fig 2

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HOIST WITH PENDANT CONTROL

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Fig 3

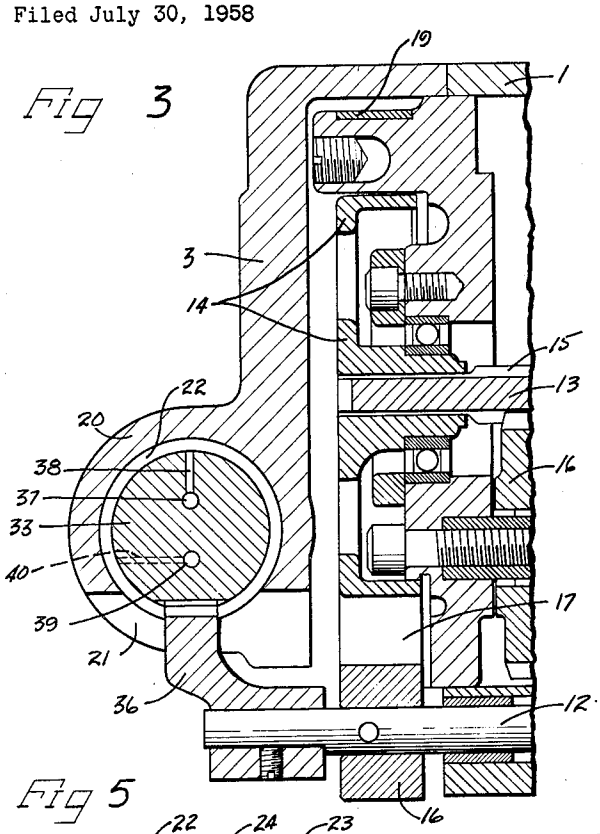


Fig 5

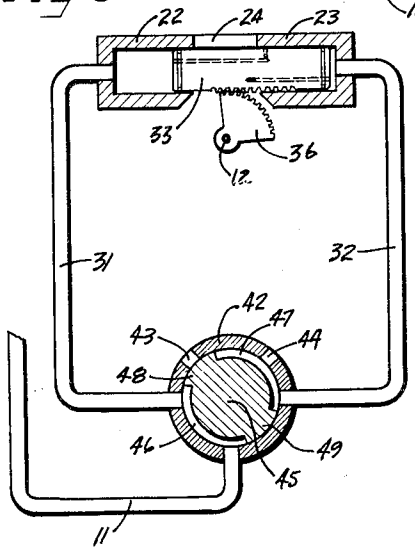
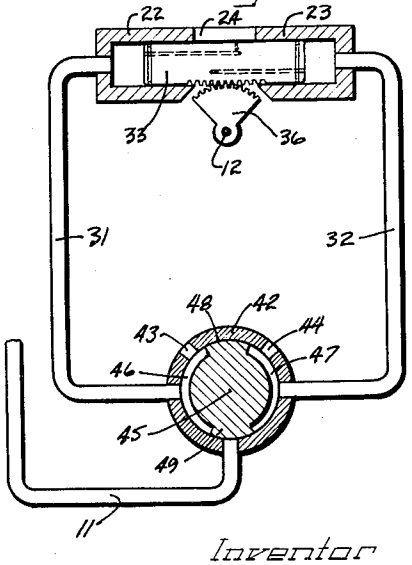


Fig 4



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HOIST WITH PENDANT CONTROL

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6 Claims. (Cl. 121—46)

This invention relates to improvements in a hoist with a pendant control, as well as to control means for an overhead hoist, the invention being highly desirable for use in connection with overhead hoists of the air actuated type, although the invention will have other uses and purposes as will be apparent to one skilled in the art.

Overhead hoists, particularly those having a lifting capacity between one and ten tons, usually embody a casing having a cover at each end, with the motor or other actuating means located adjacent one end of the casing, the braking mechanism located at the opposite end of the casing, and the actual elevating means located in the central region of the casing. There is also a control shaft extending lengthwise of the casing which shaft not only operates the brake mechanism, but also the valve means in the case of a hoist actuated by an air motor at the opposite end of the casing to control the direction of movement of the load chain. It has been customary to instigate elevating or lowering of a load by moving the control shaft a partial revolution in either direction, and this was particularly true in the case of hoists having a transverse lever affixed to the control shaft, with hand pull ropes depending therefrom. However, in the past where pendant push button type controls were utilized with air hoists, these controls depended from the air intake or motor end of the hoist and valved the incoming air causing the valve means in the hoist casing to actuate the control shaft in the proper direction, rather than vice versa. Frequently there was an unbalancing of the hoist itself, particularly if the chain was raised or lowered without any load, by virtue of the operator unconsciously exerting a pull on the suspension means for the pendant control, particularly with the suspension means for the pendant control located at the same end of the hoist as a compressed air intake line.

With the foregoing in mind, it is an important object of the instant invention to provide pendant push button type control means for an overhead hoist, which means directly actuate the control shaft of the hoist.

Another object of the instant invention resides in the provision of pendant control means for a hoist operating directly on the control shaft of the hoist, and which means are connected with that control shaft at the end opposite the power intake of the hoist.

A further feature of the instant invention resides in the provision of control means for a hoist which are housed in an integral part of the hoist casing except for the manually actuatable parts.

Another feature of the instant invention resides in the provision of pendant type control means for an air hoist, which control means operate upon the control shaft of the hoist at the end thereof opposite the air intake that drives the hoist motor.

Still a further object of the instant invention resides in the provision of control means for an air hoist including a pendant push button type actuator which directly controls movement of the hoist control shaft by way of a reciprocable air energized piston, the source of energy for the control means emanating from the supply of compressed air to operate the hoist motor.

Still another important object of this invention resides in the provision of control means for an air hoist which directly actuate the control shaft of the hoist, and are

so arranged as to automatically throttle the air driving the control means so that the full load of compressed air is not initially applied but the control means must move a predetermined distance before full line pressure becomes effective.

Also an object of this invention is the provision of control means for an air hoist embodying an air actuated piston to drive the control shaft of the hoist in either direction, the piston and its cylinder being cooperatively arranged to bleed off a portion of the air moving the piston until after the piston has moved a predetermined distance when the bleeding is automatically cut off, and full line air pressure is then established.

A further and important object of the instant invention is the provision of control means for an air hoist so arranged that the operator may at will and by simple manipulation of the control means provide any desired hoist motor speed between 0 and full speed and maintain that selected speed as long as is desirable.

While some of the more salient features, characteristics and advantages of the instant invention have been above pointed out, others will become apparent from the following disclosures, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a fragmentary pictorial illustration of an air hoist equipped with pendant control means embodying principles of the instant invention;

FIGURE 2 is an enlarged fragmentary part end elevational and part vertical sectional view, with the section taken substantially as indicated by the line II—II of FIGURE 1, looking in the direction of the arrows;

FIGURE 3 is a fragmentary transverse vertical sectional view taken substantially as indicated by the staggered section line III—III of FIGURE 2;

FIGURE 4 is a fragmentary part sectional part elevational view diagrammatically illustrating the connections between the parts of the control mechanism and the valve arrangement embodied in the pendant hand control, showing the same in neutral position; and

FIGURE 5 is a view similar in character to FIGURE 4, but showing the parts in load elevating position.

As shown on the drawings:

While the instant invention, and particularly some of the principles thereof, may be adaptable for use in connection with various types of overhead hoists, by way of example the invention is herein shown and described in association with an air hoist; i.e., a hoist driven by a motor actuated by compressed air.

In the illustrated embodiment of the instant invention, there is shown a hoist of the air motor type, comprising a casing which is substantially closed except for the essential bottom openings. This casing includes a body part **1** which is preferably molded from lightweight material, such as aluminum or magnesium alloy or the equivalent, and at each end thereof the casing is provided with molded caps or covers **2** and **3**, these covers being attached to the body part **1** in any suitable manner. The cover **2** is provided with an air intake fitting **4** to which a compressed air line **5** is connected, this line leading from any suitable source of compressed air. This cap usually houses the valve mechanism for controlling the feed of compressed air to the air motor in the casing for driving that motor in either direction. As is known in this art, the cap **2** will have a chamber therein with which the compressed air line **5** communicates, and air is valved from this chamber to the motor.

The body part **1** of the hoist contains the air motor, the hoisting means per se for elevating and lowering a load chain **7** having an end anchored as at **8**, and a brake mechanism, parts of which will be later described herein. On the top thereof a suitable hook assembly **9** is provided

by means of which the hoist is suspended from a trolley, cable, or the like. In the illustrated instance, the body part 1 is also provided with a molded integral conduit 10 or passageway leading from the air chamber in the cover 2 to a point at or adjacent the rear end cover 3. From the end of this conduit an air line 11 depends which is connected at its other end to a pendant push button type hand control to be later described, and which furnishes the power necessary to actuate the control means housed in the cover 3. While in the illustrated embodiment of the instant invention the compressed air line 5 is shown connected through the cover 2, it will of course be understood that, if desirable, this intake line 5 may connect directly with the conduit 10 at an intermediate point therealong.

In FIGURES 2 and 3 parts of the hoisting mechanism within the casing are shown, this hoisting mechanism being known to the art and forming no part of the instant invention. The mechanism includes the hoist control shaft 12 which extends lengthwise through the casing. This shaft actuates the valve means at the opposite end of the casing housed by the cover 2 which govern the flow of compressed air to the motor. Operation of the hoist in either direction is affected by rocking the control shaft 12. In FIGURE 3 a portion of the rotor shaft 13 is illustrated to the rear end of which is keyed a brake wheel or a drum 14. The rotor shaft is also provided with teeth 15 which drives a gear 16 that in turn effects rotation of the chain sprocket.

As is usual in hoists of this character, the control shaft has keyed thereto a brake cam 16 which, in the position seen in FIGURE 2 is in neutral position with the braking means applied. When the shaft 12 is rotated, this cam operates brake bands 17 and 18 which substantially circumscribe the aforesaid brake drum 14 and may be provided with suitable lining or shoes. These bands are maintained in braking position by a generally horseshoe shaped brake spring which the yoke portion is shown at 19 in FIG. 3. This spring, of course, tends to maintain the shaft 12 in neutral position as illustrated in FIGURE 2, with the brake effective.

Part of the control means embodied in the instant invention are contained within a housing or cylinder 20 that is preferably molded integrally with the rear cover 3 of the casing. This cylinder 20 is provided with an opening in the underside thereof as indicated at 21. The cylinder is preferably lined with spaced sleeves 22 and 23 forming an annular opening 24 therebetween which communicates with the opening 21 in the air cylinder. The ends of the cylinder are closed by plugs 25 and 26 each of which is provided with a sealing ring as indicated at 27. Each plug is centrally apertured as indicated at 28, and threaded into the plug 25 in alignment with the passage 28 is a fitting 29 and a similar fitting 30 is threaded into the plug 26. Depending from the fitting 29 is an air line or conduit 31 and depending from the fitting 30 is a similar conduit 32.

Inside the sleeves 22 and 23 is a piston 33 equipped at each end with a sealing ring 34 and provided with a row of rack teeth 35 on the underside thereof. These rack teeth are in mesh with a gear segment 36 fixed to the aforesaid hoist control shaft 12 to the rear of the brake cam 16, as clearly seen in FIGURES 2 and 3. The arrangement is such that the piston is in normally central position when the cam 16 is in neutral position with the brake applied, as shown in FIGURE 2. With no air pressure in the lines 31 and 32, the piston will automatically assume the position seen in FIGURE 2 when the control shaft is moved to the position shown in that figure by the brake spring.

For throttling purposes, the piston is provided with the passage 37 leading in from one end thereof and connecting to a lateral passage 38 which communicates with the space 24 between the sleeves and thus with atmosphere by way of the opening 21 in the cylinder. The passageway 37 is preferably more than half as long as the piston, as

clearly seen in FIGURE 2. A similar longitudinal passage 39 leads inwardly from the other end of the piston and communicates with a side branch passage 40 also communicating with atmosphere by way of the space 24 between the sleeves. These passages 37 and 39 are sized in keeping with the desired speed of operation and in keeping with the loads the hoist made in various sizes is intended to carry. Throttling is accomplished by way of bleeding through the respective passageway depending upon the direction of movement of the piston. When compressed air enters through the line 31, thus moving the piston to the right as seen in FIGURE 2, there will be a bleeding off of some of the compressed air through the passageway 37—38 until the passage 38 has moved sufficiently to ride within the sleeve 23, whereupon full line air pressure is then on the piston for the balance of its stroke. With either of the passageways effective to bleed off some of the compressed air, the operating speed of the hoist motor will be determined by the difference between the pressure of the incoming air and the amount allowed to escape through the passageway.

This is an important feature of the instant invention as will be more apparent hereafter, in that the arrangement permits the operator to accurately control the speed of the air motor, and thus the operator can select any desirable speed from 0 to maximum for any particular operation.

While the throttling means has been here illustrated as passages within the piston and a space between the cylinder sleeves, it is obvious that the piston and the cylinder may be correlated otherwise in order to establish the throttling. For example, the sleeves could be moved closer together and each provided with a slot gradually decreasing in thickness upwardly. Many other variations of the structure can be obtained for the same purpose, the instant passageways being herein disclosed by way of example.

Any suitable form of pendant control valve means may be utilized to selectively pass compressed air through either lines 31 or 32 and open the other to atmosphere. Again by way of illustrative example only and not by way of limitation, I have shown a form of such structure in FIGURES 1, 4 and 5. This pendant control comprises a hollow handle 41 leading to a cylinder 42 closed at both ends but having spaced openings 43 and 44 leading to atmosphere as seen in FIGURES 4 and 5. Inside the cylinder or casing 42 is a valve member 45 which may be oscillated in either direction by means of a thumb lever 45*a* seen in FIGURE 1. This valve element 45 is provided with opposed arcuate passages 46 and 47 with sealing lands 48 and 49 therebetween.

It will be seen that the aforesaid compressed air line 11 leading from the chamber 2 in the cover 12 of the hoist casing extends through the handle 41 and communicates with the cylinder 42 at the underside thereof; while the air line 31 communicates on one side with the cylinder and directly opposite thereto is the communication with the air line 32.

In operation, it is a simple expedient to cause the hoist to either elevate or lower a load depending upon the direction in which the thumb lever 45*a* is moved. For example, if the lever parallels the axis of the handle 41, the structure will be in the position seen in FIGURES 2 and 4, or neutral position with no movements of the hoist mechanism. When in this position, compressed air from the source is blocked by land 49 of the valve member 45, air line 31 is open to atmosphere by way of slot 46 and port 43, and air line 32 is also open to atmosphere by way of slot 47 and port 44.

If it is desired to elevate a load at full motor speed, the thumb lever 45*a* is moved to the right as shown in full lines in FIGURE 1, and the ports will assume the position seen in FIGURE 5 with air passing from the line 11 through the slot 46 into the line 31 causing a movement to the right of the piston from the position of FIG-

URE 4. At the same time, it will be noted that the air line 32 still communicates with atmosphere by way of slot 47 and port 44 so as not to cause any interference with the movement of the piston. The movement of the piston obviously causes a partial rotation of the hoist control shaft 12 in a clockwise direction as seen in these FIGURES and this results in operating the air motor in a direction for elevating a load. Obviously, when the thumb lever is moved toward the down position as indicated by dotted lines in FIGURE 1, the operation will be accomplished in reverse, the piston moving to the left from the position of FIGURE 4, and the line 31 will be open to atmosphere through the slot 46 and port 43, while the compressed air passes through line 32 by way of slot 47.

While the showing in FIGURE 5 illustrates full line pressure on the piston and therefore elevation at full hoist motor speed, it will be noted that the operator may move the thumb lever partially and acquire any speed he may desire for any particular operation. In other words, the operator may acquire a definite discrete movement of the piston 33 in order to produce any definite hoist speed that may be required at a particular time. Since the restrictive force on the control shaft is essentially produced by a spring and, therefore, increases at a definite rate as the shaft is turned, a given air pressure acting on the operating cylinder would produce a definite determinable amount of movement of the control mechanism. So, by moving the control thumb lever 45*a* a certain amount, the openings in the control valve handle coupled with the passageways in the piston 33 will provide the operator with any desired hoist motor speed between 0 and full speed. Near the end of the stroke of the piston 33, full line air pressure is provided on the piston as mentioned above, and will positively hold the control in the full speed position, whenever desired.

It might also be mentioned that should the operator accidentally or intentionally flip the thumb lever 45*a* to full up or down position, there will be a short delay by the bleeding action of the passageways before full line pressure is applied on the piston 33, so that the hoist motor will not be subjected to full line instantaneous pressure from a stopped position.

It will be noted that the control structure embodied in the instant invention may easily and economically be incorporated as a part of the hoist casing, and the operation of the mechanism by way of the pendant push button type control is extremely simple and positive without any danger by virtue of the automatic throttling of the air by the control means acting upon the hoist control shaft. By virtue of the location of the control means on the rear end of the hoist, the hoist is always kept in balance.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

I claim as my invention:

1. Control mechanism including a cylinder open to atmosphere at an intermediate location, a compressed air line connected to each end of said cylinder, a piston in said cylinder, said piston having a passage leading from one end thereof to a point beyond the center of the piston and communicating with the atmospheric opening in said cylinder when the piston is in central position, said piston having a similar passage leading from the other end thereof, means for operatively connecting the piston to an element to be actuated thereby, and hand operable valve means to selectively pass working compressed air through either of said lines.

2. Control mechanism including a cylinder having an opening to atmosphere centrally thereof, a reciprocable piston in said cylinder, said piston having separate passages therein each leading from an end thereof to a point beyond the center of the piston and communicating with said opening when the piston is centered and for a part only of the piston stroke in either direction, a compressed air conduit connected to each end of said cylinder, control means to selectively pass working compressed air through either of said conduits, and drive means for operatively connecting the piston to an element to be actuated thereby.

3. Control mechanism for actuating an element in either direction, including a cylinder, a piston reciprocable in said cylinder, drive means to connect the piston to the element to be moved thereby, a compressed air line connected to each end of said cylinder, said cylinder and said piston being cooperatively arranged to by-pass a portion of compressed air entering through either of said lines for a partial stroke of the piston in its driven direction, and means to selectively pass working compressed air through either of said lines.

4. In an overhead hoist, a casing, hoisting mechanism therein, a control shaft extending lengthwise of said casing to actuate the hoisting mechanism, a cylinder on said casing having an opening therein, a piston in said cylinder, a rack on said piston, a gear segment fixed to said control shaft and extending through said opening into engagement with said rack, a compressed air line leading to each end of said cylinder, and hand operable valve means to selectively pass working compressed air through either of said lines.

5. In an air hoist, a casing including a body part, a cover on one end of said body part having compressed air inlet means therein, a cover over the opposite end of said casing, hoist mechanism in said casing driven by compressed air entering said inlet means, a control shaft extending lengthwise of said casing, a cylinder molded in the second said cover, a piston in said cylinder reciprocable in opposite directions, a driving connection between said piston and said control shaft, a compressed air line communicating with each end of said cylinder, a conduit molded in said body part communicating at one one with said air inlet means and extending to the second said cover, an air line connected to the other end of said conduit, and hand operated valve means connected to all three said air lines to selectively connect either of the first two said lines to the third said line and open the other to atmosphere to actuate said control shaft in the desired direction.

6. Control mechanism including a cylinder, a normally centrally disposed piston in said cylinder, actuating means to drivingly connect said piston to an element to be moved thereby, a compressed air line connected to each end of said cylinder, hand operated valve means to selectively connect either of said air lines to a source of compressed air and open the other line to atmosphere, and said cylinder and said piston being cooperatively arranged to bleed off a portion of the air entering through either of said lines for a partial stroke of the piston in its driven direction whereby throttling of the working compressed air is obtained.

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