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LIFTING MECHANISM

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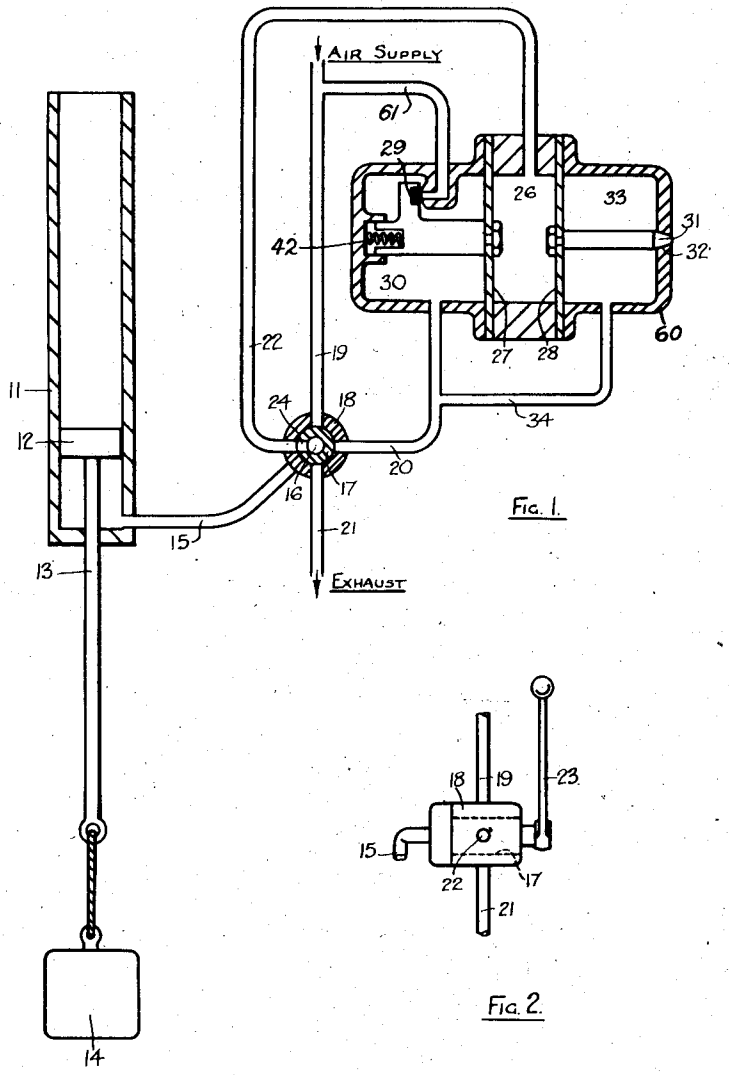


Fig. 1.

Fig. 2.

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LIFTING MECHANISM

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2 Claims. (Cl. 121—46)

This invention relates to cranes and like lifting mechanisms.

My main object is to provide means whereby a load being lifted or lowered can be very easily positioned in any required place.

According to a further object, a lifting mechanism has means for selectively holding a load in substantial balance, whereby the load can be easily moved manually to a desired position. Thus, in addition to the normal raising, lowering and stop controls there is provided a "balance" control.

These and other objects and advantages of the invention will best be understood if reference is made to the following description in connection with the accompanying sheet of drawings, wherein:

Figure 1 is a diagrammatic representation, mainly in section, of an air-pressure lifting mechanism having a regulating valve and a control therefor, constituting a fluid-pressure servo device, according to the invention; and

Figure 2 is a side elevation of the control valve.

In the case of a lifting mechanism using fluid pressure acting on a piston as its motive force, the means of the invention may include a pressure-regulating valve adapted to apply to the piston the requisite pressure to hold the load in balance on operation of the "balance" control; and it will be appreciated that the load can then be swung upwardly or downwardly within limits by the operator with very little effort, thus facilitating its being exactly placed in a desired position. Once in position the normal lowering control will, of course, be actuated, and the load then released from the hoisting tackle. Provision must be made for the setting of the pressure-regulating valve dependently upon each load.

The drawing shows a hoisting mechanism comprising a vertical cylinder 11 open at its upper end to the atmosphere and containing a piston 12 fast with a rod 13 which is to be connected to a load, indicated at 14, to be moved. Air under pressure can be supplied to the underside of the piston by a pipe 15, the latter communicating with an axial bore 16 in a rotary element 17 of a control valve 18. The casing of the latter has four holes respectively connected to four pipes 19, 20, 21 and 22 and these four holes can be selectively placed in communication with the bore 16 dependently upon the position of the rotary element, which can be turned by means of a handle 23, through a radial passage 24 in the rotary element.

A source of air under pressure is connected to the pipe 19 so that when the rotary element is turned to interconnect the pipes 19 and 15 the air pressure is applied beneath the plunger and the load is lifted. When the load has been sufficiently raised the rotary element is turned to the position shown in Figure 1, in which the pipe 22 is placed in communication with the pipe 15. The pipe 22 leads to a balance or setting chamber 26 of a servo device comprising a casing 60 divided by two diaphragms 27, 28 into the intermediate setting chamber 26 and into two end chambers 30, 33 which are interconnected with one another, by the pipe line 34, so that the fluid-pressure therein will always be the same, these two chambers constituting what may be termed a control chamber. The source of air supply under pressure communicates by the pipe line 61 with the chamber 30, being normally closed by a valve 29 which is operable by the diaphragm 27 in predetermined conditions, the valve being biased to the closed position by a spring 42. The parts 27, 29, 30, 42 constitute what is commonly called a pressure-reducing valve except that in an ordinary pressure-reducing valve the external pressure applied to the diaphragm 27 is atmospheric, whereas that is not the case in the present example. A suitable form of pressure-reducing valve which may be adapted for carrying out the present invention is disclosed in my U. S. patent specification No. 2,322,480.

In the present instance the parts are arranged so that if at any moment the pressure in the setting chamber 26 should be higher than the pressure in the control chamber (the end chambers 30, 33) the pressure difference acting on the diaphragm 27 will effect opening of the valve 29 whereby to admit pressure from the supply source (which, of course, is assumed to be higher than any pressure which may ever obtain in the setting chamber 26), the valve 29 automatically closing when the pressure difference on the diaphragm 27 ceases to exist. The diaphragm 28 carries a taper needle 31 coacting with a corresponding hole 32 whereby when the diaphragm is moved in one direction the pressure in the chamber 33 of the pressure-release valve will be partly released to atmosphere. The parts are arranged so that the diaphragm 28 is moved in this direction when the pressure in the setting chamber 26 is less than the pressure in the control chamber (chambers 30, 33). When this pressure difference disappears the valve 31 closes.

Thus, after the load has been raised and the rotary element turned to the position shown in Figure 1 the balance or setting chamber 26 has

applied to it the pressure which is actually applied beneath the piston 12. If this pressure—which we will assume to be, say, 70 lbs. per square inch—should be greater than that obtaining at the moment in either of the valve or end chambers 30, 33, the valve 29 will operate immediately until the pressure in these two chambers is also 70 lbs. per square inch. If, however, the 70 pounds per square inch pressure in the balance chamber 26 should at that moment be less than the pressure in the valve chambers, then the pressure release valve will immediately operate until the pressure in these two chambers is also 70 pounds per square inch. In this way the servo device is set for a given load.

Thereupon the rotary element is turned to interconnect the passages 15 and 21, this latter being the exhaust passage, and the load is lowered approximately to the desired position, whereupon the rotary element can be turned (through 180° from the position shown in Figure 1) in order to place the pipe 20 in communication with the pipe 15. Naturally no movement of the load will take place in this latter condition as the pressure in the valve chambers is already 70 lbs. per square inch, i. e., equal to that under the piston, the load being balanced. If, now, the operator, in order to finally position the load as required, presses down upon it, the increased pressure under the piston is transmitted to the chamber 33 of the pressure-release valve and the pressure difference applied to the diaphragm 28 raises the needle 31 and allows excess pressure to escape from the hole 32, so that the load can move slightly downwardly. This will continue until the operator releases his pressure upon the load, when the hole 32 will immediately be closed, the pressure throughout the system being again reestablished at 70 lbs. per square inch. Conversely, if the operator attempts to lift the load the reduced pressure on the piston transmitted to the chamber 30 causes the valve 29 to operate in the normal manner of the movable valve element of a pressure-reducing valve to restore the pressure, whereby the piston will be gradually raised, and, with it, the load, and this action will continue until the operator again releases the load.

When the load has been finally positioned as desired by the operator, the rotary element 17 should be turned to again interconnect the passages 15 and 21, and the load can then be disconnected from the lifting mechanism, which is free to be used for another load.

If such other load should be of different value from the preceding load, when the rotary element is turned to the position shown by Figure 1 (after the load has been lifted) the servo device will again be set dependently upon the new load.

What I claim as my invention and desire to secure by Letters Patent of the United States is:

1. The combination with a lifting device comprising a cylinder, a load-operating piston therein, one of said members adapted to be connected to a load to be lifted, a source of fluid pressure, means for connecting said source to said cylinder, to raise the load, and for disconnecting it to leave the load suspended, and means for effecting release of the pressure in said cylinder to allow of lowering the load, of a fluid-pressure-operated valving device comprised of an outer casing enclosing a setting chamber, a control chamber, a pair of movable pressure-responsive elements each having applied on one face the pressure in said setting chamber and having applied on its other face the pressure in said control chamber, valve means controlled by one of said elements whereby the pressure in said control chamber will be automatically reduced to the value of the pressure in said setting chamber when the pressure in the latter is less than the pressure in said control chamber, a second valve means controlled by the other of said elements whereby pressure will be automatically supplied from said source to said control chamber when the pressure therein is less than the pressure in said setting chamber, means for connecting said cylinder to said setting chamber, for setting purposes, and for disconnecting it, and means for connecting said cylinder to said control chamber, in which condition the load is held in balance and can be automatically moved up or down by manually-applied pressure on the load.

2. The combination with a lifting device comprising a cylinder, a load-operating piston therein, one of said members adapted to be connected to a load to be lifted, a source of fluid pressure, means for connecting said source to said cylinder, to raise the load, and for disconnecting it to leave the load suspended, and means for effecting release of the pressure in said cylinder to allow of lowering the load, of a casing interiorly divided by two diaphragms into an intermediate setting chamber and two end chambers interconnected so that similar fluid pressure will obtain therein, one of said chambers communicating with said source of fluid pressure, valve means controlled by one of said diaphragms whereby the pressure in said end chambers will be automatically reduced to the value of the pressure in said setting chamber when the pressure in the latter is less than the pressure in the end chambers, valve means controlled by the other of said diaphragms by which pressure will be automatically supplied from said source to said end chambers when the pressure therein is less than the pressure in said setting chamber, means for connecting said cylinder to said setting chamber, for setting purposes, and for disconnecting it, and means for connecting said cylinder to said end chambers, in which conditions the load is held in balance and can be automatically moved up or down by manually-applied pressure on the load.

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