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CONTROLLING DEVICE

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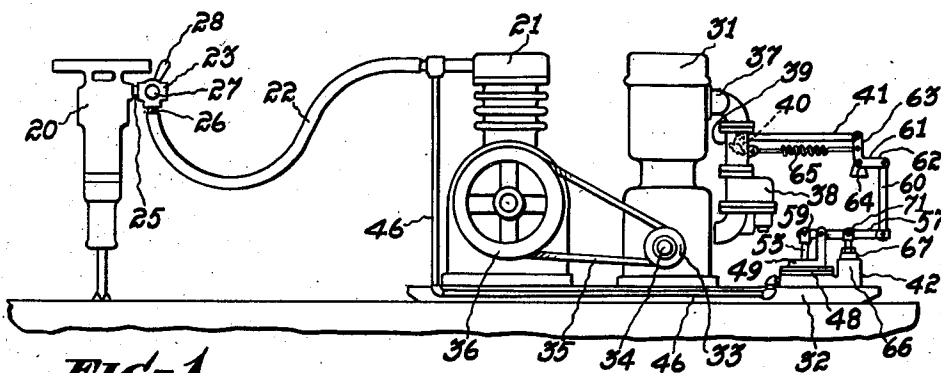


FIG. 1.

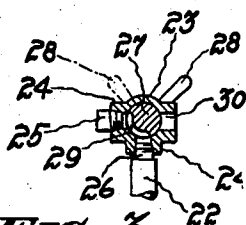


FIG. 3.

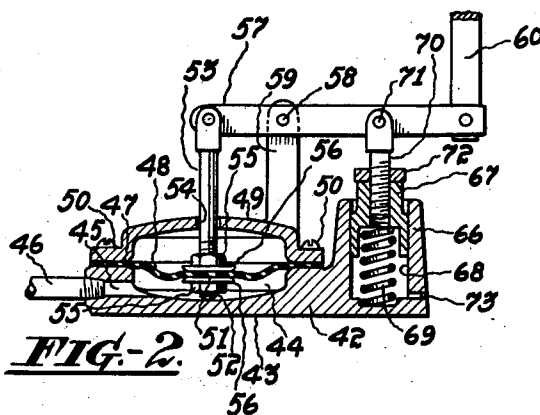


FIG. 2.

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CONTROLLING DEVICE

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1 Claim. (Cl. 230—9)

This invention relates to fluid pressure impulse systems for operating fluid actuated machines, and more particularly to a controlling device for controlling the operation of a compressor of such a system.

It is an object of the invention to control the operation of the compressor in accordance with the power requirements of the tool utilizing the discharge output of the compressor.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawing accompanying this specification and in which similar reference numerals refer to similar parts,

Figure 1 is a side elevation of a pneumatically actuated tool and the devices required for supplying the pressure fluid used for operating the tool.

Figure 2 is an elevation, partly in section, of a controlling device serving to regulate the power output of the power elements in accordance with the requirements of the tool actuated thereby, and

Figure 3 is a view, in section, of a detail.

Referring to the drawing, and at first more particularly to Figure 1, 20 is a pneumatically actuated tool, as for example a rock drill of the hammer type, and 21 is a compressor, the discharge end of which is connected to the tool 20 by a conduit 22 so that the compressor discharges directly into the conduit which constitutes the storage vessel for the pressure fluid required for operating the tool 20.

Communication between the conduit 22 and the tool 20 is controlled by manually operable valve means 23 positioned within convenient reach of the operator of the tool. The valve means 23 may, as shown, comprise a casing 24 that is connected to the tool 20 by a fitting 25, and a similar fitting 26 forms the connection between the valve casing 24 and the conduit 22.

Within the casing 24 is a rotary throttle valve 27 having a lever 28 whereby it may be rotated to its different controlling positions, and in the periphery of the throttle valve is a partly annular groove 29 to effect communication between the fittings 26 and 25 in one position of the valve and, in another position, between the fitting 26 and an exhaust port 30 in the casing 24.

The motor for driving the compressor 21 may be of any well known type but is illustrated as an internal combustion engine 31 that is mounted upon the base 32 supporting the compressor 21 and has a sheave 33 on its crank shaft 34 for a belt 35 that is trained over the drive sheave 36

of the compressor. The engine 31 is provided with the usual intake manifold 37 and with a carburetor 38 in communication with the latter through a conduit 39 containing a butterfly valve 40 that serves to control the fuel supply from the carburetor to the engine 31 in a manner well known.

The butterfly valve 40 is pivotally connected to a link 41 through which force is transmitted for oscillating the valve 40, and in accordance with the practice of the invention means acting responsively to the value of the pressure within the conduit 22 are provided for shifting the link 41 and thus the butterfly valve 40. The controlling device serving this function is designated in its entirety by 42. It comprises a casing 43 that is seated upon the base 32 to which it may be secured in any suitable manner. The casing 43 is recessed to provide a pressure chamber 44 having a port 45 to which is connected an end of a pipe 46 having its other end connected to the conduit 22 so that the pressure chamber 44 will be in constant communication with the conduit 22.

On the top of the casing 43 is a seating surface 47 that encircles the pressure chamber 44 to support the marginal portion of a flexible diaphragm 48 that is clamped to the seating surface by a cover 49 and by screws 50 that may extend through the cover and the diaphragm and be threaded into the casing.

In the central portion of the diaphragm 48 is an aperture 51 to receive a threaded end or portion 52 of a rod 53 that extends loosely through a hole 54 in the cover 49. The end 52 of the rod 53 is secured to the diaphragm by nuts 55 on the rod acting against the opposite sides of the diaphragm through washers 56 interposed between the diaphragm and the nuts.

The upper end of the rod 53 is pivotally connected to an end of a rocker arm 57 fulcrumed, intermediate its ends, upon a pivot 58 in an arm 59 on the top of the cover 49. The opposite end of the rocker arm 57 is pivotally connected to an end of a link 60 the opposite end of which is pivotally connected to an arm 61 of a bell crank 62. The other arm 63 of the bell crank is, in turn, pivotally connected to the link 41, and in the angle of the bell crank is a pivot 64 that may be supported in any convenient manner. A tension spring 65 connected at one end to the arm 63 of the bell crank and at its other end to the conduit 39 exerts a constant pull tending to maintain the throttle valve 40 in its closed position.

Means are provided to prevent a too abrupt

movement of the diaphragm and the elements actuated thereby including the throttle valve 40 and the linkage connecting the two. The controlling device 42 is accordingly provided with a checking device 66 that acts in opposition to the pressure acting against the diaphragm 48.

The checking device is preferably also arranged in the casing 43 in convenient position for connection to the rocker arm 57 at a point intermediate the pivot 58 and the link 60. It comprises a plunger 67 in a cylinder 68 on the casing 43, and interposed between the inner end of the plunger and the bottom of the cylinder 68 is a compression spring 69 that tends constantly to move the plunger 67 outwardly toward the rocker arm 57. A rod 70 is connected to the rocker arm 57 by a pivot 71 and is threaded, for adjustment, to the plunger 67 and has a lock nut 72 for holding the plunger 67 against unauthorized rotative movement with respect to the rod 70.

An orifice 73 communicates the lower end of the cylinder 68 with the atmosphere to permit a restricted flow of air into and out of the cylinder during the reciprocations of the plunger 67 to exert a checking effect upon the plunger.

During the operation of the tool 20, and therefore the compressor, the throttle valve 27 occupies a position in which the groove 29 establishes communication between the conduit 22 and the tool 20, and the total output of the compressor 21 will then pass directly to the tool for operating it. Inasmuch as the pressure chamber 44 is also in constant communication with the conduit 22 through the pipe 46 the diaphragm 48 will then be subjected to the same pressure as that existing in the conduit 22.

Such pressure acting against the diaphragm will have the effect of moving the rod 53 upwardly and imparting a counter movement to the link 60 and thereby tilt the bell crank 62 about its pivot. This movement of the bell crank will, in turn, rotate the throttle valve 40 to open it for admitting an increased supply of fuel to the engine 31.

The force thus acting against the diaphragm 48 and the consequent tilting movement of the rocker arm 57 will move the plunger 67 downwardly against the resistance of the spring 69. Owing, however, to the dash-pot effect of the check-

ing device 66 such movement of the rocker arm will take place gradually so that the throttle valve will open at a suitable rate of movement to assure a smooth acceleration of the engine speed.

5 Upon completion of a run of drilling, as when a hole of desired depth has been drilled, the throttle valve 27 is rotated to another limiting position to cut-off the flow of pressure fluid to the tool 20 and to establish communication between the conduit 22 and the atmospheric exhaust port 30. In this position of the throttle valve the discharge output of the compressor passes to the atmosphere and the pressure chamber 44 will be evacuated. The spring 69 will then act to tilt the rocker arm 57 about its pivot 58 and move the linkage connected thereto in the required direction for closing the throttle valve 40 and thereby diminish the fuel supply to the engine 31 to cause the latter to run at an idling speed until the throttle valve is again positioned to communicate the conduit 22 with the tool 20.

From the foregoing description of the invention it will be readily apparent that it forms a convenient means for controlling the power supply to the engine 31 so that the compressor 21 will operate only as required to supply the pressure fluid necessary for operating the tool 20.

I claim:

In a controlling device, the combination of a compressor and a motor for driving the compressor, a discharge conduit for conveying pressure fluid from the compressor, a power-controlling device for the motor, means constantly subjected to the pressure prevailing within the conduit and acting responsively to an increasing pressure in the conduit for actuating the power-controlling device to accelerate the speed of the motor, spring-means acting in opposition to the last mentioned means for actuating the power-controlling device to decelerate the speed of the motor in response to a decreasing pressure in the conduit, common linkage for transmitting the forces of the responsive means and the spring-means to the power-controlling device and damping means connected to the linkage and acting to damp both the power-increasing and the power-decreasing movements of the power-controlling device.

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