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PRESSURE RESPONSIVE MECHANISM

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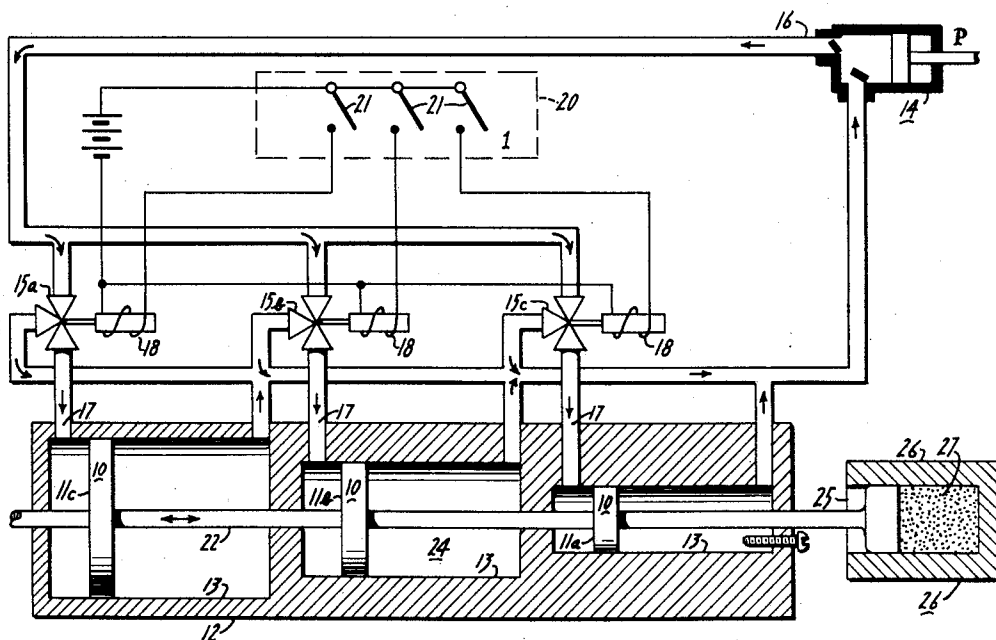


FIG. 1

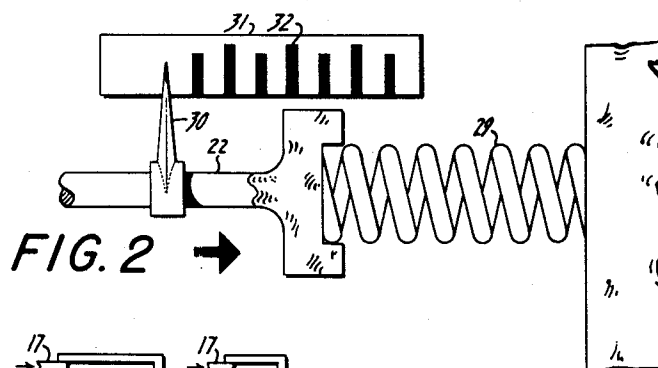


FIG. 2

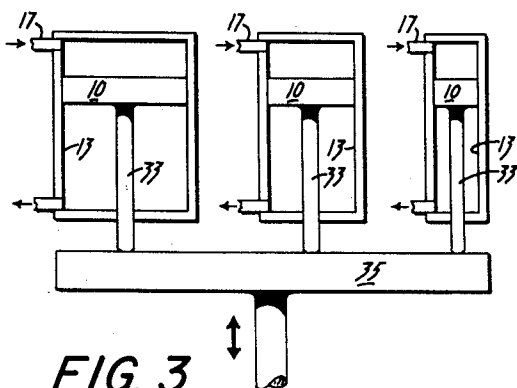


FIG. 3

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PRESSURE RESPONSIVE MECHANISM

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6 Claims. (Cl. 235—61)

This invention relates in general to pressure operated mechanisms and, in particular, to a hydraulic mechanism operable in response to information coded in a particular numerical system for selectively transmitting predetermined forces to an object.

An object of the present invention is to provide an improved pressure operated mechanism capable of supplying a predetermined force to an object in accordance with information supplied to it in coded form.

Another object of the present invention is to provide an improved hydraulic mechanism capable of moving a member in accordance with information supplied to it in coded form.

A further object of the present invention is to provide an improved hydraulic mechanism which is capable of positioning a member automatically in accordance with information supplied to it in coded form.

A still further object of the present invention is to provide an improved hydraulic mechanism for converting information in one numerical system to information in another numerical system.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings which disclose, by way of example, the principle of the invention and the best mode which has been contemplated of applying that principle.

In the drawings:

Fig. 1 illustrates schematically a pressure operated mechanism embodying the present invention.

Fig. 2 illustrates schematically a modification of the mechanism shown in Fig. 1.

Fig. 3 illustrates another modification of the mechanism shown in Fig. 1.

The invention comprises generally a plurality of pistons each having a face area proportional to a different order of a numbering system, means responsive to information in that numbering system for selectively applying a predetermined pressure per unit area to the faces of the pistons, and means for transmitting the cumulative force of the pistons to a member to be moved.

Referring to the drawing, and particularly to Fig. 1, the mechanism shown therein is illustrated as responsive to either pneumatic or hydraulic pressure and comprises a plurality of pistons 10, each having a face 11 whose area is proportional to a different order of a numbering system. As shown, each face 11 is proportional to a different order of a binary numbering system. For example, piston face 11a has an area corresponding to the first order digit "1" of the binary numbering system, face 11b has an area which is twice the area of piston face 11a and corresponds to second order digit "2," and face 11c has an area four times the area of face 11a and twice the area of face 11b, and corresponds to third order digit "4" of the binary numbering system. While only three pistons 10, corresponding to the first three orders of the binary numbering system, are shown, it is, of course, obvious that more orders may also be represented by mere-

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ly providing more pistons having face areas proportional to these additional orders.

The mechanism further includes means responsive to information coded in a numbering system, in this instance the binary system, for selectively applying a predetermined pressure per unit area to the faces 11 of the pistons 10. As shown, this means comprises a suitable housing 12 including a plurality of cylinders 13 for accommodating the respective pistons 10 in sliding engagement, a suitable source of pressure shown schematically as a hydraulic pump 14, valve means 15 for selectively connecting the output side 16 of the pump 14 to the input side 17 of each cylinder 13. Valve means 15, as illustrated, comprises three similar but separate valves 15a, 15b and 15c. Valves 15a, 15b and 15c may be of any suitable type which operates in one position to connect high pressure side 16 of pump 14 to the input openings 17 of cylinders 13 and operates in the other position to equalize the pressure on both sides of the pistons 10. The valves 15a, 15b and 15c are also preferably of the type which may be operated to either operating position automatically in response to some predetermined condition. A spring loaded, solenoid operated valve, operable in response to the conduction of current in the coil of the solenoid, is an example of this type of valve. As shown, valves 15a, 15b and 15c are selectively operated from the position shown in Fig. 1 to the other operating position (not shown) by energizing coils 18 through a suitable coding means 20 represented schematically as a plurality of two-position switches 21, the two positions corresponding to the digits "0" and "1" of the binary numbering system.

The mechanism further includes means for transmitting the cumulative force on the piston faces 11a, 11b and 11c to an object. This means, as shown in Fig. 1, comprises a shaft 22 on which pistons 10a, 10b and 10c are fixedly mounted. Shaft 22 and pistons 10a, 10b and 10c define a piston assembly 24 which is movable as a unit when pressure is applied to any of the piston faces.

The object to which the piston assembly 24 applies a force, as shown in Fig. 1, is the head 25 of a press or compact 26 employed to compress a suitable substance 27. While the shaft 22 and head 25 are made integral, they can, of course, be separate and suitable connecting means employed therebetween.

The operation of the device shown in Fig. 1 is substantially as follows. Assume, for example, that piston face 11a, corresponding to the first binary order "1," develops one pound of force when connected to pressure source 14 through valve 15c, and that pistons 10b and 10c correspond to the second and third orders of a binary system. Under such assumptions the hydraulic mechanism is capable of applying a force to the compressible material 27 up to seven pounds in seven 1-pound increments in accordance with information supplied to the coding means 20.

The mechanism shown in Fig. 1 may also be employed to position a member at a predetermined one of a plurality of spaced positions by merely providing a biasing means having a predetermined force-deflection characteristic acting in opposition to the force on piston assembly 24. Referring to Fig. 2, this biasing means comprises a helical compression spring 29 having a linear force-deflection characteristic. Indicating means shown schematically as a pointer 30 which moves in accordance with the movement of the piston assembly 24 may be employed if a visual indication of the position of the shaft is desired. However, any known indicating means may be employed depending on the information desired. For example, a scale 31, marked off in equal increments 32, may be employed with pointer 30 and the hydraulic mechanism used to convert information from one numbering system to a different numbering system, such as

binary information to digital information. In such instance the mechanism can be classified as a simple binary-to-digital converter.

The embodiment of the invention shown in Fig. 3 is, in many respects, similar in structure and function to that shown in Fig. 1. However, the means for transmitting the force on each piston face 11a, 11b and 11c to the object to be moved may be modified so that the pistons 10 move independently of each other in transmitting their respective forces to the object. As shown, this means comprises push rods 33 and plate 34. Rods 33 may be fixed either to the pistons 10 or to the plate 34 if the pistons 10 are to be moved independently of each other. However, the rods 33, as shown, are fixed to both the plate 34 and their respective pistons 10 so that the pistons 10 and plate 34 move as a unit and define a piston assembly 35 similar to that shown in Fig. 1. The operation of the mechanism shown in Fig. 3 is substantially the same as that described with respect to Figs. 1 and 2.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to the preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. A hydraulic mechanism for converting binary coded information to decimal coded information comprising in combination an assembly including a shaft and a plurality of pistons fixedly attached to said shaft, each of said pistons having a face area proportional to a different order of the binary numbering system, valve means operable in response to said binary coded information signals for selectively applying a predetermined pressure per unit area to said faces to cause movement of said assembly in one direction, means for supplying said signals to said valve means, spring biasing means having a linear force deflection characteristic tending to oppose movement of said assembly, and means movable in accordance with the movement of said assembly to indicate said decimal information.

2. A hydraulic mechanism for transmitting force to an object in response to binary coded information signals comprising in combination a plurality of pistons each having a face area proportional to a different order of the binary numbering system, pressure supply means and valve means operable in response to said binary coded information signals for selectively applying a predetermined pressure per unit area to each of said faces to move said pistons, means for supplying said signals to said valve means, and means for transmitting the force on each said selected face cumulatively to said object.

3. The combination recited in claim 2 in which said force transmitting means comprises a plate and individual

rod members disposed in force transmitting relationship between said pistons and said plate.

4. A pressure operated mechanism comprising in combination a plurality of pistons, means operable in response to a multi-bit informational signal corresponding to a series of digits each of which is assigned to a different order of a numbering system having a preselected radix for applying a predetermined pressure per unit area selectively to each of said pistons to cause movement of said pistons, the faces of said pistons corresponding in area respectively to said orders of said numbering system, and means for transmitting the cumulative force on said pistons to an object.

5. A hydraulic mechanism for moving an element comprising in combination a plurality of pistons, means operable in response to a multi-bit informational signal corresponding to a series of digits each of which is assigned to a different order of a numbering system having a preselected radix for applying a predetermined pressure per unit area selectively to each of said pistons to cause movement of said pistons, the faces of said pistons corresponding in area respectively to said orders of said numbering system, said means comprising pressure supplying means and valve means responsive to said signals for controlling the application of said pressure, and means for transmitting the cumulative force on said selected pistons to an object.

6. A hydraulic mechanism for moving an element comprising in combination a plurality of pistons, means operable in response to a multi-bit informational signal corresponding to a series of digits each of which is assigned to a different order of a numbering system having a preselected radix for selectively applying a predetermined pressure per unit area to each of said pistons to cause movement of said pistons, the faces of said pistons corresponding in area respectively to said orders of said numbering system, said means comprising pressure supplying means, valve means for each said piston for controlling the application of pressure thereto, and means for operating each said valve means in response to the corresponding bit of said multi-bit signal, and means for transmitting the cumulative force on said pistons to an object.

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