

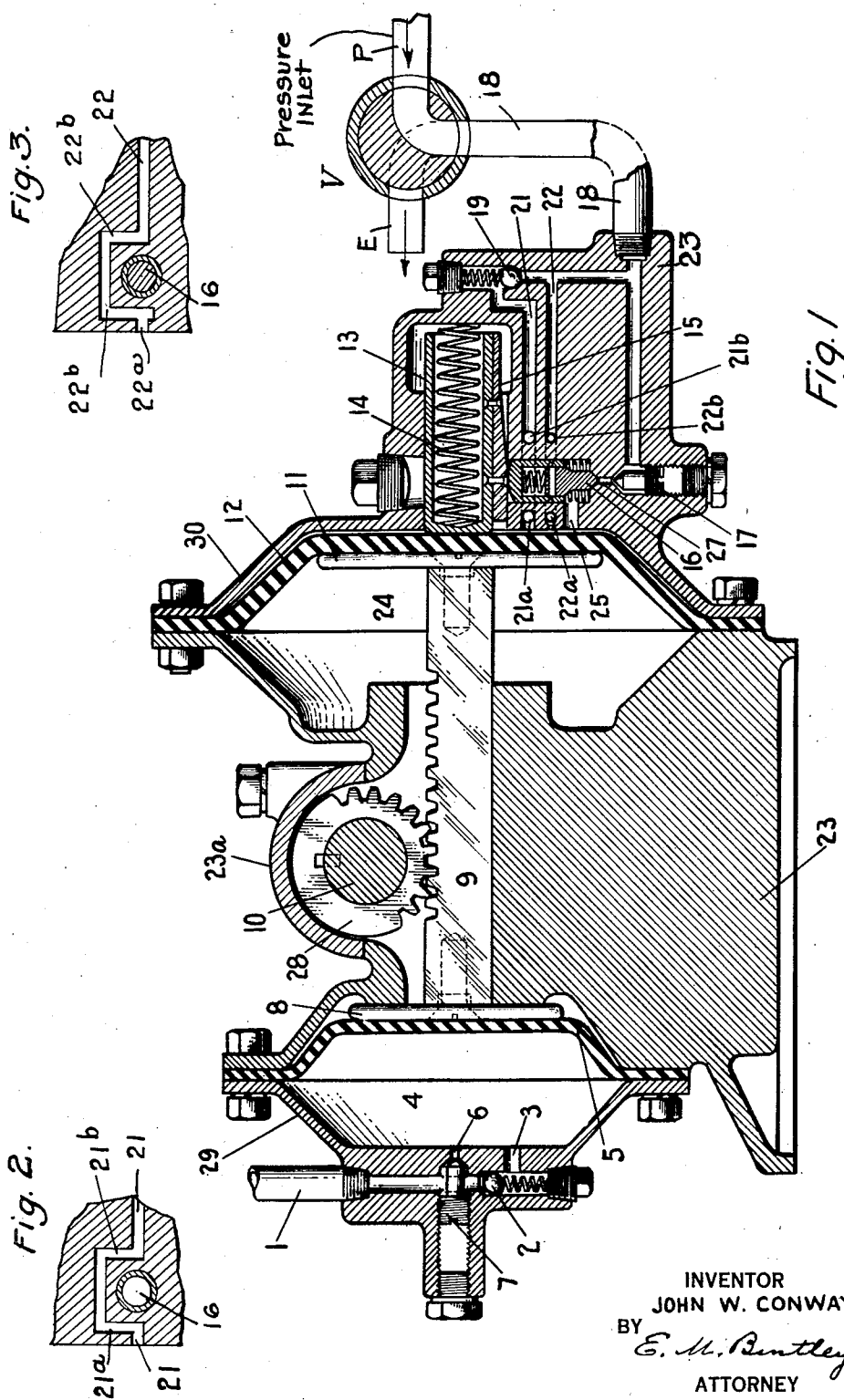
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1,957,697

DOOR MOTOR

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DOOR MOTOR

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5 Claims. (Cl. 121-44)

The invention will be hereinafter fully described and particularly pointed out in the claims.

In the accompanying drawing:—

Figure 1 is a vertical longitudinal sectional view illustrating a motor constructed in accordance with the invention. Figures 2 and 3 are detail diagrammatic views illustrating the duct arrangement.

My invention relates to a motor of the door-operating type worked by a pressure-fluid, usually compressed air, wherein the cylinders and pistons heretofore employed are replaced by flexible diaphragms in closed chambers. The result of my invention is an extremely simple and compact motor which may be manufactured at a low cost.

Referring to the drawing, 23 represents a central member which forms the base and main support of the motor. This central member is a simple casting having at its right and left ends respectively two conical hollow shells which form the two halves of the chambers in which the flexible diaphragms 5 and 12 are free to play. The diaphragm 5 at the left is of a smaller area than diaphragm 12 at the right. The base member 23, at its center also forms bearings for the short transverse shaft 10 over which is the removable cap 23^a. On the shaft 10 is the pinion 28 engaged by rack 9 which extends horizontally through a passage in central member from one diaphragm to the other. After rack 9 is placed in said passage, the discs 8 and 11 are screwed fast to its respective extremities and bear against the respective diaphragms 5 and 12. It will be understood that on one end of shaft 10, outside of said central member 23 will be fastened the usual crank arm that is connected to and operates the door. It will be observed that, as thus far described, the motor comprises only the casting 23 for the central member, which casting requires no machining except at the diaphragm seats around the peripheries of the aforesaid shells and at the bearings for shaft 10 and the rack 9. Outside of said central member 23 are only the caps 29 and 30 for the diaphragms 5 and 12, in which caps are carried all the ducts and valves needed for the motor action. These caps are circular and bolted to the diaphragm-seats on the respective shells to clamp the diaphragms in place. Being circular, the caps may be shifted around at will to suit the piping for the motive fluid. As shown in the drawing, the two diaphragms 5 and 12 are shown as resting against the right-hand wall of their respective chambers, leaving behind them the chamber space 4 at the left of diaphragm 5 and the chamber space 24 at the left of diaphragm 12. At the opposite end

of the stroke these chamber spaces 4 and 24 will, of course, be on the right, instead of left, of the respective diaphragms. At the center of chamber-cap 4 is an outflow port 6, subject to adjustment by a screw needle-valve 7 and opening into a vertical duct through the hub of the cap. This vertical duct, at its upper end, communicates with outside pipe line 1 and below the said needle-valve 7 it contains a spring pressed ball check-valve 2 with a port 3 opening into chamber-space 4. The opposite chamber-cap 30 for the large chamber 24 contains a hollow plunger 13 which is pressed horizontally against diaphragm 12 by an internal spring 14. On the under side of plug 13 is a rib-cam 15, which, as the plug moves to the right, depresses a spring-valve 16 and closes an exhaust duct 27, the capacity of that exhaust duct being adjustable by a screw needle valve 17. Thus the said cam 15 acts, at a predetermined point in its excursion to check the outflow from space 24 and thereby check the door movement from that point onward to the end of its run. After the exhaust duct 27 has been closed, as just described, there still remains an exhaust outlet from space 24 through very small ports 22^a and 22^b to duct 22 and thence to outside supply pipe 18 in which the pressure is zero during this stroke of the motor, this motor-stroke being due to the action of the opposite small diaphragm 5. The reverse stroke of the diaphragm,—that is, its leftward stroke, which we may designate as the door-opening stroke,—is caused by full pressure in supply-pipe 18 when the high-pressure air from said pipe 18 lifts the check-valve ball 19 against the tension of its spring, and thence goes, by large duct 21 through large ports 21^a, 21^b, to space 24 to give the large diaphragm 12 its leftward, or door-opening movement. The duct 21 is, in effect, continuous from the valve 19 to the space 24, the portion thereof between the ports 21^a and 21^b constituting a detour around the valve 16, as shown in Figure 2. The duct 22 is, in like manner, detoured around valve 16 between ports 22^a and 22^b, as shown in Figure 3. The said large duct 21 is, however, shut off from pipe 18 by the ball check valve 19 during the door-closing movement, when the pressure in pipe 18 is at zero, so that the valve may be seated by its spring. The change of pressure in pipe 18 from zero to maximum or vice versa is produced, in a well known manner, by a control valve which connects pipe 18 alternately to the high-pressure air supply and to the atmosphere. The type of valve referred to is well known in the art, but for purposes of illustration and without intention to limit the invention thereto, said valve is illustrated in

Figure 1. Referring to said figure, V represents the valve which may be operated in any suitable manner. The valve chamber X connects with a pressure supply through a pipe P and to the exhaust through a pipe E. The pipe 18 leads from the valve chamber as shown. That control-valve does not, however, change the pressure in the opposite space 4 on the left-hand side of the small diaphragm 5. The space 4 is kept normally in communication with the high-pressure supply from pipe 1 through check-valve 2 and port 3. But the large diaphragm 12 has about twice the area of the small diaphragm 5 and will overpower 5 if the same pressure is acting on them both. It is when the diaphragm 5 is being thus overpowered by diaphragm 12 and the air in space 4 is being squeezed out through the small back-pressure port 6 (it cannot be expelled through port 3 because of check-valve 2) that there is a back pressure through 6 acting against the incoming pressure from pipe 1. Obviously, during this movement of the parts, the fluid pressure is the same both above and below the check valve 2, so that the spring tension upon said valve is sufficient to hold it to its seat. Since port 6 is small and also adjustable in capacity by needle-valve 7, this forced overflow therethrough serves to prevent slamming of the door when it is opened by the leftward movement of large diaphragm 12 on the admission of high pressure thereto by the control valve. Assuming the door is opened by the action of large diaphragm 12, the reclosing of the door will be by the action of the small diaphragm 5 which takes place when the control valve shifts pipe 18 from its high-pressure connection to its zero, or atmospheric connection. Then the large diaphragm 12 will be inert and hence will be moved to the right by the high pressure at the left of small diaphragm 5 in space 4. The air at the right of the large diaphragm in space 24 will be squeezed out with comparative ease through port 25, valve 16, duct 27, needle-valve 17 and duct 25, the pressure in pipe 18 then being at zero, but when the rib-cam 15 acts to close valve 16, that outflow route is shut off, and there remains only the more restricted route through ports 22^a, 22^b and duct 22. Thereby the door-closing action is checked at a definite time by the action of cam 15 in closing duct 27 by means of valve 16 and proceeds thereafter at a slower rate, although with equal certainty, by the continued effect of the high pressure in space 4 back of small diaphragm 5. The checking of the reverse or door-opening movement is not instigated at a definite instant by a cam like cam 15, but occurs as the air in space 4 is squeezed out through port 6 and a back pressure accumulates sufficient to overcome the high inflow pressure from pipe 1. It will be observed that the aforesaid plunger 13 is operated, in its leftward travel, by the spring 14 and, in its rightward travel, by the small diaphragm 5, although it is the large diaphragm 12 that is checked by the action of spring valve 16, which said plunger closes through the rib-cam 15. By this means it is only needful to have the respective diaphragms abut against the discs 8 and 11 without being positively attached thereto. I am also able to adjust the speed of the motor by adjusting the check at the latter part of each stroke instead of attempting to vary the applied supply pressure. It will be particularly noted that the rack 9 rests upon the base 23 and is supported thereby in such a manner that the ends of the rack as well as the disks 8 and 13 are otherwise unsupported and project freely into the respec-

tive diaphragm chambers. It will also be noted that each cap 29 and 30 respectively is a single unitary structure completely supporting all of the valves and ducts which are necessary for the operation of the apparatus. Therefore, if it becomes necessary to remove either of the caps for the purpose of investigation, repair, or any other reason, the cap may be removed without disturbing the mounting of the rack 9, because said rack derives its sole support from the base 23 and is in no way attached to or connected with either of the caps.

What I claim as new and desire to secure by Letters Patent is:

1. A fluid pressure door motor comprising a central member having chambers in its sides, diaphragms located within said chambers and dividing each chamber into two compartments, means for independently supplying fluid pressure to one compartment of each of said chambers, means providing an exhaust duct in communication with one of said compartments, a spring pressed valve controlling said duct, a movably mounted spring pressed cam for moving said valve in opposition to its spring tension, means operated by one of said diaphragms for moving said cam in opposition to its spring pressure, and door operating means located between and engaging both diaphragms.
2. A fluid pressure door motor comprising a central member having each of its opposite sides provided with a diaphragm chamber, flexible diaphragms in the respective chambers, a rack bar movably supported by said central member and having its ends in engagement with the two diaphragms so as to be operated by them alternately, a cam plunger movably mounted at the outer side of one of said diaphragms, a spring yieldably holding said plunger in engagement with the last mentioned diaphragm, means providing a duct leading from the rear of the last mentioned diaphragm to the atmosphere, and a valve in said duct operated by said cam plunger.
3. A fluid pressure door motor comprising a central member having each of its opposite sides provided with a diaphragm chamber, removable caps each forming a part of a diaphragm chamber, diaphragms dividing said chambers into two compartments, a door operating member located between and engaging both diaphragms so as to be operated by them alternately, a plunger carried by one of said caps and bearing against the outer side of the contiguous diaphragm, a spring yieldably holding said plunger against the last mentioned diaphragm, means in the last mentioned cap providing a duct leading from the rear of the last mentioned diaphragm to the atmosphere, and a valve controlling said duct, said valve being positioned to be operated by movement of said plunger.
4. A fluid pressure door motor comprising a central member having each of its opposite sides provided with a diaphragm chamber, diaphragms of unequal diameter mounted in the respective chambers, a door operating member movably supported by the central member and having its ends in engagement with the respective diaphragms, a pressure pipe in communication with the chamber having the smaller diaphragm, at a position in rear of said diaphragm, a pressure pipe in communication with the chamber having the larger diaphragm at a position in rear of the last mentioned diaphragm, check valve interposed between said pressure pipe and said chamber, said check valve being mounted to yield to

incoming pressure, means for maintaining a constant pressure in the first mentioned pipe and an intermittent pressure in the second named pipe, means providing a duct between the rear of the larger diaphragm and the atmosphere, and a valve contained in said duct and operated by the movements of the larger diaphragm.

5. A fluid pressure door motor comprising a central member having its opposite sides provided with chamber portions of unequal diameter, cap members of corresponding diameters removably mounted upon said casing member and cooperating with the chamber portions to provide diaphragm chambers, diaphragms retained in position by said cap members and so constructed and arranged as to divide said chambers into inner and outer compartments, one of said cap members having a supply duct and an exhaust duct therein in communication with the outer compartment

of the contiguous diaphragm chamber, a spring pressed valve normally closing said exhaust duct, means operated by movement of the contiguous diaphragm in one direction for seating said exhaust valve in opposition to its spring, means carried by the other cap member for introducing fluid pressure into the outer compartment of its contiguous diaphragm chamber, said last mentioned compartment being always subject to pressure, a door operating bar located between and operatively associated with said diaphragm, said bar being of such length and so supported by the central casing member that its unsupported extremities are free to project into the outer diaphragm chamber compartments, and movement thereof is limited to the space between the caps.

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40	115
45	120
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60	135
65	140
70	145
75	150