April 24, 1951 P. C. HELZ 2,550,349

PNEUMATIC DOOR OPERATING DEVICE

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Fig. 1.

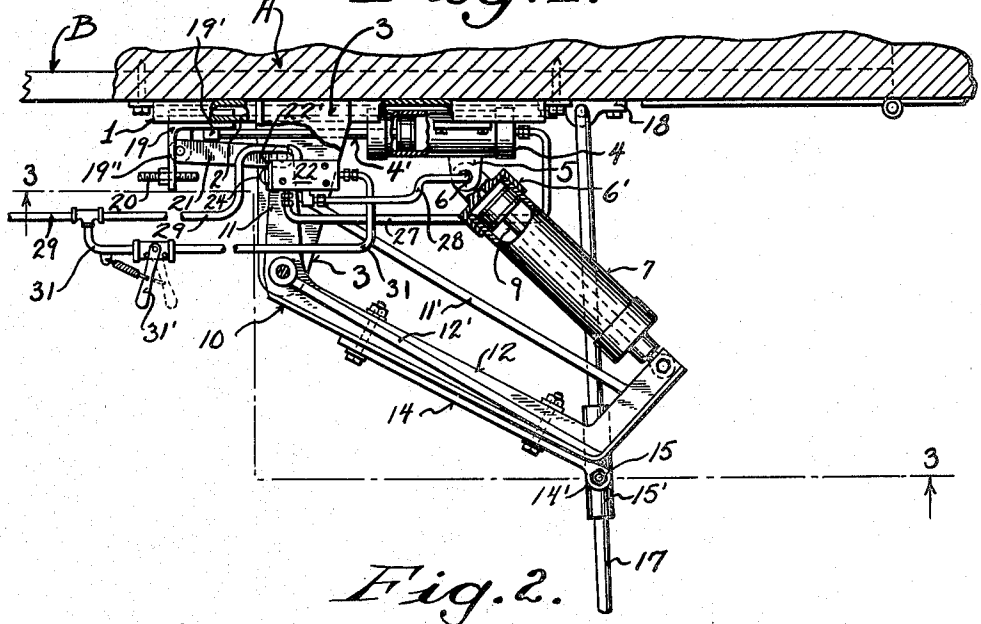
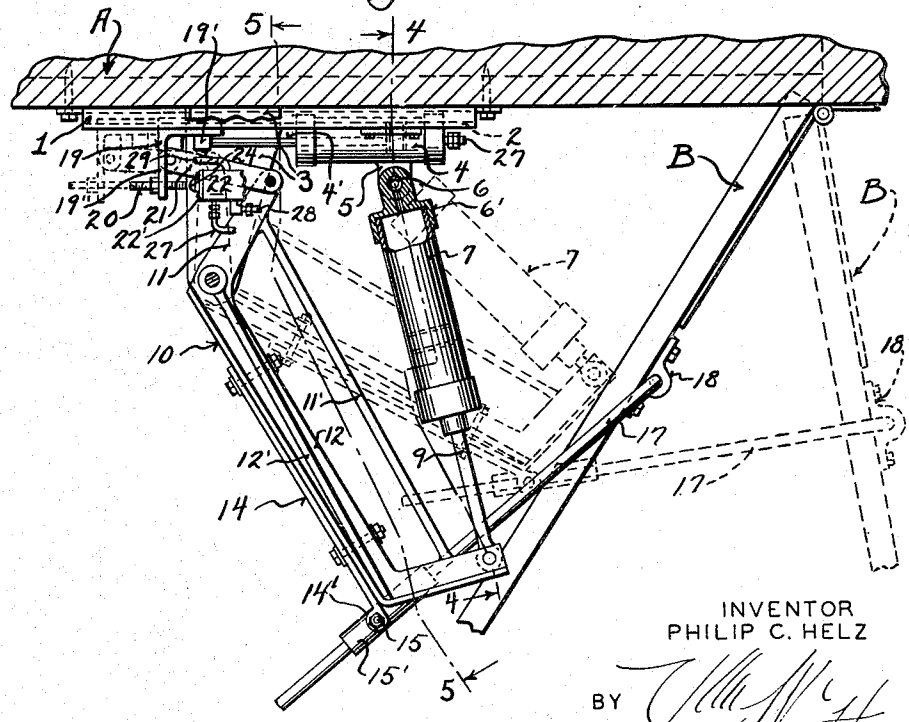


Fig. 2.



INVENTOR
PHILIP C. HELZ

BY

ATTORNEYS

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Fig. 3.

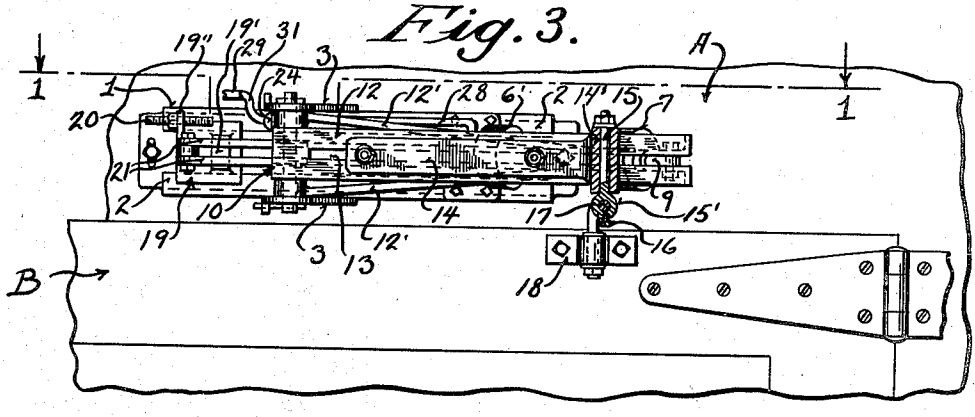


Fig. 4.

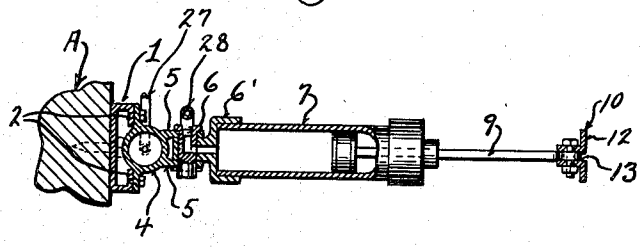


Fig. 5.

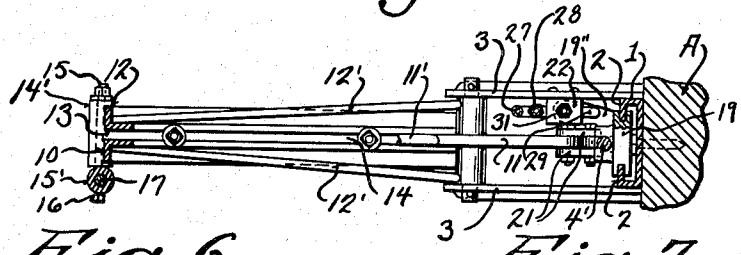


Fig. 6.

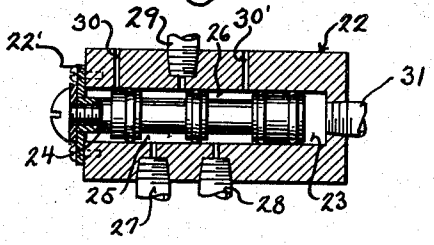
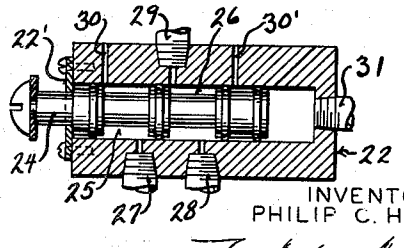


Fig. 7.



INVENTOR
PHILIP C. HELZ

BY

ATTORNEYS

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PNEUMATIC DOOR OPERATING DEVICE

Philip C. Helz, Milwaukee, Wis.

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3 Claims. (Cl. 268—66)

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My invention refers to fluid controlled door actuating mechanism.

The primary object of my invention is to provide a simple, positive and effective fully controlled fluid door actuating mechanism, in contradistinction to the standard semi-fluid door controlling mechanism, now in use, the same being combined with a spring power element to complete the cycle of operation. In this standard structure practice, as demonstrated, the spring element, due to use, frequently fails or deteriorates in its functioning.

A further object of my invention is to provide a fluid controlled master cylinder and a fluid controlled auxiliary cylinder, each of which cylinders are associated with a fluid valve, whereby fluid under pressure is introduced into the master cylinder to partially open a door, followed by the fluid being introduced into an auxiliary cylinder to complete the door opening or closing operations, the said auxiliary cylinder and associated mechanism therewith being substituted for the old standard spring element.

A still further object of my invention is to provide a bell crank lever, having a pull and thrust rod connection with a door, the long arm of which bell crank is connected to the master cylinder, while the short arm of said bell crank lever is indirectly connected to the auxiliary cylinder, whereby an initial pull action upon the door connected rod is followed by a thrust action of said rod, which is exerted by the auxiliary cylinder to complete the cycle to open or close the door, the cycle being under control of a valve which may be manually operated or said valve, under certain conditions, may be remotely actuated by an electric push button.

With the above and other objects in view, which will appear as the description proceeds, the invention resides in the novel construction, combination and arrangement of parts, substantially as hereinafter described, and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the herein disclosed invention may be made as come within the scope of the claims.

In the accompanying drawings is illustrated one complete example of the physical embodiment of the present invention constructed according to the best mode so far devised for the practical application of the principles thereof.

In the drawings:

Figure 1 represents a partially sectional plan view of the door actuating mechanism, embodying the features of my invention, the section being indicated by line 1, 1 of Figure 3.

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Figure 2 is a similar sectional elevation, illustrating the position of the mechanism and associated door partly open.

Figure 3 is a face view of the mechanism connected to a fragmental portion of the door frame and door, the section being indicated by line 3, 3 of Figure 1.

Figure 4 is a detailed cross sectional elevation, particularly illustrating the bracket and associated fluid cylinders, the section being indicated by line 4, 4 of Figure 2.

Figure 5 is a similar cross sectional elevation of the mechanism, the same being taken upon a different plain, the section being indicated by line 5, 5 of Figure 2.

Figure 6 is an enlarged detailed sectional elevation of a fluid valve employed to direct a constant fluid to both of the cylinders, the section illustrating a valve head in its closed position; and

Figure 7 is a similar sectional elevation showing the valve head in its open position.

Referring by characters to the drawings, A indicates the frame of a door opening and B a hinged door associated therewith.

Secured to the top portion of the door frame A is the base 1 of a bracket, which base is provided with longitudinally disposed track flanges 2, and extending outwardly from the base is a pair of tongues 3, 3.

The rear end of the base has secured thereto an auxiliary fluid cylinder 4, which cylinder in effect constitutes a part of the base.

For convenience in construction, the integral auxiliary base cylinder has extended therefrom apertured ears 5, 5, and pivotally mounted in the ear apertures is a hollow stud 6, which stud extends from the apertured head cap 6' of a master fluid cylinder 7.

The auxiliary cylinder 4 is provided with a standard piston rod 4' and its associated piston, while the master cylinder 7 is provided with a similar piston rod 9 and its associated piston, thus it should be noted that the master cylinder 7 in effect is pivoted to the base of the bracket.

Pivotally mounted between the tongues 3 of the bracket is the hub of a bell crank lever 10, having a short arm 11 extending inwardly towards the door frame and a long arm 12 extending obliquely towards the door hinges.

For strengthening purposes, the bell crank lever is provided with a pair of strengthening struts 12' extending from the hub to the outer

end of said lever long arm and a third strut 11', which extends from the short arm of said lever to an offset portion of the long arm, it being understood, for convenience in production, the long arm of said lever is formed from parallel angle iron strips centrally spaced apart to form an adjusting slot 13.

The adjusting slot 13 of the long arm of said lever has suitably secured thereto a strap 14, terminating with an apertured hub 14', for the reception of an eye bolt 15 loosely mounted in the hub. The bolt carries a sleeve 15' that is provided with a set screw 16, and said bolt sleeve has adjustably fitted therein a pull and thrust rod 17. The inner end of the rod 17 is downturned for the reception of a pivot clip 18, which clip is secured to the upper edge of the door B at a predetermined distance from the hinge thereof.

The offset end of the bell crank lever long arm has pivotally secured thereto the end of the piston rod 9, which is associated with the master cylinder 7.

The tracks 2 of the bracket base have slidably mounted thereon a shoe 19, which shoe is provided with a lug 19' that abuts the piston rod 4' of the cylinder 4, the said rod being provided with the usual piston reciprocated in the cylinder, as best indicated in Figure 1 of the drawings.

The slidable shoe is also provided with a right angle finger 19'', which finger has adjustably mounted therein a tappet 20.

The slidable shoe 19 has also pivoted thereto a link 21, the opposite end of which link is pivoted to the short arm 11 of the bell crank lever. Secured to the upper tongue 3 of the bracket is the casing 22 of a reciprocative valve head 24, the longitudinal center of which valve head is in alignment with the shoe tappet 20.

As illustrated in Figures 6 and 7 of the drawings, the hollow valve casing 22 is provided with a cylindrical barrel 23, into which is reciprocatively mounted the valve head 24, which valve head is provided with an annular auxiliary channel 25 and a similar annular master channel 26, it being understood that one end of the valve head 24 projects through a cap closure 22' of the valve casing.

The intermediate portion of the valve casing has fitted therein an auxiliary fluid supply pipe 27, and a master supply pipe 28, which pipes are spaced apart and communicate with the barrel 23 of the casing and the channels 25, 26 of the valve head.

Upon the opposite side of the valve casing 22, I provide a centrally disposed constant fluid pipe 29, which pipe selectively communicates with the valve head auxiliary channel and the master channel thereof.

The valve casing is also provided with a vent port 30 under control of the valve head 24, whereby upon a forward movement of said valve head, its annular chamber and associated pipe 27 are vented and a similar associated port 30' extends through the casing in communication with the master valve head chamber 26 and is cut off from said chamber when the valve head is moved forward, whereby communication is established between the constant supply pipe 29 and the master pipe 28 through the master channel 26 of the valve head.

In order to put the valve actuating mechanism into operation, I provide a starting fluid pipe 31, which pipe has fitted therein a spring controlled manually actuated valve 31' and said starting pipe communicates with the constant fluid supply pipe 29 and the rear end of the valve barrel 22, whereby the valve head is instantly shifted forwardly, as best shown in Figure 6 of the drawings, it being understood, when the slidable shoe moves rearwardly in conjunction with the auxiliary piston, the tappet 20 thereof will abut the exposed end of the valve head and push the same rearwardly, as indicated in Figure 6 of the drawings.

From the foregoing description, when the door is in its closed position, as best shown in Figure 1 of the drawings, to open the same the starting valve 21' is manipulated, whereby the valve head is moved forward, as shown in Figure 7 of the drawings. In said position the auxiliary cylinder, which is now under fluid pressure is relieved of said pressure, due to the fluid passing through the auxiliary channel and exhausting therefrom through the port 30. At the same time communication is established between the constant fluid pipe 26' and the fluid pipe 28 to the hollow pivotal connection of the master valve 7.

The constant fluid power is then discharged against the piston rod 9, and the master cylinder rod, and will cause the bell crank to swing from right to left (see Figure 2) upon its pivot, whereby a pull action is exerted upon the door B to cause the same to assume a position approximately slightly beyond a normal half opening of said door, whereby the pivot connection between the door and rod 17 has passed a dead center imaginary line, intersecting the door hinge and pivot connection with the long lever arm, as best shown in Figure 2.

When the mechanism assumes this partially open position of the door, the master cylinder has completed its stroke and also the sliding shoe 3, whereby the tappet 20 of said shoe will engage and move the valve head back to its closed position as shown in Figure 6 of the drawings, and in effecting this backward movement of the valve head, it should also be noted that the shoe has moved the auxiliary piston 4' with its piston head in its rearward position relative to the auxiliary cylinder.

Hence, when the final opening action of the door takes place, constant fluid from the pipe 29 will travel through the auxiliary channel 25 into the pipe 27 which communicates with the rear end of the auxiliary cylinder and the fluid introduced into said auxiliary cylinder will thus exert power upon the short arm of the bell crank, whereby said bell crank lever will return to its normal position of rest, as indicated in dotted lines of Figure 2, and due to this return swing of the long arm of the lever, it will exert a thrust pressure upon the rod 17, whereby said rod will push the door fully open, as shown in dotted lines in Figure 2 of the drawings. Thus the complete movement in opening a door is effected entirely by fluid pressure.

It is understood, should it be desired to open the door more fully than the position shown in dotted lines in Figure 2, this greater swing of the door may be effected by changing the position of the rod clip 18, with reference to the door hinges, whereby said clip would be moved closer to the hinges, and to complete this change of stroke, with reference to the rod 17, it is understood that the set screw 16 of the sleeve 15' is loosened, whereby said rod is adjusted in the sleeve 15' and locked therein by the set screws 16.

When it is desired to close the door, the manually actuated valve is again operated and fluid

under pressure will enter the master cylinder 7 forcing the piston and piston rod 9 outwardly and the rod 17 will exert a pull on the door B. The momentum of the swinging movement of the door will carry the pivotal point of the rod 17 on the door past dead center between the door hinges and the pivot point 15 of the rod with the bell crank lever 10. At this time the sliding shoe will actuate the slide valve and the flow of fluid under pressure to the master cylinder 7 will be cut off and fluid under pressure will enter the auxiliary cylinder 4. The piston and piston rod of the auxiliary cylinder through link connection with the short arm of the bell crank will swing the bell crank in a reverse direction toward the door frame to a normal position and the rod 17 will then push on the door and move the same to its fully closed position. The manual valve 31' is immediately released after the initial thrust on the door and this valve is returned to its normal position under influence of its spring.

While I have specifically included in my description various details of construction, it is understood that said details may be varied within the knowledge of the skilled mechanic for accomplishing the same final results.

I claim:

1. In a device for opening and closing swinging doors, a bell crank lever rockably mounted at its angle on the frame of the door and including a long and a short arm, means operatively connecting the long arm to the door, a main cylinder pivoted to the frame in spaced relation to the bell crank, a piston and piston rod for the cylinder, means pivotally connecting the piston rod to the long arm of the bell crank adjacent to its outer end, an auxiliary cylinder, a piston and piston rod for the auxiliary cylinder, means operatively connecting the piston rod of the auxiliary cylinder to the short arm of the bell crank, means including a manually operated valve for initially supplying fluid under pressure to the main cylinder for actuating the bell crank in one direction and the door to a partially opened position, and automatic means for cutting off the supply of fluid to the main cylinder after partial opening of the door and for supplying fluid under pressure to the auxiliary cylinder for further operation of the bell crank in a reverse direction and the door to its fully opened position.

2. In a device for opening and closing swinging doors as defined in claim 1 in which said means for operatively connecting the long arm of the bell crank to the door includes an operating rod pivotally secured to the bell crank and to the door.

3. In a device for opening and closing swinging doors as defined in claim 1 in which the automatic means for cutting off the supply of fluid to the main cylinder and for supplying fluid under pressure to the auxiliary cylinder includes a slide valve, and a sliding shoe secured directly to this piston rod of the auxiliary cylinder for movement with said piston rod and means for actuating the slide valve from said shoe when said shoe reaches a predetermined position.

PHILIP C. HELZ.

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