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DOOR ACTUATING MECHANISM

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It is among the objects of the invention to provide a door actuating mechanism that is dependable in operation requiring relatively little power to effect movement of even a heavy door between open and closed position, which mechanism has relatively few parts that may readily be installed and are not likely to jam and become out of order and which, with the use of a conventional hydraulic jack, will afford substantially 180 degrees movement of a door between open and closed position, and which is so designed that when the door is in open position the opening which it normally covers will be substantially completely free of any obstruction so that complete access through such opening is afforded.

According to the invention these objects are accomplished by the arrangement and combination of elements hereinbefore described and particularly recited in the claims.

In the accompanying drawings in which is shown one or more of various possible embodiments of the several features of the invention,

Fig. 1 is a side elevational view of a typical door installation, and

Fig. 2 is a transverse sectional view taken along line 2—2 of Fig. 1.

Referring now to the drawings, in the embodiment herein shown to illustrate the invention, a door 11 is so mounted that it may be pivoted from closed position, through an angle of substantially 180 degrees, to open position with respect to an opening 12 which may be in a wall 13 for example, that forms the side of a ship.

The door 11 desirably comprises a substantially rectangular panel 14 which may have a flange 15 at its periphery that extends outwardly from the panel 14 at substantially right angles thereto. The door 11 is hinged as at 16 at one of its longitudinal edges 17 to a longitudinal edge 18 of the opening 12, the complementary portions of said hinge 16 being mounted respectively by means of brackets 19 to the flange 15 of the door and to said longitudinal edge 18 of said opening 12.

When the door is in the closed position shown in broken lines in Fig. 2, the rim 21 of flange 15 desirably rests against a sealing strip 22 of resilient material positioned around the periphery of opening 12. Although the sealing strip 22 may be supported in any suitable manner, as illustratively shown, L-shaped angle members 25 are desirably provided, each of which has one of its legs 26 affixed as by welding to the periphery of the opening 12 and its other leg 27 extending inwardly from said periphery, said sealing strip 22 being mounted on said leg 27.

Means are desirably provided to prevent undue compression of the sealing strip 22 which might injure the latter when the door 11 is in closed position. Thus, for example, a rigid strip or stop 31 is affixed to the front panel 14 of the door 11 extending laterally beyond its longitudinal edge 33 so that when the door is closed, the strip 31 will abut against the portion of wall 13 adjacent the longitudinal edge 34 of opening 12 to limit the closing movement of said door 11.

In order to move the door 11 from open to closed position and vice-versa, an hydraulic actuator or jack 35 is provided which comprises a cylinder 36 pivotally mounted at one end as at 37 to a bracket 38 affixed to the inner surface of the wall 13. Slidably mounted in the cylinder 36 is a piston 39 to which one end of a piston rod 41 is affixed. The cylinder 36 has ports 42 and 43 near each end respectively through which fluid under pressure may be admitted or expelled as the case may be, in conventional manner from a suitable source to effect movement of the piston 39 in either direction.

The free end of the piston rod 41, which extends beyond the cylinder 36, is pivotally connected as at 44 to a substantially L-shaped lever 45, the shorter leg 46 of which is reversibly bent at least at its free end and as shown in Fig. 2 is pivotally mounted at its extremity to the right of hinge 16 as at 47 to a bracket 48 affixed to the wall 13 adjacent the edge 18 of opening 12.

The leg 51 of lever 46 which is longer than leg 46 is of such length that when the door 11 is in fully open position as shown in full lines in Fig. 2, said leg will extend at substantially right angles to wall 13 and the end 53 of said leg 51 will extend slightly beyond the plane of the door 11. Pivotally connected to said end 53 is one end of a connecting rod 56, the other end of which is pivotally connected as at 57 to a bracket 58 affixed to the inner surface of door 11 adjacent its edge 17.

In order that the force available from the hydraulic actuator 35 be utilized most efficiently and that the door be rotated 180 degrees, the lever 45 operated by the jack 35 should rotate less than 130 degrees and the following relationship between the elements of the door actuating mechanism is preferred.

(1) The angle between a line X extending at right angles to wall 13 from the axis of hinge 16 and a line Y extending from the axis of hinge 16 through the axis of pivotal mount 47 is desirably greater than 30 and less than 80 degrees and illustratively is approximately 45 degrees.

(2) The length of connecting rod 56 is greater than the distance between hinge 16 and pivotal mount 47.

(3) The length of connecting rod 56 is substantially the same as the length of leg 51 of lever 45.

(4) The angle between a line X extending from the axis of the pivotal mount 44 through the axis of the pivotal mount 47 and a line Y extending from the axis of pivotal mount 44 along the axis of the pivot rod 41 when the door 11 is in either open or closed position is approximately 35 degrees.

When fluid under pressure is applied to the port 42 of cylinder 36, it will urge the piston 39 to the right. Consequently, force will be exerted against the lever 45 to cause the latter to pivot in a counterclockwise direction about its pivot 47. As a result of such movement, through the linkage from the end 53 of leg 51 to bracket 58 of door 11, said door will also swing in a counterclockwise direction.

The stroke of the pivot rod 41 is such that when the pivotal mount 44 and the free end 53 of the leg 51 of lever 45 have moved through an arc of approximately 130 degrees from the position shown in full lines in Fig. 2, to the position shown in broken lines, the door 11 will have pivoted through an arc of substantially 180 degrees to closed position, so that the rim 21 of flange 15 will engage sealing strip 22 to prevent leakage past the door.

With the construction above described, maximum utilization will be made of the force available from the
hydraulic actuator 35 with resultant saving in power required to move the door from open to closed position.

It is to be understood that the dimensions above set forth are merely illustrative and can be varied slightly depending upon the physical dimensions of the components utilized.

It is also to be understood that a plurality of actuators 35 and associated mechanism could be used depending upon the size and weight of the door to be moved.

As many changes could be made in the above construction, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. Mechanism of the character described for moving a door from closed position with respect to an opening in a wall, through an angle of substantially 180 degrees to open position, said mechanism comprising a hinge connection between one edge of said door and the adjacent edge of said opening, a substantially L-shaped lever having the free end of one of its legs pivotally mounted to the inner surface of said wall laterally spaced from the edge of the opening to which said door is hinged, a rod pivotally connected at one end to the free end of the other leg of said lever and pivotally connected at its other end to the inner surface of said door and a hydraulic actuator pivotally connected at one end to the inner surface of said wall, laterally displaced from said pivotal mount of the lever and the other end of said hydraulic actuator is pivotally connected to said lever near the junction between its legs.

2. The combination set forth in claim 1 in which the length of said rod is greater than the distance between the hinge of the door to the pivotal mount of said lever and the angle defined between a line extending at right angles to said wall from the axis of the hinge connection and a line extending from the axis of said hinge connection to the axis of the pivotal mount of said lever is between 30 and 80 degrees.

3. The combination set forth in claim 1 in which the length of said rod is greater than the distance between the hinge of the door to the pivotal mount of said lever and the angle defined between a line extending at right angles to said wall from the axis of the hinge connection and a line extending from the axis of said hinge connection to the axis of the pivotal mount of said lever is between 30 and 80 degrees.

7. The combination set forth in claim 1 in which the length of said rod is greater than the distance between the hinge of the door to the pivotal mount of said lever and the angle defined between a line extending at right angles to said wall from the axis of the hinge connection and a line extending from the axis of said hinge connection to the axis of the pivotal mount of said lever is between 30 and 80 degrees.

8. The combination set forth in claim 7 in which the longer leg of said lever extends at substantially right angles to said wall when the door is in open position.

9. The combination set forth in claim 1 in which the leg of said lever to which said rod is connected is longer than the other leg and said longer leg is substantially equal in length to said rod.

10. The combination set forth in claim 1 in which the hydraulic actuator has a piston rod pivotally connected at one end to said lever and the angle between a line extending from the axis of the pivotal mount of said lever to the axis of the pivotal connection of said piston rod to said lever and a line along the axis of said piston rod is approximately 35 degrees.

11. The combination set forth in claim 1 in which the hydraulic actuator has a piston rod pivotally connected at one end to said lever and the angle between a line extending from the axis of the pivotal mount of said lever to the axis of the pivotal connection of said piston rod to said lever and a line along the axis of said piston rod is approximately 35 degrees, and the angle defined between a line extending at right angles to said wall from the axis of the hinge connection and a line extending from the axis of said hinge connection to the axis of the pivotal mount of said lever is between 30 and 80 degrees.

12. The combination set forth in claim 1 in which the length of said rod is greater than the distance between the hinge of the door to the pivotal mount of said lever and the angle defined between a line extending at right angles to said wall from the axis of the hinge connection and a line extending from the axis of said hinge connection to the axis of the pivotal mount of said lever is between 30 and 80 degrees, the hydraulic actuator has a piston rod pivotally connected at one end to said lever and the angle between a line extending from the axis of the pivotal connection of said piston rod to said lever and a line along the axis of said piston rod is approximately 35 degrees.

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