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DOOR ACTUATING MECHANISM

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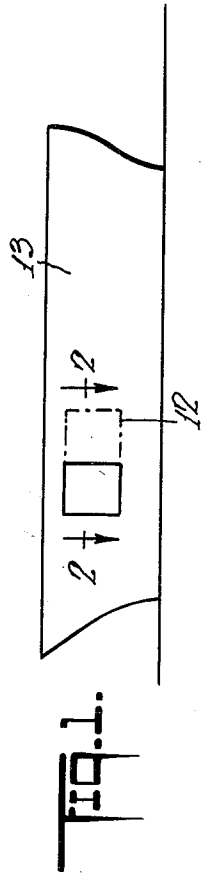


Fig. 1.

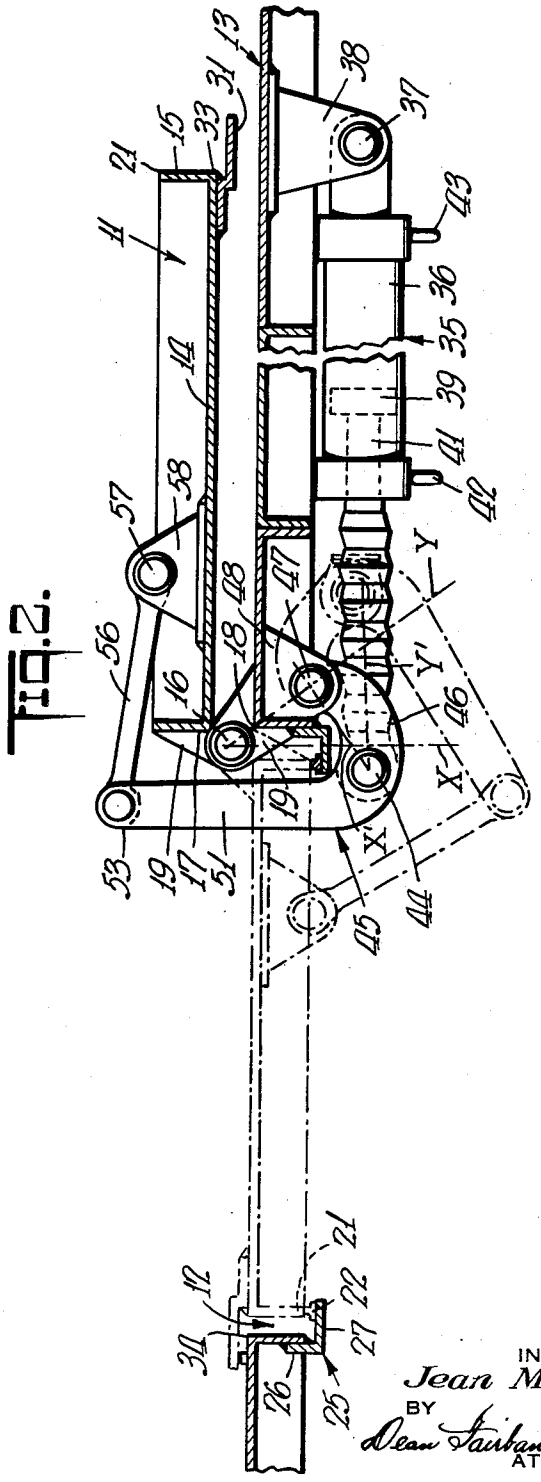


Fig. 2.

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DOOR ACTUATING MECHANISM

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12 Claims. (Cl. 268—66)

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 hereinafter 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 reversely 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' from the axis of pivotal mount **44** along the axis of the piston 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 piston 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 is 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.

3. The combination set forth in claim 1 in which the pivotally mounted leg is shorter than the other leg and is reversely bent at least at its free end and is pivotally mounted at the extremity of said reversely bent end.

4. The combination set forth in claim 1 in which 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.

5. The combination set forth in claim 4 in which said angle is approximately 45 degrees.

6. The combination set forth in claim 1 in which the lever is adapted to move through an angle of less than 130 degrees while said door moves through an angle of approximately 180 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 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.

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