March 5, 1935. W. O. LUM 1,993,613

HYDRAULIC OPERATOR

Filed Dec. 19, 1929

Fig. 1.

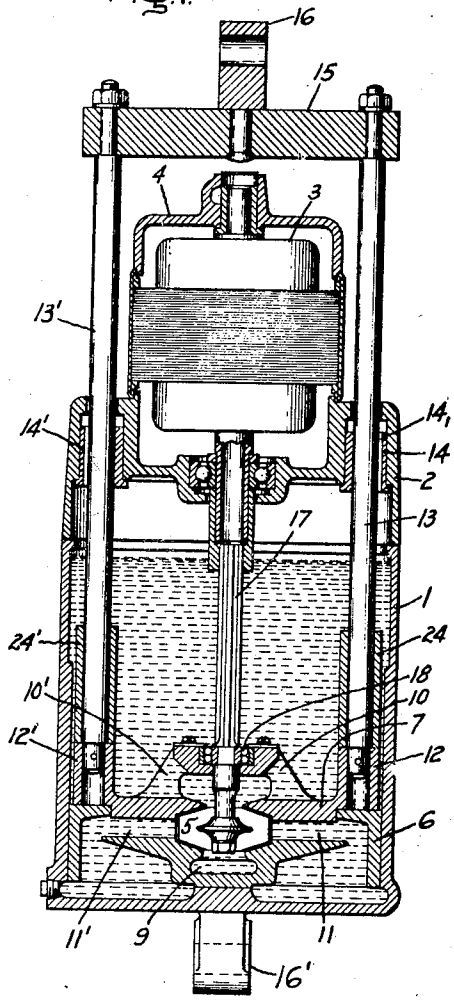


Fig. 2.

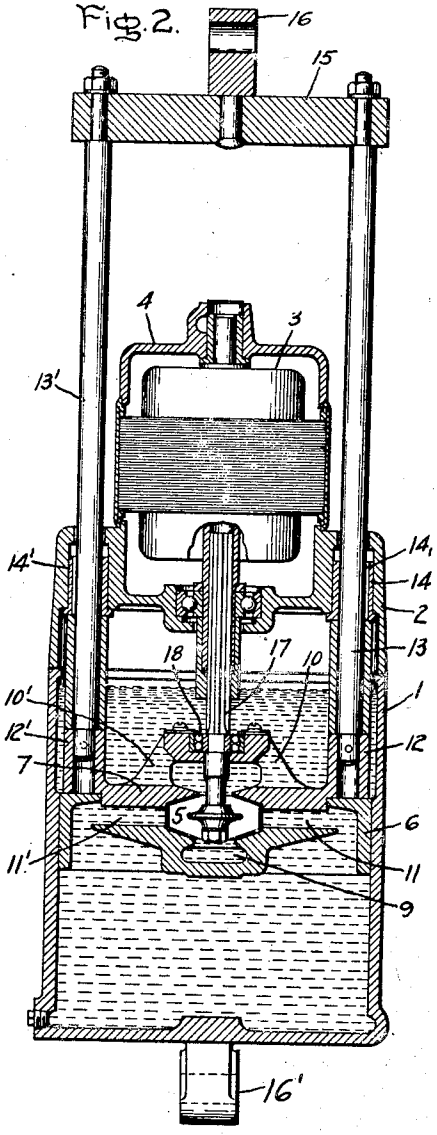


Fig. 3.

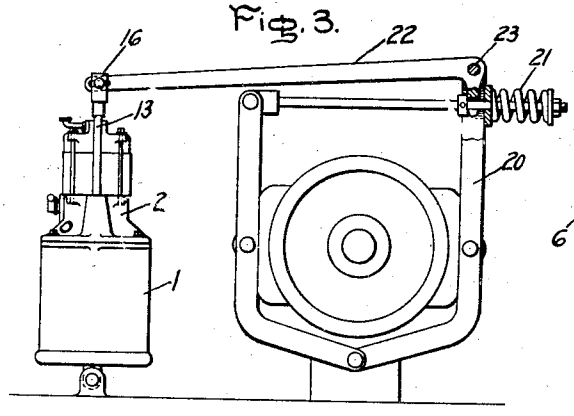
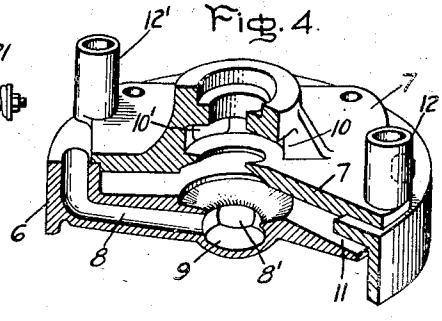


Fig. 4.



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UNITED STATES PATENT OFFICE

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HYDRAULIC OPERATOR

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Application December 19, 1929, Serial No. 415,341

20 Claims. (Cl. 60—52)

My invention relates to improvements in electro-hydraulic pressure operating means such as described in my copending application Serial No. 193,016, filed May 20, 1927, and assigned to the same assignee as this application.

In devices of the hydraulic operated type now in use the lack of a compact unit results in unwieldy apparatus not readily placed to operate the devices to be actuated thereby. The lack of a compact unit prohibits the use of such devices where space is of prime importance, although such hydraulic devices are highly desirable.

The lack of relative movement of the hydraulic operator with respect to its base and the device worked upon permits only straight line movement of the operating member of the operator, hence limiting its application further or requiring other than a pivotal connection with said operating member.

It is an object of this invention to produce a hydraulic operator to take the place of large alternating or direct current magnets and solenoids, and to replace air cylinders where quiet and smooth upward thrust is desired through a given distance.

Another object of my invention is to provide a fluid pressure operated device in the form of a compact unit which is readily applied to actuate a given device.

A further object of my invention is the provision of a compact electro-hydraulic unit provided with a relatively movable two-point mounting permitting other than straight line movement between the operator and the device worked upon.

Another object of my invention is the provision of a combined piston and impeller for a hydraulic operator.

Further objects will appear hereinafter.

In the preferred embodiment of my invention a casing in the form of a cylinder vertically mounted is provided on one end of which is placed an eye for pivoted attachment to some base, and slidably mounted on the other end a work engaging member provided with an eye for pivoted engagement with a device worked upon.

The interior of the casing is filled with liquid and provided with a piston which carries an impeller pump. The impeller is provided with an electrical driving means.

The piston is provided with communicating passages therethrough so that the liquid can be pumped into that part of the cylinder below the piston to raise the piston, or be permitted to flow back up through the piston to permit the piston to settle in the cylinder. Thus the piston is raised and lowered.

Connected to the piston are means which extend through the casing and carry a member provided with means for engaging the object or apparatus to be actuated. Of course the member is moved up and down in response to the piston movements.

A peculiar construction of the casing keeps the oil from discharging over the outside of the casing during the energization of the operator.

My invention will be better understood from the following description when considered in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

In the accompanying drawing, Fig. 1 represents a cross section of the hydraulic operator in its position of rest; Fig. 2 represents a cross section with the piston in a raised position; Fig. 3 shows the method of attaching the operator to a brake; Fig. 4 is a detailed showing of the piston.

In Fig. 1 the casing or cylinder is designated by the numeral 1. A covering or cylinder head 2 is mounted on the top of the casing and supports an electric motor 3 which is covered by means of the cup-shaped member 4. An impeller 5 is mounted in a piston 6 which slides in the cylinder 1. When actuated, the impeller 5 receives oil at its top and bottom sides through the openings 10, 10', 9 and 8 and 8' (Fig. 4) and discharges the oil in a radial direction through the orifices 11 11', thereby creating a pressure in the oil below the piston. Mounted upon the upper part 7 of the piston are the extensions 12, 12' which support the rods or extensions 13, 13'. These extensions slide in the bearings 14, 14' each of which is provided with a slot such as 14_1. Clearances are provided in the cylinder head 2 to permit the extensions or rods 13, 13' to pass through the cover without touching the same. Tubular spacers or stops 24 and 24' are provided on extensions 13 and 13' to limit the upward travel of the piston. Cross member 15 is supported by the extensions 13 and 13'. This cross member in turn supports a work engaging element or eye member 16. An eye member 16' pivotally supports the casing.

Power is supplied to the impeller 5 by means of the splined shaft 17 which is rotatably mounted in the piston and supported by the bearing 18.

The bearing 18 in Figs. 1 and 2 is of the self-aligning type so that should any misalignment

occur at any point in the travel of the piston from its lowermost to its top position, such misalignment will not cause any binding or damage to the rotating parts.

Referring to Fig. 4, the details of the piston will be more clearly seen. The piston consists of two parts, a lower part 6 and an upper part 7 which carries the extensions 12, 12'. The passageways 8 and 8' which open up into the cup-shaped portion 9 on the lower side of the impeller permit the oil above the piston to pass through the piston and be expelled by means of the impeller 5 through the openings 11, 11'. Oil from above the piston also passes through the passageways 10, 10' and comes into the upper portion of the impeller 5 and is expelled through the orifices 11, 11'.

The bearings 14, 14' act as wipers for the rods 13, 13'. However, oil which adheres to the rods 13 and 13' will return to the space which is above the bearings 14, 14' because of the clearance in the cover around the extensions. The oil which is there received will then return to the oil reservoir by means of the slot 14_1.

The operation of the device is as follows: When it is desired to raise the work engaging member 16, the motor 3 is energized to rotate the shaft 17 which in turn drives the impeller 5. The liquid within the casing enters the portion of the piston 6 in which the impeller is located through the passageways 10, 10', 8, 8' and 9, as heretofore described and explained, and is discharged in a radial direction through passages 11, 11'. This causes a pressure differential with the pressure exerting a force upon the bottom of the piston to cause it to be raised within the cylinder, the rate at which the piston is raised depending upon the area of the piston, the load lifted thereby, the impeller diameter and the rate of rotation of the motor. To permit the piston to return to its lower position, the motor 3 is deenergized. The oil then flows backwards from the underside of the piston through the passageways to the other side of the piston. A dash-pot effect is obtained by this action, so that the piston settles easily.

Fig. 3 shows an application of the hydraulic operator to a brake mechanism. In the particular showing, the brake is biased to the "on" position by means of the spring 21. The lever 22, which is pivoted at the point 23, is connected to the work engaging eye member 16. It will be seen that upon operation of the hydraulic operator to raise the member 16, the lever 22 will operate against the spring 21 to release the brake.

Its application, however, is not confined to brakes but may be applied to such devices as clutches, doors, window openers, spot welders and pumps and fulfills the functions of solenoid and air cylinders.

It will be apparent that the invention is susceptible of being modified to meet different conditions encountered in its use and I therefore aim to cover by the appended claims all modifications within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. A fluid pressure device including a fluid containing cylinder, a piston for the cylinder having passages extending through the piston and forming a centrifugal pump housing therein with the inlets and outlets on opposite sides of the piston, and an impeller rotatably mounted in said housing for creating a pressure differential between the opposite sides of the piston for moving the same.

2. A fluid pressure device comprising a fluid containing cylinder, a piston for the cylinder having a plurality of interconnected passages extending through the piston and forming a double inlet centrifugal pump housing within the piston with the inlets and outlets on opposite sides of the piston, and an impeller rotatably mounted in the said housing for creating a pressure differential between the opposite sides of the piston for moving the same.

3. A device for applying pressure comprising a fluid cylinder, a two-part piston therein forming a housing between said parts, and an impeller carried by the piston in said housing for creating a pressure differential between the two sides of the piston for moving the same.

4. A device for applying pressure comprising a fluid cylinder, a two-part piston therein having one part provided with pressure applying means and another part cooperating therewith to form a housing therebetween, an impeller carried by said piston within said housing and arranged to create a pressure differential between the two sides of the piston for moving the same, and an electric motor for driving the impeller.

5. A device for applying pressure comprising a fluid cylinder, a two-part piston therein having one part provided with pressure applying means and another part cooperating therewith to form a housing therebetween, an impeller disposed in said housing and rotatably mounted therein, and a bearing for said impeller mounted in one of said parts, said impeller being arranged to create a pressure differential between the two sides of the piston for moving the same and means for driving the impeller.

6. In combination, a fluid container, a liquid therein, a piston immersed in said liquid and movable in said container in response to a pressure differential in said liquid, an impeller for creating a pressure differential in said liquid for moving said piston, said piston having a pump housing as a part thereof and carrying said impeller therein and having communicating passages extending through said piston whereby liquid may be forced therethrough from one side of said piston to the other side by said impeller, means supported by said piston and extending through said container for supporting a work engaging member, said last named means being movable with said piston to actuate said work engaging member, and driving means mounted on said casing for driving said impeller.

7. An electro-hydraulic operator unit comprising a cylinder, a piston reciprocable in said cylinder, said piston comprising two parts and forming a pump housing therebetween with communicating passages extending through said parts to permit the passage of fluid through said piston and housing from one side thereof to the other and an electric motor driven impeller carried by said piston within said housing for creating a pressure differential to operate said piston.

8. In combination, a pivoted load member and an electro-hydraulic mechanism for operating the load member including a fluid containing cylinder mounted for pivotal movement, a piston reciprocating in the cylinder and having a pressure applying member extending from the cylinder and pivotally connected with said load mem-

ber, and an electric motor driven centrifugal pump mounted in the cylinder for transferring fluid from one side of the piston to the other to create a fluid pressure differential on the opposite sides of the piston for operating said load member.

9. In combination, a casing mounted vertically, a liquid in said casing, a piston immersed in said casing and movable therein in response to a pressure differential in said liquid, an impeller pump carried by said piston for creating a pressure differential in said liquid, driving means for said pump mounted on said casing, means connectng said impeller pump and driving means, and a self-adjusting bearing carried by said piston for supporting said connecting means without subjecting any part of the apparatus to strain due to any misalignment of said connection during operation thereof.

10. In combination, a casing provided on one end with a pivot and a driving means mounted on the other end and having a hollow shaft, liquid within said casing, a piston, an impeller mounted in said piston and surrounded by said liquid, a splined shaft carried by said impeller cooperating with said hollow shaft and telescoping therein, said impeller actuated by said driving means to create a pressure differential in said liquid to move said piston.

11. In an electro-hydraulic operator unit, a cylinder, a liquid therein, a piston reciprocable in said cylinder and an impeller carried by said piston for creating a pressure differential in said liquid to move said piston, a motor for driving said impeller and provided with a hollow shaft, a splined shaft cooperating therewith and telescoping therein, said splined shaft connected to said impeller to drive the same.

12. In a vertical hydraulic operator unit a casing, a liquid therein, a pressure responsive device immersed in said liquid and movable therein in response to pressure differential in said liquid, a pressure creating means mounted in said pressure responsive device for creating a pressure differential in said liquid, a driving means for said pressure creating means connected thereto and mounted on top of said casing, means mounted on said pressure responsive device extending upwardly from said cylinder and movable into and out of said casing and supporting a work engaging member, and stops on said last means which act to limit the upward movement of said last means out of the casing upon movement of said piston.

13. A pressure operated device comprising a liquid container, a liquid therein, a pressure responsive means immersed in said liquid and a pressure creating element mounted in said means for creating a pressure differential to move said means in said casing, said means being constructed to permit the liquid to pass therethrough from one side of said means and come into contact with said element on both sides thereof and to be expelled from said element to the other side of said means to create a pressure differential in said liquid to move said means.

14. In a pressure operated device, a casing, a liquid within said casing, a pressure responsive element immersed in said liquid and movable in said casing, an impeller mounted in said element, said element being constructed to rotatably support said impeller and provided with communicating means permitting said liquid to come into contact with both sides of said impeller from one side of said element and other communicating means in said element to permit said liquid to be discharged from said impeller to the other side of said element, said liquid being forced by said impeller to flow through said communicating means in said element from one side of said element to the other to create a pressure differential in said liquid to move said element.

15. In combination, a casing, a liquid therein, a pressure responsive device immersed in said liquid and movable in said casing and a pressure creating means mounted in said device for creating a pressure differential in said liquid to move said device, a driving means, and a sliding connection between said driving means and said pressure creating means, to drive said last means, and a self-adjusting bearing carried by said pressure responsive device for supporting said connection without subjecting any part of the apparatus to strain due to misalignment of said connection during operation thereof.

16. In combination, a casing, a liquid in said casing, a pressure responsive device immersed in said liquid and movable in said casing in response to a pressure differential created in said liquid, a pressure creating means for creating said pressure differential, means mounted on said device extending upwardly from said casing and supporting a work engaging member, and bearings for said last means which act as wipers to remove the liquid from said last means as said means move into and out of the casing upon movement of said pressure responsive device, and a chamber between said casing and one end of said bearing surrounding said last means into which liquid from said last means may drain, and a slot cut into said bearing permitting said liquid to drain back into the liquid in said casing from said chamber.

17. In combination, a casing mounted vertically provided with a pivotal mounting on the lower end of said casing, a liquid in said casing, a piston immersed in said liquid and movable in said casing in response to a pressure differential in said liquid, a pump carried by said piston for creating a pressure differential in said liquid, and communicating means extending through said piston whereby the liquid may be forced therethrough from one side of the piston to the other by said pump, and a driving means for said pump and connected thereto mounted on the top of said casing and rods mounted on said piston and movable therewith extending from said casing and supporting a work engaging member to move the same.

18. In combination, a vertically mounted casing, a liquid therein, a piston reciprocable in said casing and carrying an impeller pump for creating a pressure differential in said liquid to move said piston, a motor mounted on said casing for driving said pump, connections between said pump and said driving means, means mounted on said piston and carried therewith extending through said casing, and a work engaging member supported by said last means, the means mounted upon said piston moving into and out of said casing with said piston in response to a pressure differential created by said pump upon operation of said motor.

19. In combination, a load member and an electro-hydraulic mechanism for operating said load member including a pivotally mounted casing, a driving means mounted thereon opposite to the pivotal mounting of said casing, a liquid

therein, a piston reciprocable in said casing, rods carried by said piston in spaced relation and extending through said casing adjacent said driving means, a work engaging member carried by said rods and provided with a pivotal connection for engaging said load member for applying pressure thereto, and pressure creating means in said casing and connected to said driving means for creating a pressure in said liquid for moving said piston to apply pressure to said load member.

20. In combination, a pivoted load member and an electro-hydraulic mechanism for operating the load member including a casing pivotally mounted, a liquid therein, a reciprocable piston therein and movable in response to pressure within said liquid, rods carried by said piston in spaced relation and extending through said casing opposite to the pivotal mounting thereof, a work engaging member carried by outer ends of said rods provided with a pivot for engaging said load member, and pressure creating means for creating a pressure in said liquid to move said piston to increase the distance between said pivoted end and the pivoted load engaging member whereby a pressure is applied to said pivoted load member.

WALTER O. LUM.