July 30, 1968 E. W. JACKOBOICE 3,394,544

INTEGRATED CYLINDER AND POWER UNIT

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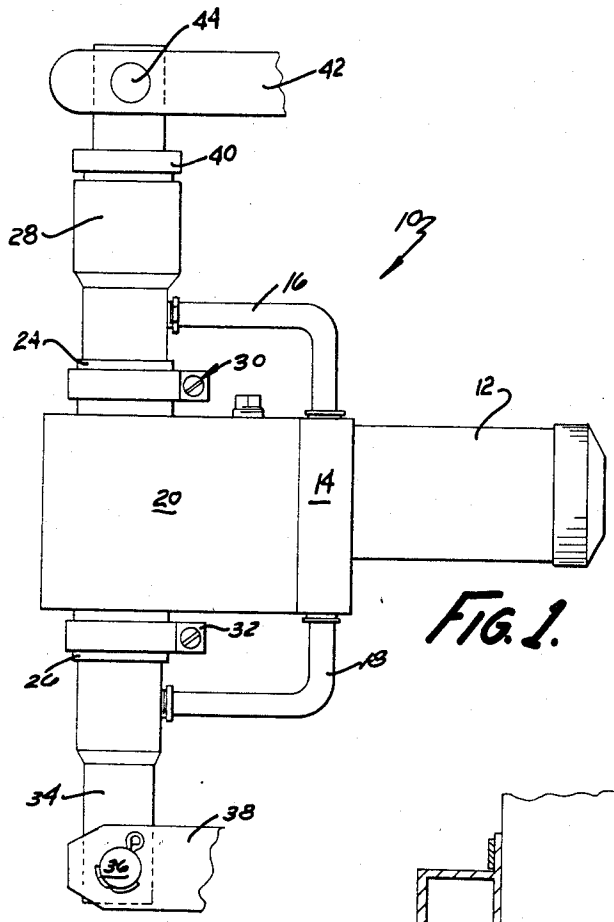

FIG. 1.

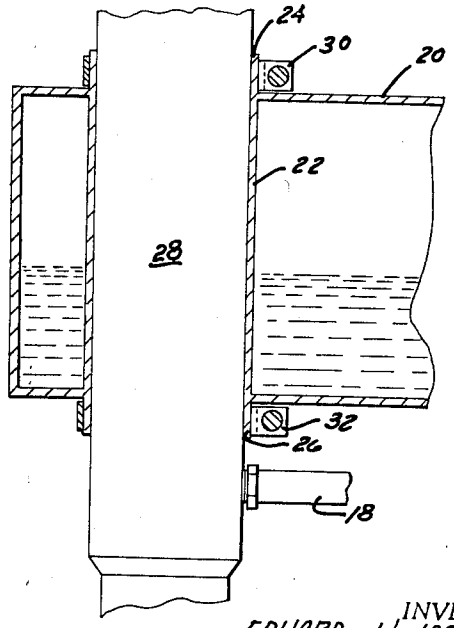

FIG. 2.

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INTEGRATED CYLINDER AND POWER UNIT

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ABSTRACT OF THE DISCLOSURE

An integrated, unitary hydraulic power unit of particular utility in operating vehicular implements such as snowplows and the like, comprised of a power unit including a motor and pump attached to a control valve which is in turn attached to a fluid reservoir, and a hydraulic cylinder including a housing and a ram or piston member, with the power cylinder housing mounting within a vertical passage extending downwardly through the fluid reservoir, such that the power cylinder may be mounted between relatively movable portions of the implement and the vehicle itself in order to move and actuate the former while simultaneously serving to support and mount the power unit through whose reservoir the cylinder extends.

This invention relates to fluid cylinders and the power units for operating such cylinders, and more particularly to a unique form of integrated cylinder and power unit providing a unitary structure having a number of preferred operational features.

Fluid cylinders, particularly those operated through pressurized hydraulic fluids, are used in a very great number of industrial and commercial applications involving the raising and lowering or other displacement of mechanical loads. In most previous applications, the cylinders were individually mounted to perform the desired work and were connected by elongated supply lines to a suitable power unit including generally a motorized pump, a control valve, and a tank or reservoir for fluid to be supplied to the pump. In many applications, however, the space which was available for mounting such components was strictly limited, and consequently more compact structures were developed which in one manner or another sought to integrate the different components. Thus, fluid power systems were developed which had a variety of specialized compact configurations designed for a specific application and having little or no versatility. Such a situation is clearly undesirable from a manufacturing point of view, in that production costs per unit are inevitably increased due to the continuous requirement of design and development expenditures. Such specialized manufacturing conditions are also undesirable from a consumer's point of view, since the expensive specialized power units can rarely be utilized for any other purpose once their intended usage is completed, or no longer exists.

Accordingly, it is a major object of the present invention to provide a compact, integrated cylinder and power unit which is fully compatible with a wide variety of mounting space limitations by virtue of certain substantially universal mounting provisions.

It is a further major object of the present invention to provide a cylinder and power unit of the foregoing nature which is at once integrated into a substantially unitary structure and which is also relatively adjustable, so that

different portions of the device may be positioned wherever space permits.

A still further major object of the invention is to provide an integrated, unitary-type cylinder and power unit having the foregoing attributes which nonetheless is separable into individual component portions to achieve maximum flexibility and versatility in mounting and operational conditions of all types.

The foregoing major objects of the invention and the advantages provided thereby, together with numerous other objects and advantages no less a part thereof, will become increasingly apparent following a consideration of the ensuing specification and its appended claims, particularly when taken in conjunction with the accompanying illustrative drawings setting forth a preferred embodiment thereof.

In the drawings:

FIG. 1 is an enlarged side elevation of the novel device, together with typical environmental structure illustrating the mounting thereof; and

FIG. 2 is a fragmentary, side elevation of a portion of the structure of FIG. 1, with parts thereof being shown in central section.

Referring now in more detail to the drawings, the integrated device **10** includes a combined motor and pump **12** which together form a driven pump means for providing fluid under pressure. The motor and pump **12** include an electric motor section which is shaft-coupled to a fluid pump, with both components being mounted in a single housing for maximum compactness. Such units are commercially available from a number of manufacturing sources, and consequently no detailed disclosure is deemed to be required. The pump portion of the motor and pump unit **12** is directly connected in flow communication to a control valve apparatus **14**, by which pressurized fluid from the motor and pump unit **12** may be directed to a desired location, and by which such pressurized fluid may be relieved from a pressurized location, as by fluid conduits **16** and **18** which preferably are flexible hydraulic lines. The control valve **14** is of a known type having internal passages which may be selectively opened and closed through internal valving means, as is known in the art.

Secured to the control valve **14** on its side opposite from the pump and motor unit **12** is a fluid reservoir **20** which, as will be understood, serves to hold a supply of fluid which the valve **14** may admit to the pump portion of the motor and pump **12**, to be placed under pressure by the latter for operational purposes. The reservoir **20** of the invention has a vertically oriented cylindrical passage formed directly through it, preferably by an internal sleeve-like member **22** (FIG. 2) which extends from the top of the reservoir to the bottom thereof, with the hydraulic fluid in the reservoir having an open flow path all about the said sleeve-like passage-forming member. The fluid cylinder **28** of the integrated device is located within the cylindrical passage in the reservoir, from which it extends both downwardly and upwardly, as shown. As stated, the reservoir, control valve, and motor and pump are all physically interconnected, and thus these components form a compact, unitary power unit structure. As will be seen, this unitary structure is mounted upon the power cylinder itself, thereby dispensing with the need for any additional structure for mounting the power unit.

Fluid cylinders of the general type illustrated are, of course, very well known, but in accordance with the con-

cept of the present invention the elongated cylindrical body of the cylinder **28** is secured in place within the vertical passage in the reservoir **20**. This is accomplished by a pair of circular clamping members **30** and **32**. These clamping members encircle flange-like top and bottom members **24** and **26**, respectively, which may be said to comprise extensions of the said sleeve-like member **22** which forms the internal passage within the reservoir. The said top and bottom extension flanges should be made to be diametrically contractable by the clamping members **30** and **32**, as by making the extensions somewhat resilient and/or by providing longitudinal slits spaced around the circumference thereof. By such a construction, tightening of the clamping members **30** and **32** tightens the extensions **24** and **26** about the cylinder **28** to firmly fasten it to the reservoir **20**. As a result of the cooperative mounting operation of the clamping members **30** and **32** and the extensions **24** and **26**, such members may be said to comprise a coupling means for mounting the power cylinder to the integrated power unit structure, or to the fluid reservoir **20** forming a part thereof. Also, it will be seen that such coupling means may be said to actually comprise a portion of the total cylindrical passage formed through the power unit structure, since the "coupling means" in effect form the end extremities of this passage.

The lower extremity of the cylinder **28** has a solid mounting extension **34** by which the cylinder is connected, as by a transverse pin **36** passing through the extension **34**, to an exterior structure **38** which is typically either a fixed mount or an extending arm of the machinery to be operated by the cylinder. The upper portion of the cylinder **28** has a protruding piston or plunger member **40** which is extendable from the cylinder under fluid pressurization thereof by the pump and motor unit **12**. Piston **40** is typically pivotally secured to an extending fork arm **42** or the like, as by a transverse pin **44**, with the fork arm **42** normally being the actuated member of the external machinery to be operated by the integrated device.

In the specific embodiment illustrated in FIG. 1, it will be noted that the cylinder **28** is of the double-acting variety. In such a cylinder, pressurized fluid directed through a first fluid conduit or line (as for example line **18**) while a second line (such as **16**) is relieved pressurizes the lower extremity of the cylinder to drive the piston **40** outwardly thereof. This raises fork arm **42** relative to the exterior structure **38** secured to the bottom of the cylinder. Similarly, pressurized fluid directed through the second conduit or line (line **16**) while the first line (**18**) is relieved pressurizes the upper extremity of the cylinder **28** to retract the piston **40** back into the cylinder, thereby lowering fork arm **42** relative to structure **38**. While a double-acting cylinder is illustrated as being preferred, it will of course be recognized that single-acting cylinders of suitably similar outward physical characteristics are equally suited for use in the integrated device of the invention, which pertains to the physical interrelationship of the various components more than the specific components themselves.

Having now described the structural details of the invention and their relative positioning and assembly, and having also indicated the general operation of the integrated device, the new and desirable features provided thereby are likely to already be apparent to those familiar with the fluid cylinder and power unit art. Firstly, since the motor and pump **12**, the control valve **14**, and the fluid reservoir **20** are physically connected into a compact, unitary structure, and since this unitary structure is securely clamped to the power cylinder **28**, none of the components making up the said unitary structure requires any individual mounting structure, and the operational mounting of the entire integrated device is accomplished merely by installing the power cylinder into the desired area and between the members desired to be actuated.

Additionally, and of considerable importance, is the fact that the integrated device is extremely well suited to installation in a variety of different small and cramped mounting areas, inasmuch as the complete device is extremely compact and the unitary structure just noted is readily adjustable relative to the power cylinder. That is, by merely loosening the aforesaid clamping means at each end of the cylinder, the entire unitary structure may be rotated relative to the cylinder, about the longitudinal axis of the latter. This will instantly be recognized by those familiar with the art as an extremely useful attribute from a design and installation point of view, solving many bothersome problems existing heretofore.

Finally, and of even further importance, is the fact that if desired, the unitary structure consisting of the motor and pump **12**, the control valve **14**, and the fluid reservoir **20** may readily be completely removed from the cylinder **28** by merely loosening the clamping members **30** and **32**, temporarily disconnecting the fluid lines **16** and **18**, and drawing the cylinder **28** upward and out of the cylindrical passage formed through the reservoir. Consequently, the universality and operational flexibility of the integrated device are even further enhanced, inasmuch as the power cylinder and power unit comprised of the said unitary structure may if desired by mounted and operated at any given separation, so long as the lines supplying the actuating fluid or hydraulic couple the two together.

It is conceivable that upon becoming familiar with the foregoing specification, others skilled in the art may design embodiments of the concept underlying the invention which differ in specific details from the preferred embodiment shown and described hereinabove. All such further embodiments as utilize the concepts of the invention and are clearly within its spirit should thus be considered as within the scope of the claims appended herebelow, unless these claims by their language specifically state otherwise.

I claim:

1. In combination, an integrated fluid cylinder and power unit and a vehicular implement such as a snowplow or the like, comprising: a power cylinder having a housing and piston means extendable upwardly therefrom upon fluid pressurization thereof and retractable downwardly thereinto upon relief of such pressurization; said power cylinder housing having mounting structure at its bottom by which it may be rigidly anchored against downward movement with respect to the frame or like portions of such vehicle; said implement having a movable lever-like positioning and actuating element which when moved serves to move other portions of the implement accordingly; said piston means having mounting structure at its top for attaching it to said positioning and actuating element of such implement, such that upon upward extension of said piston means the same will move said element and thereby effect movement of such implement; driven pump means for providing fluid under pressure; a fluid reservoir for storing a supply of fluid; a valve apparatus for directing pressurized fluid from said pump means to said cylinder and for directing relieved fluid from said cylinder to said reservoir; said pump means, valve apparatus, and reservoir physically joined together to form a distinct and separate compact unitary power unit; and coupling means for connecting said unitary power unit to said cylinder housing above the said mounting structure at the bottom thereof and holding said power unit in place upon said housing, such that said housing serves as the operational mount for the power unit.

2. The combination defined in claim **1**, wherein said means for coupling said power unit to said cylinder housing comprises an adjustable clamping mechanism, said mechanism being releasable, and said power unit upon

release of said clamping mechanism being movable relative to said cylinder housing to provide relative positional adjustment therebetween even after the attachment of said cylinder housing to said vehicle frame portions and attachment of said piston means to said positioning and actuating element of said implement.

3. The combination defined in claim 1, wherein said power unit reservoir has a vertical passage extending from top to bottom therethrough, and wherein said cylinder housing is located within such passage.

4. The combination recited in claim 3 wherein said cylinder housing is slidable within said reservoir passage, and wherein said coupling means for connecting said power unit to said housing is releaseable, said cylinder

upon release of said coupling means being withdrawable from said passage, such that said cylinder and said power unit may be operated and used even when physically separated from each other.

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