Feb. 16, 1960 R. S. DICKINSON 2,924,943

HYDRAULIC ACTUATING MECHANISM

Filed June 24, 1957 2 Sheets-Sheet 1

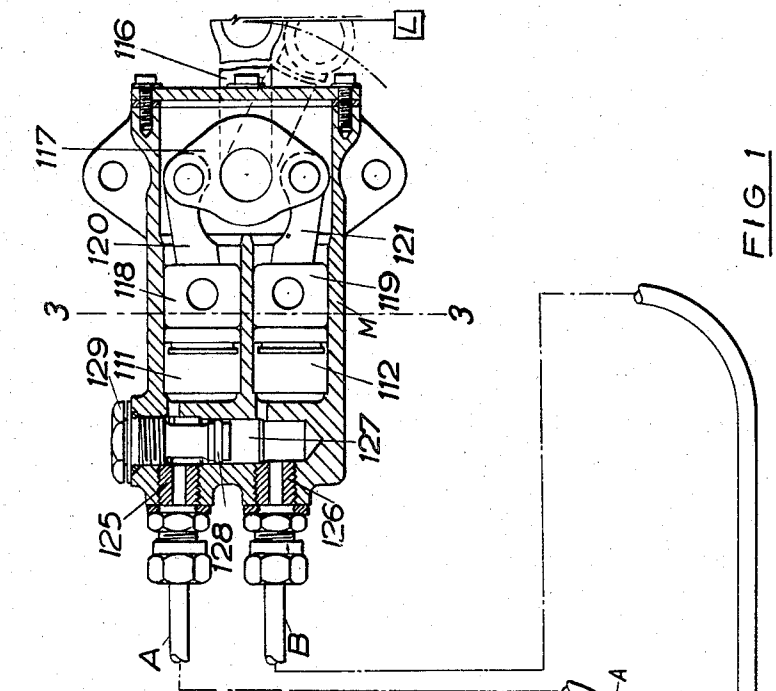


FIG. 1

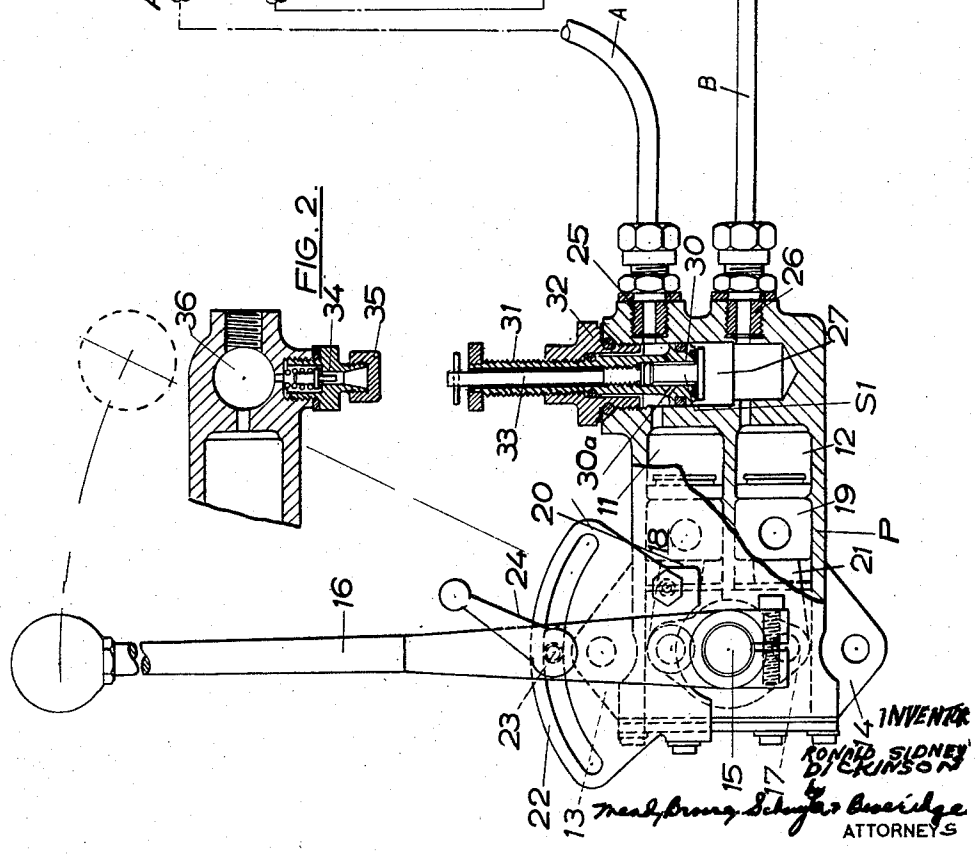


FIG. 2.

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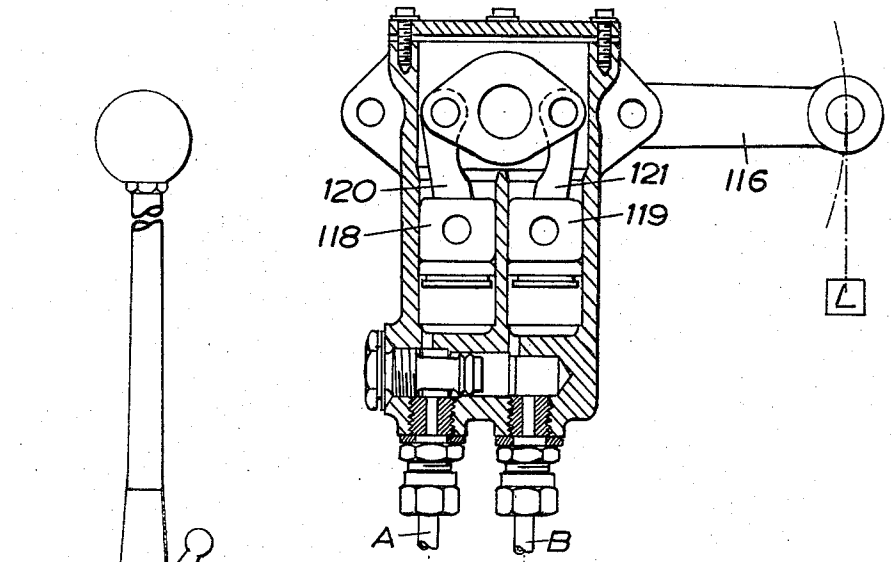
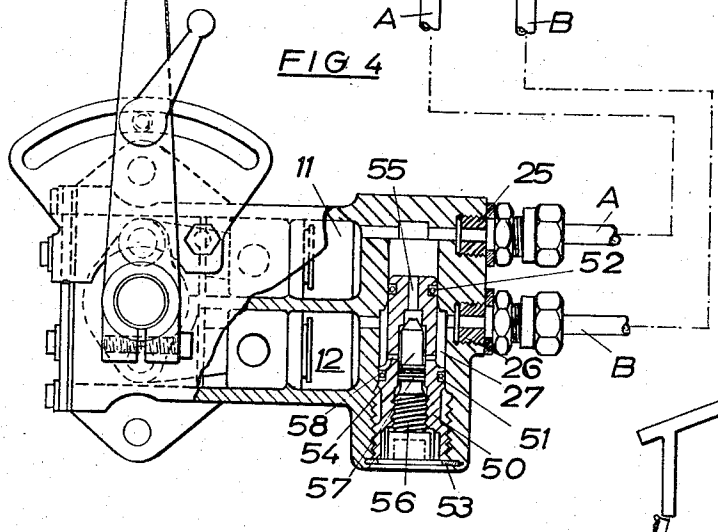


FIG 4



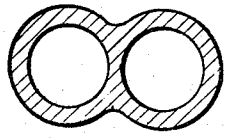


FIG 3

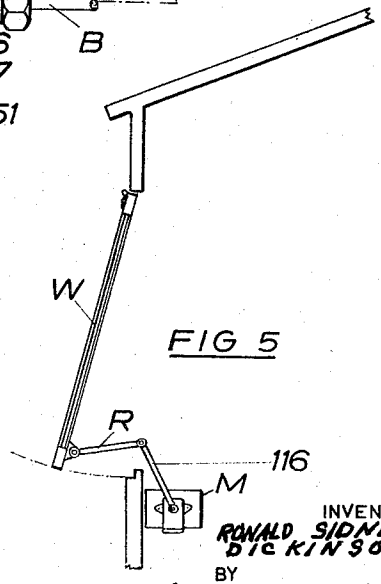


FIG 5

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HYDRAULIC ACTUATING MECHANISM

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5 Claims. (Cl. 60—54.5)

The present invention concerns a hydraulic load-actuating mechanism, for use where the displacement, such as the lifting and lowering of a load, is to be effected from a remote point.

One object of the invention is to provide such a mechanism which is capable of sustaining the load after the operating force has been removed and which is capable of being locked against unauthorized attempts to displace the load from its selected position.

According to the present invention a hydraulic load-actuating mechanism comprises a manually operated single-stroke pump having two hydraulic connections for transmission and reception of liquid respectively on manual operation of the pump in a given direction, and a load-displacing hydraulic motor coupled to the load and having two hydraulic connections each communicating by way of a conduit with one of the connections of the pump. Thus if a mechanical effort is applied to operate the pump, liquid under pressure flows through one conduit from the pump to the motor and flows through the other conduit from the motor to the pump, the load being displaced by the motor.

Both the pump and motor each preferably have two separate cylinders which may be disposed side by side with pistons linked to a semi-rotating shaft so as to move in opposite directions, and each piston is preferably provided with a positive form of seal such as a rubber packing ring.

A lockable manually operated by-pass valve between the hydraulic conduits is preferably provided for synchronisation of the respective attitude of the semi-rotary shafts of the pump and motor.

A manually operated liquid volume adjustment device is preferably fitted to compensate for volume change due to temperature variation of the hydraulic fluid.

The invention will be described further by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a general arrangement showing the pump and motor partially in vertical section;

Fig. 2 is a sectional detail;

Fig. 3 is a detail in horizontal section taken on the line 3—3 of Fig. 1;

Fig. 4 is a sectional general arrangement of the construction shown in Fig. 1 with a different valve embodiment; and

Fig. 5 is a diagram showing one application of the hydraulic mechanism in accordance with the invention.

A preferred form of hydraulic mechanism in accordance with the invention comprises a single-stroke pump P, a motor M of construction generally similar to that of the pump and two hydraulic conduits A and B, interconnecting the pump P and the motor M.

The pump has two parallel horizontal cylinders 11 and 12, formed in a monobloc casing provided with attachment lugs 13 and 14 for mounting on a wall or other appropriate surface.

A semi-rotary shaft 15 journalled in the casing extends through an oil seal and is externally attached to a manual operating lever 16.

Within the casing the shaft 15 is fixed to a yoke 17 which is coupled to pistons 18 and 19 by pivotally attached connecting rods 20 and 21 respectively. The manual operating lever 16 can be clamped in any selected position within an arc relative to an arcuately slotted bracket 22 by means of a locking screw 23 rotatable by a lever handle 24.

Connections 25 and 26 in the pump casing provide communication between the conduit A and cylinder 11 and between the conduit B and cylinder 12 respectively.

The motor M has parts corresponding to those of the pump P thus far described except that its semi-rotary shaft 115 is externally attached to a load displacement arm 116. A connection 125 in the motor casing provides communication between the conduit A and the motor cylinder 111 and likewise a connection 126 provides communication between the conduit B and the motor cylinder 112. A load L, shown diagrammatically is connected mechanically to the arm 116.

Now, assuming that the parts of the pump and the motor are in the positions shown, by moving the operating lever 16 to the position shown in chain-dotted lines, the pump piston 18 will be advanced into the cylinder 11 causing liquid to flow from the pump cylinder 11 through the conduit A from which liquid will flow into the motor cylinder 111 causing a corresponding displacement of the motor piston 118; and simultaneously liquid will flow in the reverse direction in the conduit B with corresponding movement of the pump and motor pistons 19 and 119 respectively. This movement of the motor pistons will be reflected in a corresponding movement of the displacement arm 116 into the position shown in chain-dotted lines, lowering the load L.

The pump casing P includes a cylindrical bore 27, the opposite ends of which communicate with one or other of the lines A or B. The motor unit M has a bore 127 generally corresponding to the bore 27 of the pump unit. This bore 127 is normally blocked by a sealing plug 128 at the lower end of a filling screw 129. In the cylinder 27 of the pump unit a plunger 30 carried by an adjustment screw 31 is displaceable on rotation of the screw 31 relative to a fixed packing sleeve 32. The position of the plunger 30 in the bore 27 defines the volume of liquid associated with the bottom pipe line B and the associated lower pistons and cylinders of the pump and motor respectively. Adjustment of the screw 31 provides a means for temporarily compensating for temperature induced changes in this volume of liquid, without permanently affecting the synchronisation of the units. Thus if the internal pressure builds up because of a rise in temperature and consequent expansion of the liquid, the plunger 30 is moved upwardly by screwing out the screw 31. If on the other hand the liquid contracts, the plunger 30 is moved down to tighten up the circuit and eliminate any loss of motion in the stroke.

Synchronisation is effected by means of a by-pass valve S1 mounted on the end of an inner spindle 33 threadedly engaged in a tapped bore coaxially within the screw 31. This valve S1, when open, allows liquid to flow through an oblique bore 30*a* in the plunger 30 permitting direct transfer of liquid between the cylinders 11 and 12.

Filling is carried out, with the filling screw 129 removed from the motor unit, by introducing liquid under pressure through a non-return valve 34 (Fig. 2) which is normally closed by a cap 35.

This valve opens into a bore 36 in the pump casing. The bore 36 is coaxial with the bore 27 but of somewhat

smaller diameter, and provides communication between the lower end of the bore **27**, the lower pump cylinder **12**, and the bottom pipe line B. As liquid flows in through the valve **34** liquid and air flow out at the top of the motor casing through the tapped bore **127** in which the filling screw **129** is normally engaged. This screw **129** is then replaced after liquid is seen to flow out free of air bubbles.

In the embodiment shown in Fig. 4 the pump unit P is disposed with its cylinders horizontal and the motor unit M is arranged with its cylinders vertical, the pistons of the motor unit being disposed with their crowns lowermost in the cylinders.

The general construction of the pump unit and the motor unit is identical to that shown in Fig. 1 with the exception of an alternative synchronising valve and volume control mechanism arranged to be included within the cylindrical bore **27** in the pump unit.

In the alternative valve embodiment shown in Fig. 4 a plunger **50** having a threaded portion, is arranged to co-operate with a threaded portion of the valve bore **27** and is adjustable in or out of the bore by rotation of the plunger. The plunger is fitted with oil seals **51** and **52**, oil seal **51** being adapted to seal a counter-bored portion of the cylindrical bore **27**, and oil seal **52** being arranged to work between the fluid passages connecting cylinder **11** and connection **25**, and cylinder **12** and connection **26**.

The counter-bored portion of the cylindrical bore **27** provides an annular chamber around plunger **50** which allows for the passage of fluid between cylinder **12** and connection **26** above oil seal **51**, and by suitably dimensioning the bore **27**, the counter-bored portion thereof, and the plunger **50**, displacement of the latter may be arranged to affect the volume of both the hydraulic circuits by a substantially similar amount.

The limits for plunger adjustments are established in one direction by the plunger **50** butting against the bottom of the cylindrical bore **27**, free passage of fluid being maintained between cylinder **11** and connection **25**, and in the other direction by a retaining washer **53**.

A synchronising valve is coaxially arranged within the plunger **50** and comprises a valve needle **54**, being a loose fit within its retaining chamber to allow passage for the hydraulic fluid, and adapted in its closed position to seal a bore **55** arranged coaxially with the plunger **50**.

Valve needle **54** is adjustable to close and open the valve upon rotation of an adjusting screw **56**, sealing washers **57** being inserted between the adjusting screw **56** and the valve needle **54**.

By rotation of the screw **56** the valve may be allowed to open, allowing hydraulic fluid to flow between cylinder **11** and cylinder **12** via passages **58**, the chamber containing the valve needle **54** and axial bore **55**.

One practical application of the invention is for the remote opening and closing of windows in buildings (Fig. 5). The arm **116** of a motor M is connected through a linkage rod R to a window W hinged horizontally about its upper edge. Such a window may be locked in its closed position by opening the synchronising valve (S1 or **54**), releasing lever handle **24** and moving the operating lever **16** of its pump to an attitude opposite to that corresponding to the closed window condition, closing the synchronising valve and relocking lever handle **24**. By carying out the operations described above displacement of the load becomes impossible without causing a fracture or severe leakage, since one filled cylinder in the motor is connected to a filled cylinder, instead of the one unfilled cylinder, in the pump, and a hydraulic lock occurs.

I claim:

1. A hydraulic master-and-slave mechanism comprising a single-stroke pump constituting a master unit, a load-actuating hydraulic motor constituting a slave unit and responsive to fluid displacement generated by said pump, said pump and said motor each comprising a

casing formed with a pair of separate cylinders arranged in parallel and side-by-side relationship, a piston in each cylinder, and means linking corresponding ends of the pistons in each casing to cause movement of one piston in one direction to produce a corresponding movement of the second piston in the opposite direction, a pair of hydraulic fluid conduits interconnecting the pump and motor cylinders, said conduits being connected to said casings so as each to place a pump cylinder in communication with a corresponding motor cylinder, the pump casing being formed adjacent its connection with said conduits with a chamber into which said conduit connections open, and an adjustable plunger displaceably arranged in said chamber and sealing said chamber between the conduit openings thereto, the position of said plunger in said chamber defining the volume available to be occupied by the hydraulic fluid associated with the conduit at least on the free side of the plunger to provide means for compensating for variation with temperature of the volume of said hydraulic fluid.

2. A hydraulic mechanism as set forth in claim 1 including normally closed valve and passage means in said plunger operable when opened to place said pump cylinders in communication with each other to permit synchronization of the respective attitudes of the pump and motor pistons.

3. A hydraulic mechanism as set forth in claim 1 further comprising a manually operable spindle, said plunger being formed with a threaded, axial bore and said spindle being threadedly displaceable in said axial bore, a valve carried at the free end of the plunger and normally isolating the axial bore therein from said chamber, said valve being engageable for opening by said spindle, said plunger being formed rearwardly of its free end with a passage communicating at one end with said axial bore and at the other end with a region of said chamber behind said valve, whereby opening of the valve by the spindle places the pump cylinders in communication with one another through said chamber, said passage and said axial bore and allows hydraulic fluid to flow to permit synchronisation of the respective attitudes of the pump and motor pistons.

4. A hydraulic mechanism as set forth in claim 1 wherein the inner end of the chamber in the casing communicates with one of the conduit connections and said chamber is counterbored at its other end to threadedly receive the plunger, the counterbore communicating with the other conduit connection and defining an annular space around a portion of said plunger, said plunger further comprising fluid sealing means in said chamber between the two conduit connections, an annular shoulder between said other conduit connection and the threaded portion of the counterbore, and further fluid sealing means carried by said shoulder, whereby displacement of said plunger varies the volumes of said chamber and said annular space by similar amounts to vary by similar amounts the volume available to the hydraulic fluid in the pump and motor cylinders the interconnecting conduits.

5. A hydraulic mechanism as set forth in claim 4 wherein the plunger is formed throughout its length with an axial bore, and is provided intermediate its ends with a transverse passage establishing communication between the annular space and said axial bore, said axial bore communicating at its free end with said chamber said plunger further comprising a valve seat formed in said axial bore intermediate the free end thereof and said transverse passage, an internally threaded portion at the end region of said axial bore remote from said free end, and a correspondingly threaded, manually displaceable needle valve engaged in said threaded region so as to co-operate with said valve seat and open and close said axial bore, thereby to enable the two pump cylinders to be placed into communication with one another through said chamber, said axial bore, said transverse passage and said annular space, to permit syn-

chronisation of the respective attitudes of the pump and motor pistons.

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