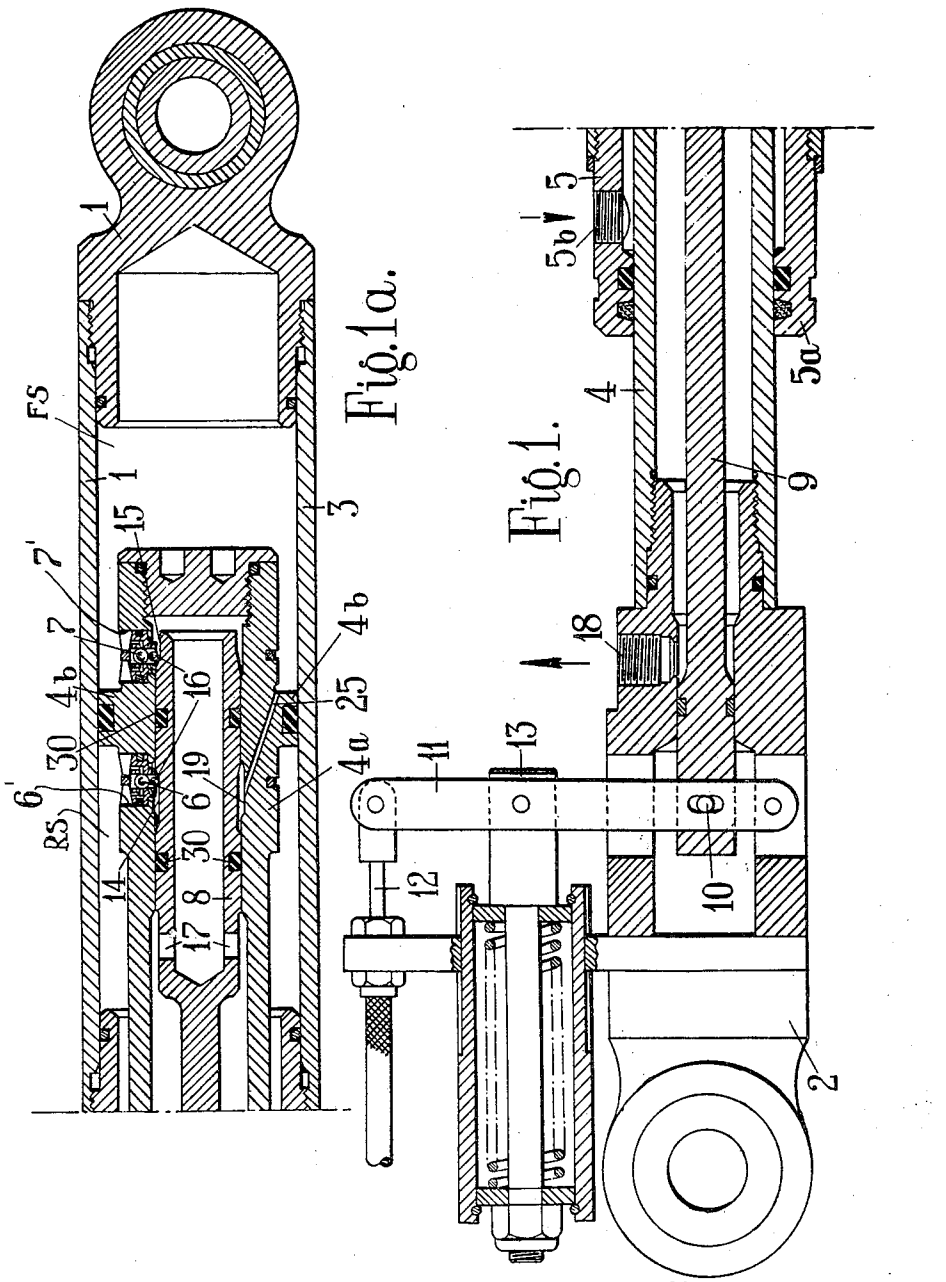
July 17, 1962 W. McKENZIE MORRISON 3,044,451

HYDRAULIC RAM AND SELECTOR MECHANISM

Filed Sept. 21, 1959 2 Sheets-Sheet 1



Inventor
W. McK. Morrison
By Elsworth Downing & Seebold
Attys

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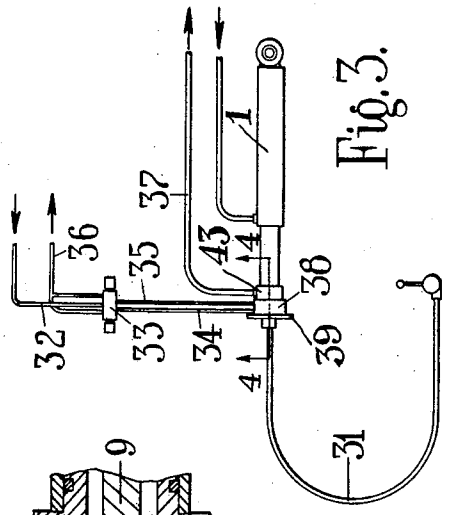


Fig. 3.

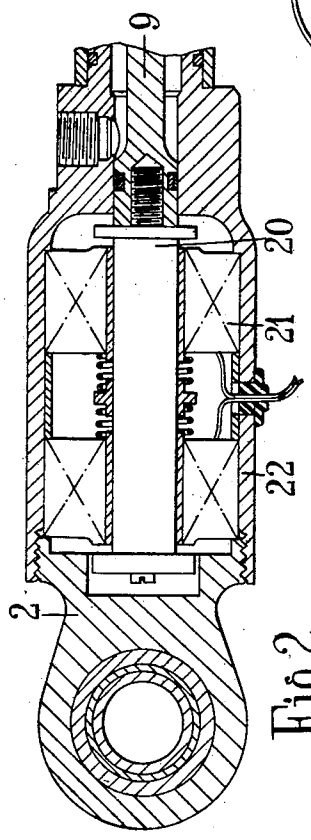


Fig. 2.

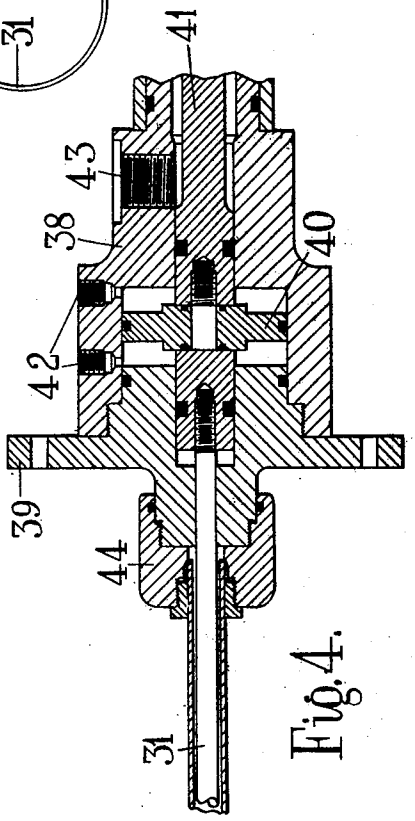


Fig. 4.

Inventor

W. McK. Morrison

By Glascock Downing & Seebold

Attys

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HYDRAULIC RAM AND SELECTOR MECHANISM

William McKenzie Morrison, Wolverhampton, England, assignor to Turner Manufacturing Co. Limited, Wolverhampton, England

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This invention relates to a self contained hydraulic ram and selector mechanism and has been devised with a view to providing an arrangement which is of more convenient form and capable of being easily manufactured with a substantial saving in cost compared with existing conventional mechanisms.

The invention accordingly consists in an hydraulic ram and selector mechanism comprising a ram cylinder through which hydraulic fluid is supplied, a hollow ram piston within the cylinder for controlling the fluid pressure at the closed end of the cylinder and a hollow selector member disposed within the piston and manually or otherwise controlled from the other end of the cylinder to vary its position within the piston to control a pair of valves exposed respectively to the pressures prevailing at opposite ends of the cylinder so as to cause the piston to move in one or another direction until it reaches a position in which the valve previously opened by the selector member is closed.

In the accompanying drawings a preferred arrangement, together with a variation thereof, is illustrated by way of example.

In these drawings:

FIGURES 1 and 1*a* are contiguous longitudinal central sections through a ram and selector mechanism with a cable operated selector plunger.

FIGURE 2 is a section similar to FIGURE 1 showing a solenoid operating arrangement.

FIGURE 3 is a schematic representation of a system which permits alternative modes of operation of the selector plunger.

FIGURE 4 is a longitudinal section through an operating assembly in the system shown in FIGURE 3.

Referring now to FIGURE 1 of the drawings the arrangement shown is specifically intended for varying the distance between a pair of bearing supports **1**, **2**, one of the bearing supports **1** being screw threaded into the closed rear end of an hydraulic ram cylinder **3** whilst the other bearing support is attached to the outward or front end of a hollow ram piston rod **4** which passes through a gland **5** screw threaded on the front end of the ram cylinder **3** and which has an enlarged flanged portion **5***a* at its head end by which the ram piston rod **4** is slidably engaged in the ram cylinder **3**. An enlargement **4***b* on the piston head divides the interior of the cylinder into front and rear chambers FS and RS respectively. The working fluid is admitted to the chamber RS behind the piston head **4***a* in the ram cylinder **3** by means of a radial opening **5***b* in the gland which is connected to an accumulator or pump (not shown). In the wall of the piston head **4***a* on opposite sides of the enlargement **4***b* are a pair of ball valves **6**, **7**, located in ports or passages **6'**, **7'** which regulate the flow of the working fluid from the respective chambers of the ram cylinder **3** to the interior of the ram piston head **4***a* which contains a selector member in the form of a hollow plunger **8** which is open at its front end. This hollow plunger **8** is integral with a rod **9** which extends within the ram piston and is connected by a pin **10** at its outward end to a link **11**. The link **11** is pivoted at one end to bearing support **2** and pivotally connected at the other end to a push/pull cable **12**. Intermediate its points of connection with the rod **9** and cable **12** the link

11 is pivotally connected to the plunger **13** which is spring urged to retain the selector plunger **8** in neutral position when the ram is stationary.

The outside surface of the hollow plunger **8** is formed with two separate shallow longitudinally elongated recessed cam surfaces **14**, **15** which are adapted selectively to operate the respective ball valves **6**, **7** in the head **4***a* of the ram piston depending upon the position of the selector plunger **8** in the head of the ram piston. Each such ball valve in fact includes an actuating ball **16** which engages the cam surface which increases in depth towards its end or ends whereby the actuating ball **16** is forced outwards as a result of a certain longitudinal sliding movement of the plunger **8** to displace the valve ball **6** or **7** from its seating against the prevailing fluid pressure. The back end of the hollow selector plunger **8** is formed with radial ports **17** to allow the working fluid entering the plunger via either ball valve **6** or **7** to be exhausted to the interior of the ram piston **4** whence it escapes through a radial opening **18** at the rear of the latter and is conducted back to a fluid supply tank (not shown). In addition the head of the ram piston is formed with a straight narrow transfer duct or passage means **25** which extends obliquely from the front face of its flanged portion **4***b* to a shallow recess **19** in the inside wall surface of the ram piston. The duct provides a communication path between the chambers FS and RS as will later be described.

The selector plunger instead of being operated through a cable could be directly manually operated.

Alternatively and as shown in FIGURE 2 the end of the selector plunger rod **9** may be directly connected to the end of the core piece **20** of a solenoid **21** of for example, an A.C. 50 cycle 200–240 volt type such as is capable, in the instance described, of transmitting a 5 ounce force to the selector plunger, this being made possible by the use of annular composite polytetrafluorethylene-rubber seals **30** between the selector plunger **8** and the ram piston **4**. The solenoid is contained in a housing **22** which extends between piston rod **4** and bearing support **2**.

In operation hydraulic fluid admitted continuously to the back of the ram cylinder **3** from a pump or accumulator exerts a force on the rear active surface of the ram piston head **4***a*, this force being balanced by the pressure prevailing in the front chamber FS of the ram cylinder **3** which acts on the front active surface of the ram piston head the area of the latter being in this instance twice that of the rear active surface, so that the static pressure in the front of the ram cylinder **3** is half the working pressure in the back chamber RS of the ram cylinder. In this equilibrium or neutral position both ball valves **6**, **7** are closed under the influence of the respective pressures and the ram piston is hydraulically locked.

In order to extend the ram the selector plunger **8** is moved a short distance rearwards or away from the closed end of the cylinder to open the rearward ball valve **6** which allows fluid to flow from the chamber RS to the chamber FS of the ram cylinder via recess **19** and duct **23**, the other valve **7** being closed. The system then ceases to be equilibrium and due to the increase in pressure in the front chamber FS of the ram cylinder **3**, extension takes place.

In order to retract the ram the selector plunger **8** is moved in the opposite direction past the neutral position to a position in which the front ball valve **7** is opened and the rear ball valve **6** is closed so as to permit the fluid in the front chamber FS of the ram cylinder **3** to enter the plunger head and thereafter pass rearwardly through the ports **17** to the annular space between the

selector plunger rod 9 and the piston rod 4 and thence to the fluid tank through outlet 18.

The distance which the selector plunger 8 travels between the opening of the respective ball valves 6, 7 in the course of which the piston is not active is of the order of 15% of the total movement in relation to the mean position. This dead motion can easily be regulated by varying the diameter of the valve balls to vary the characteristics of the ram. Alternatively, or in addition, the profiles of the cam recesses 16 can be varied. By these means the ram can be arranged to execute a fast or slow working or return stroke as required.

Referring now to FIGURE 3 of the drawings the system shown therein is one which includes three alternative means for controlling the selector mechanism. At the controlling end of the mechanism there is an operating assembly 30 to which there is coupled a manually operable cable 31 and which forms part of a low pressure hydraulic or pneumatic circuit including a feed line 32, and a change-over valve 33 which is operable alternatively by a solenoid or by hand to control the direction of fluid flow through supply pipes 34, 35 connected to the operating assembly 30. Pipes 36 and 37 are for returning discharged fluid to the reservoir.

Referring now to FIGURE 4 the operating assembly comprises a pilot cylinder which is defined by the rear end 38 of the ram (c.f., 4, FIGURE 1) and a flanged cylindrical mounting block 39. This cylinder contains a piston 40 fixed at one end to selector plunger 41 (c.f., 9, in FIGURE 1) and at the other end to cable 31 the outer case of which is held to the block 39 through the medium of an anchor bush 44. The pipes 34 and 35 (FIGURE 3) are connected to ports 42 in the rear end of the ram which also includes an outlet 43 connected to discharge pipe 37.

Operation of the solenoid manually operated valve 33 results in extension or retraction of the pilot piston 40 and thereby the selector plunger thus either extending or retracting the main ram.

In the event of electrical or other failure of the valve 33 by disconnecting pipes 34 and 35 it is still possibzle to operate the ram by operating the cable 31 which is directly connected with the selector plunger 41.

Another advantage of the invention is that only two pipe connections to the ram are required in contrast with the four or five connections in conventional arrangements. Also the ram can be operated from an accumulator for long periods since in the neutral position of the selector element the ball valves are retained on their seatings without leakage by the pressure of the hydraulic fluid. The ram is hydraulically locked when the selector element is in its neutral position and as previously mentioned the force required to be exerted by a solenoid or the equivalent is compared with other and known arrangements extremely small.

I claim:

1. A hydraulic ram and selector mechanism comprising a cylinder having a closed end and on open end, a hydraulic fluid inlet adjacent the open end of the cylinder, a hollow piston in the cylinder, said piston having front and rear surfaces and including means dividing the interior of the cylinder into front and rear chambers, said piston being provided with passage means connecting the front and rear chambers, a hollow piston rod extending axially from the rear surface of said piston and protruding from the open end of the cylinder, a hydraulic fluid outlet adjacent the end of said hollow piston rod remote from said piston, a selector plunger slidably mounted in at least said hollow piston, said plunger having a bore therein and an open end, the piston on each side of the means on the piston dividing the cylinder into front and rear chambers being provided with a port between the interior of the piston and the front and rear spaces, respectively, a removable valve assembly located in each port, one of said valve assemblies controlling said passage means, cam means on said selector plunger co-operable with each of said valve assemblies, and said plunger having port means communicating with the bore of the plunger and the interior of the hollow piston rod, the arrangement being such that upon movement of the plunger means in a direction away from the closed end of the cylinder the cam means actuates the valve assembly cooperable with the passage means to open such valve means to permit the hydraulic fluid in the rear chamber to flow through the passage means into the front chamber with the other valve assembly remaining closed while upon movement of the plunger in a direction towards the closed end of the cylinder, the cam means co-operable with the other valve assembly opens said other valve assembly to permit fluid in the front chamber to flow into the bore of the plunger, the interior of the piston rod through the port means and be discharged through said fluid outlet with the first-named valve means remaining closed.

2. The hydraulic ram and selector mechanism as claimed in claim 1 in which each valve assembly is a ball valve.

3. The hydraulic ram and selector mechanism as claimed in claim 1 including means for moving said selector plunger, said means being an electric solenoid operably coupled and aligned with said selector plunger.

4. The hydraulic ram and selector mechanism as claimed in claim 1 including means for moving said selector plunger, said moving means comprising mechanically operated linkage means operably connected to said selector plunger.

References Cited in the file of this patent

UNITED STATES PATENTS

2,317,549	Muller et al.	Apr. 27, 1943
2,574,335	Leduc	Nov. 6, 1951
2,711,158	Leduc	June 21, 1955
2,755,876	Muller	July 24, 1956
2,909,157	Reis	Oct. 20, 1959