April 3, 1945. G. T. HARCOURT 2,372,721

PORTABLE HYDRAULIC RIVETER

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Fig. 1.

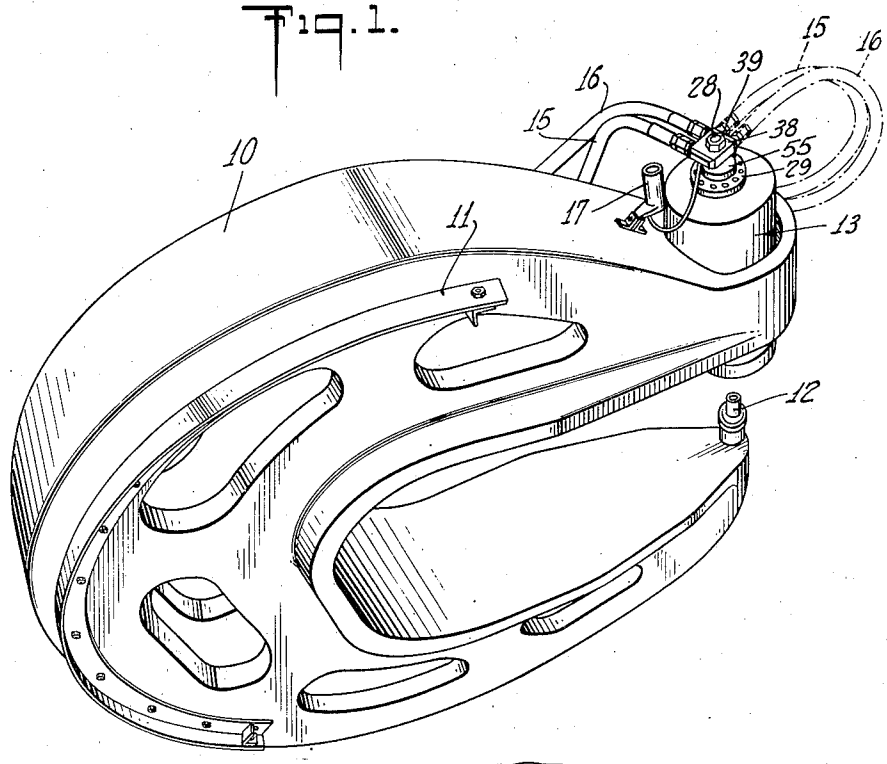
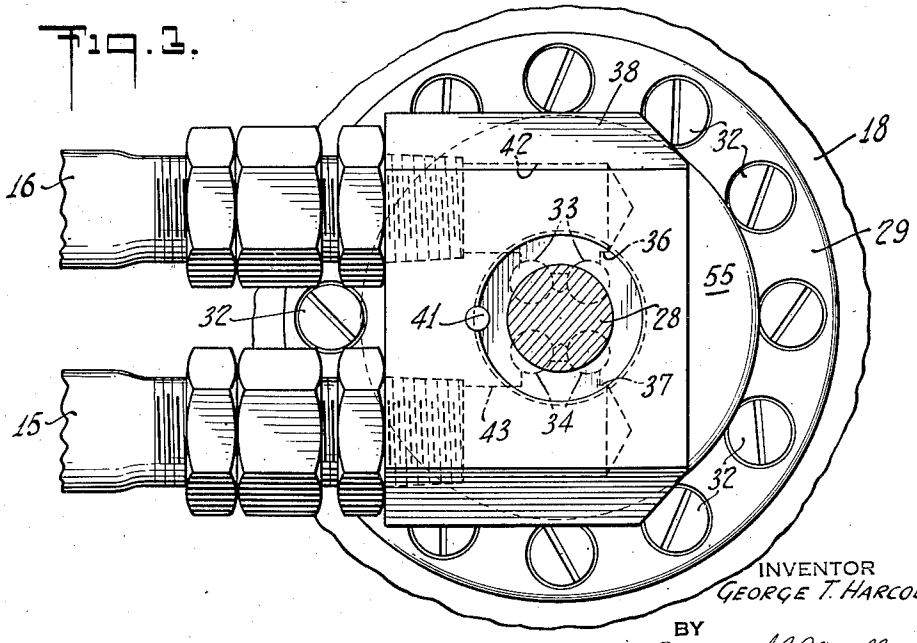


Fig. 3.



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Fig. 4.

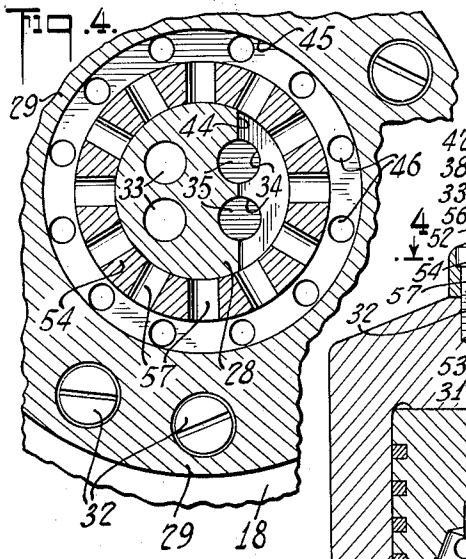


Fig. 2.

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PORTABLE HYDRAULIC RIVETER

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Application February 20, 1942, Serial No. 431,715

6 Claims. (Cl. 285—97.1)

This invention relates to portable hydraulic riveters and more particularly to a swivel coupling between the riveting cylinder and one or more fluid conducting hose lines.

The invention has special reference to hydraulic cylinders having a duplex oil connection for delivering oil at one pressure to the cylinder in a direction to drive the piston contained in the cylinder through a power stroke, while, alternatively, oil at a lower pressure may be directed to the cylinder in a direction to return the piston.

The principal object of the invention is to permit the pressure fluid supply lines of a hydraulic cylinder of the class described to be moved to any selected position of rotation independently of the cylinder.

Another object is to permit the maximum working pressures of which the cylinder is capable to be reached without loss of pressure fluid through the swivel connection.

A further object is to automatically lock the swivel connection against turning movement when the hydraulic pressure increases to such a degree as to stretch the hose.

According to the present embodiment of the invention these objects are attained by means including a tubular conduit rotatably mounted in the cylinder, the conduit having passages communicating with the interior of the cylinder on opposite sides of the piston therein, and a flanged head on the inner end of the conduit urged by the fluid pressure within the cylinder on to a stationary valve seat to restrict the escape of fluid around the conduit.

Other objects and structural details of the invention will be apparent from the following description when read in conjunction with the accompaning drawings, wherein:

Fig. 1 is a view, in perspective, of the yoke of a compression riveting assembly, the invention being disclosed as embodied in a hydraulic cylinder on the yoke;

Fig. 2 is a view, chiefly in longitudinal section, of the hydraulic cylinder and the pressure fluid swivel connection mounted therein;

Fig. 3 is a fragmentary view, in cross section, taken along the line 3—3 of Fig. 2, showing in particular the manner in which the pressure fluid hose lines are coupled to the tubular conduit; and

Fig. 4 is a fragmentary view, in cross section, taken along the line 4—4 of Fig. 2.

As shown in Fig. 1 the riveting assembly here disclosed as embodying the invention is designed for heading cold rivets by the application of extremely high pressure. It comprises a riveting yoke 10 of generally C-shape having affixed on opposite sides thereof pulley tracks 11 (one shown) by which the yoke may be suspended from an overhead support. The yoke is movable under manual control to positions in which the opposed arms of the yoke embrace the work and relatively movable jaws at the outer ends of the arms are brought to alignment with a selected unset rivet. The relatively movable work engaging jaws include a stationary die 12, located in the lower arm of the yoke, and a complementary movable die, reciprocable within a hydraulic cylinder 13 in the upper arm of the yoke. The movable die, indicated at 14 in Fig. 2, functions as a plunger or piston rod within the cylinder 13, being movable toward and from the stationary die 12 by the force of pressure fluid admitted to the cylinder through a pair of hose lines 15 and 16 leading from a remote pressure fluid source. Preferably fluid is supplied to the cylinder 13 by a power generating unit including among its elements a pump and a motor therefor controlled by an electric switch 17 mounted on the yoke. Upon manipulation of the switch, fluid in successive stages of pressure is directed through hose line 15 to one end of the cylinder 13 and acts upon piston rod 14 in a direction to move it toward the stationary die 12. As a part of the same operation, and following the attainment of a predetermined intensified pressure in the hydraulic circuit, the supply of fluid through hose line 15 is interrupted and fluid under a first or low stage of pressure is introduced through line 16 into the cylinder in a direction to effect the return stroke, during which the piston die 14 moves axially away from the stationary die 12.

The riveting yoke 10 may be moved independently of the power generating unit to a variety of working positions, and it is desirable that the intermediate hose lines 15 and 16 be coupled to the cylinder 13 by a swivel connection permitting the lines to be swung out of any position in which they might hinder movement of the yoke. The design of the swiveled coupling between the fluid conducting hose lines and the cylinder presents problems of efficient fluid control, particularly in the assembly disclosed which in its physical embodiment is intended to exert a final pressure of 90 to 100 tons. The structure of the swivel connection and of the hydraulic cylinder are the principal subjects of this invention.

Referring more particularly to Fig. 2, the hydraulic cylinder 13 is composed of two sections 18 and 19 secured in axial alignment by screws 21 passed through an apertured flange on section

19 into the lower edge of section 18. The apertured flange on section 19 rests on an internal shoulder in yoke 10 while reciprocable movement of the composite cylinder is prevented by a locking ring assembly 22, located in an annular groove in section 19 below the upper arm of yoke 10. Screws 23 secure the ring assembly 22 to the yoke. Upper section 18 of the cylinder provides a chamber 24 for the reciprocation of a piston head 25 to which rod 14 is secured. In section 19 of the cylinder a central bore 26 receives rod 14 with a sliding fit. A packing assembly 27 is positioned in a counterbore in the inner end of section 19 and prevents the escape of fluid from chamber 24 around the piston rod. Reciprocation of the piston assembly is effected by the introduction of fluid under pressure into the chamber 24 alternately at points in advance of and rearward of the piston head 25.

The area rearward of the piston head 25 communicates with the exterior of the cylinder through a conduit 28 which, together with a bushing 29 therefor, is positioned in a cylinder opening 31. The bushing 29 has a close fluid tight fit within the opening 31, and, outside the cylinder, is formed with an annular flange through which bolts 32 are passed into the cylinder. The conduit 28 is rotatably mounted in the bushing 29 and has two sets of longitudinal bores 33 and 34, the former of which sets opens through the inner end of the conduit into chamber 24 rearward of the piston 25. The bores 34 are closed at the front end of the conduit by welding material 35. The sets of bores 33 and 34 terminate near the outer end of the conduit 28 where they are connected to respective radial ports 36 and 37. The outer end of the conduit extends beyond the bushing 29 and is slightly tapered to receive a coupling block 38 (see also Fig. 3) with a press fit. A locking nut 39 is threaded on to a reduced head of the conduit and holds the coupling block 38 against outward movement. To hold the block 38 against rotary movement relative to the conduit 28 a dowel pin 41 (Fig. 3) is placed in complementary aligned notches in the block and conduit. The coupling block 38 further is formed with recesses 42 and 43 occupying positions on opposite sides of the conduit and communicating at their inner ends respectively with ports 36 and 37. At their outer ends the recesses 42 and 43 are adapted for connection to fluid conducting hose lines. In the present instance recess 42 is connected to line 15 and recess 43 to line 16. Accordingly, the respective recesses 42 and 43 may be referred to as the high pressure and low pressure inlets.

The fluid entering inlet 42 from hose line 15 passes through port 36 to the longitudinal bores or passages 33 and is conducted thereby to the rear of chamber 24 and acts on the rear face of piston head 25 to drive the piston die 14 forwardly through the power or compression stroke. The fluid entering inlet 43 from hose line 16 passes by way of port 37 to the closed longitudinal bores 34 and is directed through a series of communicating ports and passages from the tubular conduit to the front of chamber 24 where it acts on the front face of piston head 25 to return the piston die 14 to the normal position of Fig. 2. The ports and passageways leading to the front of chamber 24 comprise a port 44 in the conduit 28, an internal annular groove 45 in bushing 29 opposite port 44, a passage 46 connecting groove 45 to an external annular groove 47 in the bushing, and a passageway 48 in the wall of cylinder 13 arranged to communicate at one end with groove 47 and opening at its other end into the front of chamber 24. The port 44 in the tubular conduit is of arcuate shape and receives fluid from both passages 34.

To prevent the escape of the high pressure fluid from the rear of piston chamber 24 around conduit 28, and to prevent outward movement of the conduit, the inner end of the conduit is formed with an annular flanged head 49 engageable with a valve-like seat 51 on the inner end of bushing 29. During the power stroke the fluid in the rear of chamber 24 reacts upon the flanged head 49 to urge the conduit outward and press the head firmly on to the seat 51. Any substantial loss of pressure resulting from the escape of fluid around the conduit 28 is in this manner positively prevented. In addition, the tight frictional engagement effected at this time between the flanged head 49 and seat 51 holds the conduit and hose lines against oscillation, maintaining them in the position to which they are set at the start of the riveting operation. In the illustrative embodiment of the invention, the conduit is frictionally locked against swivel movement when a cylinder pressure of about 5000 pounds per square inch is attained. To restrict the passage of any fluid which might escape around head 49 and to prevent the loss of pressure fluid from the low pressure chamber in advance of piston head 25, there is provided a packing assembly 52 surrounding the conduit rearward of head 49 and positioned in a counterbore 53 in bushing 29. The packing assembly 52 is made up of the conventional strips of fibrous material held together by metal rings including a central spacing element 54. The packing assembly is held in position within the counterbore 53 by a clamp nut 55 acting through a washer 56 positioned atop the assembly. The clamp nut 55 is threaded on the outer end of the bushing 29 and is adjustable in order further to compress the packing assembly when its effectiveness is reduced by wear. The central ring 54 of the packing assembly lies between the arcuate port 44, in conduit 28, and annular groove 45 in bushing 29. A series of closely spaced ports 57 (see also Fig. 4) in ring 54 permit constant communication between port 44 and groove 45 through the packing assembly. By reason of the arcuate shape of port 44 and the close spacing of ports 57 the return passages in bushing 29 and cylinder 13 may receive fluid from the recesses 34 in any position of rotation of the conduit.

It will be evident that modifications may be made in the structure disclosed without departing from the spirit of the invention. It is unnecessary, for example, to form a pair of passages 33 or 34 in the tubular conduit. One of each could be used with comparable results. Also, the bushing 29 might be eliminated, in which case the flanged head 49 on the conduit would engage the cylinder directly.

What is claimed is:

1. In a portable hydraulic riveter comprising a yoke, a cylinder supported thereby and having a reciprocating power piston therein, and a hose for supplying hydraulic pressure fluid to the cylinder to drive the piston on its power stroke, said hose being capable of withstanding the pressure applied in the rivet setting portion of the piston stroke without stretching and being adapted to stretch under the relatively greater pressure during the rivet heading operation; the combination of a swivel connection between the hose and cyl-

inder comprising a conduit connected to the hose and swivelly mounted relatively to the cylinder, and means for automatically locking the conduit against swivel movement in response to the establishment of pressure at the rear end of the cylinder, prior to the rivet heading operation.

2. In a hydraulic press, a power cylinder having a front port and a rear port, a swivel connection establishing continuous communication between a pair of hoses and the respective cylinder ports, said swivel connection comprising a conduit mounted in a closure for the rear end of the cylinder and rotatable relative to the cylinder about an axis extending longitudinally of the cylinder, a passageway in said conduit establishing communication between the rear cylinder port and its associated hose, a second passageway in said conduit establishing communication between the front cylinder port and its associated hose, said second passageway including a radial port extending through the periphery of the conduit, and means for simultaneously sealing said passageways from each other and locking the conduit against swivel movement upon the attainment of a relatively high pressure in the rear end of the cylinder, said last mentioned means comprising complementary engageable surfaces of substantial area carried by said conduit and closure respectively.

3. In a device of the character described, a hydraulic cylinder, an opening in the wall of said cylinder communicating with a pressure chamber therein, a bushing in said opening, a tubular conduit through which fluid flows to and from said pressure chamber swivelly mounted in said bushing and urged outward by fluid within said pressure chamber acting on the inner end thereof, a flanged head on the inner end of said conduit seated against the inner end of said bushing to prevent or limit outward longitudinal movement of said conduit and to restrict the escape of fluid from said pressure chamber, a counterbore in the outer end of said bushing, a packing assembly positioned in said counterbore and surrounding said conduit, and an adjustable clamp nut holding said packing assembly within said counterbore.

4. In a device of the character described, a pressure fluid work cylinder having an opening in the rear end wall of said cylinder; a bushing in said opening; a tubular conduit fitting said bushing and rotatable relatively thereto; a counterbore in said bushing; a packing assembly positioned in said counterbore and including a central spacing ring surrounding said conduit; fluid conducting passages in said conduit one opening through the inner end of said conduit into the rear end of the cylinder; and communicating ported areas in said conduit, the central ring of said packing assembly, said bushing, and said cylinder, connecting another of the fluid conducting passages in said conduit to the front end of the cylinder.

5. A device according to claim 4, characterized in that said communicating ported areas comprise a radial port of arcuate shape in said conduit, and a series of radial ports in the central ring of said packing assembly one or more of which communicate with said arcuate port in any position of rotation of said conduit.

6. A swivel joint for connecting a hydraulic cylinder to a pair of hose lines, comprising a bushing adapted to be mounted in the rear end wall of the cylinder, a conduit swivelly mounted in said bushing, said conduit having a pair of longitudinally extending passages adapted to be connected to the respective hose lines, one of said passages discharging directly into the rear end of the cylinder, the other passage opening through a radial port and communicating with the front end of the cylinder, a packing surrounding the conduit and sealing the space between the latter and the bushing on opposite sides of said radial port, a pair of complementary annular shoulders on the bushing and conduit respectively to limit rearward movement of the conduit relative to the bushing, the front end of the conduit having an unbalanced area exposed to the pressure of hydraulic fluid in the rear end of the cylinder to force the conduit rearwardly with the complementary shoulders in tight frictional engagement thereby preventing rotation of the conduit and leakage of pressure fluid past said shoulders when the pressure in the rear end of the cylinder is relatively high, said conduit being mounted for limited reciprocating movement in the bushing to permit the shoulders to be released from frictional locking engagement and to permit the conduit and hose lines to be swivelled relative to the cylinder whenever the pressure in the rear end of the cylinder is relatively low.

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