

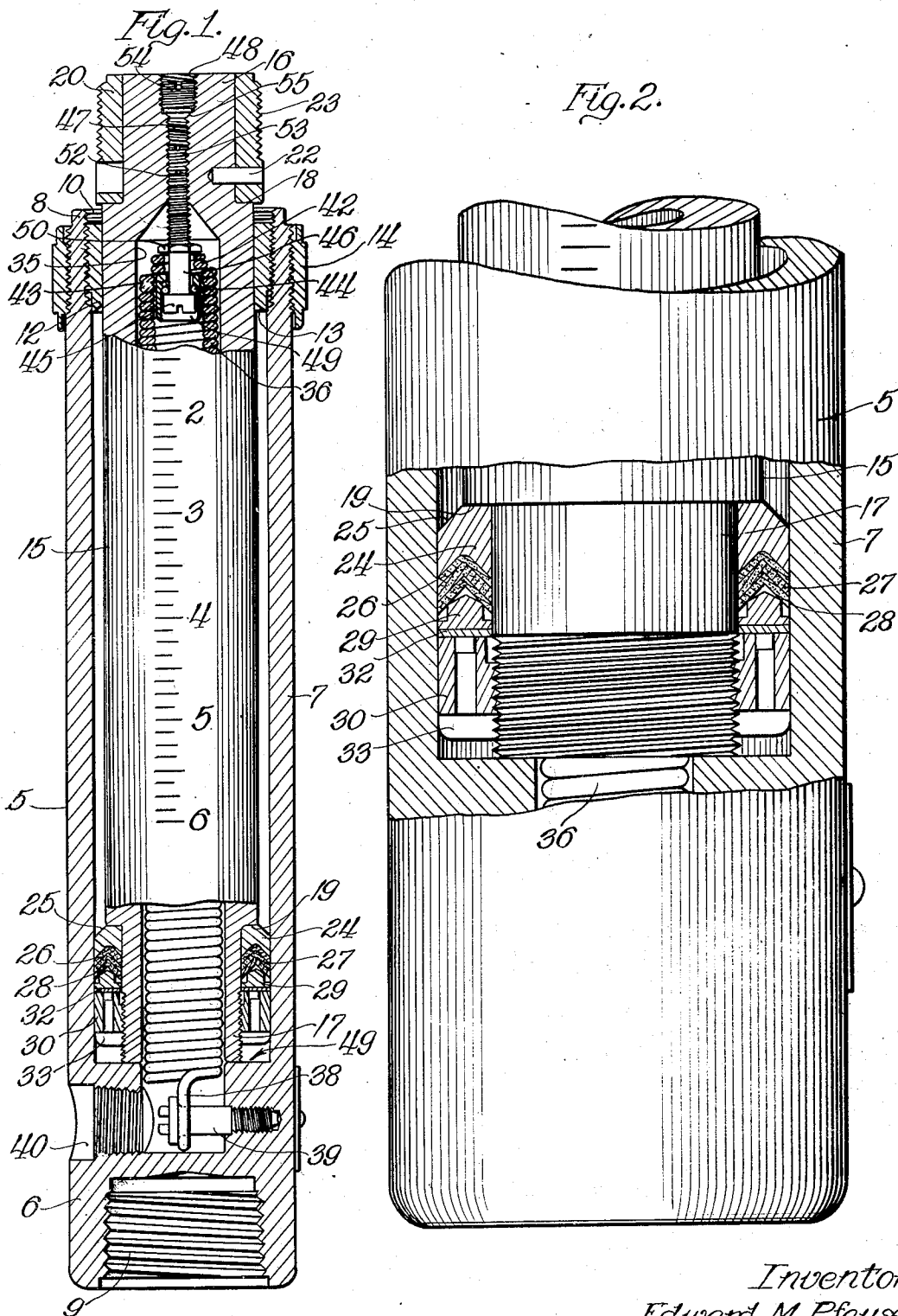
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HYDRAULIC RAM CONSTRUCTION

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HYDRAULIC RAM CONSTRUCTION

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This invention relates to hydraulic ram units, and more particularly is directed to units of this type used for pushing and pulling operations in connection with lifting, bending and straightening of metal structures and the like.

In ram units of this type, which are operable in all angular positions, the fluid for actuating the plunger is transmitted to the ram unit from a remote pressure developing source through a flexible pressure transmitting line. When the pressure is released, it is ordinarily necessary to drive the fluid from the ram unit by pushing the plunger inward to bring it to its retracted or initial position. It is frequently inconvenient to do so.

The present invention contemplates overcoming this disadvantage by incorporating suitable means in the ram unit for automatically restoring the ram plunger to its inner limiting position with the cylinder upon release of the fluid pressure. This mechanism operates entirely independently of the operator, and is controlled solely by the release of pressure at the pump or pressure developing source.

Another feature of the present invention is the provision of a novel type of sealing means between the plunger and the cylinder, consisting of annular V-shaped cups secured to the inner end of the ram plunger and effectively sealing the space between the cylinder and plunger to prevent leakage of fluid therepast.

One of the important advantages obtained by the present construction resides in the provision of a one-piece ram cylinder construction consisting of the base, cylinder portion and top cap all formed from a single piece of stock, such as cold rolled steel shafting or the like. This eliminates any possibility of leakage at threaded junctions, such as heretofore employed and produces a more compact and stronger unit. In combination with the plunger construction, a very strong, highly efficient and compact unit is provided which is light in weight thereby to facilitate its positioning in any location desired.

Still another feature of the present invention is the provision of stop means carried by the outer end of the ram cylinder and cooperating with corresponding means on the inner end of the plunger for limiting outward movement of the plunger. Preferably I form such means with frusto-conical contact surfaces which move into abutting engagement upon extension of the plunger. This effectively prevents any cold flowing of metal at the stop surfaces, thus eliminating the burring produced by the square

shoulder abutments hereto employed, which tended to cause binding of the stop disc of the plunger after continued use.

In connection with the automatic plunger return means, I preferably provide a novel type of pre-stressing means which initially tends to hold the plunger in its inner limiting position, and is positive in returning the plunger to such limiting position. The construction is such that easy assembly and adjustment of such prestressing means is possible.

The present construction is also advantageous in the economy and simplicity of construction and compactness of the parts, thereby facilitating assembly and use of the mechanism.

Other objects and advantages of the present invention will appear more fully from the following detailed description which, taken in conjunction with the accompanying drawing, will disclose to those skilled in the art the particular construction and operation of a preferred form of the present invention.

In the drawing:

Figure 1 is a vertical sectional view through a ram unit embodying the present invention;

Figure 2 is an enlarged view of a portion of the structure shown in Figure 1, with portions broken away for the sake of clarity.

Referring now in more detail to the drawing, the ram cylinder is indicated generally at 5 and comprises a base 6, a cylindrical body portion 7 and an end portion 8. This member is preferably formed from cold rolled steel shafting as a one-piece unit, whereby leakage at threaded connections, which was possible in prior ram cylinder constructions in which the base member was threaded to a rolled or seamless tubular cylinder, is eliminated.

The lower end of the base member is recessed as indicated at 9, and is provided with suitable internal threads or similar coupling means adapted to form quick detachable couplings for securing various work and reaction engaging members to the end of the ram cylinder for use in various metal bending and straightening operations. The type of members adapted to be connected in this manner is more clearly disclosed in my copending application, Serial No. 72,750, filed April 4, 1936, now Patent No. 2,165,504.

As the upper end 8 of the ram cylinder I provide an internal threaded portion 10 adapted to receive the stop ring 12 which is threaded therein, and which preferably is formed with a tapered or frusto conical stop surface, for a

purpose to be hereinafter described. The outer surface of the end portion 8 may also be threaded for receiving various types of coupling members, as disclosed in my patent referred to above, and when such couplings are not employed, the threads may be suitably protected by the sleeve ring 14 threaded thereover and enclosing this portion of the ram cylinder.

The ram plunger is indicated generally at 15, and comprises a tubular member having reduced end portions 16 and 17, which form radial shoulders 18 and 19, respectively. At its outer end 16 the plunger is provided with a suitable coupling engaging member 20 which may be secured thereto by means of a pin 22 or in any other suitable manner. The member 20 may be externally threaded as indicated at 23 for receiving quick detachable work-engaging members or the like of the type shown in my aforesaid copending applications. Obviously, other types of coupling means may be employed in place of the threads 23, such as a snap-on plunger type of coupling, as described in Mandl & Pfau's Patent No. 1,982,008, issued November 27, 1934.

Seated against the shoulder 19 at the inner end of the plunger is the stop disc 24 which is provided with a corresponding bevelled shoulder 25 adapted to engage the surface 13 of the stop ring 12 when the plunger moves into its outer limiting position. The provision of the conical surfaces for stopping the outward movement of the plunger insures that a positive stop will be obtained without any cold flowing of metal due to pressure, which thereby eliminates the burring produced by the shoulder type of abutments which have heretofore been employed. Such burring tends to cause binding of the stop disc of the plunger after continued use, scoring the surface of the plunger, and producing faulty operation of the unit. The angle of the shoulder 25 is obtuse enough that there is no tendency of the parts to stick by wedging together. The upward thrust thereby does not batter the stop ring 12 inwardly, as in prior constructions; but instead tends to spread the same radially. The inner axially facing portion of the stop disc 24 is provided with an annular groove of substantially V-shaped section, which is adapted to receive the plunger cup 26 also of annular V-shape. An intermediate plunger cup 27 is provided between the cup 26 and the outer cup 28. These cups are preferably formed of leather or similar material forming an effective seal with the internal surfaces of the body portion 7 of the plunger, and are maintained in tight engagement with the external surfaces of the reduced end 17 of the plunger and the internal surface of the cylinder 7 by means of a spreader ring 29 which has an annular bevelled projecting shoulder engaging the outer cup member 28, and held in position by means of the retaining nut 30 threaded inwardly over the end 17 of the plunger to force the spreader member 29 axially against the plunger cups. The packing ring or cup 27 or 28 may be made of a material impervious to the oil or other liquid used in the ram, as and for the purpose disclosed in my copending application Serial No. 68,244, of March 11, 1936, to prevent seepage of the liquid at high pressure through the porous leather cups 26 and 27 or 28, as the case may be.

Preferably a suitable spring washer 32 is disposed intermediate the spreader 28 and the retaining nut 30. The washer 32 is preferably formed of wavy contour to be flattened as the

nut 30 is drawn up. The nut 30 is provided with a suitable kerfed portion 33 facilitating its threading over the inner end of the plunger. This provides an effective seal to prevent any leakage of fluid under pressure from the interior of the cylinder outwardly past the plunger cups 26, 27 and 28. This also insures that the fluid will effect positive displacement of the plunger outwardly of the ram cylinder.

It is to be noted that when the ring 24 strikes the stop ring 12 the full hydraulic pressure on the piston tends to compress the packing cups 26, 27, 28 between the back of ring 24 and the front of ring 29. When a rubber cup is employed for the cup 28, it will flow into the available space and distribute the applied pressure, preventing cutting of the leather cups even though the angle of the backing ring 29 is not the same as the angle of the cups 26, 27. The same is true if the intermediate cup 27 is made of rubber, and cups 26 and 28 of leather or other pervious material.

The plunger is preferably provided with an axial recess 35 extending from the inner end 17 thereof to approximately the plane of the radial shoulder 18. Within this recess I dispose a helically coiled spring member 36, which is preferably of rectangular or ovate section, and is closely wound, being provided at its lower end with the normally extending portion 38 adapted to fit around the shank of a retaining stud 39 which threads into the plunger base 6 and is accessible from the inlet opening 40 to which the flexible fluid transmitting conduit is attached when the unit is placed in operation. This conduit (not shown) is connected to any desired pressure developing means, as disclosed in my patent aforesaid.

The fitting (not shown) which is inserted in the opening 40 comprises an outer part with a tapered thread for making a fluid tight fit with the threads at the inner end of the opening 40 and a cylindrical part back of the threads which cylindrical part fits closely the outer cylindrical part of the opening 40 so that side strain on the fitting will not tend to cause loosening of the threaded point.

The opening 40 is formed in the portion of the body below the shoulder 49, whereby the threaded socket may be formed in the solid part of the cylindrical body of which the ram cylinder is constructed and disposed within the confines of the cylindrical body.

At its upper end, the spring member 36 is provided with several coils 42 of smaller diameter than the normal spring diameter which engage over a suitable retaining beading member 43 carried by the ball members 44 upon the head end 45 of an adjusting screw 46.

The outer reduced end 16 of the plunger is provided with a suitable threaded portion 47, and at its outer end is counter-bored and tapped as indicated at 48. In assembling the mechanism, the coils 42 of the spring are first engaged over the retainer 43 which is mounted by means of the balls 44 on the head 45 and preferably has its outer end crimped over, as indicated at 49 to retain the member on the head 45. The nut 50 is then threaded down over the stem of the screw 46 to lock the coils 42 of the spring about the shank of the screw 46, and the ball supported retainer 43 permits relative movement of the spring members, providing a swivel bearing at this point which allows swivelling of the ram plunger with respect to the spring member with-

out putting any undue torsional strain on the spring. The smaller coils act as a ledge or abutment on which the ball retainer 43 takes the load of the spring while the nut 50 holds the ball retaining unit and screw in position on the spring until the threaded end of the screw can be threaded into the opening 47 by means of a screw driver operated from the opposite end of the spring. After the spring and screw have thus been initially secured to the outer end of the plunger, the plunger is inserted into the ram cylinder and the stop disc 12 is threaded into the end 8 of the cylinder to provide a bearing guide for the plunger and also to serve as a stop member, as heretofore described. The lower end of the spring is then secured by means of the screw 39 to the base portion of the cylinder.

This initial setup does not provide for any stressing of the spring, and in order to insure that the plunger will positively return to its initial limiting position upon release of the pressure in the cylinder, I provide suitable mechanism at the outer end of the plunger for insuring a predetermined prestressing of the spring member.

It will be noted that the outer end of the screw 46 is provided with a kerf 52, which may be engaged by a screw driver passed down through the opening 47 to thread the screw 46 outwardly of the end 16 of the plunger, thereby placing tension upon the spring member to produce initial prestressing thereof, which will insure that the plunger returns to its innermost limiting position upon release of pressure. In order to maintain the screw 46 against relative movement which might tend to unthread the same from the plunger, I provide a lock screw 53 which is threaded into the outer end of the plunger and jams against the end of the screw 46 to lock the same in position.

In order to prevent leakage of the fluid within the recess 35 of the plunger outwardly through the threaded opening 47, a suitable plunger plug 54 may be provided, which is threaded into the counterbored portion 48 and seats against the shoulder 55 to provide a fluid-tight seal which will prevent any leakage of pressure internally through the plunger.

It should be noted that the spreader member 29 incorporated in the sealing assembly at the inner end of the plunger has an annular bevelled shoulder portion with a wider tapered surface than that of the plunger cups 26 to 28, whereby upon pressure engagement of the spreader with the plunger cups, there is a tendency to move the outer edge portions or lips of the cups outwardly, causing them to contact the plunger and cylinder surface. At the same time the follower or spreader, when moved into contact with the center of the V-cups, causes them to expand under pressure. This produces a more efficient sealing action than was heretofore possible, and prevents leakage of fluid past the stop disc 24.

The threaded portion about the external surface of the end 8 of the cylinder is shown only as one example of a suitable way to attach fittings or work reaction members. Other mechanical expedients forming quick detachable couplings may be employed without departing from the present invention.

The spring 36 makes it possible to obtain many of the effects of the push-pull type of ram, and has some advantages over such a ram, since as soon as the valve controlling the fluid pressure to the ram unit is opened, the spring immediately retracts the plunger, whereas, with the push-pull

type of ram, it is necessary to pump the plunger back after the reversing valve has been completely turned to the opposite seating position. Since most of the so-called pulling operations readily resolve themselves into push operations so far as the ram is concerned, the particular unit disclosed is of particular advantage in all types of work requiring either pushing or pulling.

Preferably, I provide suitable graduations on the external surface of the ram, whereby the operator may observe the extent to which the plunger is moved outwardly of the cylinder thereby to gauge the extent of movement imparted to the work by the ram.

It will be readily understood that by reason of the one-piece construction of the ram cylinder, simplicity of design is obtained with the additional elimination of possible leakage at the threaded connections of the parts which are ordinarily used in making up such a cylinder. Further, the one-piece construction produces a simplified plunger guide and stop ring mechanism at the outer end of the cylinder, and also provides ready means for the attachment and detachment of work-engaging members.

I am aware that various changes and modifications may be made in certain details of the construction herein shown and described, and I therefore do not intend to be limited except as defined by the scope and spirit of the appended claims.

I claim:

1. A ram unit comprising a ram cylinder, a ram plunger reciprocatory therein, a coiled spring within said plunger, anti-friction means providing a swivel support for one end of said spring within the outer end of said plunger, means for securing the other end of said spring to said cylinder adjacent the inner end of said plunger, and means at said outer end of said plunger for producing a predetermined stress in said spring after said plunger has been assembled in said cylinder.

2. In combination, a ram cylinder, a ram plunger reciprocatory therein, spring means extending axially within the plunger and having a reduced end portion, a load supporting screw having clamping means receiving said end portion for supporting the same from the outer end of said plunger, means for securing the other end of said spring means to the base of said cylinder, locking means for locking said load supporting means in predetermined position in said plunger, sealing means preventing internal or external leakage of fluid past said plunger, and means operable from the outer end of said plunger for producing a predetermined tension in said spring means after said plunger has been assembled in said cylinder.

3. A ram comprising a ram cylinder having a closed end, a plunger inserted into the opposite end of said cylinder and supported for reciprocatory movement therein, an axial bore within said plunger for receiving a coiled spring member, means at the outer end of said plunger providing an anti-friction load supporting bearing for one end of said spring member, means accessible externally of said cylinder for securing the opposite end of said spring to the closed end of said cylinder, and means in the outer end of said plunger for producing predetermined initial stress in said spring member after said plunger has been assembled in position.

4. A ram unit comprising, in combination, a ram cylinder closed at one end and open at the

other, a ram plunger mounted for movement out of and into said cylinder through said open end, said ram plunger being tubular in form and closed at the outer end and open at the inner end, a coiled spring within said ram plunger, means for fastening one end of said spring to said ram cylinder adjacent the closed end thereof, and means for fastening the other end of said spring to said ram plunger adjacent the closed end thereof, the last named fastening means being adjustable through said closed end of said ram plunger for tensioning said spring after assembly of said ram plunger and spring with said ram cylinder.

5. A ram unit comprising, in combination, a ram cylinder open at one end and closed at the other and having a transverse port adjacent said closed end opening into said cylinder, a ram plunger mounted for movement out of and into said cylinder through said open end, said ram plunger being tubular in form and closed at the outer end and open at the inner end, a coiled spring within said ram plunger, a retaining member insertable through said transverse port and fastened to the wall of said ram cylinder for securing one end of said spring thereat, and means for fastening the other end of said spring

to said ram plunger adjacent the closed end thereof, the last named fastening means being adjustable through said closed end of said ram plunger for tensioning said spring after assembly of said ram plunger and spring with said ram cylinder.

6. A ram unit comprising, in combination, a ram cylinder closed at one end and open at the other, a ram plunger mounted for movement out of and into said cylinder through said open end, said ram plunger being tubular in form and closed at the outer end and open at the inner end, a coiled spring within said ram plunger, means for fastening one end of said spring to said ram cylinder adjacent the closed end thereof, and means for fastening the other end of said spring to said ram plunger adjacent the closed end thereof including a member axially threaded in said closed end of said ram plunger and adjustable therethrough for tensioning said spring after assembly of said ram plunger and spring with said ram cylinder, and locking means for holding said threaded member in any operative position to which it may be adjusted to prevent movement therefrom due to tension of said spring.

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