July 31, 1945. C. H. NYSTROM 2,380,607

FLUID PUMP

Filed Jan. 19, 1945

Fig. 1

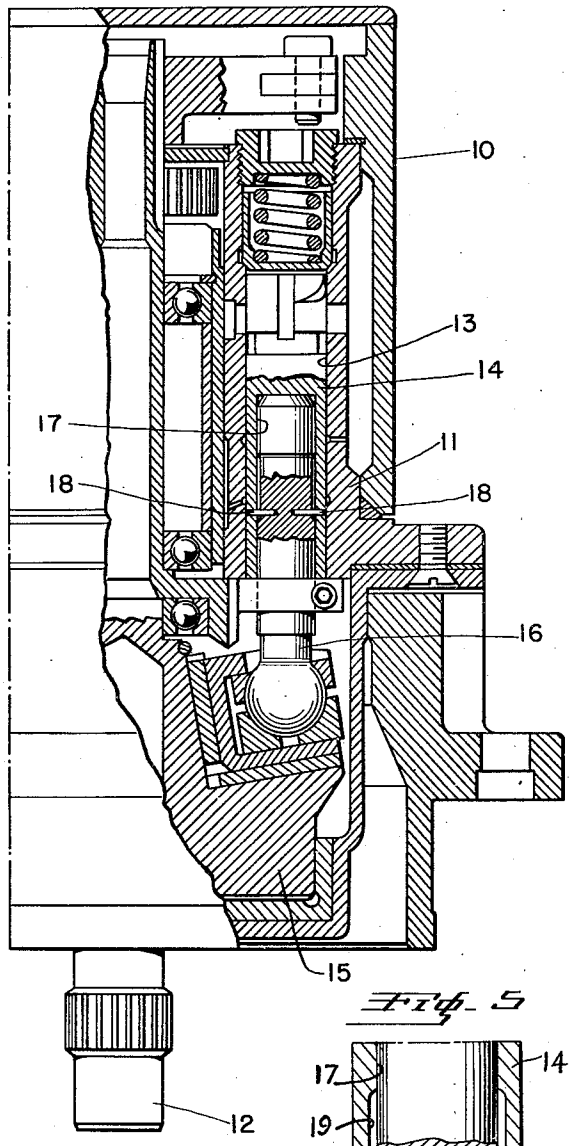


Fig. 2

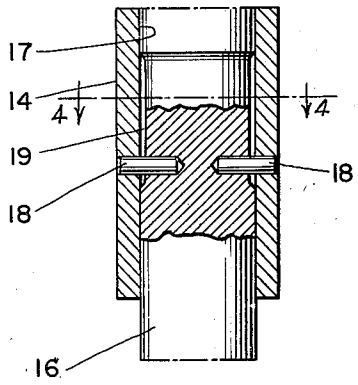


Fig. 3

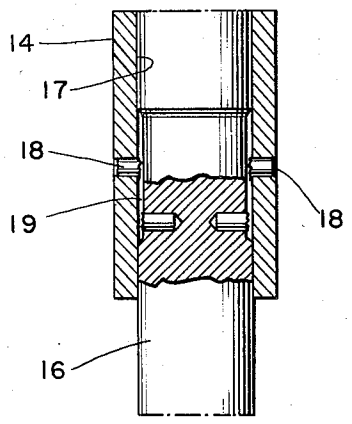


Fig. 5

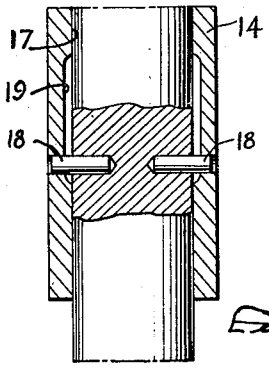
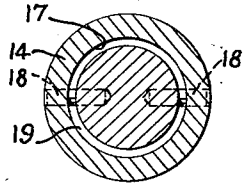


Fig. 4



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FLUID PUMP

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Application January 19, 1945, Serial No. 573,525

10 Claims. (Cl. 309—4)

This invention relates to fluid pumps, and particularly to single cylinder and multicylinder pumps of the type having a plunger movably mounted in a barrel with a rod connecting the pump-operating means to the plunger for operating the plunger in its barrel.

In single cylinder pumps with the rod for operating the plunger connected thereto by shear pins, if the plunger seized in its barrel and the pins were sheared by the continued operation of the rod, the further movement of the rod might cause the rod and plunger to seize due to the presence of some of the sheared metal in the close fit between the rod and plunger, and thereby cause further damage to the pump. In multicylinder pumps with a plunger movable in a barrel for each cylinder and each plunger having a rod for actuating the plunger and connected thereby by shear pins, should a plunger seize within its barrel and continued operation of the rod cause breakage of the shear pins, the rod and plunger might seize, as stated above, and cause breakage of the operating mechanism of the pump or prevent further movement of the rod, thereby preventing any further operation of the pump.

The primary object of the invention is to provide a recess on the plunger or on the rod for operating the plunger, which recess is between the rod and plunger and adjacent the pins connecting the rod and plunger, which recess allows movement of the rod relative to its plunger after shearing of the connecting pins without any further injury to the pump, and in the case of a multi-cylinder pump allows the pump to continue to operate with only the loss of power from the particular cylinder involved.

This recess may be on the plunger bore or on the rod extending therein, or the rod may be provided with a bore adapted to receive a reduced end on the plunger in which case the recess may be in the wall of the bore in the rod or in the reduced end of the plunger extending therein.

Other objects and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawing. It will be understood that many changes may be made in the details of construction and arrangement of parts, without departing from the spirit of the invention as expressed in the accompanying claims. I, therefore, do not wish to be limited to the exact details of construction and arrangement of parts shown and described, as the preferred form of the invention has been given by way of illustration only.

In the drawing:

Fig. 1 is a longitudinal side view, partly in section, of a fuel pump constructed in accordance with the present invention; Fig. 2 is a fragmentary detail showing the plunger and its operating ball rod upon an enlarged scale; Fig. 3 is a view generally similar to Fig. 2 and illustrating the operation of the present invention; Fig. 4 is a sectional view taken on line 4—4 of Fig. 2 looking in the direction of the arrows; and Fig. 5 is a view similar to Fig. 2 but showing another form of the invention.

Referring more particularly to the drawing, wherein the invention has been shown applied to a fuel pump for a multicylinder engine for the purpose of illustrating the invention, and wherein similar reference characters designate corresponding parts throughout the several views, 10 indicates an outer cylindrical pump-casting forming a housing for a cylinder block 11. The cylinder block 11 is provided with a central bore having a shaft 12 which is adapted to be driven from the cam shaft of the engine, and the block 11 is also provided with a plurality of barrels 13 which form the pump cylinders and are arranged symmetrically therearound. Such fuel injection pumps and their operation are generally disclosed in U. S. Patent No. 2,093,477 to B. G. Parsons, and therefore only the specific elements as are necessary for an understanding of the present invention are herein described.

Plungers 14 are reciprocatively mounted in each of the barrels 13, and are actuated by a swash plate 15, mounted upon the central shaft 12, through a ball rod 16 for each plunger 14 and which is secured to said swash plate 15 at one end and has its opposite end extending into a bore 17 in the adjacent end of the plunger 14 and is secured therein by the shear pin 18.

Due to the required close fit between the plunger 14 and its barrel 13, it has been found that where the plunger 14 seizes in its respective barrel 13 due to the presence of some foreign matter within the barrel such as from the fuel, the plunger 14 would cease operation entirely and thereby prevent further operation of the engine, or the ball rod would break the swash plate whereby the broken pieces would fall into the teeth of the gear or into the bearing and thereby invariably ruin the drive mechanism. In some cases where the plunger 14 seized and the ball rod 16 caused the shearing or breaking

off of the pins 18 when the pins 18 broke off, a small amount of the sheared metal would be caught in the close fit between the ball rod 16 and plunger 17 which, upon continued reciprocatory movement of the ball rod 16 in the plunger bore 17, would frequently cause the ball rod 16 to seize within the bore 17 and prevent further operation of the engine or breakage of the swash plate as stated above.

To overcome the difficulties which have been encountered, as outlined above, I have found that by constructing the ball rod 16 with an undercut recess or groove 19 adjacent the shear pin connection between the ball rod and plunger bore 17, these difficulties could be avoided.

The recess 19 must however be of the proper size and location or other difficulties will be encountered. The recess 19 must be of such length as to allow the continued reciprocatory motion of the ball rod 16, the full stroke of such rod without the outer surface of the ball rod engaging the sheared end of the pin on the bore, and also this recess 19 must not extend out of the plunger bore 17 when the plunger is at withdrawn position.

It is pointed out that the recess 19 must not be cut too deeply into the surface of the ball rod 16, or working or play may be present which might cause the pins to begin to flex or bend and break of themselves.

While the depth of the recess 19 may be varied within a wide range, I have found that with this depth from .009 in. to .014 in. to be a practical working range although it might be either above or below these limits and still be satisfactory in operation.

As shown in Fig. 4, the recess 19 may be formed entirely or circumferentially surrounding the ball rod 16 and this is believed to be the most practical construction for production purposes, because it would facilitate the manufacture and assembly of the structure, but it is pointed out that it is not necessary that the recess 19 entirely surround the ball rod 16 so long as the width of the recess is greater than the degree of any turning action of the plunger so as not to interfere therewith.

Another way in which the advantages of this invention could be realized would be as shown in Fig. 5 to form the recess 19 on the inner surface of the bore 17 instead of on the ball rod 16, but this arrangement might be more difficult and expensive to manufacture.

With the device constructed acording to this invention, should the plunger 14 seize within the barrel 13 for any reason, and the ball rod 16 shear the pins 18 as previously described, the ball rod 16 will be free to reciprocate within the bore 17 of the plunger and because of the recess 19 the ball rod will not seize within the bore 17 due to the presence of some of the sheared metal as stated above, but will continue to reciprocate, and the pump and engine continue operation, with only the loss caused by the lack of operation of the disabled plunger.

From the foregoing it will be seen that I have provided simple, efficient and economical means for obtaining all of the objects and advantages of the invention.

Having thus described the invention, what I claim is:

1. In a fluid pump, a barrel, a plunger mounted for movement in said barrel, a plunger rod for moving said plunger within said barrel, a shear pin connecting said plunger rod to said plunger, and a recess in one of said members adjacent said shear pin.

2. In a multicylinder fluid pump, a barrel for each cylinder, a plunger mounted for movement in each barrel, a plunger rod for moving said plunger, a shear pin connecting each plunger rod to its respective plunger, and a recess in one of said members adjacent said shear pin for allowing movement of said plunger rod relative to its plunger in the event of breakage of said shear pin.

3. In a fluid pump, a barrel, a plunger mounted for movement in said barrel, a plunger rod for moving said plunger within said barrel, a shear pin connecting said plunger rod to said plunger, and a recess in one of said members adjacent said shear pin for allowing movement of said rod relative to said plunger in the event of breakage of said shear pin.

4. In a fluid pump, a barrel, a plunger mounted for movement in said barrel, a plunger rod for moving said plunger within said barrel, a plurality of shear pins connecting said plunger rod to said plunger, and a recess in one of said members adjacent said shear pins.

5. In a fluid pump, a barrel, a plunger mounted for movement in said barrel, a plunger rod for moving said plunger in said barrel, a shear pin connecting said plunger rod to said plunger, and a circumferential recess in said plunger rod adjacent said shear pin.

6. In a fluid pump, a barrel, a plunger mounted for movement in said barrel, a plunger rod for moving said plunger in said barrel, a shear pin connecting said plunger rod to said plunger, and a circumferential recess in one of said members between the adjacent surfaces thereof and adjacent said shear pin.

7. In a fluid pump, a barrel, a plunger mounted for movement in said barrel, a plunger rod for moving said plunger in said barrel, a shear pin connecting said plunger rod to said plunger, and a recess in one of said members adjacent said shear pin, said recess being at least .009 in. in depth.

8. In a fluid pump, a barrel, a plunger mounted for movement in said barrel, a plunger rod for moving said plunger in said barrel, a shear pin connecting said plunger rod to said plunger, and a recess in one of said members adjacent said shear pin, said recess being not over .014 in. in depth.

9. In a fluid pump, a barrel, a plunger mounted for movement in said barrel, a plunger rod for moving said plunger in said barrel, a shear pin connecting said plunger rod to said plunger, and a recess in one of said members adjacent said shear pin, said recess having a depth of at least .009 in. and not over .014 in.

10. In a fluid pump, a barrel, a plunger mounted for movement in said barrel, a plunger rod for moving said plunger in said barrel, a shear pin connecting said plunger rod to said plunger, and a recess in one of said members adjacent said shear pin, said recess being of such depth as to allow continued movement of said plunger rod relative to said plunger in the event of breakage of said shear pin.

CARL H. NYSTROM.