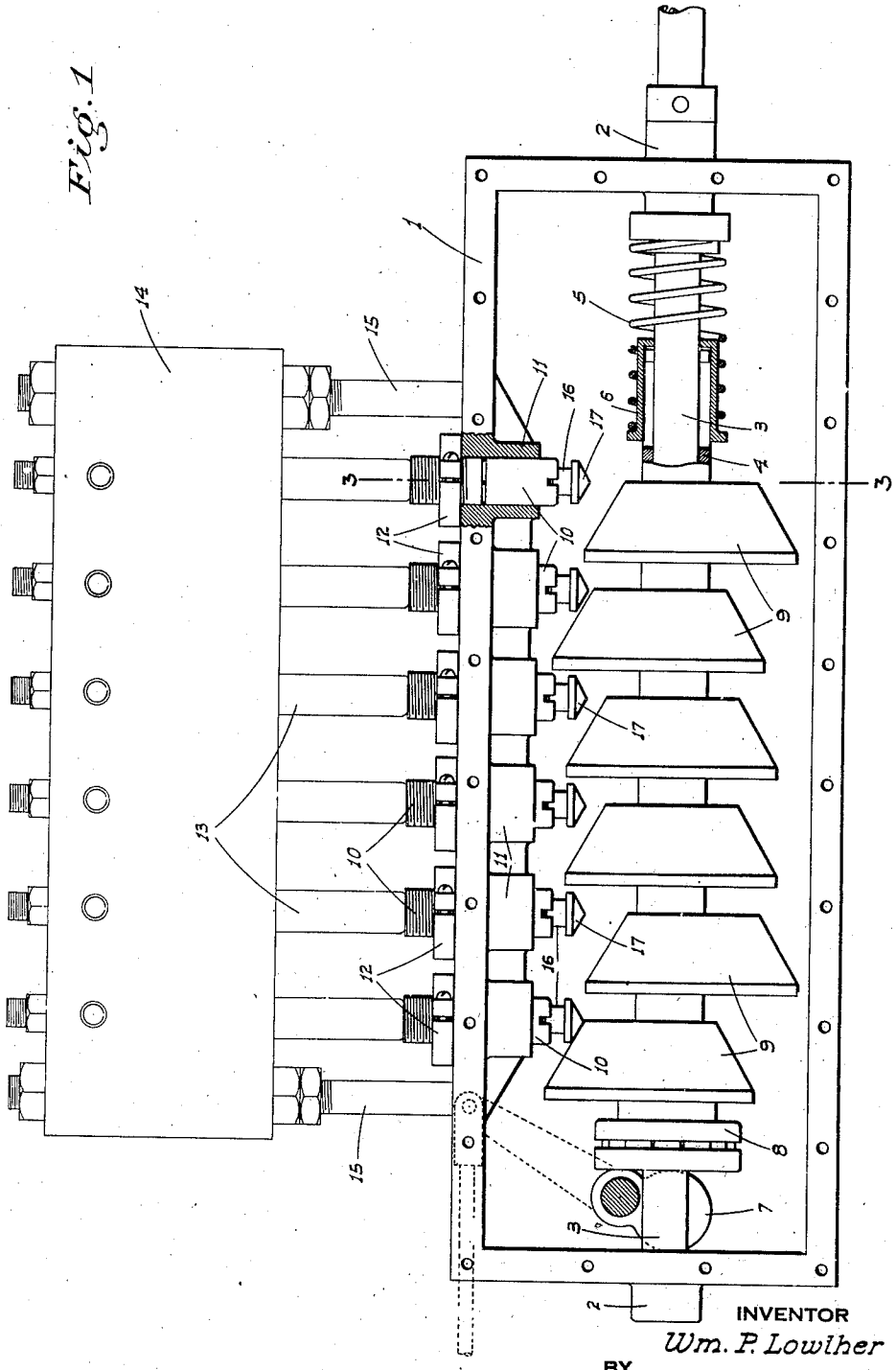
Dec. 15, 1942. W. P. LOWTHER 2,305,540

PLUNGER LIFT CONTROL

Filed Sept. 27, 1940 2 Sheets-Sheet 1

Fig. 1



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Fig. 2

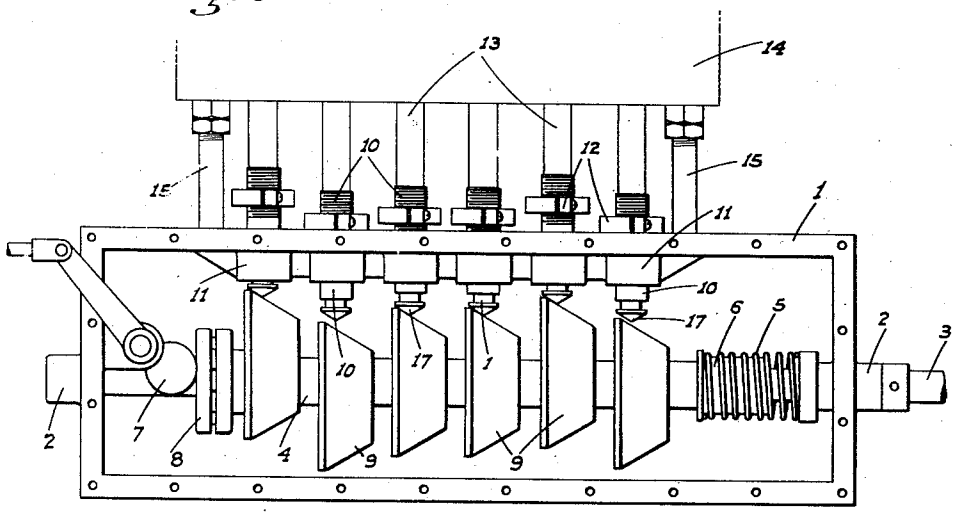


Fig. 3

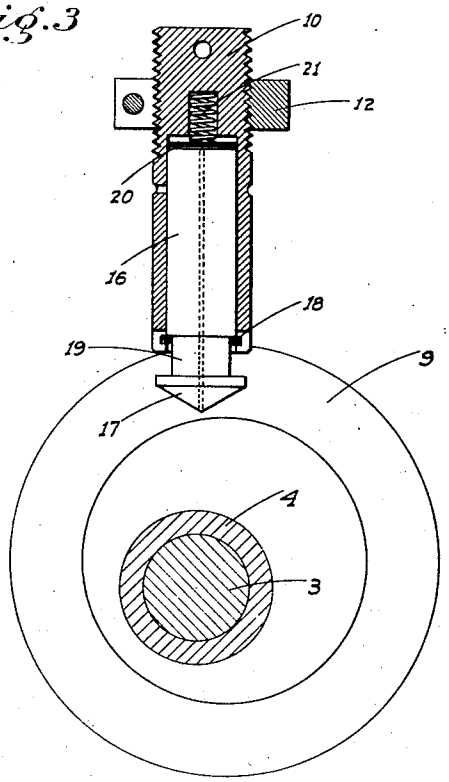
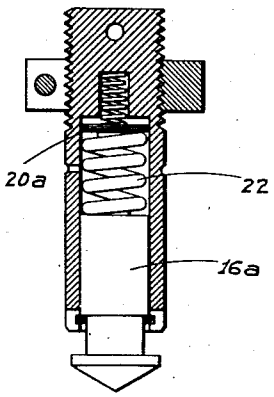


Fig. 4



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UNITED STATES PATENT OFFICE

2,305,540

PLUNGER LIFT CONTROL

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Application September 27, 1940, Serial No. 358,647

3 Claims. (Cl. 74—569)

This invention relates to actuating mechanisms for multiple-plunger oil or grease pumps, fuel pumps such as are used for fuel injection of Diesel engines, and similar units.

The principal objects of my invention are to provide a plunger lift control unit arranged so that any degree of lift from zero to the full limit may be instantly obtained; one in which the lifting stroke takes place rapidly and for a relatively short time so that the pump cylinders from which the plungers project have a correspondingly longer time to fill; one in which the left control tappets, while out of engagement with the actuating cams during the greater portion of the rotation of the latter, are so constructed that cushioned engagement of the tappets with the cams is always had, thus avoiding any hammering and excessive wear.

A further object of the invention is to produce a simple and inexpensive device and yet one which will be exceedingly effective for the purpose for which it is designed.

These objects I accomplish by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings similar characters of reference indicate corresponding parts in the several views:

Figure 1 is a side elevation of the apparatus, partly in section and with the cam housing removed, and showing the cams fully retracted and the tappets idle.

Figure 2 is a similar view, showing the cams advanced.

Figure 3 is a fragmentary cross section on line 3—3 of Fig. 1.

Figure 4 is a sectional elevation of a modified form of tappet unit, for use with oil or grease pumps.

Referring now more particularly to the characters of reference on the drawings, the device comprises an elongated housing 1, having end bearings 2 for a drive shaft 3 which projects from one end of the housing for connection with a drive means.

Slidably keyed on the shaft within the housing is a sleeve 4, urged in one direction by a spring 5 engaging a thimble 6 on the sleeve at one end, and adapted to be moved in the opposite direction, against the resistance of the spring, by a manually actuated shifting fork 7 straddling the shaft beyond the sleeve at the end thereof opposite the spring and disposed to engage a thrust bearing 8 mounted on the shaft and contacting the adjacent end of the sleeve.

Fixed on the sleeve in spaced relation along the same are cams 9. These are frusto-conical members, all facing in the same direction (toward the spring engaged end of the sleeve) and disposed in eccentric and circumferentially staggered relation on the sleeve.

Mounted on the housing radial with the shaft and spaced lengthwise thereof the same as the cams, are the tappet units. There are of course the same number of these units as there are cams, and they are mounted on the housing relative to the cams so that their axial lines if projected lie immediately adjacent the planes of the small ends of the corresponding cams when the latter are in full retracted position, as shown in Fig. 1.

Each tappet unit comprises an elongated socket member 10 slidable in and projecting through a bearing 11 in the top of the housing 1 and threaded for a certain distance from its upper end. An adjustable nut 12 is clamped about the threaded portion and normally bears against the outer face of the housing. The nut is yieldably maintained in that position by the normal pressure of the plunger 13 of the pump unit 14 whose operation is controlled by the tappet. The pump body is mounted rigid with housing 1 by suitable means such as studs 15.

The socket member is open on its lower end to slidably receive the tappet plunger 16. The plunger projects from the lower end of the socket and is formed with a cone shaped head 17 to engage a cam and cut on the same angle as the cam.

Downward movement of the plunger is limited by the engagement of a split spring ring 18 in the socket member near the bottom, with the shoulder formed at the upper end of a reduced portion 19 on the plunger just above the head. The upper end of the plunger then clears the bottom of the socket bore by a small margin which may be altered to suit by means of shim discs 20 resting on the plunger. A weak spring 21 seated in the socket member bears against the shims and allows of upward movement of the plunger with a light pressure only.

The nuts 12 on all the socket members are normally set so that when the cams are fully retracted, the plunger heads 17 just clear the same even when the latter are in their topmost position on the sleeve 3.

It will therefore be seen that if the cams are advanced from their fully retracted position, the

tappet units will be intermittently lifted with the rotation of the cams, and the extent of such lift will be governed by the amount of advance of the cams, and of course by the angle of slope of the latter.

The eccentric positioning of the cams on the sleeve 3, relative to the amount of possible lift imparted by the cams to the tappet units, is such that with any advanced position of the cams, the tappet units will only be engaged thereby for a relatively short portion of a complete revolution of the cams, so that the tappet units are clear of the cams, and are supported by the nuts 12, for relatively great periods. This feature of course gives the pump cylinders a longer time to fill up than would otherwise be obtained before a lifting of the tappets and a fluid ejecting action occurs. Also, when the tappet units are finally engaged by the cams, a very rapid lifting action is obtained.

Due to the normal or initial clearance between the plungers 16 and the bottom of the socket bore, and the use of the weak springs 21 urging the plungers down, the initial lift of the plungers merely compresses the springs, and no load is taken until the plungers (or the shims) actually engage the bottom of the sockets, to then lift the socket members also.

This is a very valuable feature since the initial contact of the plungers and cams is cushioned and takes place smoothly, and the heads 17 become firmly engaged with the cams before the heavy lifting load is taken and which would otherwise severely jar the tappet units and cause excessive wear.

The nuts 12 being adjustable, the normal clearance of any tappet head from its cam may be varied so as to correspondingly vary the lift obtained.

The plunger shown in Fig. 3 is used with a Diesel fuel pump. For use with other pumps such as grease pumps, when the outlet from a pump cylinder may possibly be closed, I use the plunger structure shown in Fig. 4.

In this case, the plunger 16*a* is relatively short, the remaining space between the plunger and the shims 29*a* being occupied by a heavy spring 22. This spring is of sufficient strength to take a normal load without deflection, but if excessive resistance prevents upward movement of the socket unit, the spring will yield and permit of the cam-urged upward movement of the plunger within the socket member without possible breakage of any part.

From the foregoing description it will be readily seen that I have produced such a device as substantially fulfills the objects of the invention as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described my invention, what I claim as new and useful and desire to secure by Letters Patent is:

1. A plunger control mechanism comprising a housing, a driven shaft turnably mounted in the housing, a cam mounted in connection with the shaft, a tappet unit for engagement at one end with the cam mounted in connection with the housing radially of the shaft, said unit comprising an outer socket member having a blind bore open at its end nearest the cam, a cam engaging plunger slidable in the bore, a normally slack compression spring of a strength sufficient to take a predetermined load without deflection, slidably mounted in the bore between the plunger and the bottom of the bore, means limiting the movement of the plunger and spring in the direction of the cam, a relatively weak spring in the bore normally maintaining the plunger and spring at their limit of movement in said direction and stop means between the socket member and housing limiting movement of the latter toward the cam; the cam being disposed so that the cam engaging end of the plunger is clear of the cam during a portion of each revolution of the latter.

2. In a cam and tappet unit, said unit including an outer socket member adapted to be mounted for movement radially of the axis of rotation of the cam and having a bore open at its end nearest the cam, a cam engaging plunger slidable in the bore for a distance not less than the full throw of the cam and a normally slack spring between the plunger and the bottom of the bore resisting a predetermined normal operating pressure.

3. A plunger control mechanism comprising a housing, a driven shaft turnably mounted in the housing, a cam of frusto-conical form turnable with the shaft and movable axially, a tappet unit for engagement with the cam slidably mounted in the housing radially of the shaft, the cam being movable from a position in which the axial line of the tappet unit projects adjacent the small end of the cam to a position in which said axial line projects adjacent the large end of the cam, means to move the cam axially and means preventing any lift of the tappet unit when the cam is disposed with its small end adjacent the axial line of the tappet.

WILLIAM P. LOWTHER.