June 22, 1943. E. HAHN 2,322,356

INJECTION PUMP

Filed May 6, 1941 2 Sheets-Sheet 1

Fig. 1

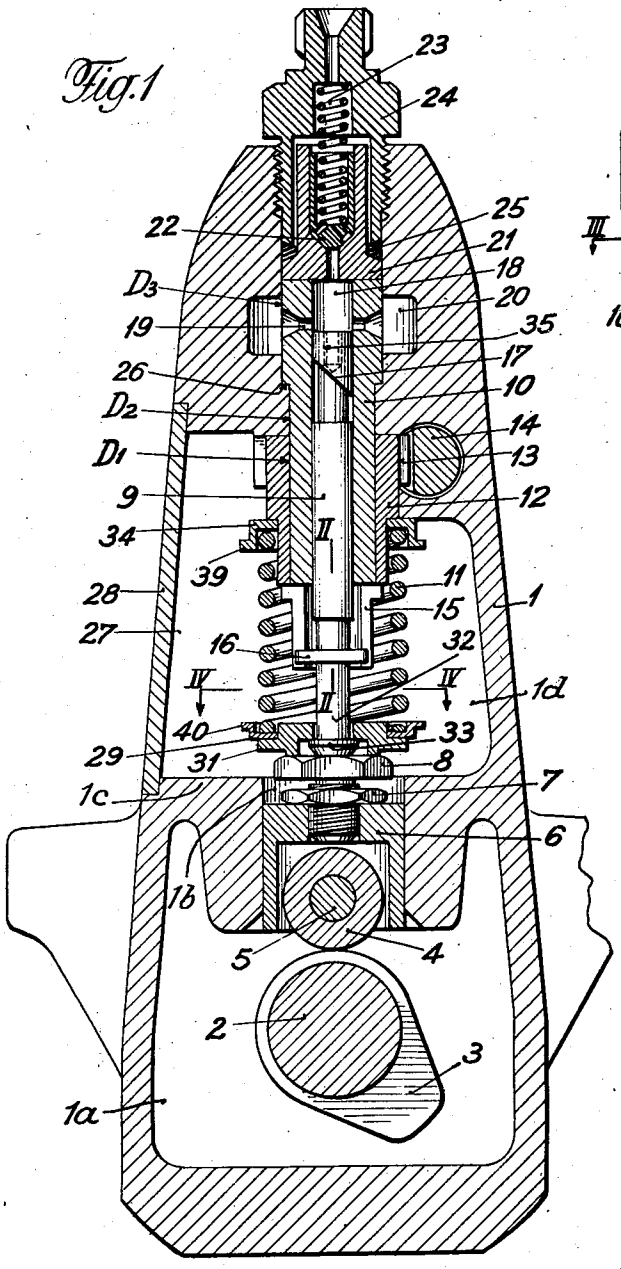


Fig. 2

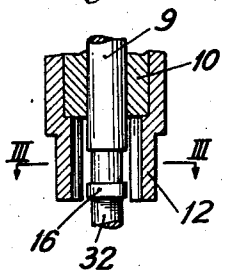


Fig. 3

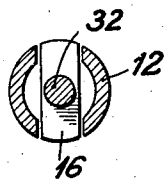
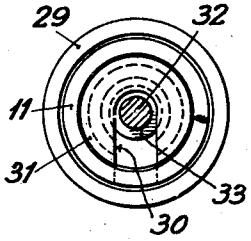


Fig. 4



Inventor,
Erwin Hahn
by Sommers & Young,
Attorneys

June 22, 1943. E. HAHN 2,322,356

INJECTION PUMP

Filed May 6, 1941 2 Sheets-Sheet 2

Fig.5

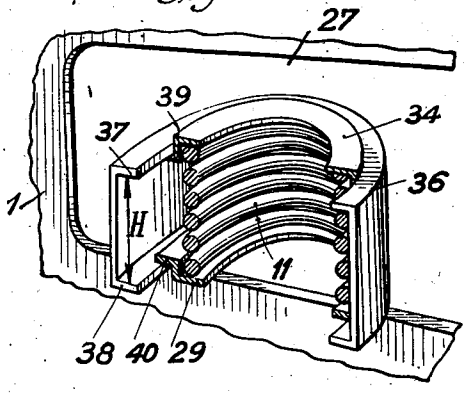


Fig.6

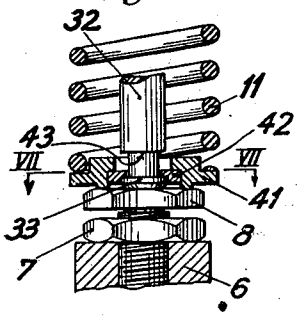


Fig.7

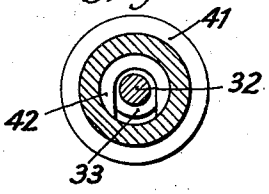


Fig.10

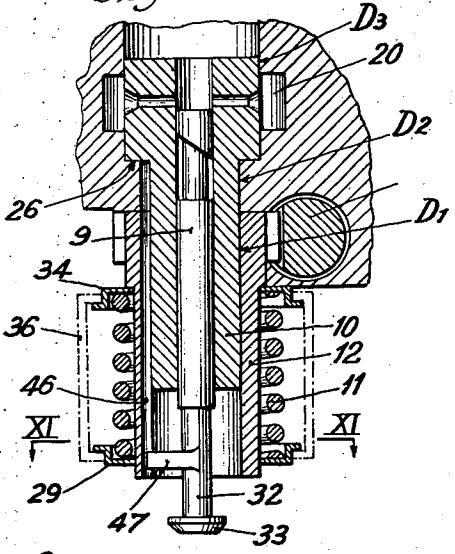


Fig.8

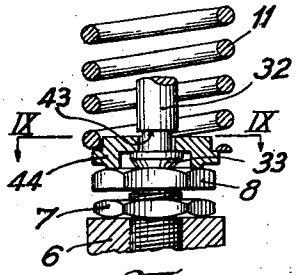


Fig.11

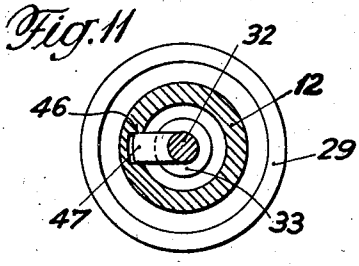
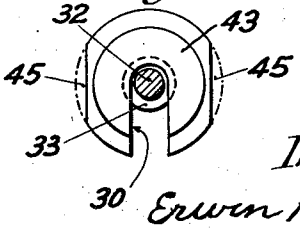


Fig.9



Inventor,
Erwin Hahn
by Sommers & Young,
Attorneys

Patented June 22, 1943 2,322,356

UNITED STATES PATENT OFFICE

2,322,356

INJECTION PUMP

Erwin Hahn, Arbon, Switzerland, assignor to Aktiengesellschaft Adolph Saurer, Arbon, Switzerland

Application May 6, 1941, Serial No. 392,142
In Germany May 7, 1940

2 Claims. (Cl. 103—41)

This invention relates to injection pumps and more particularly to fuel injection pumps of the slide controlled type having an inclined edge provided on the plunger piston for regulating the delivery of the pump. Injection pumps of this type are known wherein all the elements of the pump including the cam shaft are lodged in a single piece casing, into which the pump cylinder is introduced and pressed down from the side thereof situated opposite the cam shaft, and wherein the pump plunger is pressed against a cam actuated push rod by means of a spring disposed in a laterally open chamber of the casing, the push rod being guided in a bore penetrating with a constant diameter a partition wall between the cam shaft and the laterally open spring chamber. When in an injection pump of this type the necessity arises, owing to a defect, to replace one or more pump elements, or a spring, a push rod, or any other part, the pump must be dismounted, removed from the engine and completely disassembled. In order to replace any part lodged in the casing, the cam shaft always must be taken off first. When a governor is combined with the pump, this governor must be removed. In case an injection timing device is mounted on the pump, it must also be removed. The change of any part of such a pump accordingly is expensive and results in a considerable loss of time, particularly when such a pump defect happens on a vehicle motor so that this latter remains inoperative on the road until a replacement pump is on hand, or even must be salvaged.

There have been made efforts to create pumps permitting an easy exchange of parts. For example the pump casing was made in two parts, the cam shaft and the push rod being lodged in a separate lower casing portion and the pump cylinders in an upper casing portion. In this case the replacement of a pump element can be effected without disassembling the cam shaft and without removing the governor and eventually the injection timing device, but the entire upper pump block must be dismounted. In known pumps of this type the pump plungers remain in the lower casing portion when the upper block is removed, and when the block is to be assembled again, the pump cylinders in this block must be lowered, against the action of all retracting springs, over the plungers loosely held in the lower casing portion. Owing to the difficulty of assembling the pump in this manner, a replacement of a pump element on a vehicle motor on the road is not possible with such a type of pump.

It has also been proposed to render the connection between the plunger and the push rod accessible from the side so that the plunger can be disconnected and removed with the cylinder without disassembling the cam shaft or parts of the casing, but in known constructions of this type it is not possible to remove the retracting springs or the push rods without disassembling the casing or removing the cam shaft.

According to further known pump designs, in which a simple replacement of pump elements has been aimed at, the different parts including the retracting spring for the plunger and the toothed control segments can be pulled out upwardly. This construction has the disadvantage that the diameter of the bore in the casing in which the pump assembly is introduced from above, must be larger than the diameter of the spring and of the toothed segments. Accordingly, complicated packings on a large circumference must be used, and soft packing material is required for making radial joints, as well as hard packing material for the axial joints. Mounting of such pump elements therefore requires great care.

The object of the present invention is the provision of an injection pump of the above mentioned type in which the pump elements can be replaced in extremely simple manner without requiring extensive disassembling operations and without presenting the mentioned difficulties of known pump constructions for reassembling the packings and correctly resetting the pump elements. In the pump according to the invention it is possible to loosen the connection between the spring serving for retracting the pump plunger and the plunger through the lateral opening without rotation of the plunger, so that the plunger and the cylinder can be dismounted from the side opposite the cam shaft, and all other parts such as retracting spring, spring cups, regulating sleeve, toothed segment and push member can be taken off through the lateral opening. In this manner a replacement can be effected in a vehicle motor on the road without any risk, and without requiring the removal of the injection pump from the motor. The pump casing is made in a single piece without any separate portion; in the same casing there are lodged all the pump elements together with the cam shaft, and the pump cylinders are introduced from the side of the casing opposite the cam shaft.

The accompanying drawings illustrate several

practical embodiments of an injection pump according to the invention.

Fig. 1 is an axial section through an injection pump.

Fig. 2 is a fragmentary vertical section along the line II—II of Fig. 1.

Fig. 3 is a horizontal section along the line III—III of Fig. 2.

Fig. 4 is a horizontal section along the line IV—IV of Fig. 1.

Fig. 5 is a perspective view in section showing an auxiliary device used in the dismounting operation.

Fig. 6 is an axial section of a modified detail part of the pump.

Fig. 7 is a transverse section along the line VII—VII of Fig. 6.

Fig. 8 is a sectional view of a further modified detail part of the pump.

Fig. 9 is a section along the line IX—IX of Fig. 8.

Fig. 10 is a fragmentary axial section of a further modification of the pump according to the invention.

Fig. 11 is a transverse section on the line XI—XI of Fig. 10.

Referring to Figs. 1 to 4, the pump casing 1 is made of a single piece and contains all the elements of the pump. A lower chamber 1*a* of the casing contains the cam shaft 2 having a cam 3 cooperating with the cam follower 4 carried by the journal 5 supporting the push member 6. This push member is slidably guided in a bore 1*b* of a partition 1*c* separating the chamber 1*a* from an upper chamber 1*d*. The push member 6 carries a pressure screw 8 adjustably secured thereto by means of a counter nut 7. The pump plunger 9 tightly fitting into the pump cylinder 10 is constantly urged toward the pressure screw 8 of the push member by means of a retracting spring 11. A regulating sleeve 12 surrounds the cylinder 10 and is provided with teeth 13 meshing with a rack 14 slidably guided in the casing 1. Movement of the rack transversely to the axis of the plunger 9 causes a movement of rotation of the sleeve 12. The lower end of this sleeve is provided with axial recesses 15 engaging a driver 16 on the plunger 9 capable of vertically moving with the plunger and transmitting rotation from the sleeve 12 to the plunger.

The upper end of the plunger 9 is provided in known manner with an inclined regulating edge 17 permitting, upon a rotation of the plunger, to vary the amount of fuel delivered by the pump. Fuel arrives in the pump chamber 18 from the suction chamber 20 through the ducts 19 opened by the plunger 9 when it is in its lower position. A valve body 21, containing the pressure valve 22 applied on its seat by a spring 23, is tightly fitting upon the pump cylinder 10. The cylinder 10 is pressed upon its seating surface 26 in the casing 1 by means of a closure plug 24 transmitting pressure to the casing 1 by the intermediary of the pressure valve body 21 and the packing 25. The chamber 1*d* of the pump casing is provided with a lateral opening or window 27 which can be easily closed by a cover 28.

According to the present invention the retracting spring 11 for the pump plunger 9 is connected to the plunger by means of a connection which can be easily detached through the window 27. In the example according to Figs. 1 to 4 this connection is realized by means of a lower spring abutment composed of two parts. The lower end of the spring is supported by an upper cup 29 on which the spring bears directly, and by a lower disc 31 provided with a radial slot 30 and carried on a shoulder of a collar 33 formed on the plunger rod 32. This collar bears on the pressure screw 8 carried by the push member 6. The upper end of the retracting spring 11 is maintained in a spring washer 34 bearing against the casing 1 and at the same time preventing an axial displacement of the regulating sleeve 12.

The inner diameter D_1 of the regulating sleeve 12, as well as the diameters D_2 and D_3 of the bore in the casing 1 into which is inserted the pump cylinder 10 are at least equal or greater than the greatest diameter of any member forming a part of the pump plunger, that is at least equal or greater than the diameter of the driver 16. In this manner it is possible, after having detached the connection between the spring 11 and the pump plunger 9, to pull this latter together with the cylinder 10 upwardly across the bores D_1 and D_2 and remove these parts from the pump casing 1. To facilitate this removal, the upper end of the plunger 9 is preferably provided with a threaded hole 35, so that a screw bolt can be engaged in this hole and the plunger 9 and the cylinder 10, owing to the driver 16 bearing against the lower end of the cylinder, pulled easily out of the casing by means of this bolt.

For disconnecting the spring 11 from the pump plunger 9 preferably an assembling sleeve 36 shown in Fig. 5 is used, adapted to take up the pressure exerted by the spring so as to relieve the plunger from the spring action. This sleeve 36 has the shape of a horseshoe in plan view and in cross section it is of channel shape. The inner distance H between the two flanges 37, 38 is slightly greater than the shortest distance between the two spring cups 29 and 34 when the spring is compressed. Both springs cups 34 and 29 are provided with small rims 39 and 40, respectively, the rim 40 projecting diametrically beyond the slotted disc 31, and when the spring is compressed to its smallest length, the flanges 37 and 38 can be introduced over these rims.

The removal of a pump element is obtained in the following manner: The cover 28 is removed from the lateral opening 27 of the chamber 1*d*. First the pressure plug 24 is loosened and the pressure valve body 21 together with the valve 22 is pulled out. Then the cam shaft 2 is turned to bring the push member 6 and the plunger 9 to their highest position, in which the retracting spring is compressed to its smallest length. The assembling sleeve 36 can now be pushed with its flanges 37 and 38 over the rims 39 and 40 of the spring cups 29 and 34. The cam shaft 2 is turned back to return the push member 6 to its lowermost position. The spring 11, the plunger 9 and the spring cup 29 are maintained in their upper position by the assembling sleeve 36. A screw bolt is now screwed into the threaded hole 35 on the upper end of the plunger, and this plunger is then first pushed downwardly by means of this bolt, to thereby release the disc 31 provided with the slot 30. Now this disc 31 forming the connection between the spring 11 and the plunger 9 can be removed laterally, so that the collar 33 of the plunger rod 32 is free to move upwardly, and the plunger can be pulled up-

wardly by means of the screw bolt until the driver 16 abuts against the lower side of the pump cylinder 10. By a further pulling action exerted on the plunger, the cylinder 10 is also pulled upwardly by the intermediary of the driver 16 and removed from the pump casing 1 through the bore D_1 in the regulating sleeve 12 and the bores D_2 and D_3 in the casing 1.

The introduction of a new pump cylinder and plunger is effected in the same easy way. Care must be taken only that the driver 16 engages correctly in the recesses 15 of the regulating sleeve 12. When the pump plunger and the cylinder are to be exchanged, the other parts, such as the regulating sleeve 12, the spring 11 with the spring cups 29 and 34, and the assembling sleeve 36, as well as the push member 6 can remain in their respective places. But if one of these members must be exchanged, it can be removed from the casing 1 without difficulty through the lateral opening 27 and replaced by a new part. All the replacement operations can be carried out without removing the injection pump from the motor and without any supplementary disassembling work, and for this reason these operations can be effected in an extremely short time and without any risk.

In the modification of the connection between the retracting spring 11 and the pump plunger 9 according to Figs. 6 and 7, the spring abutment is again made in two parts, a closed annular disc 41, and a slotted washer 42 formed by a wedge of horseshoe shape bearing on the collar 33 of the plunger rod 32. In order to facilitate the removal of the spring washer 42, it is advantageous to recess the rod 32 just above the collar 33, so as to form a shoulder 43, which acts as abutment for the washer 42 when the disc 41 is raised and urges the washer laterally away from the disc 41, so that it can easily be gripped.

Figures 8 and 9 show a further modified connection between the pump plunger 9 and the retracting spring 11. In this modification the spring disc is formed by a single part 44 provided with a slot 30 and with a spring supporting rim portion from which two segments are cut off at 45. At these two places where the rim is cut off, the spring 11 projects diametrically beyond the slotted disc 44, so that the spring itself can be gripped and raised, whereafter the disc 44 can be pulled out laterally.

In the modification according to Figs. 10 and 11 the upward removal of the plunger is realized by the fact that the bore D_1 of the regulating sleeve 12 and the bore D_2 of the casing 1 are provided with a groove 46 engaging the driver 47 on the plunger rod 32. In this example a single driver arm 47 is provided so that a single groove 46 is required in the regulating sleeve 12 and in the pump casing for removing the plunger. But there could be provided several driver arms and several grooves. The diameter D_3 of the upper cylinder portion must be so large, in this arrangement, that the shoulder 26 of the cylinder 10 forms a tight joint at the upper end of the groove 46. In Fig. 10 an assembling sleeve 36 is shown in dash and dot lines, which is adapted to release the plunger from the pressure of the spring.

I claim:

1. An injection pump comprising a single piece casing formed with a bore, a pump cylinder removably inserted in said bore, a pump plunger reciprocable in said cylinder, said casing being provided with a chamber having a lateral opening, a plunger retracting spring disposed in said chamber and detachably connected with said plunger, said spring connection including an abutment shoulder on the plunger, a radially slotted disc loosely engaged on the plunger and resting on said shoulder, an annular spring cup carried by said disc to support one end of said retracting spring, and a spring cup supporting the other end of the retracting spring, said two spring cups having annular rim portions whereby an auxiliary sleeve member may be inserted through said lateral opening to engage the rim portions of said spring cups and relieve the plunger from spring pressure to permit removal of said slotted disc engaged on the plunger and withdrawal of said plunger and pump cylinder from said bore in the pump casing.

2. An injection pump comprising a single piece pump casing formed with a bore, a pump cylinder removably inserted in said bore, said casing being provided with a chamber having a lateral opening, a pump plunger reciprocable in said cylinder, the outer end of the plunger extending into said chamber, an abutment shoulder on the outer end of the plunger, a radially slotted disc loosely engaged on the plunger and resting on said shoulder, and a plunger retracting spring unit disposed in said chamber and having one end thereof supported by said radially slotted disc to transmit spring pressure to the plunger, said end of the spring unit having portions projecting diametrically beyond the periphery of the slotted disc whereby said spring unit can be engaged by its projecting portions to relieve the plunger from spring pressure and permit removal of said slotted disc from the plunger and withdrawal of said plunger and pump cylinder from said bore in the pump casing.

ERWIN HAHN.