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PLUNGER CONTROL MEANS FOR FUEL PUMPS

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FIG. 1

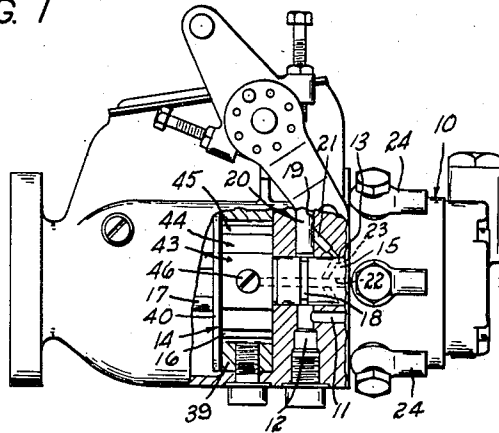


FIG. 2

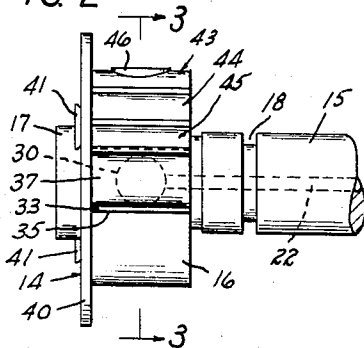
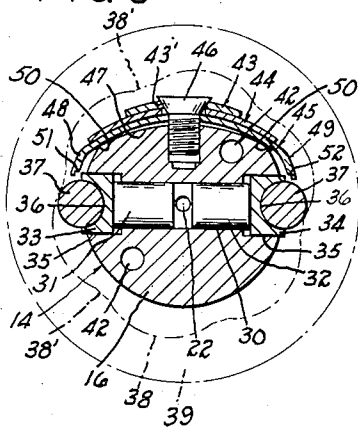


FIG. 3



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PLUNGER CONTROL MEANS FOR FUEL PUMPS

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12 Claims. (Cl. 103—161)

The present invention relates to fuel pumps for internal combustion engines and, more particularly, to a new and improved control means for use in connection with the pumping elements of a fuel pump. The invention is particularly applicable to fuel pumps of the type disclosed in my prior Patent No. 2,641,238, granted June 9, 1953.

In a fuel pump of the type having a reciprocating plunger, it frequently is desirable to adjust and control the maximum output of the pump by means limiting the stroke of the plunger. A principal object of the present invention is to provide improved means of this character for controlling the stroke of the plunger in a fuel pump of the type having rotary pumping means and in which there is mounted a pumping plunger for reciprocation transversely of the axis of rotation of the pumping means.

A more specific object of the invention is to provide such a plunger control means which can be mounted on the pump to provide the exact plunger stroke desired within very close tolerances.

Another specific object is to provide such a control means which is adjustable and which can be accurately and precisely set in a simple manner.

A further object is to provide control means of the type referred to which is of simple and compact construction so that it can be easily and simply fabricated and assembled, which will not interfere with or adversely affect the normal operation of the pump, and which will be sufficiently rugged to operate effectively over long periods of use.

Other objects will be in part obvious, and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangement of parts which will be exemplified in the construction hereafter set forth and the scope of the application of which will be indicated in the appended claims.

In the drawings:

Figure 1 is a side view partially in cross section of an exemplary pump to which the present plunger control means has been applied;

Figure 2 is an enlarged fragmentary side view of the rotor of the pump shown in Figure 1, showing the control means thereon; and

Figure 3 is a cross-sectional view taken along the line 3—3 of Figure 2 and including the actuating cam in phantom.

Referring to the drawings, Figure 1 shows an exemplary fuel pump which is generally similar to the fuel pump disclosed in my prior Patent No. 2,641,238, supra. In the interests of brevity and simplicity of presentation, only those parts of the pump will be described here which are necessary to an understanding of the present invention.

The exemplary pump shown in the drawings comprises a pick-up pump, indicated generally at 10, which draws fuel from a supply tank (not shown) and delivers the fuel through the passageways 11 and 12 to a central bore 13 in the main body of the pump. Disposed in the bore 13 for rotation therein is a rotor 14 consisting of a distributor

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portion 15 having a pumping section 16 of enlarged diameter at its left-hand end as viewed in Figure 1. The combined distributor 15 and pumping section 16 forming the rotor 14 are adapted to be driven by the engine with which the pump is associated, such as by means of a shaft (not shown) connected to the coupling 17.

The fuel entering the bore 13 through the passageway 12 is permitted to pass by way of a circumferential groove 18 in the distributor 15 to a bore 19 which is opposite from the passageway 12, and in which is disposed a metering valve 20. The bore 19 communicates intermediate its ends with a diagonal passageway 21 which in turn connects at its inner end with the main bore 13. The setting of the metering valve 20 which may be accomplished manually or otherwise determines the amount of fuel which will enter into the diagonal passageway 21.

The distributor 15 has an axial passageway 22 and a plurality of inlet ports 23, which are adapted to communicate successively with the diagonal passageway 21 as the distributor is rotated. The axial passageway 22 also is provided with an outlet port (not shown) which communicates with the outlet connections 24 in sequence as the distributor is rotated. The disposition of the ports 23 and 24 is such that the axial passageway 22 will alternately be placed in communication with the inlet passageway 21 and with one of the outlets 24 in sequence.

The fuel which is admitted to the axial passageway 22 from the diagonal passageway 21 when one of ports 23 is in registry therewith is subsequently pumped to one of the outlets 24 by means of the pumping mechanism mounted in the enlarged pumping section 16, and which is best shown in Figure 3 of the drawings. As shown in Figure 3, the axial passageway 22 communicates at its lower end with a transverse passageway 30 in which are slidably mounted opposed plungers 31 and 32. The plungers 31 and 32 which are reciprocated in the manner described hereafter cooperate to produce the desired pumping action.

The outer ends of the plungers 31, 32 abut, respectively, against shoes 33 and 34, which are generally rectangular in outline and which are slidably mounted in slots 35 in the periphery of the enlarged pumping section 16. Each of the shoes is provided at its outwardly facing surfaces with an arcuate groove 36, forming a seat for a roller 37. The grooves 36 are preferably slightly more than semicircular in cross section so that the rollers 37 will be embraced therein and be prevented from escaping outwardly therefrom. The rollers 37 are adapted to engage the interior surface 38 of a ring-like cam 39 supported by the pump housing and extending about the rotor section 16. The interior surface 38 of the cam 39 is provided with a plurality of spaced lobes 38', which are arranged to drive the rollers and hence the plungers inwardly periodically as the pumping section is rotated. The disposition of the lobes is such that, when the distributor is in communication with the fuel inlet passageway 22, the plungers will be permitted to move outwardly either by reason of the pressure of the fuel entering the passageway 22 and/or because of centrifugal force to receive the fuel in the passageway 30 between the opposed ends of the plungers; and then, when the distributor has been rotated to close the communication with the inlet passageway 22 and to establish communication with one of the outlets 24, the plungers are driven inwardly to pump a charge of fuel to one of the cylinders of the engine.

In the specific embodiment shown in the drawings, the shoes 33, 34 and the rollers 37 are maintained in operative position in an axial direction by a plate 40, which is attached to the left-hand end of the pumping section 16 (as viewed in Figures 1 and 2), as by means of the screws 41 cooperating with tapped holes 42. As best shown in Fig-

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ure 1, the opposite ends of the shoes and rollers abut against the main pump body and thus the addition of the single plate 40 is sufficient to effectively retain the shoes and rollers in position against lateral displacement. As will be appreciated, this simple mounting of the shoes and rollers permits quick and easy assembly of the pumping section.

In accordance with the invention, the maximum output of the pump is controlled by a simple adjustable leaf spring arrangement which in the specific embodiment comprises three normally curved spring leaves 43, 44 and 45 of relatively heavy gauge secured to the rotor at their midpoint by means of a screw 46. Preferably, the opening 43' of the outer leaf 43 is beveled or chamfered in a manner complementary to the conical portion of the head of the screw 46 with which it engages to insure accurate centering of the plates and also to assist in locking the screw 46 in adjusted or set position. In order to provide the necessary clearance for the spring leaves 43, 44, 45 and also to assist in balancing the structure, the rotor is relieved at 47.

In accordance with the invention, the spring 45 is provided with angularly related end portions 48 and 49 and is sufficiently elongated so that the end portions may engage the adjacent corners of the shoes 33 and 34. The normal curvature of the spring 45 is slightly greater than that of the relieved portion 47 so that the spring 45 will bear against and fulcrum at the corners 50. The end portions 48 and 49 are preferably precisely dimensioned such as by milling so that they will engage the adjacent corners of the shoes 33, 34 without interfering with the action of the rollers 37. In the preferred embodiment the ends 48 and 49 are formed with notches 51 and 52, respectively, aligned with the corners of the shoes with which the ends of the spring are adapted to engage. While the springs 43, 44, 45 are sufficiently flexible so that they may be adjusted, they nonetheless are sufficiently rigid so that there is no appreciable flexing of the end portions 48 and 49 by the impact of shoes 33 and 34. In other words, the end portions 48 and 49 act as fixed stops which can be precisely adjusted by flexing the center portions of spring 45.

As will be apparent from Figure 3 of the drawings, the screw 46 may be turned inwardly to draw in the reinforcing springs 43 and 44 and the center of the spring 45 to cause the outer end portions 48 and 49 to pivot outwardly to increase the permitted stroke of the plungers 31, 32. Conversely, the screw 46 may be turned in a releasing direction to permit the springs to increase in curvature at the center and thus pivot the end portions 48 and 49 inwardly to reduce the maximum stroke of the plungers. In general, only a very slight change is required to adjust the pump for optimum operation. If desired, the amount of turning of the screw 46 required to produce a desired change in the maximum output of the pump may be readily calibrated.

A further feature of the adjustable leaf spring arrangement is that the attachment thereof to the rotor completes the assembly of the unit. As previously mentioned, the shoes and rollers are retained against lateral displacement by the plate 40 and main body of the pump and the spring arrangement 43, 44, 45 prevents the shoes and rollers from disengaging in a radial direction. Thus no additional means is required to retain the shoes and rollers in operative position.

It thus will be seen that there has been provided in accordance with the invention a simple and precise means for assembling the rotor and for limiting the stroke of the plungers 32, 33. Also the adjustment of the maximum stroke of the plungers can be accomplished without dismantling the rotor merely by adjusting a single setscrew 46. The retaining means in no way interferes with the normal operation of the pump.

As many changes could be made in the above construction and many apparently widely different embodi-

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ments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the language used in the following claims is intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim:

1. In a fuel pump, a rotor having a transverse bore, pumping means including a plunger in said bore, and means for adjustably limiting the outward stroke of the pumping means comprising a flexible arcuate member attached to the rotor and extending along the periphery of the rotor with an end portion thereof in alignment with the bore, said member having an intermediate portion spaced from the periphery of the rotor and means adjustably connecting said intermediate portion of the member to the rotor to flex the member and thereby vary the outward spacing of said end portion.

2. In a fuel pump, a rotor having a plurality of bores, a plurality of plungers in said bores, and means for controlling outward movement of the plungers comprising a flexible curved member attached to the rotor having portions thereof facing the outer ends of the bores and adjustable means for variably flexing said curved member and thereby moving said portions.

3. In a fuel pump, a rotor having transverse bores, pumping means in said bores, and means for adjustably controlling the stroke of the pumping means comprising an arcuate spring leaf extending about the rotor between the ends of the bores and having its ends engageable with the pumping means, and radially adjustable means attaching the spring intermediate its ends to the rotor for varying the curvature and end spacings of the spring, said spring being in engagement with the rotor adjacent its ends.

4. In a fuel pump, a rotor having a diametric throughbore, a pair of plungers in said throughbore, and means for controlling outward movement of the plungers comprising an arcuate spring leaf extending along the periphery of the rotor and having its end portions adjacent the ends of the throughbore, and means attaching the spring leaf intermediate its ends to the rotor, said last-named means being adjustable to vary the curvature and end spacings of the spring.

5. In a fuel pump, a rotor having a pair of oppositely spaced notches and a throughbore extending between the notches, a shoe slidably mounted in each notch, a pair of plungers in the throughbore adapted to abut against the shoes, and means retaining the plungers and shoes in assembled position in said throughbore and notches, respectively, comprising a plate secured to an end face of the rotor and overlying the ends of the notches, and an arcuate retainer strip extending along the periphery of the rotor between the notches and having end portions engageable with the shoes, said retainer strip being adjustably attached to the rotor intermediate the ends of the strip.

6. In a fuel pump, a rotor having a transverse bore, a pair of plungers in said bore, and means for limiting outward movement of the plungers comprising an arcuate spring leaf extending about the periphery of the rotor between the ends of the bore and having end portions registering with the bores, a portion of the rotor covered by the spring being relieved to form an area of reduced curvature, and means attaching the spring leaf to the relieved portion of the rotor, said last-named means being adjustable to vary the flexing and end spacings of the spring.

7. In a fuel pump, a rotor having a diametric throughbore, a pair of plungers in said throughbore, shoes slid-

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ably mounted in the rotor at the ends of the bore and engageable by the plungers, and adjustable means attached to the periphery of the rotor limiting outward movement of the shoes comprising a flexible arcuate member extending between the shoes and having end portions engageable with the shoes and means for varying the curvature and end spacings of said member.

8. In a fuel pump, a generally cylindrical rotor having a transverse bore, a portion of the periphery of the rotor between the ends of the bore being relieved to provide an area of reduced curvature, pumping means in the bore, and an arcuate spring leaf extending between the ends of the bore about said area of reduced curvature and spaced therefrom, said spring being seated against the ends of said zone of reduced curvature and having end portions engageable with the pumping means to limit outward movement thereof, and means connecting the center of the spring leaf to said area of reduced curvature, said last-named means being adjustable to vary the spacing of the center of the spring leaf from the area of reduced curvature and thus varying the spacing of said end portions.

9. In a fuel pump, a rotor of generally cylindrical shape having a pair of oppositely spaced slots in its outer periphery and a throughbore interconnecting the slots, a shoe slidably positioned in each slot, a pair of plungers in the throughbore engageable with the shoes, and adjustable retaining means for the shoes comprising an arcuate spring leaf disposed about the rotor having its ends disposed for engagement with the shoes, the periphery of the pumping portion being relieved at the center portion of the spring leaf to form a space therebetween, means connecting the spring to the relieved portion of the rotor, said means being adjustable to vary the curvature and end spacings of the spring.

10. In a fuel pump, a rotor of generally cylindrical shape having a transverse throughbore, a pair of plungers in the throughbore, and adjustable retaining means for the plungers comprising a first arcuate spring leaf attached to the periphery of the rotor having end portions registering with the ends of the throughbore, and reinforcing arcuate spring leaves extending along the mid-portion of the first spring, the periphery of the rotor being relieved intermediate the ends of the leaf springs,

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and adjustable means at the centers of the spring leaves for adjustably connecting the springs to the relieved portion of the rotor.

11. In a fuel pump, a rotor of generally cylindrical shape having a pair of oppositely spaced rectilinear slots in its outer periphery and a radial throughbore interconnecting the slots, a shoe of generally rectangular shape slidably positioned in each slot, a pair of plungers in the throughbore engageable with the shoes, and adjustable retaining means for the shoes comprising an arcuate spring leaf attached to the rotor having angularly related ends for engaging the shoes, the periphery of the rotor being relieved intermediate the ends of the spring leaf, and an adjustable screw extending through the centers of the spring leaf for adjustably connecting the spring leaf to the relieved portion of the rotor.

12. In a fuel pump, a rotor of generally cylindrical shape having a pair of oppositely spaced rectilinear slots in its outer periphery and a radial throughbore interconnecting the slots, a shoe of generally rectangular shape slidably positioned in each slot, a pair of plungers in the throughbore engageable with the shoes, and adjustable retaining means for the shoes comprising a first arcuate spring leaf attached to the rotor having angularly related ends for engaging the corners of the shoes and reinforcing arcuate spring leaves extending along the mid-portion of the first spring, the periphery of the pumping portion being relieved at the mid-point of the leaf springs, and an adjustable screw extending through the centers of the spring leaves for adjustably connecting the springs to the relieved portion of the rotor.

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