

Aug. 12, 1930.

F. EGERSDÖRFER

1,772,828

FUEL PUMP FOR INTERNAL COMBUSTION ENGINES

Filed Aug. 3, 1927

3 Sheets-Sheet 1

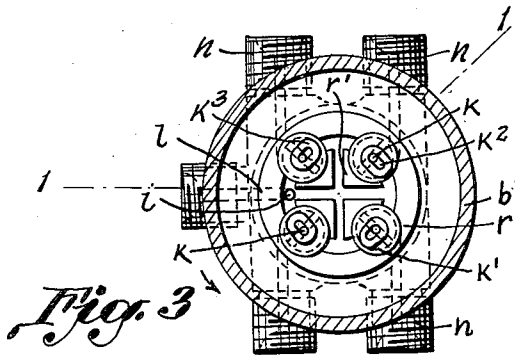


*Fig. 3.*

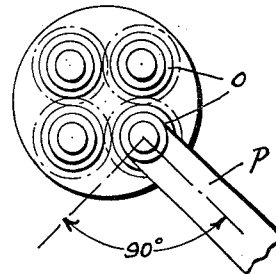


*Fig. 4.*

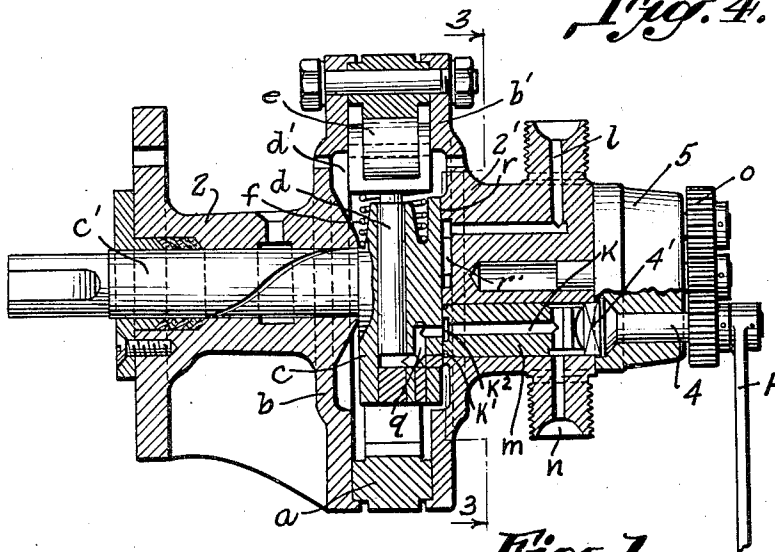


*Fig. 1.*

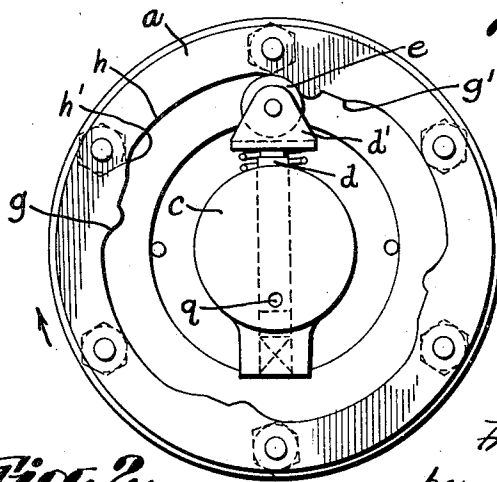


*Fig. 2.*

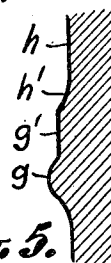


*Fig. 5.*

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Aug. 12, 1930.

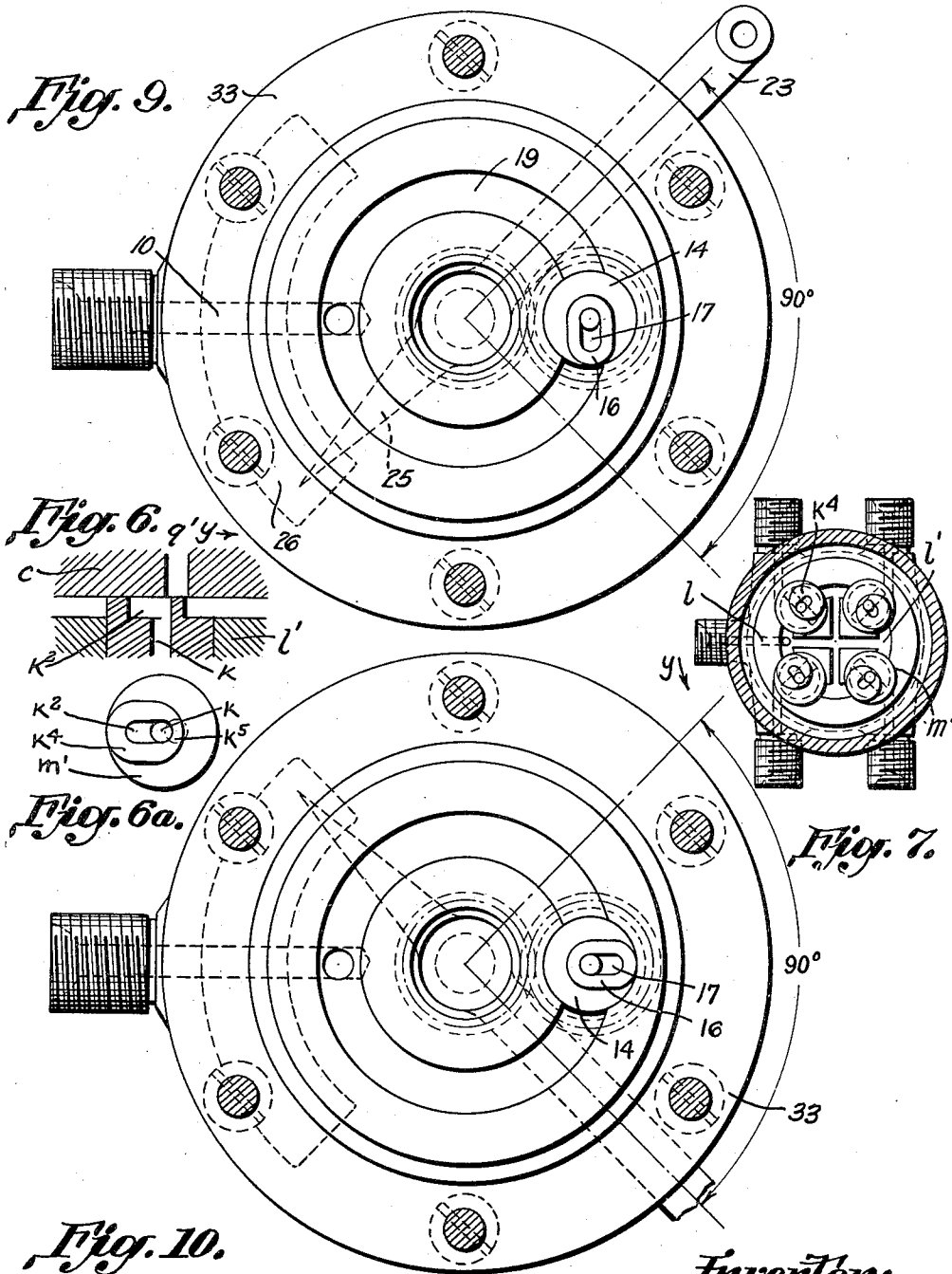
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FUEL PUMP FOR INTERNAL COMBUSTION ENGINES

Filed Aug. 3, 1927

3 Sheets-Sheet 2



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Aug. 12, 1930.

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FUEL PUMP FOR INTERNAL COMBUSTION ENGINES

Filed Aug. 3, 1927

3 Sheets-Sheet 3

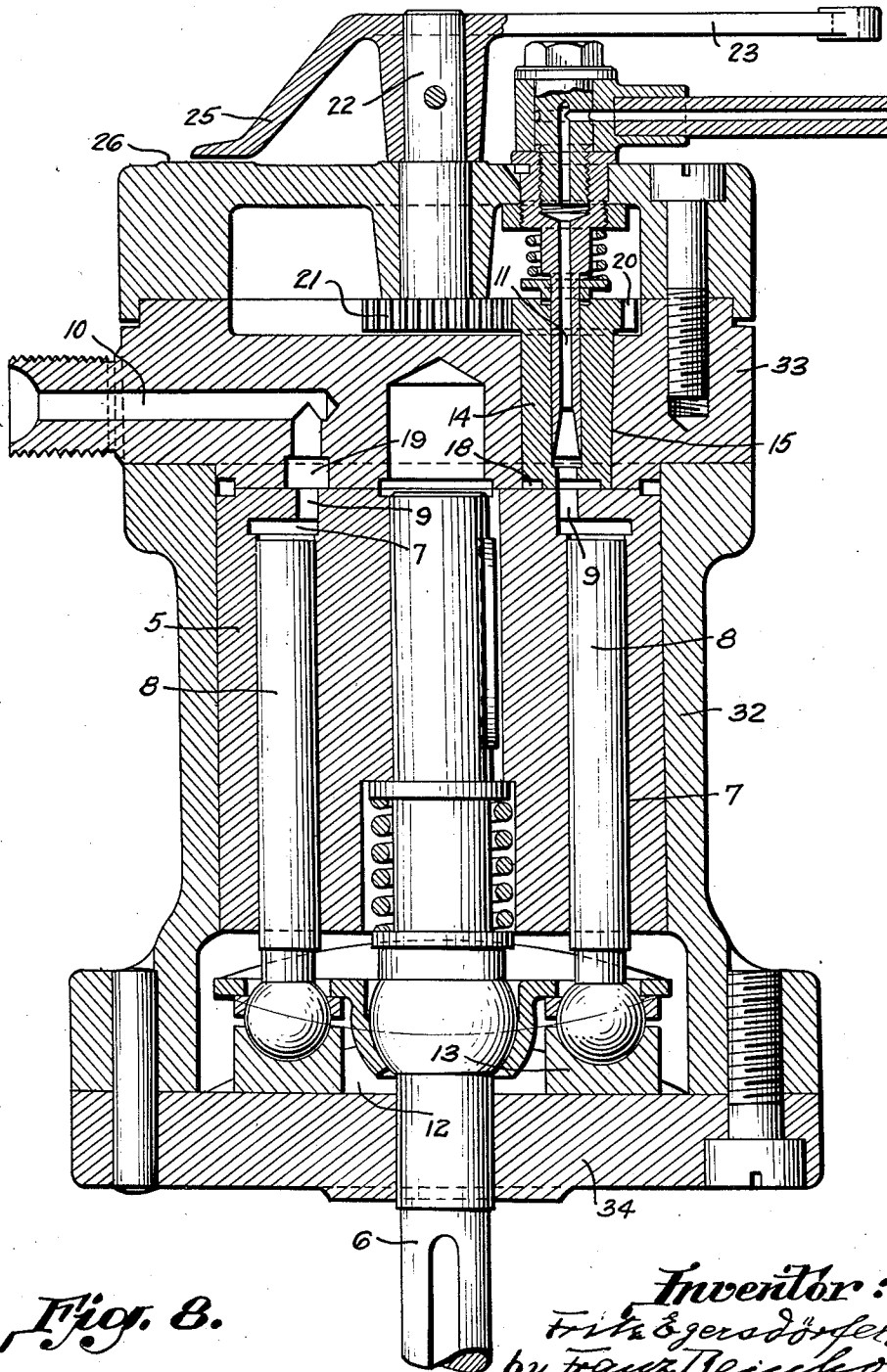


Fig. 8.

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## UNITED STATES PATENT OFFICE

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## FUEL PUMP FOR INTERNAL-COMBUSTION ENGINES

Application filed August 3, 1927, Serial No. 210,303, and in Germany May 7, 1926.

My invention relates to improvements in fuel pumps for internal combustion engines, and more particularly in fuel pumps of the type in which a pump cylinder having a piston or plunger reciprocating therein is adapted to be moved from a suction port communicating with the supply of fuel to the pressure port communicating with the fuel nozzle of the cylinder of the engine. There are various constructions of engines of this type. In one construction the cylinder is rotatable about an axis disposed perpendicularly to the axis of the cylinder, and in another construction the cylinder is in the form of a drum adapted to be rotated about an axis disposed parallel to the axis of the cylinder. One of the objects of the improvements is to provide a fuel pump of this type which is provided with novel means for regulating the supply of fuel to the cylinders of the engine, and with this object in view my invention consists in constructing the port or ports connected with the fuel nozzle or nozzles so that the operative length thereof taken in the direction of the movement of the cylinder can be varied, so that the period of time the cylinder communicates with the port is varied according to the amount of fuel to be supplied to the nozzle. For thus varying the operative length of the said port, an elongated port is provided at the end face of a cylindrical member mounted within the body of a pump and adapted to be turned with the said elongated port at a greater or smaller angle to the direction of the movement of the cylinder. Thus, when the said elongated port is in the direction of the said movement, the cylinder communicates therewith a comparatively large period of time, so that much fuel is supplied to the nozzle. But when setting the same angularly of the direction of the movement of the cylinder, and more particularly when setting the same perpendicularly to the said direction, the said period of time is reduced so that a smaller amount of fuel is supplied to the nozzle.

In internal combustion engines, and more particularly in engines of the Diesel-type, the period of time within which the fuel is to be injected is short, while in pumps heretofore

proposed the time of the pressure stroke is large. Now, another object of the improvements is to provide a pump in which the time of the pressure stroke of the pump is reduced, so that the fuel is suddenly injected into the cylinder of the engine, and with this object in view my invention consists in constructing the cam for imparting reciprocating movement to the piston or plunger of the pump with several rises for imparting a plurality of reciprocating movements to the plunger for each rotation of the pump cylinder, and I provide a plurality of pressure ducts one for each of the rises of the cam and adapted to be successively connected with the cylinder. In the preferred construction the portions of the said cam controlling the pressure and suction strokes of the plunger are not alike so as to impart equal suction and pressure strokes to the plunger or piston, but the portions of the cam controlling the suction strokes of the plunger are considerably elongated as compared to the portions controlling the pressure strokes.

Another object of the improvements is to provide means for preventing the deposition of drops of fuel at the delivery end of the fuel nozzle, and with this object in view my invention consists in providing means for creating a vacuum within the pressure duct at the end of the pressure stroke of the plunger. In one embodiment of the invention the said vacuum is created by connecting the pressure duct with the suction duct of the pump, and in another embodiment of the invention the driving mechanism for the plunger of the pump is constructed so that the plunger is suddenly retracted at the end of the pressure stroke.

Other objects of the improvements will appear from the following description.

For the purpose of explaining the invention several examples embodying the same have been shown in the accompanying drawings in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawings,

Fig. 1, is a sectional elevation of the pump, Fig. 2, is an elevation looking from the

right in Fig. 1, the right hand head of the pump casing being removed,

Fig. 3, is a sectional elevation taken on the line 3—3 of Fig. 1 and looking in the direction of the arrows,

Fig. 4, is an elevation showing the gear wheels for regulating the pump,

Fig. 5, is a diagrammatical sectional view showing a part of the cam face controlling the movement of the piston or plunger of the pump shown in Figs. 1 to 4,

Figs. 6 and 6<sup>a</sup>, are respectively a detail sectional view and an end view showing a modification of the construction of the pressure duct,

Fig. 7, is an end view similar to the one shown in Fig. 3, and further illustrating the modification shown in Figs. 6 and 6<sup>a</sup>,

Fig. 8, is a sectional elevation showing a modification of the pump, and

Figs. 9 and 10, are top plan views of Fig. 8 with the top part of the head removed and showing the member containing the pressure duct in different positions.

In the example shown in Figs. 1 to 4, my improved pump consists of a casing provided by a ring *a* and heads *b* and *b*<sup>1</sup> fixed thereto and formed each with a hub 2, 2', a cylinder *c* within the said casing and made integral with a shaft *c*<sup>1</sup> rotatably mounted in the hub 2, and a plunger *d* mounted within the cylinder *c*. The ring *a* is internally formed with a cam face having four rises *g* and depressions *h*, and the plunger *d* is formed with a bifurcated end *d*<sup>1</sup> providing a bearing for a roller *e* engaging the cam face *g*, *h*. The bifurcated head of the plunger *d* is acted upon by a spring *f* tending to force the same outwardly and with the roller *e* into engagement with the cam face *g*, *h*. The hub 2' is formed with a suction duct *l* adapted to be connected with the fuel supply, and with pressure ducts *k*, *n* adapted to be connected to the cylinders of the engine, both ducts *l* and *k*, *n* ending through the inner face *r* of the hub 2' and being disposed equal distances away from the axis of the shaft *c*<sup>1</sup>. The bore of the cylinder *c* is connected with a port *q* ending through the right hand face of the cylinder in position for being successively brought into communication with the suction duct *l* and the pressure ducts *k*, *n*.

The portions *k* of the pressure ducts are formed in cylindrical members *m* rotatably mounted in corresponding bores of the hub 2', and the said ducts end into elongated ports *k*<sup>2</sup> made in the end faces of the cylindrical members *m*, as is best shown in Fig. 3, the said elongated ports extending from the axis of the members *m* to one side and being surrounded each by a ridge *k*<sup>3</sup> rising from the end face *k*<sup>1</sup> of the members *m*. The inner end face *r* of the hub 2' is formed with segmental ridges *r*<sup>1</sup> having a height equal to the height of the ridges *k*<sup>3</sup>. Thus, between

the ridges *r*<sup>1</sup> and *k*<sup>3</sup> bearing on the end face of the cylinder *c* in the manner shown in Fig. 1, depressed portions are formed in said end face *r*, and the said depressed portions communicate with the suction duct *l*. At their rear ends the cylindrical members *m* are slotted, and the said slotted portions are engaged by the flat heads 4' of spindles 4 rotatably mounted in a head 5 secured to the hub 2'. At their outer ends the spindles carry gear wheels *o* in mesh with each other, and to one of the spindles 4 a lever *p* is secured. By means of the said lever all the spindles 4 can be simultaneously rotated for setting the cylindrical members *m* with the elongated ports *k*<sup>2</sup> thereof in different angular positions relatively to the direction of the movement of the port *q*, Fig. 3 showing the said elongated ports *k*<sup>2</sup> in tangential positions.

As appears from Fig. 2, the main parts of the portions *h* of the cam faces of the ring *a* are concentric to the axis of the shaft *c*<sup>1</sup>, and at the forward end thereof looking in the direction of the rotation of the cylinder indicated in Fig. 2 by the arrow, there is an eccentric portion *h*<sup>1</sup>. The portions *g* located at the rear ends of the portions *h* are inclined at a large angle, so that the inward stroke of the plunger *d* is completed within a short period of time. At the rear of the portions *g* there are concentric portions *g*<sup>1</sup> the radius of which is a little larger than that of the inner parts of the portions *g* and smaller than that of the portions *h*.

The operation of the machine is as follows:

The suction duct *l* is connected to the supply of fuel, and the four pressure ducts *n* are connected each with one of the cylinders of the engine. It may be assumed that the cylindrical members *m* are set in the positions shown in Fig. 3, in which the elongated ports *k*<sup>2</sup> are tangential to the direction of the movement of the port *q*. The cylinder *c* is rotated by means of the shaft *c*<sup>1</sup> in the direction of the arrow, and the roller *e* rides on the cam face *g*, *h*. In the position of the parts shown in Figs. 2 and 3 the plunger *d* has just begun its inward or pressure stroke by riding with its roller *e* on the portion *g* of the cam face, and the duct *q* opens into one of the pressure ducts *k*, *n*, thus injecting fuel into one of the cylinders. The supply of fuel to the cylinder continues until the roller *e* has arrived at the innermost part of the portion *g* and the plunger *d* is at the end of the pressure stroke. Upon further rotation of the cylinder the roller *e* is suddenly thrown into engagement with the portion *g*<sup>1</sup> of the cam face, and the plunger is slightly retracted, the duct *q* being still in communication with the pressure duct, and being partly closed by the rear part of the ridge *k*<sup>3</sup>. Thus a vacuum is created within

the bore of the cylinder *c*, so that the fuel is suddenly retracted from the nozzle, and the deposition of drops of fuel on the said nozzle is prevented. After leaving the portion *g'* the plunger is further forced outwardly by the spring *f* while being in engagement with the portion *h'* of the cam face, and the duct *q* has passed the rear part of the ridge *k<sup>3</sup>* and got into communication with the suction duct *l*. Thus fuel is taken into the cylinder. Finally, the roller *e* engages the concentric portion *h* of the cam face, so that the fuel remains within the bore of the cylinder until the roller *e* arrives at the next portion *g* of the cam face.

If it is desired to reduce the supply of fuel to the cylinder of the engine the cylindrical members *m* are simultaneously turned through a suitable angle by means of the lever *p* and the gear wheels *o*, which may be done either by hand or by a suitable governor. By thus setting the ports *k<sup>2</sup>* into angular position relatively to the movement of the port *q* the length of time the said ports are in communication with the duct *q* is reduced. Thus, during the first part of the pressure stroke of the plunger *d* the fuel is forced from the duct *q* into the space provided between the ridges *k<sup>3</sup>* and *n<sup>1</sup>* and into the suction duct *l*, and it is supplied to the duct *k, n* and the nozzle only when the duct *q* and the port *k<sup>2</sup>* are in communication with each other. In the same way the duct *q* arrives at the end of the elongated intake end *k<sup>2</sup>* of the pressure duct and the supply of fuel to the nozzle is interrupted at an earlier moment than before.

From the foregoing description of the fuel pump it will be understood that the time of the delivery of fuel from the pump to the individual nozzles is exceedingly small, first, by providing a single cylinder *c* and plunger *d* for a plurality of nozzles, second by supplying the fuel from the said cylinder to the duct *k, n* only during a very short period of time, and more particularly, while the duct *q* is in communication with the port *k<sup>2</sup>*, and third, because the portion *g* of the cam face is very short, and the plunger is suddenly forced inwardly for performing its pressure stroke. It will be understood that any one of the said features is capable of reducing the period of time in which the fuel is delivered, and that by combining all the said features, the fuel is injected into the cylinder at high velocity. But I wish it to be understood that I do not limit myself to a structure in which all of the said features are combined.

In Figs. 6 and 7 I have shown a modification in which the vacuum following the pressure stroke is created within the pressure duct *k, n* by connecting the said pressure duct with the suction duct. As appears from the said fingers, the ridge *k<sup>4</sup>* formed at the end face

of the cylindrical members *m'* is reduced in breadth at its rear end *k<sup>5</sup>*, so that its breadth is smaller than the diameter of the delivery end of the duct *q'* communicating with the bore of the cylinder *c*. Therefore, when the duct *q'* moving in the direction of the arrow *y* shown in Figs. 6 and 7 arrives at the end of the port *k<sup>2</sup>* it connects the said port through a passage *l'* with the suction duct *l*. At the same time the roller *e* of the plunger is at the innermost point of the part *g* of the cam face of the ring *a*. Therefore the vacuum within the suction duct *l* is transmitted to the duct *k, n*, and the fuel is retracted from the nozzle.

In Figs. 8 to 10 I have shown my invention as embodied in a fuel pump comprising a rotary drum having cylindrical bores or pockets disposed concentrically of the axis of rotation of the drum. As shown, the pump comprises a cylinder 32 formed with heads 33 and 34, and a cylindrical drum 5 rotatable within the cylinder 32, the said drum being keyed to a rotary shaft 6 passed through the head 34. The drum 5 is provided with bores or pockets 7 disposed concentrically around the axis 6 and having plungers 8 reciprocating therein. The bores 7 are adapted for communication through ducts 9 with a suction duct 10 and with a pressure duct 11. The inner face 12 of the head 34 is inclined relatively to the axis 6, and it is engaged by shoes 13 rockingly mounted on the outer ends of the plungers 8. Thus reciprocating movement is imparted upon rotation of the drum 5 to the plungers 8, as is known in the art. The construction of the pump so far described is known in the art and I deem it not necessary to describe the same more in detail.

Referring now to the novel parts of the pump, the pressure duct 11 is provided within a cylindrical member 14 rotatably mounted in a bore 15 of the head 3 and having a construction similar to the cylindrical members *m* described with reference to Figs. 1 to 5. Thus, the said cylindrical member 14 is formed at its end face with a ridge 16 providing an elongated port 17, the said ridge bearing on the end face of the drum 5, as is shown in Fig. 8. Outside the ridge 16 a chamber 18 is provided between the end face of the drum and the end face of the member 14, and the said chamber communicates through an annular passage 19 with the suction duct 10.

The member 14 is formed at its outer end with gear teeth 20 meshing with a gear wheel 21 keyed to a spindle 22 carrying a handle 23. Thus, by turning the handle 23 the member 14 is rotated with its elongated port 17 into the desired position, Fig. 9 showing the said port in a position tangential to the movement of the duct 9, and Fig. 10 showing the same in the position perpendicular to the said movement, the said positions of the port being the end positions thereof. For thus

setting the member 14 the hand lever 23 is turned through an angle of 90°, as has been indicated in Figs. 9 and 10. For indicating the position of the port 17, a hand 25 made integral with the hand lever 23 plays on scale marks 26.

The operation of the pump is as follows:

By the rotation of the drum 5 reciprocating movement is imparted to the plungers 8, so that fuel is alternately taken into the bores 7 and delivered therefrom. When the velocity of the outward stroke of the plunger is at its maximum, the duct 9 moves across the ridge 16 and the port 17 so as to deliver the fuel from the duct 9 to the fuel nozzle. Immediately thereafter the duct 11 gets into communication with the annular passage 19, so that the excess of fuel is returned to the suction duct 10.

It appears therefore that also in the construction shown in Figs. 8 to 10, the fuel is delivered to the nozzle at high velocity, and that the supply of fuel can be regulated by setting the member 14 in different angular positions.

I claim:

1. A fuel pump, comprising a body formed with a suction duct and a pressure duct, a block in which the intake part of said pressure duct is formed, said suction duct being separate from said block, a member formed with a cylindrical pocket, a piston reciprocating in said pocket, operating means for said piston, and means for moving said body and member relatively to each other for alternately throwing said pocket into communication with said suction and pressure ducts, said block being adapted to be set with varying parts of the cross-sectional area of the pressure duct into position for communication with said pocket.

2. A fuel pump, comprising a body formed with a suction duct and a cavity, a block formed with a pressure duct and movable in said cavity, said suction duct being separate from said block, a member formed with a cylindrical pocket, a piston reciprocating in said pocket, operating means for said piston, and means for moving said body and member relatively to each other for alternately throwing said pocket into communication with said suction and pressure ducts, said block being adapted to be set with varying parts of the cross-sectional area of the pressure duct into position for communication with said pocket.

3. A fuel pump, comprising a body formed with a suction duct and a cavity, a block formed with a pressure duct and movable in said cavity, said pressure duct having an elongated intake end, a member formed with a cylindrical pocket, a piston reciprocating in said pocket, operating means for said piston, and means for moving said body and member relatively to each other for alter-

nately throwing said pocket into communication with said suction and pressure ducts, said block being adapted to be set with said elongated intake end at different angles to the direction of the relative movement of said pocket and ducts.

4. A fuel pump, comprising a body formed with a suction duct and a cylindrical cavity, a cylindrical block formed with a pressure duct and mounted in said cavity, said duct having an elongated diametrical intake end, a member formed with a cylindrical pocket, a piston reciprocating in said pocket, operating means for said piston, and means for moving said body and member relatively to each other for alternately throwing said pocket into communication with said suction and pressure ducts, said block being adapted to be turned about its axis with said elongated intake end at different angles to the direction of the relative movement of said pocket and ducts.

5. A fuel pump, comprising a body formed with a suction duct and a cavity, a block formed with a pressure duct and movable in said cavity, said block being formed around the intake end of said pressure duct with a ridge, a member formed with a cylindrical pocket, a piston reciprocating in said pocket, operating means for said piston, said body, member and ridge providing a chamber communicating with said suction duct, and means for moving said body and member relatively to each other for alternately throwing said pocket into communication with said suction and pressure ducts, said block being adapted to be set with varying parts of the cross-sectional area of the pressure duct into position for communication with said pocket.

6. A fuel pump, comprising a body formed with a suction duct and a cylindrical cavity, a cylindrical block formed with a pressure duct and mounted in said cavity, said duct having an elongated intake end and being formed around said intake end with a ridge, a member formed with a cylindrical pocket, a piston reciprocating in said pocket, operating means for said piston, said body, member and ridge providing a chamber communicating with said suction duct, and means for moving said body and member relatively to each other for alternately throwing said pocket into communication with said suction and pressure ducts, said block being adapted to be set with varying parts of the cross-sectional area of the pressure duct into position for communication with said pocket.

7. A fuel pump, comprising a body formed with a suction duct and a plurality of pressure ducts, each adapted to be connected with a fuel consumer of its own, said body being formed around said pressure ducts with ridges, a member formed with a cylindrical pocket, a piston reciprocating in said pocket, operating means for said piston, said body,

member and ridges forming a chamber into which said suction duct opens, and means for moving said body and member relatively to each other for successively throwing said pocket into communication with said suction and pressure ducts.

8. A fuel pump, comprising a body formed with a suction duct and a pressure duct, a member formed with a cylindrical pocket, a piston reciprocating in said pocket, operating means for said piston, means for moving said body and member relatively to each other for alternately throwing said pocket into communication with said suction and pressure ducts, and means momentarily for creating a vacuum within said pressure duct immediately following the transmission of fuel from said pocket into the same.

9. A fuel pump, comprising a body formed with a suction duct and a cavity, a block formed with a pressure duct and movable in said cavity, said block being formed around the intake end of said pressure duct with a ridge, a member formed with a cylindrical pocket, a piston reciprocating in said pocket, operating means for said piston, said body, member and ridge providing a chamber communicating with said suction duct, and means for moving said body and member relatively to each other for alternately throwing said pocket into communication with said suction and pressure ducts, said block being adapted to be set with varying parts of the cross-sectional area of the pressure duct into position for communication with said pocket, said ridge being narrower at the rear part of the pressure duct than the diameter of the passage through which communication is established between said cylindrical pocket and said ducts.

10. A fuel pump comprising a body formed with a suction duct and a pressure duct, a member formed with a cylindrical pocket, a piston or plunger reciprocating in said pocket, a cam face formed on said body for imparting reciprocating movement to said piston or plunger, and means for moving said body and member relatively to each other for alternately throwing said pocket into communication with said suction and pressure ducts, said cam face being formed with a portion controlling the suction stroke of said piston or plunger, a portion controlling the pressure stroke of said piston or plunger, and a portion immediately following said last-named portion controlling a slight retracting movement of said piston or plunger.

11. A fuel pump, comprising a body formed with a suction duct and a pressure duct, a member formed with a cylindrical pocket, a piston or plunger reciprocating in said pocket, a cam face formed on said body for imparting reciprocating movement to said piston or plunger, and means for moving said body and member relatively to each

other for alternately throwing said pocket into communication with said suction and pressure ducts, said cam face being formed with a portion controlling the suction stroke of said piston or plunger, and a portion more abrupt than said portion controlling the suction stroke for imparting the pressure stroke to said piston or plunger.

12. A fuel pump, comprising a body formed with a suction duct and a pressure duct, a member formed with a cylindrical pocket, a piston or plunger reciprocating in said pocket, a cam face formed on said body for imparting reciprocating movement to said piston or plunger, and means for moving said body and member relatively to each other for alternately throwing said pocket into communication with said suction and pressure ducts, said cam face comprising a portion controlling the suction stroke of said piston or plunger, a portion formed for holding said piston or plunger in position, and a portion more abrupt than said portion controlling the suction stroke for imparting the pressure stroke to said piston or plunger.

13. A fuel pump, comprising a body formed with a suction duct and a pressure duct, a member formed with a cylindrical pocket, a piston or plunger reciprocating in said pocket, a cam face formed on said body for imparting reciprocating movement to said piston or plunger, and means for moving said body and member relatively to each other for alternately throwing said pocket into communication with said suction and pressure ducts, said cam face being formed with a portion controlling the suction stroke of said piston or plunger, a portion more abrupt than said portion controlling the suction stroke for imparting the pressure stroke to said piston or plunger, and a portion immediately following said last-named portion and slightly receding relatively thereto and controlling a slight retracting movement of said piston or plunger.

14. A fuel pump, comprising a cylindrical hollow body formed about its internal circumference with a cam face, a member formed with a cylindrical pocket disposed substantially diametrically of said body and rotatable about an axis coinciding with the axis of said body, a piston or plunger reciprocating within said pocket and in engagement with said cam face, said member being formed with a passage connected with said pocket, and said body being provided with suction and pressure ducts in position for alternate communication with said passage, a block in which said pressure duct is formed and movable relatively to said body in a direction for setting said pressure duct with varying parts of its cross-sectional area in position for communication with said passage, and means for rotating said body and member relatively to each other.

15. A fuel pump, comprising a cylindrical hollow body formed about its internal circumference with a cam face, a member formed with a cylindrical pocket disposed substantially diametrically of said body and rotatable about an axis coinciding with the axis of said body, a piston or plunger reciprocating within said pocket and in engagement with said cam face, said member being formed with a passage connected with said pocket, and said body being provided with suction and pressure ducts in position for alternate communication with said passage, a block in which said pressure duct is formed and movable relatively to said body in a direction for setting said pressure duct with varying parts of its cross-sectional area in position for communication with said passage, said block being formed around the intake end of said pressure duct with a ridge, and said body, member and ridge forming a chamber between the same into which said suction duct opens, and means for rotating said body and member relatively to each other.
16. A fuel pump, comprising a cylindrical body formed about its inner circumference with a cam face, a member formed with a substantially diametrical pocket rotatable within said body about an axis coinciding with the axis of said body, a piston or plunger within said pocket and in engagement with said cam face, said body being formed with suction and pressure ducts in position for alternate communication with said pocket, and means for rotating said body and member relatively to each other, said cam face comprising a portion controlling the suction stroke of said piston or plunger, a portion controlling the pressure stroke of said piston or plunger, and a portion immediately following said last-named portion controlling a slight retracting movement of said piston or plunger.
17. A fuel pump, comprising a cylindrical body formed about its inner circumference with a cam face, a member formed with a substantially diametrical pocket rotatable within said body about an axis coinciding with the axis of said body, a piston or plunger within said pocket and in engagement with said cam face, said body being formed with suction and pressure ducts in position for alternate communication with said pocket, and means for rotating said body and member relatively to each other, said cam face comprising a portion controlling the suction stroke of said piston or plunger and a portion more abrupt than said last-named portion controlling the pressure stroke of said piston or plunger.
18. A fuel pump, comprising a cylindrical body formed about its inner circumference with a cam face, a member formed with a substantially diametrical pocket rotatable within said body about an axis coinciding with the axis of said body, a piston or plunger within said pocket and in engagement with said cam face, said body being formed with suction and pressure ducts in position for alternate communication with said pocket, and means for rotating said body and member relatively to each other, said cam face comprising a portion controlling the suction stroke of said piston or plunger, a portion more abrupt than said last-named portion controlling the pressure stroke of said piston or plunger and a portion immediately following said last-named portion and slightly receding relatively thereto and controlling a retracting movement of said piston or plunger immediately following the pressure stroke thereof.
19. A fuel pump, comprising a body formed with a suction duct and a pressure duct, said body being formed around said pressure duct with a ridge, a member formed with a cylindrical pocket, a piston reciprocating in said pocket, operating means for said piston, said body, member and ridge forming a chamber into which said suction duct opens, and means for moving said body and member relatively to each other for successively throwing said pocket into communication with said suction and pressure ducts.
- In testimony whereof I hereunto affix my signature.
- FRITZ EGERSDÖRFER.