989,535.

N. McCARTY.

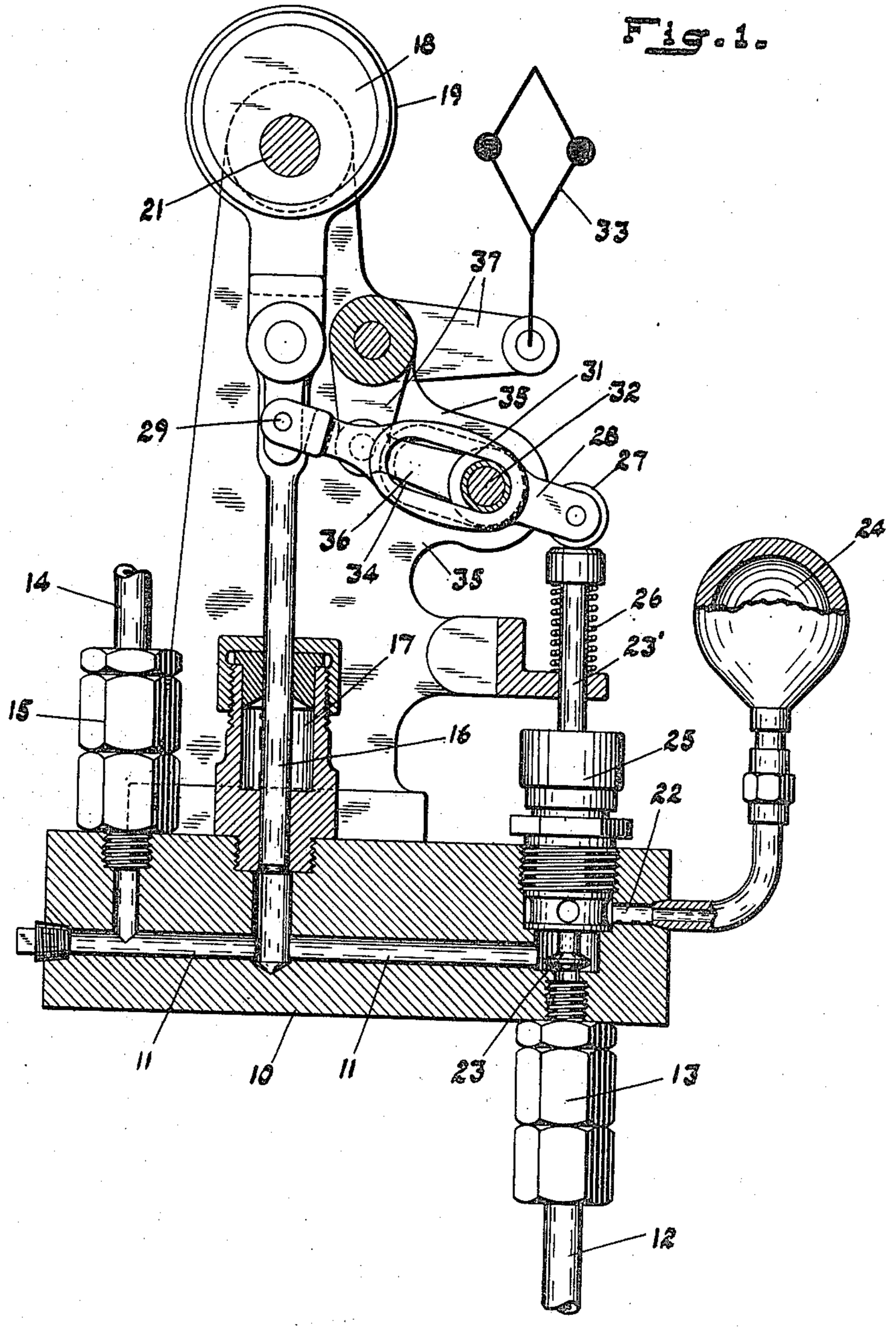
GOVERNED PUMP.

APPLICATION FILED JUNE 10, 1910.

Patented Apr. 11, 1911.

2 SHEETS—SHEET 1.

Fig. 1.



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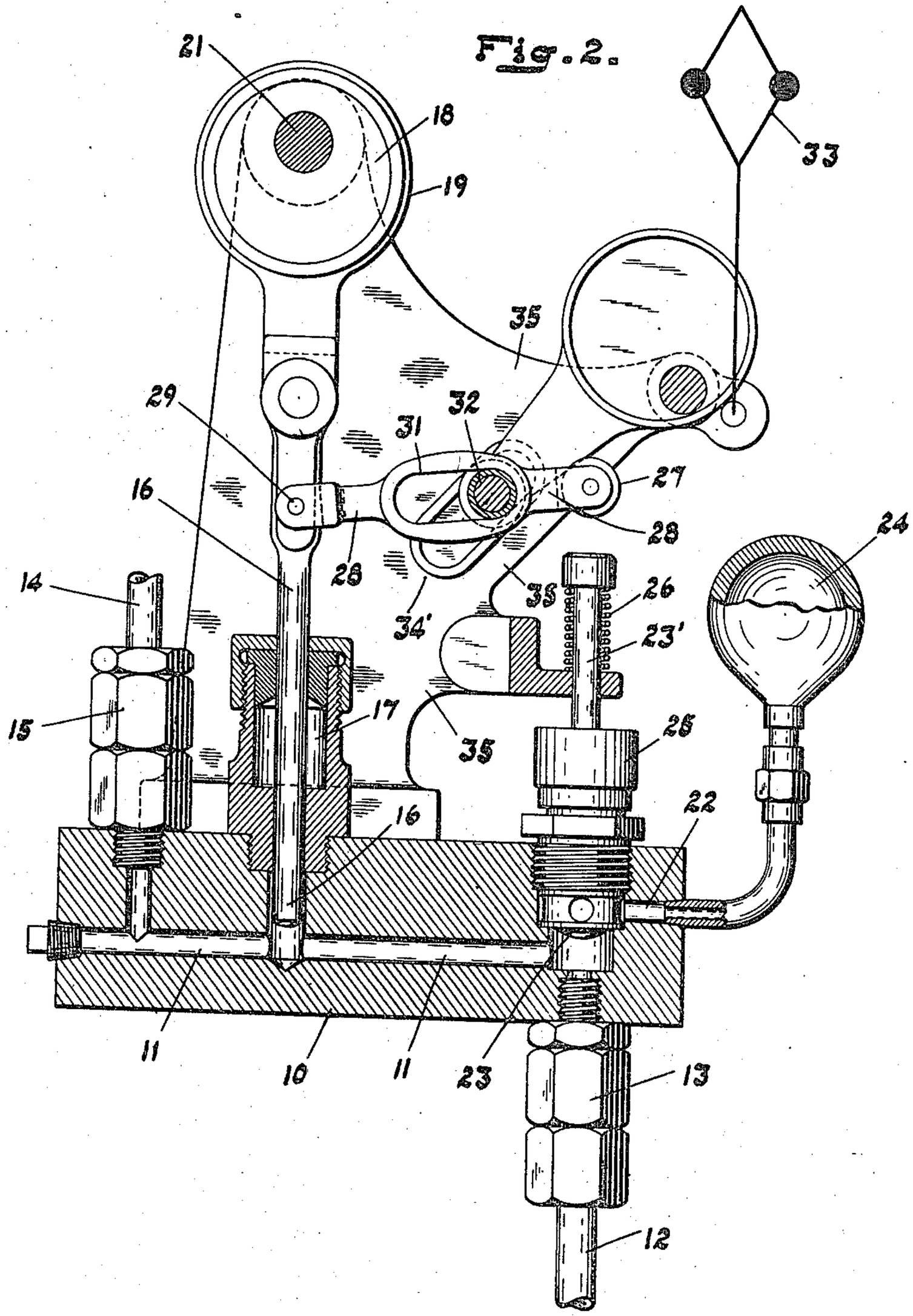
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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GOVERNED PUMP.

989,535. Specification of Letters Patent. Patented Apr. 11, 1911.

Application filed June 10, 1910. Serial No. 566,130.

To all whom it may concern:

Be it known that I, NORMAN McCARTY, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented a new and useful Governed Pump, of which the following is a specification.

The object of my invention is to produce a pump especially adapted for use in delivering variably measured quantities of liquid fuel to an internal combustion engine of the slow-burning type. While the pump is especially designed for the use above mentioned, it is by no means limited to such use.

The accompanying drawings illustrate my invention.

Figure 1 is a vertical section of a pump embodying my invention and of such construction that the stroke of the relief valve is uniform in length for all positions of adjustment of the mechanism, and Fig. 2 is a similar view of a pump in which the throw of the relief valve varies.

Pumps of the class described operate in connection with an internal combustion engine into which the fuel must be projected under very considerable pressures and the pump mechanism is, therefore, subjected to such considerable pressures.

In the drawings, 10 indicates the main body of the pump having a pump chamber 11, an inlet 12 with an inwardly opening check valve 13, an outlet 14 with an outwardly opening check valve 15, and a displacing plunger 16 projecting into the pump chamber 11 through a suitable packing gland 17. The plunger 16 is given a uniform reciprocation by means of an eccentric 18 and strap 19 carried by a shaft 21, which is constantly rotated by the engine or other machine to be served by, or to operate, the pump.

The parts thus far described are of an ordinary type. Each withdrawal of plunger 16 will draw into the pump chamber 11 a uniform quantity of liquid and each inward movement of the plunger will discharge the same uniform quantity from the pump chamber. In order, therefore, to vary the quantity of liquid projected through the outlet 14 for any given inward stroke of the displacing plunger 16, I provide mechanism by which a desired proportion of the contents of the pump chamber may be temporarily projected from the pump chamber through a relief passage 22 in such manner that it may return to the pump chamber upon the next outward stroke of the displacing plunger. The relief passage 22 is guarded by a relief valve 23. In the present form this relief valve is of the inwardly opening plunger type, so that its opening movement serves to decrease the capacity of the pump chamber, the amount of decrease depending upon the amount of projection of the plunger valve into the pump chamber so that, when this relief valve is projected inwardly in order to be withdrawn from its seat and thus furnish a relief passageway for a portion of the contents of the pump chamber, the movement of the valve itself will serve to project a portion of the contents of the pump chamber out of that chamber either into and through the relief passage or through the main passage 14, depending upon the condition of receptivity of the relief passage. The amount of this discharge will, of course, depend upon the displacing value of the relief valve and if this displacing value does not exceed the minimum fuel requirements of the engine which is being supplied by the pump, no serious objection arises, and, of course, the displacing value of the relief valve may be reduced to zero by the use of a rotary valve. But where the pump is operating against very high pressure, the plunger of the relief valve must be of considerable size as compared with the pump chamber, and its displacing value thus becomes very appreciable.

In order to compensate the displacing value of the relief valve, I connect to the relief passage 22 a relief chamber 24. This chamber 24 is arranged a short distance above the highest point in the pump chamber and has a capacity several times greater than the displacing value of the displacing plunger 16 and said chamber is so formed and connected with the passage 22 as to be air-tight so that, when liquid from the pump chamber 11 is driven through passage 22 into the relief chamber 24, the air in said chamber will be put under more or less pressure. Instead of an air-tight chamber capable of having produced within itself the

desired pressures by reason of the action of the pump, a connection might be made between the top of the chamber and a suitable pressure maintaining pump or other source of supply, but this would be a needless complication.

The plunger 23′ of the relief valve 23 is projected through a suitable packing gland 25 and the valve is normally held to its seat by a spring 26. The upper end of the valve stem 23′ is adapted to be engaged and the valve shifted from its seat by means of a roller 27 carried by a lever 28 pivotally connected at 29 with the displacing plunger 16. The lever 28 is provided at an intermediate point with a longitudinal slot 31 in which is mounted a shiftable fulcrum 32, said fulcrum being automatically shifted by means of suitable connections which connect it with a speed control governor 33.

Thus far, the structures shown in the two forms are identical and the two forms differ merely in the manner in which the lever 28 is adjusted with relation to the relief valve so that its effect upon the relief valve will be varied. In the form shown in Fig. 1, the fulcrum 32 travels in a guide slot 34 which is formed in the main frame 35 at an angle which corresponds with the angle of slot 31 when the displacing plunger 16 is at its outermost point and valve 23 is, therefore, at the extreme of its inner stroke so that, with the parts in these positions, the fulcrum 32 may be shifted throughout its entire range of adjustment without affecting the inner position of the valve 23. Of course, the valve 23 at its outer limit is uniform in its position because it seats upon its seat, which is fixed, and consequently the throw of valve 23 will be uniform for all possible positions of adjustment of fulcrum 32, although the time within which the throw of the relief valve takes place will vary. The fulcrum 32, in the form shown in Fig. 1 is connected by a link 36 with a bell crank lever 37 connected to the speed control governor 33.

In the form shown in Fig. 2, the fulcrum 32 is mounted in a guide way 34′ formed in the main frame 35 and this guide way lies at a considerable angle to the slot 31 in any of its positions and the movement of the fulcrum 32 in its slot 34′ serves to shift roller 27 toward and from the outer end of the valve stem 23′ so that, as the two arms of the lever 28 are relatively varied so that the uniform stroke of the displacing piston 16 produces a greater or less swing of roller 27 about fulcrum 32, the roller 27 will at the same time be moved toward or from the valve stem and the consequent effect of the uniform stroke of the displacing piston 16 upon valve stem 23 will be varied.

The operation of the structure shown in Fig. 1 is as follows: Pipe 14 is connected to a receiver in which a high pressure is maintained, such for instance as the feeding or atomizing chamber of an internal combustion engine like the Diesel motor. The fulcrum 32 is shown in that position of adjustment which will produce the maximum time of movement of valve 23 and consequently the minimum discharge of liquid through outlet 14, this discharge being zero if valve 23 does not reach its seat until the displacing plunger 16 reaches the inner end of its stroke. Assuming the pump chamber and passages to be emptied of liquid, fulcrum 32 would be shifted to its extreme position at the left in order to get the parts into working condition. With such an adjustment, reciprocation of plunger 16 would first serve to fill chamber 11 with liquid and then intermittently discharge liquid through passage 14, the valve 23 closing very quickly at an early point in the inward stroke of plunger 16. Assuming the passages to be filled with oil, excepting the relief passage 22 and chamber 24, and the parts in the positions of adjustment shown in Fig. 1, the inward projection of the displacing plunger 16 decreases the capacity of the pump chamber 11 and the withdrawing movement of the relief valve 23 increases the capacity of the pump chamber so that, if these two plungers were exactly of the same capacity and their speeds of movement were exactly the same, there would be merely a reciprocation of liquid within the pump chamber. Such a condition, however, can rarely exist and practically the capacity-increasing movement of the relief valve (because it is conveniently smaller) is less than the capacity-decreasing movement of the displacing plunger and consequently a volume of liquid equal to the difference in displacing volume of the two plungers is forced by the displacing plunger past valve 23 into passage 22 and chamber 24, there producing an increase of air pressure which is less than spring 26 but greater than the head of liquid in the passage 12 and if the valve 23 does not close until just at the moment when plunger 16 reaches the end of its stroke there will be no discharge through passage 14 because the check-valve 15 is held by a very high pressure. On the out-stroke of plunger 16, the valve 23 will be making an in-stroke and the difference of their volume-effects upon the chamber 12 will be supplied by liquid which will be forced from chamber 24 by reason of the air pressure therein. Intermediate positions of adjustment of the fulcrum 32 will result in a greater or less intermittent inflow of liquid from the supply pipe 12 and a greater or less outflow through pipe 14, the chamber 24 serving as a compensating chamber into which any surplus of liquid will be driven and from which it will be returned to the pump cham-

ber, this compensating action of the chamber 24 being available not only during the instroke of the displacing plunger but also during the instroke of the valve.

In the form shown in Fig. 1 the speed of the movement of the relief valve varies, while its displacing movement relative to the chamber 11 remains constant. In the form shown in Fig. 2 both the displacing movement of the valve and the time of such movement are varied, and the consequence is that the time of compensating action of the relief chamber 24 varies with relation to the reciprocation of the displacing plunger to a considerable degree depending upon the position of adjustment of the fulcrum 32.

Referring particularly to Fig. 2 with the parts in the positions of adjustment shown, when plunger 16 is withdrawn a charge of oil will flow into chamber 11 past valve 13 and at the end of the up stroke roller 27 will come into engagement with the head of stem 23′ so as to open valve 23, thus projecting the stem of the valve into the chamber and compensating, to a greater or lesser extent, the volume-increasing action of plunger 16 so as to more or less diminish the further inflow of fuel. When the plunger 16 starts on its downward stroke the valve 23 will of course start on its closing stroke but the inward movement of the plunger 16 having a greater volume decreasing effect upon chamber 11 than the volume increasing effect of the stem of the valve, there will be an outflow of liquid from the chamber 11, first past valve 23 either until that valve closes or until the pressure within chamber 24 equals the pressure which is maintained in pipe 14 against the opening of check valve 15. Whenever valve 23 closes however the further inward movement of the plunger 16 will serve to drive a quantity of liquid out of chamber 11 past plunger 16 into pipe 14. On the next up stroke of plunger 16 the first flow of liquid into the chamber 11 will be from chamber 24 against the action of spring 26, which is comparatively light, thus partially emptying chamber 24 before fuel is drawn into chamber 11 from the supply pipe 12. The action is the same no matter what the adjustment of fulcrum 32 may be, differing only in degree depending upon the disstance to which the stem of valve 23 is projected into chamber 11 and the time during which the valve 23 is held open.

I claim as my invention:

1. The combination, in a fuel pump having a main chamber, a valved inlet, a valved outlet, and a relief passage, of a displacing plunger projectable into said chamber, a relief valve controlling the relief passage and projectable into the chamber, means controlled by the displacing plunger for opening and closing the relief valve, means for varying the effect of the relief valve controlling means to vary the time during which said valve is open on the displacing stroke of the displacing plunger, and a pressure chamber communicating with the relief passage.

2. The combination, in a fuel pump having a main chamber, a valved inlet, a valved outlet, and a relief passage, of a displacing plunger projectable into said chamber, a relief valve controlling the relief passage, means controlled by the displacing plunger for opening and closing the relief valve, means for varying the effect of the relief valve controlling means to vary the time during which said valve is open on the displacing stroke of the displacing plunger, and a pressure chamber communicating with the relief passage.

3. The combination, in a fuel pump having a main chamber, a valved inlet, a valved outlet, and a relief passage, of a displacing plunger projectable into said chamber, a relief valve controlling the relief passage and projectable into the chamber, means controlled by the displacing plunger for opening and closing the relief valve, and a pressure chamber communicating with the relief passage.

4. The combination, in a fuel pump having a main chamber, a valved inlet, a valved outlet, and a relief passage, of a displacing plunger projectable into said chamber, a relief valve controlling the relief passage, means controlled by the displacing plunger for opening and closing the relief valve, and a pressure chamber communicating with the relief passage.

In witness whereof, I have hereunto set my hand and seal at Indianapolis, Indiana, this seventeenth day of May, A. D. one thousand nine hundred and ten.

NORMAN McCARTY. [L. S.]

Witnesses:

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THOMAS W. McMEANS.