

June 15, 1943.

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2,322,181

FUEL INJECTING AND METERING MEANS

Filed Aug. 29, 1939

2 Sheets-Sheet 1

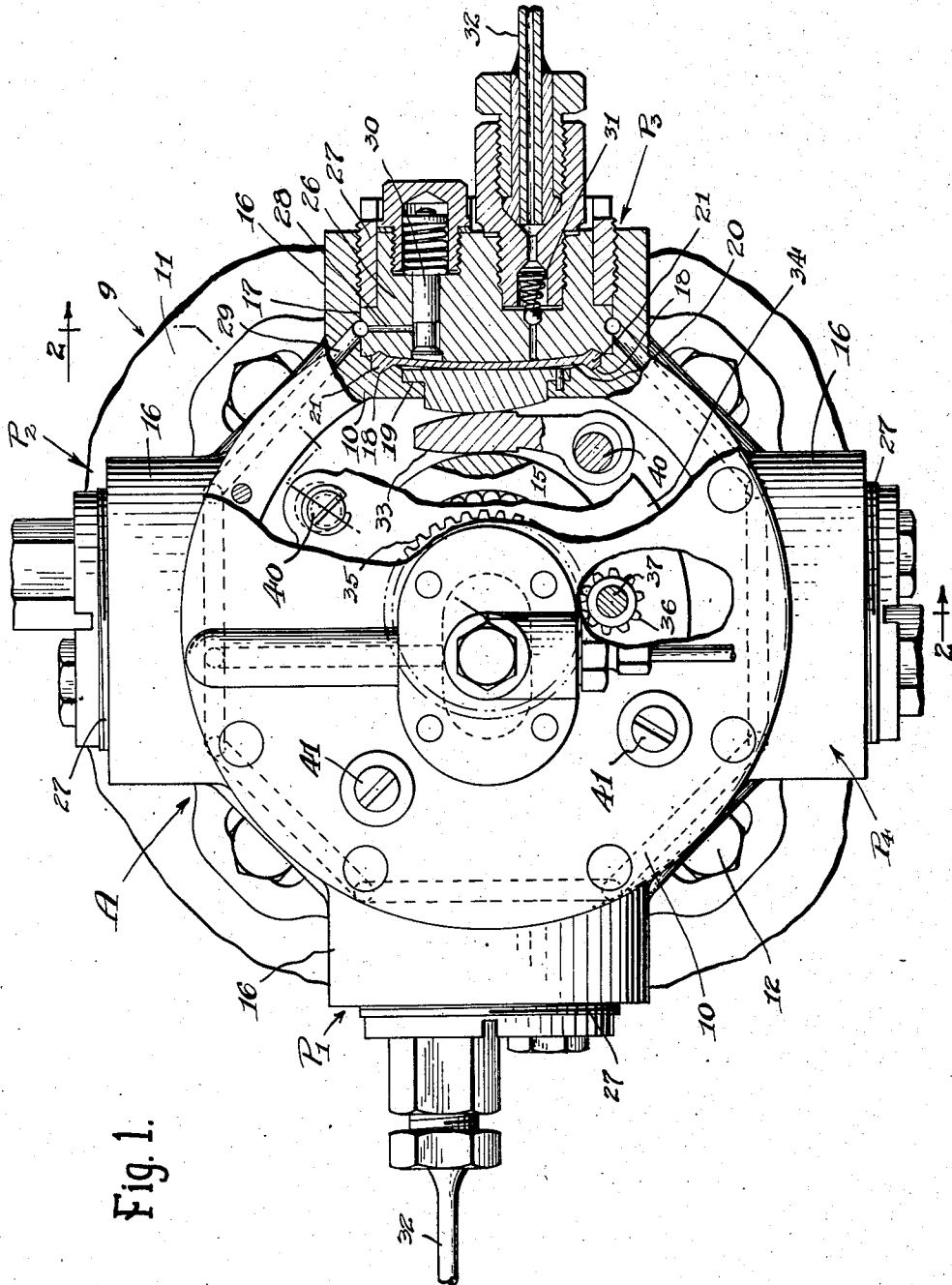


Fig. 1.

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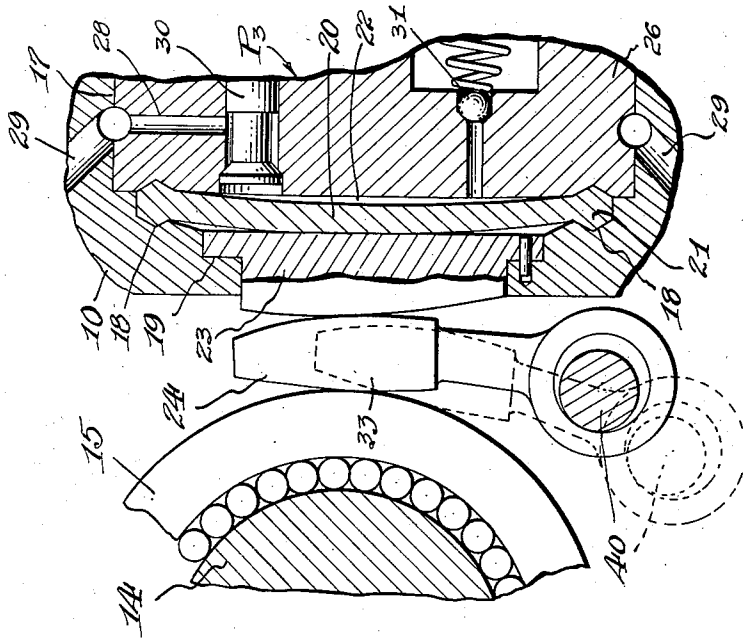


Fig. 3.

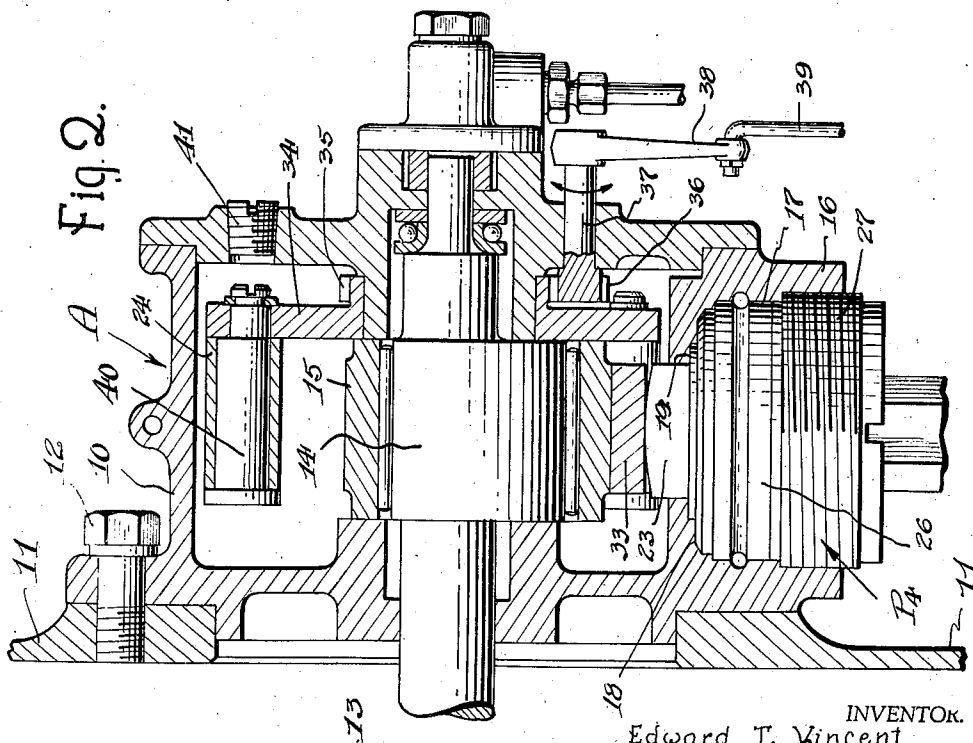


Fig. 2.

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UNITED STATES PATENT OFFICE

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FUEL INJECTING AND METERING MEANS

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6 Claims. (Cl. 103—38)

My invention relates to a fuel injection system for an internal combustion engine and more particularly to a multiple fuel metering and pumping instrumentality.

It is found to be quite difficult to adjust and regulate a plurality of fuel pumping devices of the conventional type so as to accurately control the fuel injection in an internal combustion engine of the compression ignition type. It is quite important that all engine cylinders should receive the same amount of fuel at all times, and that the engine throttle should simultaneously vary the volume of injected fuel to all cylinders alike. In many of the fuel injection devices employed at present in compression ignition engines, it is difficult to maintain equal distribution of fuel with the result that such engines do not perform satisfactory.

An object of my present invention is overcome these difficulties by providing an improved fuel metering and pumping system in which is had a positive control of volume of fuel to be injected into the engine.

A further object of my invention is to provide an improved and novel multiple fuel metering and pumping system for internal combustion engines and to insure efficient engine performance by providing improved adjusting means therefor.

A still further object of my invention is to control engine operation in such a way as to insure uniformly good engine performance by providing readily adjustable means that will simultaneously adjust each pumping instrumentality associated with each engine cylinder to control engine operation, while also providing means permitting individual adjustment of all said pumping instrumentalities to insure equal fuel distribution.

For a more detailed understanding of my invention reference may be had to the accompanying drawings which illustrate a preferred embodiment of my invention, and in which,

Fig. 1 is a plan view of my improved fuel metering and pumping device, with parts thereof being broken away to illustrate some of the internal construction, and

Fig. 2 is a vertical sectional view taken substantially on the line 2—2 of Fig. 1, and,

Fig. 3 is an enlarged detail view of one of the fuel metering and pumping instrumentalities, illustrating in detail the construction and adjustable support of the pump actuating mechanism.

The present invention is adapted for use more particularly with an engine 9 of the compression

ignition type, but may obviously be incorporated in any type of fuel injection engine. In such multiple cylinder engines it is preferred to provide a plurality of fuel pumps, each pump serving one or a group of engine cylinders. The structure herein illustrated and described provides a plurality of such pumping instrumentalities and is identified in its entirety by the reference character "A" comprising in general a casing 10 which may be secured to an engine crankcase 11 by means of bolts 12 of other suitable fastening devices. A shaft 13 is driven by any suitable driving connection in timed relation with respect to the engine crankshaft (not shown). An eccentric 14 is carried by this shaft 13 and operates to move the eccentric ring 15 in an orbital path and to successively actuate the plurality of pumping instrumentalities P₁, P₂, P₃, and P₄.

In Figs. 1 and 3 the pumping instrumentality P₃ is shown in section, and it will be understood that all said pumping instrumentalities are substantially alike. The casing body carries bossess 16 each of which are internally bored out as at 17 or otherwise suitably machined to receive the pump body of a pumping instrumentality or pump unit. Same is provided with an annular recess 18 and counterbored as at 19. A flexible member 20, preferably consisting of spring steel and provided with an annular rib 21, is supported within the pump bore, said annular rib 21 seating in the annular recess 18, this flexible member comprising a movable diaphragm which forms one wall of a pump chamber 22 (see Fig. 3). A push plate or plunger 23 is supported in said counterbored portion 19 and is so carried by the casing as to permit same to be moved outwardly to actuate said flexible steel diaphragm. A cam follower 24 engages said push plate and is actuated by said eccentric ring or actuator 15 as will be explained in more detail hereafter.

The pump chamber is bounded on the side opposite said diaphragm by a pump body 26 seating in the bored out portion 17 and held securely therein by a gland 27. Said pump body 26 is provided with an inlet passage 28 which registers with an inlet passage 29 carried in the casing 10, said passages 29 being constructed and arranged to register with the inlet passages 28 of all said pump bodies. A spring closed inlet valve 30 controls the inlet of fuel into the pump chamber 22 and a spring closed check valve 31 controls the outlet of fuel from said pump chamber 22, and suitable conduits 32 leading to the engine communicate with the outlets of each said pump-

ing instrumentalities. These valves are preferably substantially conventional one-way valves.

The pump chamber 22 is so designed and constructed as to define a chamber of a predetermined volume, and when same is totally evacuated a full charge of fuel is injected into the fuel line or conduit 32 associated therewith, and the engine is operated at maximum speed or load.

In order to control engine operation the stroke of the push plate 23 and diaphragm is varied. This is accomplished by adjustably varying the position of the cam follower 24. This cam follower comprises a tapered member, the tapered portion 33 being supported to be adjustably positioned relatively to said push plate 23 and eccentric actuator 15. An annulus or throttle plate 34 is supported in such a way as to permit same to be angularly adjusted, said plate 34 carrying the external gear teeth 35 which are constructed for engagement with a gear 36 carried on the jack shaft 37. An arm 38 is secured to said shaft 37 and actuated by a draft rod 39. As the arm 38 is rocked the gear 36 is rotated and thereby angularly adjusts the position of the annulus or throttle plate 34. The cam followers 24 are carried by this plate 34, same being pivotally secured thereto by the pin 40. Thus the tapered cam follower can be relatively adjusted in any number of preselected positions intermediate the push plate 23 and eccentric ring or actuator 15, thereby varying the working stroke of the diaphragm 22.

Each cam follower is adjustably carried by this annulus or throttle plate 34, the pin 40 having a reduced eccentric end portion mounted in the plate 34, said pin being arranged to be turned on its axis or partially rotated in order to relatively shift same with respect to the throttle plate and to thereby adjust the position of the cam follower.

I will thus be seen that each of said tapered cam followers can be adjusted relative to the throttle plate 34 in accordance with the individual characteristic of each individual pumping instrumentality, thereby adjusting each of said pumping instrumentalities so as to provide for uniform distribution of fuel into each of said fuel lines or conduits 32, and these pumps are suitably adjusted as desired by moving the annulus or throttle plate 34 to control the engine output.

It is found that the above described mechanism serves to efficiently control engine operation and provides for uniform distribution of fuel to the engine fuel supply lines of conduits 32. The device is easily adjusted to meet any engine requirement, and is positively and readily actuated to insure a good engine performance at all times.

I have thus provided a simple mechanism for the control of engine operation, which can be economically manufactured and serviced. Although I have described a preferred embodiment of my invention and have illustrated but one embodiment thereof, it will be understood that changes may be made therein without departing from the spirit of my invention as defined in the appended claims.

I claim:

1. In a fuel injection system for internal combustion engines, a fuel pumping and fuel metering instrumentality including a pump structure having a chamber provided with an inlet and an outlet, a flexible diaphragm extending transversely of said chamber and defining one wall of said chamber, said flexible diaphragm being initially flexed, means including a push plate contacting at all times with the diaphragm and

operable for actuating said diaphragm, stop means reacting against said push plate to limit the inward movement of the diaphragm and adjustable means associated with said push plate and including an adjustable tapered cam follower manually operable to vary the stroke of said diaphragm to vary the volume of fuel discharged from said pumping instrumentality.

2. A fuel pumping device comprising a pump body structure having inlet and outlet passages, said body structure having a convex surface and arranged for said passages to terminate at said surface in spaced relation to each other, a flexible steel diaphragm relatively closely overlaying said surface and constructed to normally yieldingly flex out of whole surface contact with respect to said surface and to be substantially uniformly spaced therefrom to provide a pump chamber of a predetermined capacity, said diaphragm being initially flexed, means including a push plate contacting at all times with the diaphragm and operable to move said diaphragm towards said surface to evacuate said pump chamber, and stop means reacting against said push plate to limit the inward movement of the diaphragm.

3. A fuel pumping device comprising a pump body structure having inlet and outlet passages, said body structure having a convex surface and arranged for said passages to terminate at said surface in spaced relation relative to each other, a flexible steel diaphragm relatively closely overlaying said surface and constructed to normally yieldingly flex out of contact with respect to said surface and to be substantially uniformly spaced therefrom to provide a pump chamber of a predetermined capacity, said diaphragm being initially flexed and means including a push plate contacting at all times with the diaphragm and operable to move said diaphragm towards said surface to evacuate said pump chamber, stop means reacting against said push plate to limit the inward movement of the diaphragm, and adjustable means associated with said push plate and including a tapered cam follower manually adjustable to control the displacement of said pump, whereby to control the volume of fuel discharged through said pump outlet.

4. A metering fuel pump comprising a pump casing having a pump chamber and inlet and outlet fuel passages communicating with said chamber, valve means for said passages, said casing having an internal rounded convex surface defining a wall of said pump chamber, a metallic diaphragm having a rounded inner surface relatively closely overlaying the rounded surface of said casing and defining another wall of said pump chamber, said diaphragm being initially flexed in one direction and thereby substantially uniformly spaced from the internal rounded surface of the casing, means including a push plate contacting at all times with said diaphragm and operable to act on said diaphragm to move same towards the surface of the casing to displace the fuel in said pump chamber and discharge same through said outlet, stop means reacting against said push plate to limit the inward movement of the diaphragm, and manually adjustable means operable to vary the movement of said push plate for varying the amount of fuel discharged per stroke.

5. In a fuel injection system for internal combustion engines, a fuel pumping instrumentality including a pump structure having a chamber provided with an inlet and an outlet, a flexible

diaphragm operable in said chamber for evacuating same, means including a push plate contacting at all times with said diaphragm for actuating said flexible diaphragm, stop means reacting against said push plate to limit the inward movement of the diaphragm, and including a tapered cam follower manually adjustable to vary the stroke of said flexible means to vary the volume of fuel discharged from said pumping instrumentality.

6. A metering fuel pumping instrumentality for a multi-cylinder engine, a casing, a plurality of pumps substantially equally angularly spaced about said casing, each pump having an inlet and outlet and supported by said casing, each pump including a pump chamber, a flexible diaphragm,

5 said diaphragm being initially flexed, and a push plate contacting at all times with said diaphragm an eccentric cam driven by said engine, stop means reacting against said push plate to limit the inward movement of the diaphragm, a manually adjustable ring, tapered cam followers adjustably carried by said ring and each independently adjustably positioned to vary the stroke of the push plate associated therewith, 10 and means operable to manually adjust said ring to simultaneously adjust all said cam followers for simultaneously varying the strokes of all said flexible diaphragms to control the engine operation.

15 EDWARD T. VINCENT.