Aug. 4, 1936. L. BEEH 2,049,487

FLUID DISTRIBUTING AND DELIVERY CONTROL MEANS

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Fig. 5

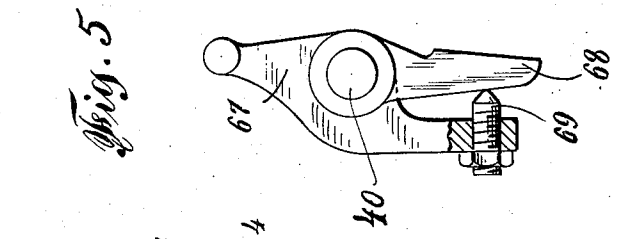
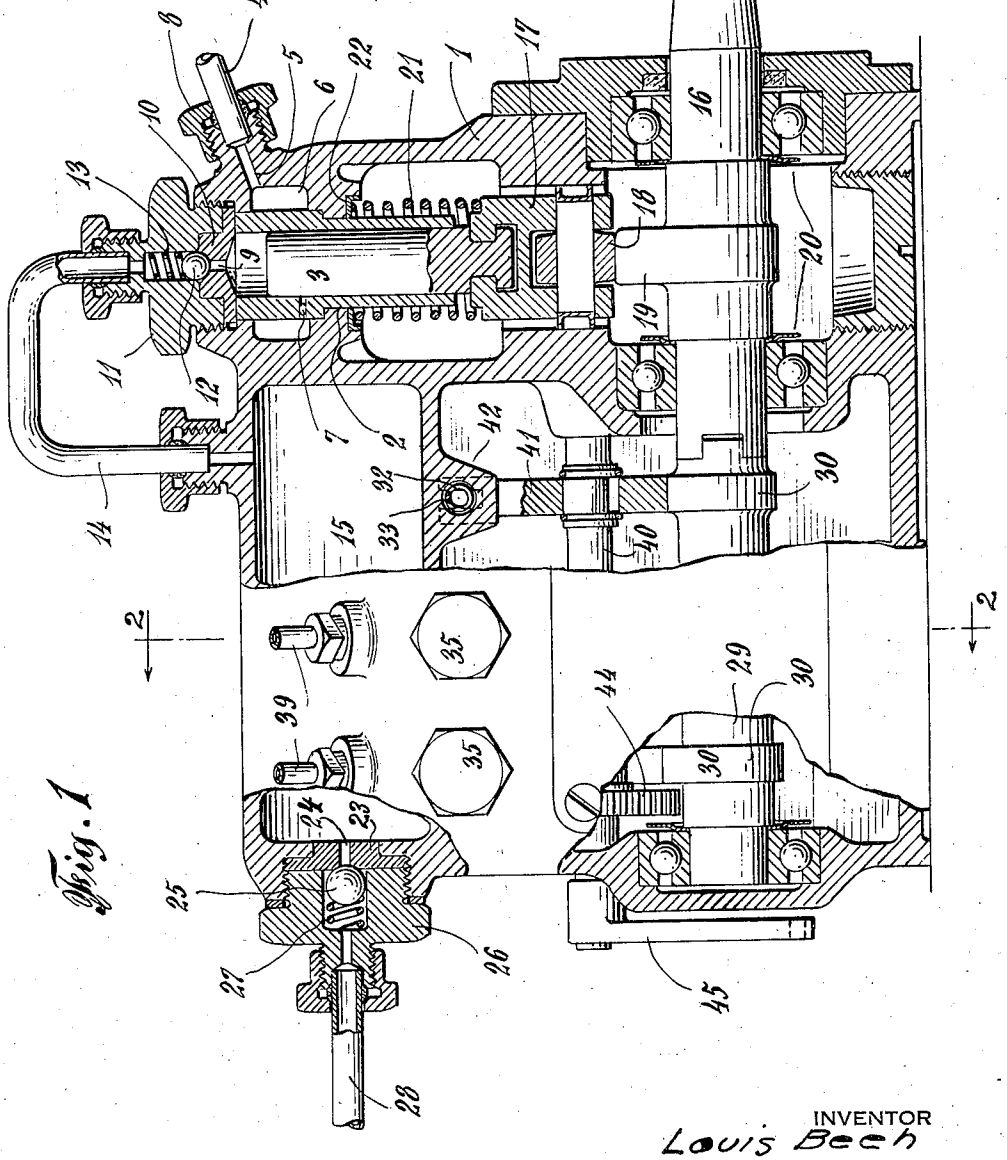


Fig. 1



INVENTOR
Louis Beeh
BY
ATTORNEY

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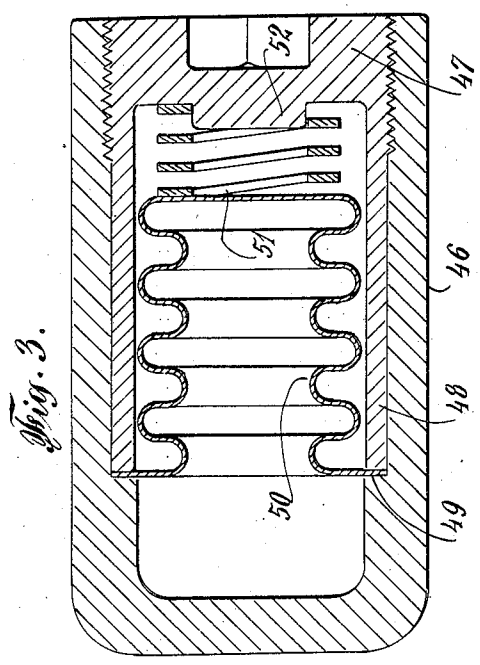


Fig. 3.

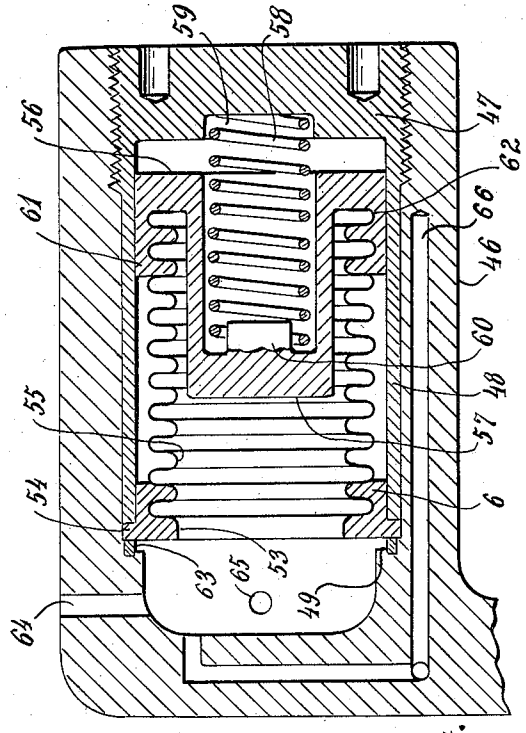


Fig. 4.

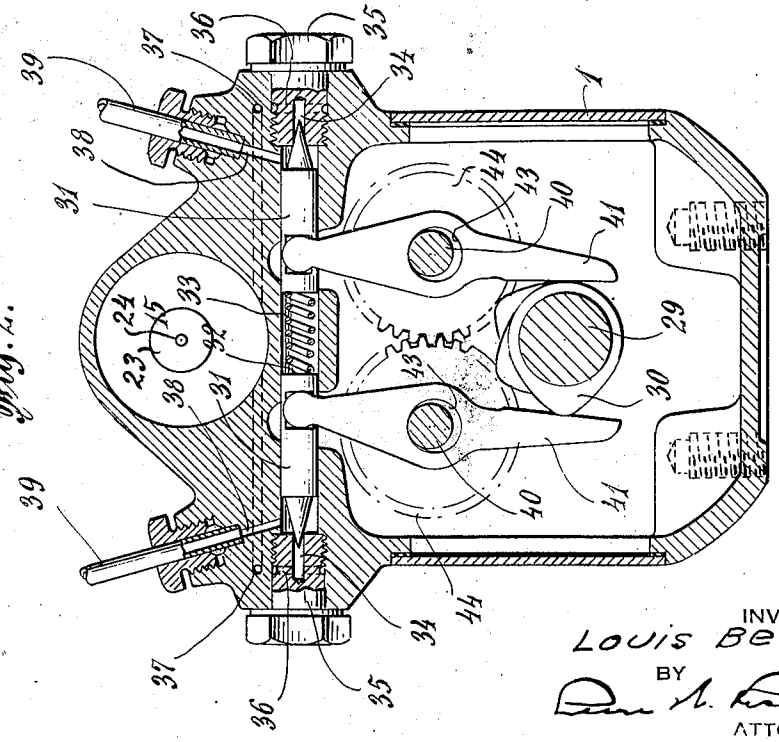


Fig. 2.

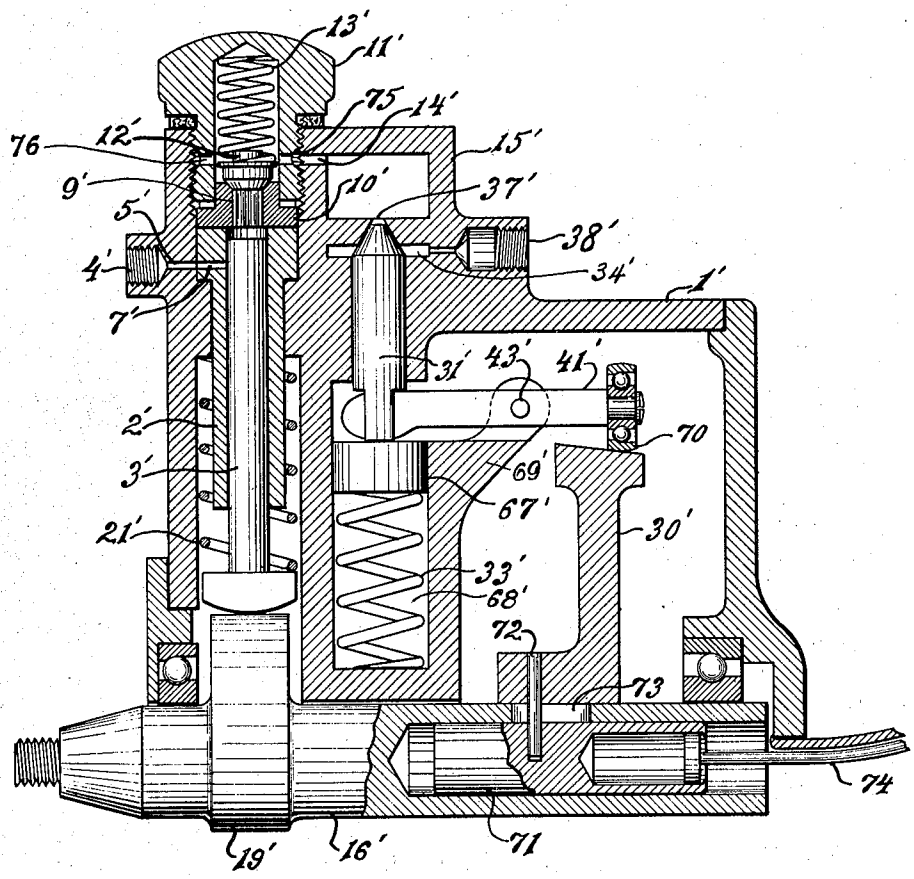
INVENTOR
Louis Beeh
BY
ATTORNEY

Aug. 4, 1936. L. BEEH 2,049,487

FLUID DISTRIBUTING AND DELIVERY CONTROL MEANS

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Fig. 6



INVENTOR
Louis Beeh
BY
ATTORNEY

Patented Aug. 4, 1936 2,049,487

UNITED STATES PATENT OFFICE

2,049,487

FLUID DISTRIBUTING AND DELIVERY CONTROL MEANS

Louis Beeh, Longmeadow, Mass., assignor to United American Bosch Corporation, Springfield, Mass., a corporation of New York

Application November 18, 1932, Serial No. 643,136

5 Claims. (Cl. 137—145)

This invention relates to improvements in supply systems and particularly to fuel supply systems for internal combustion engines.

An object of the invention is to provide a compact system of unitary construction, easy to install, efficient and accurate in operation and inexpensive to produce.

It has heretofore been customary in building the so-called rail type of fuel injection pump, to make the pump cylinder, the receiving tank or reservoir into which the cylinder delivers and the valves and cams, in the form of separate units and to install them at various places on the engine. With my invention, however, these parts constitute a single apparatus of relatively small size and having a single main operating shaft. A pump according to my invention can therefore be more readily set up and operatively connected and it can be likewise adapted to suit engines of various sizes.

The nature and objects of the invention are set forth at length in the ensuing description and the novel features are pointed out in the appended claims, but the disclosure is explanatory only and alterations in various details may be made without departing from the principle or essential structure of the invention.

On the drawings:

Fig. 1 is a side view partly in section of a pump according to this invention;

Fig. 2 is a cross section on the line 2—2 of Fig. 1;

Figs. 3 and 4 are longitudinal sectional views of tanks or reservoirs into which the pump delivers;

Fig. 5 presents a modification showing an operating detail; and

Fig. 6 is a longitudinal sectional view of another type of pump according to my invention.

On the drawings the same numerals identify the same parts throughout.

In practical form the pump comprises a casing or housing 1, suitably shaped to receive and mount a barrel or cylinder 2 in which reciprocates a plunger or piston 3. At 4 is indicated the fuel supply pipe, which connects by way of a duct 5 in the casing 1 with a chamber 6 surrounding the barrel 2, this chamber communicating with the interior of the barrel through an inlet port 7. The supply pipe 4 is secured to the casing 1 by gland 8, and the barrel 2 has an outlet port 9 through which the fuel is discharged by the plunger 3. Both ends of the barrel 2 are open and one end is closed by a head 10 in which the port 9 is provided and this head 10 is held in place by a cap 11 which fits over the head and has screw threaded engagement with a suitable bore in the casing 1. The outlet port 9 is controlled by a ball valve 12 which seats in the outer end of this port and this valve is normally held closed by a spring 13 in a recess in the cap 11. The cap has a passage extending through it communicating with a conduit 14 secured to the cap at one end and at the other to a delivery tank 15 in which fuel is received under pressure and from which it is taken to supply the cylinders of the engine equipped with this pump.

The main operating shaft is shown at 16 mounted to rotate in the lower part of the casing 1. The barrel 2 is rigidly mounted with respect to the shaft 16 and its adjacent end is open so that the plunger 3 can project therefrom. The projecting end of this plunger is suitably attached to a tappet or head 17 carrying a roller 18 which runs in contact with a cam 19 on the shaft 16. Ball bearings for the shaft on the casing 1 are shown at 20. A spring 21 surrounding the barrel or cylinder 2 and disposed in a suitable cavity in the casing 1 seats against the top of this cavity at one end and against the tappet 17 at the other and tends to move the plunger 3 downward, thus holding the roller 18 in constant engagement with the cam 19. A flange ring 22 at the top of this cavity surrounding the cylinder 2 provides a seat for the upper end of this spring.

One end of the tank 15 remote from the barrel 2 is provided with a counterbored opening which receives a plug 23 with a perforation 24 which is closed by a ball valve 25 in a recess of a cap 26 which is screwed into place over the plug 23. A spring 27 in this cap holds the ball against its seat and the cap is provided with a duct or passage therethrough which communicates with a conduit 28 secured to this cap. The purpose of the port 24 and valve 25 is to by-pass the fuel through the conduit 28 back to the supply tank connected to the pipe 4 whenever the pressure in the tank or reservoir 15 becomes great enough to force the valve 25 open.

The inner end of the drive shaft 16 is coupled to shaft 29 suitably mounted in the casing 1 and carrying cams 30, at separated points along the length thereof. The casing 1 is hollow in this part and above the shaft 29 mounted to reciprocate in a suitable bore 32 in the bottom of the reservoir 15 are metering valves 31 arranged in line with each other and extending transversely of the reservoir 15 and shafts 16 and 29. These valves have a coil spring 33 between their adjacent ends, this spring tending to force these valves to

closed position. At their ends remote from the springs 33 the valves are conical or pointed and enter passages 34 in screw plugs that are carried by the casing 1 and close the ends of the bore 32. The passages 34 communicate through suitable openings with a circumferential groove 36 in the outer surface of plugs 35 and these grooves 36 are connected by passages 37 with the bottom of the reservoir 15. At 38 are outlet ports communicating with the bore 32 at points adjacent the inner ends of the plugs 35 and these outlet ports 38 lead to conduits 39 which are united to the separate cylinders of the engine. Hence when the valves 31 are opened, fuel can flow from the reservoir 15 to the distributor conduits 39 by way of the passages 37, 36, 34, 32 and 38.

Above the shaft 29 are parallel shafts 40 carrying operating arms 41 and having forked upper ends 42 but engaging opposed shoulders in the sides of the valves 31. The arms 41 are mounted on eccentrics 43 carried by the shafts 40; and these shafts are also provided with fixed gears 44. One of the shafts projects to the outside of the casing 1 and carries an arm 45. Hence by turning the arm 45 the gears are operated and the eccentrics 43 are turned to adjust the point of support of the arms 41. At their lower ends these arms are engaged by the cams 30 and operated so as to operate the valves 31 against the spring 33. There are two arms 41 for each cam 30 and as many arms 41 as there are engine cylinders. The cams 30 are angularly disposed on the shaft 29 and the cycle is of course such that one arm 41 will be caused to open its associated valve 31 every time one of the cylinders of the engine is in condition that fuel is to be admitted.

Normally the fuel is delivered into the pressure reservoir 15 and would be at sufficient pressure at all times to flow out of the distributor conduits 39 when the valves 31 are opened. But to insure enough pressure in this reservoir under all conditions I may employ the construction shown in Figs. 3 and 4. In Fig. 3 the reservoir comprises a shell 46 having one end permanently closed and the other closed by a head 47 screwed into place and having a cylindrical extension 48 which grips between its inner end and a shoulder 49 in this casing the edge of an expansible diaphragm 50 of suitable material. This diaphragm may have the form of a corrugated tube closed at one end and open at the other, and secured against the shoulder 49; and between this closed end and the head 47 is a spring 51 seating against the closed end and surrounding a protuberance 52 on the inside of the head 47. When this reservoir or chamber is filled with fuel the corrugated tube 50 will expand and as the pressure inside of the chamber drops, the spring 51 will partially collapse the corrugated tube 50. Thus the pressure in the reservoir 46 will be maintained substantially constant.

In Fig. 4 the extension 48 grips between its inner end and a shoulder 49 a ring 53 having a surrounding flange 54. In this ring is secured one end of an expansible corrugated tubular element 55 having its opposite end affixed to a plunger 56. This plunger comprises a hollow head 57 between which and the head 47 is a coil spring 58 seating in a recess 59 at one end and surrounding a boss 60 in the plunger 56 at the other. This plunger has a rim 61 surrounding the central portion 57 to which the element 55 is attached and the ring 53 and rim 61 have inside grooves corresponding to the corrugations of the element 55 as shown at 62. Between ring 53 and shoulder 49 is a gasket 63. The shell has an opening 64 to which the pipe 14 may be connected and an opening 65 to which the relief pipe 28 may be joined. This shell 46 also has a passage 66 which extends for the most part lengthwise of the shell communicating at one end with the interior and connected by suitable passages to parts controlled by the valves 31. In this reservoir also pressure will expand the element 55 against the spring 58, and when pressure drops, the spring 58 will cause the element 55 to contract and maintain the pressure in the reservoir.

It will be understood that a corrugated tube, such as shown at 50, or a similar element, such as shown at 55, in Figs. 3 and 4, can readily be mounted in the reservoir chamber 15 merely by making the chamber 15 long enough to provide sufficient room within it at the end adjacent the barrel 2.

In Fig. 5 the arm 41 is shown as made of two sections 67 and 68, both pivotally mounted on the supporting shaft 40. The arm 67 engages one of the valves 31 and the arm 68 is actuated by the cam 30. The arm 67 carries an adjusting screw 69 which abuts the arm 68 and by this screw the operation of the valves 31 can be regulated.

The casing 1 is recessed, as shown in Fig. 2, below the valves 31 to enable the arms 41 to connect therewith.

In the foregoing description the valves 31 are above the shaft 29 and extend transversely. Fig. 6 shows a construction in which the valves can be arranged radially around this shaft. With this arrangement it is possible to effect operation of all the valves with a single cam instead of a number of cams shown and described above as 30. In Fig. 6 the casing 1' mounts a cylinder or barrel 2' in which reciprocates a plunger 3'. A threaded socket 4' in the casing provides for the connection of the fuel supply pipe which delivers through a duct 5' to the inlet port 7'. The outlet port for each barrel or cylinder is shown at 9' in a head 10' for the barrel 2', this head 10' being held in place by a cap 11' which is screwed into a threaded opening at the top of the casing over the head 10' and has in a recess therein a spring 13' to hold the outlet valve 12' closed. The barrel 2' discharges through a port 14' into a pressure reservoir 15' at the top of the casing. This reservoir has a discharge port 37' in the bottom controlled by a valve 31' having a cone-shaped end. The outlet port 37' leads to a cavity 34' communicating with a threaded opening 38' in which the distributor conduits 39 will be affixed. The valve 31' will be actuated as before by an arm 41' mounted on a pivot 43', the end of this arm being forked to engage shoulders on the valve 31'. The end of the valve remote from the opening 37' is enlarged and has the form of a plunger head 67' which abuts a spring 33' in a recess 68' in the casing 1'. This casing has a projection 69' which mounts the pivot 43'. Below the barrel 2' and plunger 3' is a main shaft 16' having a cam 19' and carrying a cam 30' which engages a ring 70 mounted anti-frictionally on the outer end of the lever or arm 41'. The cam 30' is secured to a sliding plunger 71 in an axial bore in the shaft 16' and is connected thereto by a pin 72 which can slide in a straight slot 73 in the side of the shaft 16'. A Bowden wire 74 is attached to the plunger 71 and shifts the plunger to move it axially along the shaft 16'. The circumference of the cam 30' is such that the timing of the valves 31' is thereby changed. The cap 11' has a circumferential groove 75 adjacent the port 14' and

ports 76 connect these grooves to the recess 13' so that whenever the valves 12' open, fuel is transferred by the pump into the reservoir 15'.

With this construction only a single cam 30' is necessary and there will be as many valves 31' and arms 41' mounted in the casing 1' in radial position around the main shaft as there are cylinders to which fuel must be furnished. A spring 21' as before keeps the plunger in contact with eccentric 19'.

Of course while the construction above described may be used to supply fuel, I may also employ it for other purposes.

It is understood of course that the pump shown in Fig. 6 may include several valves, such as the valve shown at 31', all in radial position with respect to the shaft 16'; but in any case only a single cam 30' will be needed. The barrel and plunger may be in one transverse plane, that is a plane at right angles to the axis of the main shaft. For an engine having a large number of cylinders the valves 31' may be arranged all around the shaft. For a plurality of such valves 31' the reservoir 15' will be curved and will likewise lie in a plane transverse to the axis of the shaft, said plane containing the valves 31'. When the valves 31' extend all around this shaft the reservoir will have the form of a chamber that is annular and will deliver to one of the distributor conduits 39 whenever one of the valves is open.

Having described the invention, what is claimed is:

1. A control device for a fluid distributing system including a source of supply, valves controlling the distribution of fluid from said source, arms to actuate the valves, said arms being arranged in pairs, means for mounting the arms to enable them to be adjusted in unison, and means between each pair of arms to operate the same.

2. A control device for a fluid distributing system including a housing connected to a source of supply, a pair of oppositely disposed needle valves, said valves opening in the direction of flow from said source, actuating mechanism for said valves comprising parallel shafts, levers pivotally mounted on said shafts engaging said valves, means to adjust said levers through rotation of said shafts and a cam shaft between said levers for actuating the same.

3. A control device for a fluid distributing system including a housing connected to a source of supply, a pair of oppositely disposed needle valves, said valves opening in the direction of flow from said source, actuating mechanism for said valves comprising parallel shafts, levers pivotally mounted on said shafts engaging said valves, and a cam shaft positioned below said parallel shafts and between the lower end of said levers for actuating the same.

4. A control device for a fluid distributing system including a housing connected to a source of supply, a pair of oppositely disposed needle valves, said valves opening in the direction of flow from said source, actuating mechanism for said valves comprising parallel shafts, levers pivotally mounted on said shafts engaging said valves, and a cam shaft positioned below said parallel shafts and between the lower ends of said levers for actuating the same, said levers being mounted upon eccentrics on said parallel shafts and said shafts being geared together for simultaneous adjustment.

5. A control device for a fluid distributing system including a housing connected to a source of supply, a cam shaft within said housing, a needle valve reciprocative in a bore in said housing, a plug closing said bore and providing a seat for said valve, said valve opening in the direction of the flow of fluid from said source, a lever also enclosed by said housing and disposed between said cam shaft and said valve, and means projecting externally of said housing for adjusting the lift of said valve.

LOUIS BEEH.