

Aug. 27, 1940.

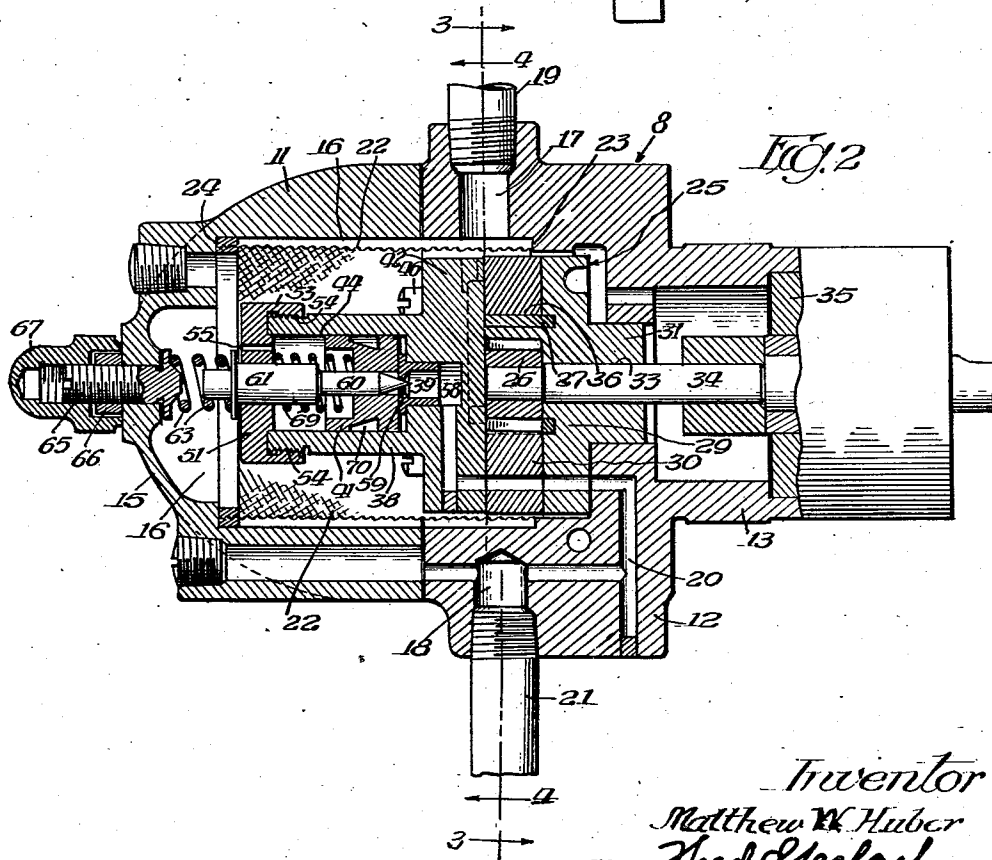
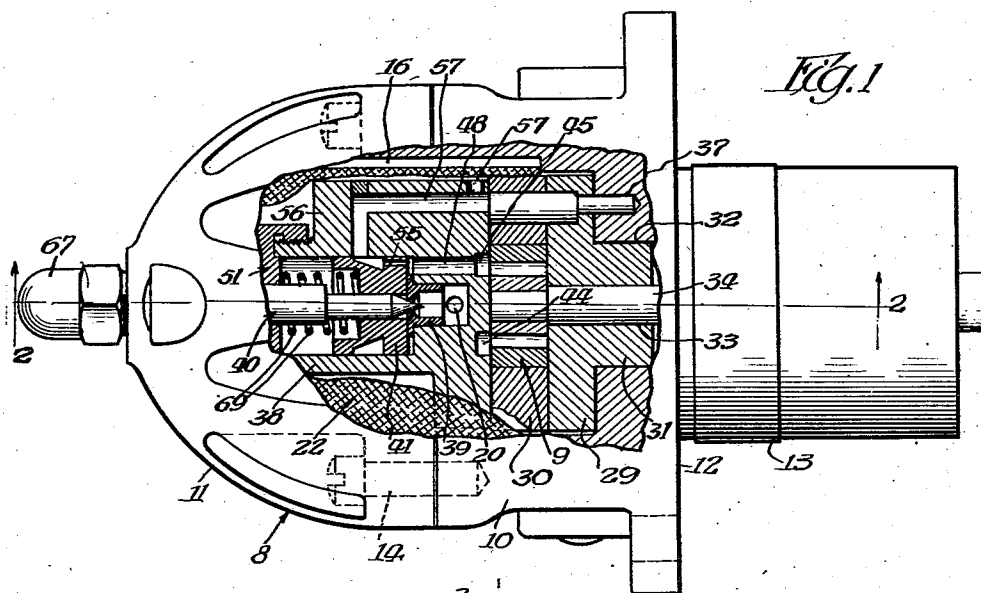
M. W. HUBER

2,212,833

OUTLET CONTROL VALVE FOR FUEL PUMPS

Filed Nov. 28, 1938

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 3

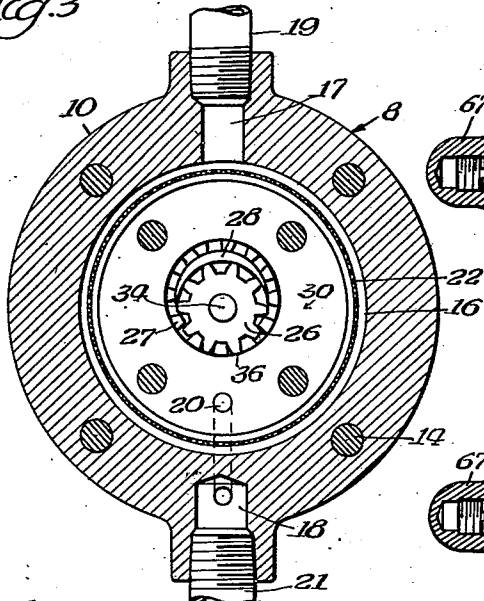


Fig. 4

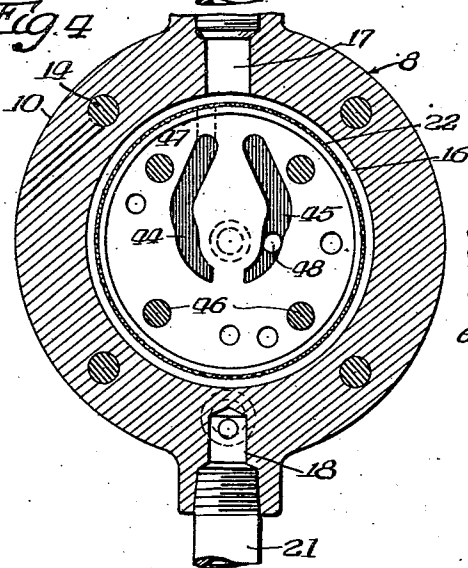


Fig. 5

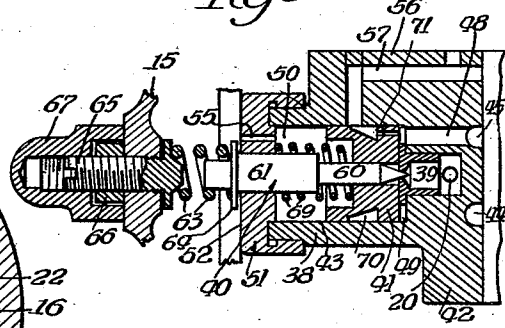


Fig. 6

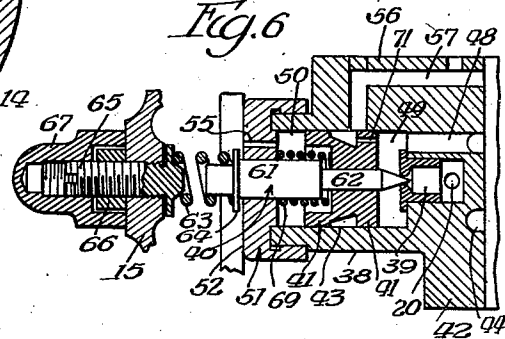


Fig. 7

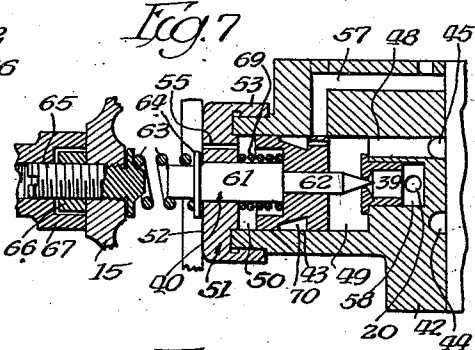
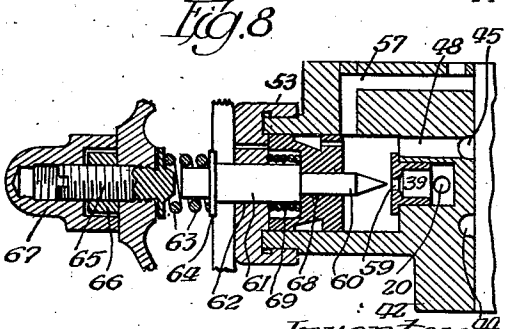


Fig. 8



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UNITED STATES PATENT OFFICE

2,212,833

OUTLET CONTROL VALVE FOR FUEL PUMPS

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Application November 28, 1938, Serial No. 242,671

6 Claims. (Cl. 103—42)

The present invention relates generally to outlet control valves for fuel pumps. More particularly the invention relates to that type of valve which is associated with and forms a part of the outlet side of a motor driven fuel pump for an oil burner of the nozzle and motor driven blower variety and includes an outlet orifice leading to the burner nozzle and an orifice controlling needle valve, and in addition a by-pass, and serves to control the flow of fuel to the burner nozzle via the orifice.

One object of the invention is to provide a valve of this type which is so designed and constructed that it operates automatically in connection with the starting of the motor for the pump and the blower to effect a delayed opening of the needle valve so that there is no pumpage of the fuel to the burner nozzle until the blower reaches its normal operating speed and hence there is a sufficient supply of air for proper combustion of the fuel and air mixture.

Another object of the invention is to provide an outlet control valve of the last mentioned character which includes an elongated valve housing having a longitudinally extending bore therein with one end serving as a pressure chamber for the pumped fuel or pumpage and the other end serving as a dash-pot chamber and in addition includes a valve plunger which is slidably mounted in the bore to move back and forth between the two chambers and operates when shifted to substantially the outer end of the dash-pot chamber as the result of the flow of the pumped fuel into the pressure chamber to shift the needle valve into its open position with respect to the orifice.

A further object of the invention is to provide a valve of the type and character under consideration which is generally of new and improved construction, consists of but a small number of parts, and effectively and efficiently fulfills its intended purpose.

Other objects of the invention and the various advantages and characteristics of the present outlet control valve will be apparent from a consideration of the following detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion hereof.

In the drawings which accompany and form a part of this specification or disclosure and in which like numerals of reference denote corresponding parts throughout the several views:

Figure 1 is a plan view of an oil burner fuel

pump having applied thereto an outlet control valve embodying the invention, parts of the pump and valve being broken away and shown in section for illustrative purposes;

Figure 2 is a vertical longitudinal sectional view on the line 2—2 of Figure 1;

Figure 3 is a vertical transverse sectional view on the line 3—3 of Figure 2;

Figure 4 is a vertical transverse sectional view on the line 4—4 of Figure 2; and

Figures 5, 6, 7 and 8 are sectional views of the valve illustrating in detail the manner in which the needle valve is opened in a delayed manner in connection upon starting of the pump.

The valve which is shown in the drawings constitutes the preferred embodiment of the invention. It is illustrated in connection with, and forms a part of, a pump for supplying fuel under pressure to an oil burner (not shown) of the nozzle and blower variety. The pump is of the internal gear type and comprises a housing 8 and an internal gear pump 9. It is adapted to be driven conjointly with the rotor of the burner blower by an electric thermostatically controlled motor (not shown). The housing 8 serves as a housing for the gear pump 9 and the improved outlet control valve and consists of a pair of complementary longitudinally aligned elongated parts 10 and 11. The part 10 embodies at one end thereof an integral cross wall 12 and a tubular extension 13 outwardly of the cross-wall. The housing part 11 fits against and is secured by bolts 14 to the other end of the part 10 and has an outer cross wall 15. The interior portions of the parts 10 and 11 of the pump housing communicate with one another and together define a fuel chamber 16. During operation of the pump, fuel is adapted to be drawn into the housing via an inlet port 17 and to be discharged from the housing to the burner via an outlet port 18. The inlet port is formed in the housing part 10 and leads to the chamber 16. It is located substantially diametrically opposite the outlet port 18 and is connected by a pipe 19 to a tank or other fuel source. The outlet port 18 communicates with the outlet control valve by way of an angular duct 20 and is connected to the nozzle of the burner with which the pump is associated by way of a pipe 21. A cylindrical strainer 22 is disposed within the chamber 16 and serves to strain the fuel entering the chamber via the inlet port 17. This strainer is spaced a small distance from the chamber forming wall of the pump housing and fits between an annular shoulder 23 in the central portion of the housing part 10 and an annular

shoulder 24 on the cross-wall 15 of the housing part 11. When the internal gear pump 9 is driven fuel is drawn into the chamber 16 via the inlet port 17 and after being placed under pressure by the gear pump is discharged to the burner nozzle via the hereinafter described outlet control valve, the duct 20, the outlet port 18 and the pipe 21. The chamber 16 within the pump housing 8 is at all times during normal operation of the pump filled with fuel, and a part of the pumped fuel or pumpage is by-passed back into the chamber as hereinafter described. The fuel within the chamber 16 is under substantially atmospheric pressure, whereas the fuel after passing through the pump is placed under sufficient pressure so that the part thereof that passes to the burner nozzle by way of the pipe 21 is atomized by the nozzle to form a combustible fuel and air mixture.

The internal gear pump 9 is of standard or conventional design. It is mounted in a body 25 and consists of a gear 26, a rotor 27, and a crescent 28. The body 25 is mounted in the housing part 10 and consists of a part 29 and a part 30. The part 29 is disposed for the most part inwardly of the cross wall 12 of the housing part 10 and embodies at its inner end a cylindrical extension 31, which as shown in Figures 1 and 2, fits within a circular hole 32 in the cross wall 12. A bore 33 is formed in the central portion of the body part 29. This bore extends from one end of the part 29 to the other and serves as a bearing for a longitudinally extending shaft 34. One end of this shaft extends longitudinally through the tubular extension 13 of the part 10 of the pump housing 8 and is connected in any suitable manner to, and for drive by, the armature shaft of the electric motor for driving the rotor for the blower of the burner. A fluid-tight sealing device 35 is mounted within the outer end of the extension 13 and serves to prevent any leakage of fuel around the shaft 34. The part 30 of the body 25 fits against the inner end of the body part 29 and embodies in the central portion thereof a circular chamber 36. This chamber extends from one end of the body part 30 to the other and is eccentrically disposed with respect to the bore 33, as shown in Figures 2 and 3. A pin 37 extends through the parts 29 and 30 of the body 25 and into the cross wall 12 of the part 10 of the pump housing and serves to retain the body 25 in fixed relation with the pump housing. The inner end of the shaft 34 projects into the chamber 36 and carries the gear 26 of the internal gear pump 9. Such gear is keyed or otherwise fixedly secured to the inner end of the shaft so that it is driven by the shaft in response to operation of the aforementioned electric motor. The rotor 27 corresponds in diameter to and fits rotatably within the chamber 36. It is in the form of an internally toothed ring gear and surrounds and meshes with the gear 26, as shown in Figure 3. The crescent 28 is stationary. It is formed as an integral part of the part 29 of the body 25 and fits within and seals the crescent shaped space between the gear 26 and the rotor 27, that is, the space where the teeth of the gear are not in mesh with the teeth of the rotor due to the eccentric position of the gear with respect to the rotor. One side of the chamber 36 constitutes the suction side of the internal gear pump 9 and the opposite side constitutes the pressure side of the pump. As hereinafter described, the suction side communicates with the chamber 16 within the pump housing and the pressure side is connected to discharge into the

outlet control valve. When the shaft 34 is driven by the electric motor, the gear 26 and the rotor 27 due to the fact that they are in mesh revolve within the chamber 36 and the pump is thus caused to operate. During operation of the pump a partial vacuum is created in the suction side due to the fact that the teeth of the gear 26 at such side come out of mesh with the teeth of the rotor and in response to this action fuel is sucked or drawn from the chamber 16 into the suction side of the chamber 36 and flows into the space between the teeth of the gear and the rotor. When the teeth of the gear mesh with the teeth of the rotor at the pressure side of the pump 9 the aforesaid spaces are filled and the fuel is forced under pressure from the pressure side of the chamber into the outlet control valve, as hereinafter described.

The improved outlet control valve serves to control the flow of fuel from the outlet or pressure side of the internal gear pump 9 to the burner nozzle via the duct 20, the outlet port 18, and the pipe 21, and is of such design and construction that upon starting of the electric motor for driving the gear pump and the rotor of the blower for the burner there is a delayed opening with the result that no fuel flows to the nozzle until after the motor reaches its normal operating speed and the blower is at full capacity. As shown in Figures 1 and 2 of the drawings, the valve comprises a housing 38, an orifice plug 39, a needle valve 40, and a valve plunger 41. The valve housing 38 is in the form of a casting and is disposed in the chamber 16 in the pump housing 8. It is disposed in a concentric position within the strainer 22 and embodies at one end thereof an enlarged circular head 42. At its other end the valve housing 38 embodies a longitudinally extending bore 43. The head 42 fits against the part 30 of the body 25 and is provided in the inner face thereof with a pair of opposed arcuate grooves 44 and 45. Bolts 46 extend through the marginal portion of the head 42 and into the outer portion of the body part 30 and serve to hold the valve body 38 in fixed or connected relation with the body 25. One end of the groove 44 in the inner face of the head 42 leads to the suction or inlet side of the chamber 36 for the internal gear pump 9 and the other end of this groove communicates with the chamber 16 and the pump housing 8 by way of a hole 47. The groove 45 faces and communicates with the pressure side of the chamber 36 and receives the pumped fuel or pumpage from such side. When the gear pump 9 is in operation, fuel is drawn into the suction side of the chamber 36 from the chamber 16 by way of the hole 47 and the groove 44 and the fuel under pressure which is discharged from the pump enters the groove 45 and flows from this groove into the inner end of the bore 43 by way of a duct 48. The inner end of the bore 43 constitutes a pressure chamber 49 in the valve housing 38 and the outer end of the bore constitutes a dashpot chamber 50. The bore 43 extends from the enlarged head 42 to the outer end of the valve housing 38. The outer end of the bore, that is, the end which defines the dashpot chamber 50, is closed by a cap 51. This cap embodies an end wall 52 and an annular inwardly extending side wall 53. The side wall fits around the outer end of the valve housing 38 and is removably secured thereto by means of a screw thread connection 54. A hole 55 extends through the end wall 52 of the cap and as a result the dashpot chamber 50 is in

constant communication with the fuel filled chamber 16 within the pump housing 8. The valve housing 38 is provided at one side thereof with an integral laterally extending lug 56. A by-pass 57 is formed in this lug. One end of the by-pass leads to and communicates with the central portion of the bore 43 and the other end of the by-pass leads to and communicates with the chamber 16. The orifice plug 39 fits within a socket 58 in the central portion of the enlarged head 42 of the valve housing and embodies an orifice 59. The socket 58 leads to and forms the inlet end of the duct 20. The orifice 59 is centrally disposed with respect to the bore 43 and is controlled by the needle valve 40. When the needle valve is in its open position, as hereinafter described, fuel under pressure in the pressure chamber 49 is permitted to flow through the orifice 59, the socket 58, the duct 20, and the pipe 21 to the nozzle of the burner with which the pump is used. The duct 48 for conducting the pumpage or fuel under pressure from the groove 45 to the pressure chamber 49 in the inner end of the valve housing 38 is located at one side of the socket 58, as shown in Figure 1. The needle valve 40 extends longitudinally through the bore 43 and comprises at the inner end thereof a stem 60 and at its outer end an enlarged cylindrical shank 61. The shank fits slidably within a circular bearing forming hole 62 in the central portion of the end wall 52 of the cap 51 so that the valve is slidable longitudinally from a closed position wherein the inner end of the stem 60 closes the orifice 59 into an open position wherein the inner end of the stem is disposed outwardly of the orifice and hence exposes the latter so that the pumped fuel or pumpage is free to flow from the pressure chamber 49 to the burner nozzle by way of the socket 58, the duct 20, the outlet port 18, and the pipe 21. A compression spring 63 urges the needle valve into its closed position. This spring is disposed between the cross wall 15 of the part 11 of the pump housing 8 and the end wall 52 of the cap 51. The inner end of the spring abuts against a washer 64 on the outer end of the enlarged shank of the needle valve and the other outer end of the spring abuts against the inner end of an adjusting screw 65. The adjusting screw, as shown in Figure 2 of the drawings, extends through the central portion of the cross wall 15 and is held in its various adjusted positions by means of a lock nut 66. A cap 67 surrounds the nut and the outer end of the adjusting screw and serves to prevent unauthorized adjustment of the screw. By turning the screw in one direction or the other, the compression spring 63 may be adjusted as to compression. Adjustment of the screw is effected by removing the cap 67 and then loosening the lock nut and turning the screw in the desired direction. The valve plunger 41 is mounted in the bore 43 so as to slide back and forth between the pressure chamber 48 and the dashpot chamber 50. It serves in a measure to control the by-pass 57 and embodies a central opening 68 for the stem 60 of the needle valve 40. As shown in the drawings, the plunger is approximately half as long as the bore and is urged toward the orifice plug 39 by a compression spring 69. The latter surrounds the central portion of the needle valve and is arranged so that one end abuts against the outer end of the valve plunger and the other end abuts against the central portion of the end wall 52 of the cap 51. When the gear pump 9 is started as the result of starting of the herein-

before described electric motor, the pumped fluid or pumpage from the pressure side of the chamber 36 flows into the pressure chamber 49 at the inner end of the valve housing and causes the valve plunger to move toward the cap 51. Movement of the valve toward the cap is retarded as the result of the fact that the dashpot chamber 50 is filled with fuel and such fuel flows slowly from the dashpot chamber into the chamber 16 via the hole 55 in the end wall of the cap 50. The outer end of the valve plunger is adapted to engage the inner end of the shank 61 of the needle valve slightly before the plunger reaches its full sliding movement in the direction of the dashpot chamber. As the result of this the needle valve is unseated or opened during the final shift or sliding movement of the valve plunger in the direction of the cap 51. In order further to retard sliding movement of the valve plunger in connection with opening of the needle valve so that there is a pronounced delayed opening of the valve in connection with starting of the pump, the plunger is provided with a circumferential groove 70 and a purging hole 71. The purging hole leads from the inner face of the valve plunger 38 to the groove and permits of a limited flow of the pumpage or pumped fuel from the pressure chamber 49 to the groove 70. The groove extends around the central portion of the plunger and during the initial stage of shift of the plunger toward the cap 50 communicates with the end of the by-pass and permits the pumpage that flows through the purging hole to by-pass to the chamber 16 via the by-pass 57. The inner end of the valve plunger is so designed that it serves to close the inlet end of the by-pass 59 slightly before the outer end of the plunger is brought into abutment with the inner end of the shank 61 of the needle valve. As a result of this, the by-pass is closed against the outflow of pumpage or pumped fuel there-through directly prior to final outward shift of the valve plunger. When the by-pass is closed by the inner end of the valve plunger the valve plunger is subject to the full pressure of the pumpage and hence moves more rapidly at the conclusion of its travel toward the cap and effects ready opening of the needle valve against the force of the compression spring 63. When the plunger is shifted into abutment with the cap the by-pass is open, as shown in Figure 7, and as a result part of the pumpage flows to the nozzle of the burner via the socket 58, the duct 20, the outlet port 18, and the pipe 21, and the remainder of the pumpage flows through the by-pass 57 back into the chamber 16 within the pump housing. When the plunger is in its fully open position, that is, when it is in abutment with the cap 51, the compression spring 69 is in its fully compressed position, as shown in Figure 7. When the motor for driving the burner blower and the internal gear pump 9 is stopped the flow of pumped fuel or pumpage into the pressure chamber 49 also stops and as a result the compression spring 69 shifts the plunger back toward the orifice plug 39. As soon as the plunger is shifted a short distance away from the cap 51 the compression spring 63 operates to shift the needle valve into its closed position. During shift of the valve plunger 41 toward the orifice plug 39 suction is created in the dashpot chamber 50 and fuel from the chamber 16 within the pump housing is drawn into the dashpot chamber through the hole 55. The outlet control valve as the result of its specific design and construction comprehends a quick closing of the needle valve upon

stoppage of the electric motor for the internal gear pump and a pronounced delayed opening of the needle valve upon starting of the pump. By having a delayed opening of the needle valve during starting of the gear pump, there is no flow of fuel to the burner nozzle until the blower of the burner reaches its full capacity and is capable of supplying sufficient air to form a proper combustible mixture at the nozzle of the burner.

The operation of the pump and outlet control valve is as follows: When the electric motor for the blower and gear pump is started, the needle valve 40 is in its closed position with respect to the orifice plug 39 and the valve plunger 41 is in abutment with the plug, as shown in Figure 4. In addition, the dashpot chamber 50 at the outer end of the valve housing 38 is filled with fuel. As soon as the gear pump is set into operation it draws fuel from the chamber 16 within the housing 8 of the pump and such fuel flows into the suction side of the pump via the hole 47 and the groove 44 in the enlarged head 42 of the valve housing. The fuel which is placed under pressure by the action of the gear pump flows through the groove 45 and the duct 48 into the pressure chamber 49 at the inner end of the valve housing 38. As the pumped fuel or pumpage builds up within the pressure chamber the valve plunger moves against the force of its compression spring 69 towards the cap 51, as shown in Figure 5. At this point movement of the valve plunger toward the cap is retarded as a result of the slow evacuation of the fuel in the dashpot chamber and because a part of the pumpage is by-passed into the chamber 16 via the purging hole 71, the annular groove 70, and the by-pass 57. Movement of the valve plunger toward the cap is extremely slow until the inner end of the valve plunger closes the inlet end of the by-pass, as shown in Figure 7.

At this point, the outer end of the plunger comes in contact with the inner end of the enlarged shank 61 of the needle valve and the plunger is in condition or position to effect opening of the needle valve against the force of the compression spring 63. As soon as the inlet end of the by-pass valve is closed by the inner end of the valve plunger and the entire pressure of the pumped fuel or pumpage is applied to the plunger, the plunger is shifted at a slightly increased rate of speed into abutment with the cap 51 and effects opening of the needle valve against the spring 63. As soon as the needle valve is opened, as shown in Figure 7, a part of the pumped fuel or pumpage flows through the orifice 59 in the orifice plug 39 into the socket 58 and then from the socket to the nozzle of the burner via the duct 20, the outlet port 18, and the pipe 21, and the remainder of the fuel or pumpage flows back into the chamber 16 in the housing 8 via the by-pass 57. When the motor for the burner blower and the internal gear pump 9 is stopped, the flow of pumpage or pumped fuel into the pressure chamber 49 diminishes as the gear pump slows down. As soon as the pressure of the pumpage in the pressure chamber is insufficient to hold the valve plunger in its fully opened position, that is, in abutment with the cap 51, the compression spring 69 between the end wall 52 of the cap and the outer end of the valve plunger operates to shift the plunger towards the orifice plug. As soon as the plunger moves from the cap the compression spring 63 for the needle valve shifts the needle valve into its closed position and stops the flow of pumped fuel or pumpage to the nozzle.

After closing of the needle valve, the spring 69

completes the return or retractile movement of the plunger. Such movement is comparatively slow due to the fact that the filling of the dashpot chamber 50 is slow in view of the size of the hole 55. During retraction of the plunger the fuel within the pressure chamber is exhausted to the chamber 16 in the pump housing by way of the purging hole 71, the groove 70 and the by-pass 57. By varying the size of the purging hole 71 or the hole 55 in the end wall of the cap 51, or by changing the characteristics of the valve plunger spring 69 the time it takes to effect opening of the needle valve in connection with starting of the motor for the pump may be adjusted or varied as desired.

The herein described outlet control valve consists of but a small number of parts and hence may be manufactured at a low and reasonable cost. It comprehends an extremely slow or retarded opening of the needle valve in connection with starting of the internal gear pump 9 and in addition a comparatively quick closing of the valve in connection with stoppage of the gear pump, and in this connection effectively and efficiently fulfills its intended purpose.

Whereas the outlet control valve has been described in connection with, and as being adapted primarily for, a fuel pump for an oil burner, it is to be understood that it may be used in connection with other pumps where a delayed opening of the needle valve is desired. It is also to be understood that the invention is not to be restricted to the details set forth since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. An outlet control valve for a liquid pump comprising in combination a housing having a pressure chamber therein with an inlet and an outlet for the pumped liquid and also having a dashpot chamber in communication with the pressure chamber and provided with a bleed hole, a spring closed valve for controlling the outflow of pumped liquid from the pressure chamber to the outlet, a plunger mounted in the housing for sliding movement between the two chambers and adapted in response to the flow of pumped liquid into the pressure chamber to move in the direction of the dashpot chamber, a connection between the valve and the plunger whereby the valve is caused to move into its open position against the force of the spring slightly before the plunger reaches its complete stroke in said dashpot chamber, means for retracting the plunger toward the pressure chamber upon stoppage of the flow of pumped liquid into said pressure chamber, and means for venting the pressure chamber during the retractile movement of the plunger.

2. An outlet control valve for a liquid pump comprising in combination a housing having a pressure chamber with an inlet and an outlet for the pumped liquid and also having a dashpot chamber surrounded with fluid and provided with a restricted bleed-hole whereby it is in communication with such fluid, a spring closed valve mounted in the housing and operative to control the outflow of pumped liquid from the pressure chamber through the outlet, a plunger mounted in the housing for sliding movement between the two chambers and adapted in response to the flow of pumped liquid into the pressure chamber to

move in the direction of the dashpot chamber and exhaust the fluid in the latter via the bleed-hole, a connection between the valve and the plunger whereby the valve is caused to move into its open position against the force of the spring slightly before the plunger reaches its complete stroke in the direction of said dashpot chamber, spring means for retracting the plunger towards the pressure chamber upon stoppage of the flow of pumped liquid into such chamber, and means for venting the pressure chamber of the pumped liquid therein during retractile movement of said plunger.

3. An outlet control valve for a liquid pump, comprising in combination an elongated housing having a longitudinally extending bore therein provided with closed ends and defining at one end thereof a pressure chamber and at its other end a dashpot chamber, and also having for the pressure chamber an inlet and an outlet for the pumped liquid, and a by-pass leading from the central portion of the bore, a spring closed valve for controlling the flow of pumped liquid from the pressure chamber through the outlet, a plunger mounted in the bore for sliding movement from the pressure chamber into the dashpot chamber and back again and adapted in response to the flow of pumped liquid into the pressure chamber to move from said pressure chamber past the by-pass and into the dashpot chamber, a connection between the valve and the plunger whereby the valve is caused to move into its open position against the force of its spring as the plunger moves past the by-pass into the dashpot chamber, means in the form of a purging hole and a circumferential groove in the plunger for effecting limited communication between the pressure chamber and the by-pass during initial movement of the plunger from said pressure chamber into the by-pass chamber in order to retard movement of the plunger, and means for retracting the plunger into the pressure chamber upon stoppage of the flow of pumped liquid into said pressure chamber.

4. In combination with a liquid pump having a housing therefor with a liquid receiving chamber for the liquid to be pumped and pumping elements for the liquid in communication with said chamber, an outlet control valve for the pump comprising a housing in the chamber having a pressure chamber with an inlet and an outlet for the pumped liquid and also having a dashpot chamber with a bleed-hole in communication with the chamber of the pump housing, a spring closed valve for controlling the outflow of pumped liquid from the pressure chamber through the outlet, a plunger mounted in the housing for movement between the two chambers and adapted in response to the flow of pumped liquid into the pressure chamber to move in the direction of the dashpot chamber, a connection between the valve and the plunger whereby the valve is caused to move into its open position against the force of its spring during movement of the plunger in the direction of said dashpot cham-

ber, and means for retracting the plunger toward the pressure chamber upon stoppage of the flow of pumped liquid into said pressure chamber.

5. In combination with a liquid pump having a housing therefor with a liquid receiving chamber for the liquid to be pumped and pumping elements for the liquid in communication with said chamber, an outlet control valve for the pump disposed in the aforesaid chamber and comprising an elongated housing having a longitudinally extending bore therein and having closed ends and one end thereof defining a pressure chamber and the other end thereof defining a dashpot chamber, and also having for the pressure chamber an inlet and an outlet for the liquid pumped by the elements, a bleed-hole establishing communication between the dashpot chamber and the liquid receiving chamber in the pump housing and a by-pass leading from the central portion of the bore to said last mentioned chamber, a spring closed valve for controlling the flow of pumped liquid from the pressure chamber through the outlet, a plunger mounted in the bore for sliding movement from the pressure chamber into the dashpot chamber and back again and adapted in response to the flow of pumped liquid into the pressure chamber to move from said pressure chamber past the by-pass and into the dashpot chamber, a connection between the valve and the plunger whereby the valve is caused to move into its open position against the force of its spring as the plunger moves past the by-pass into the dashpot chamber, means in the plunger for effecting limited communication between the pressure chamber and the by-pass during initial movement of the plunger from said pressure chamber into the dashpot chamber in order to retard movement of the plunger, and means for retracting the plunger into the pressure chamber upon stoppage of the flow of pumped liquid into said pressure chamber.

6. An outlet control valve for a liquid pump, comprising a housing having a bore therein with one end thereof closed and defining a pressure chamber, and also having for said chamber an inlet and an outlet for the pumped liquid and a by-pass leading from the central portion of the bore, a spring closed outlet control valve, a plunger mounted in the bore for sliding movement from the pressure chamber past the by-pass and back again and adapted in response to flow of pumped liquid into the chamber to move from said chamber and thence past the by-pass, a lost motion connection between the valve and the plunger whereby the valve is caused to move into its open position when the plunger moves past the by-pass, means for retracting the plunger toward the pressure chamber upon stoppage of the flow of pumped liquid into said pressure chamber, and means for venting the pressure chamber during the retractile movement of the plunger.

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