

May 4, 1943.

A. G. SCHLOSSER

2,318,337

FLUID PUMP

Filed Oct. 14, 1939

2 Sheets-Sheet 1

Fig. 1.

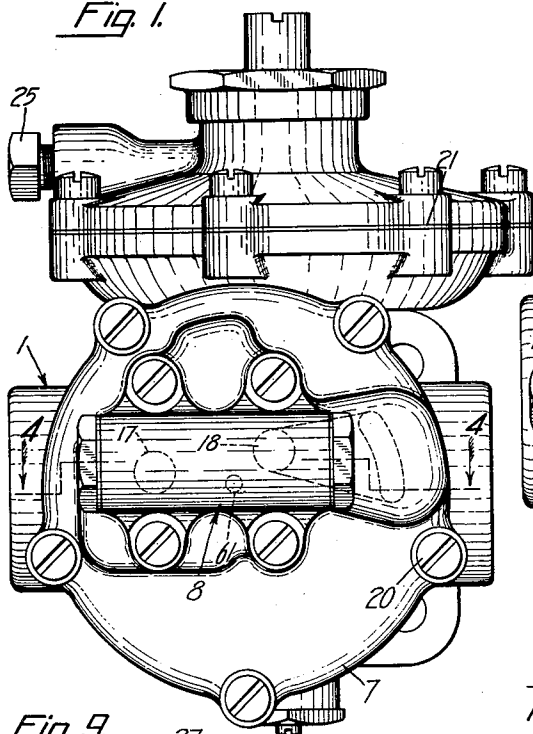


Fig. 2.

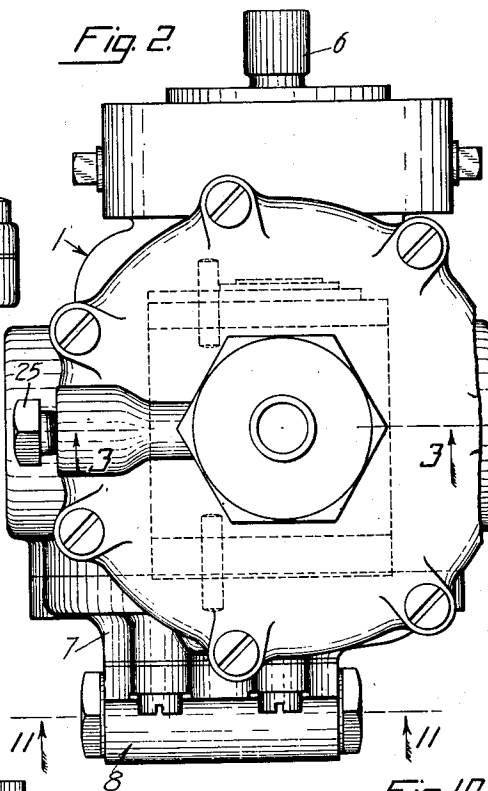


Fig. 9.

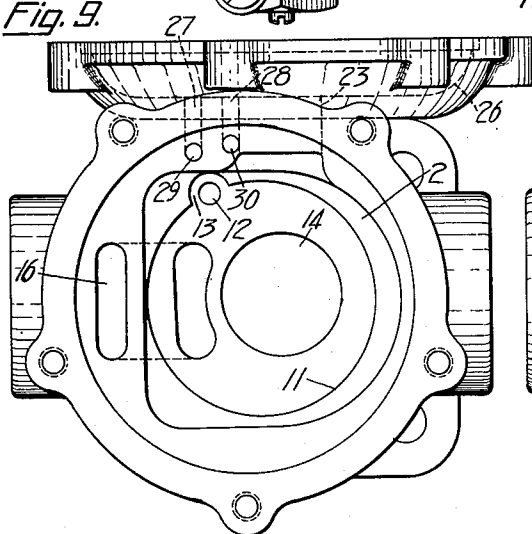


Fig. 10.

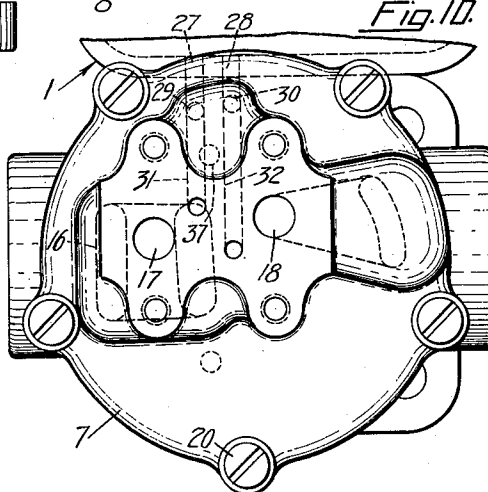
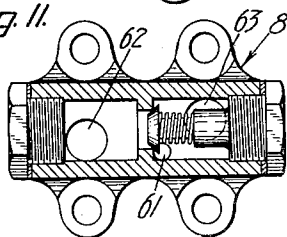


Fig. 11.



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May 4, 1943.

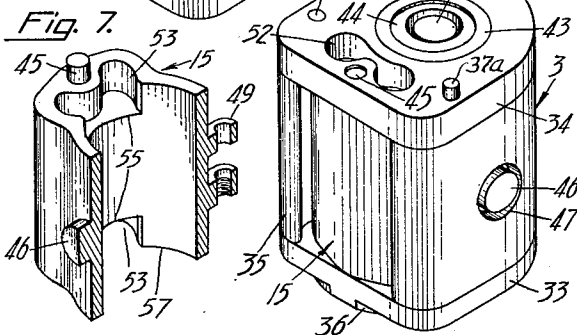
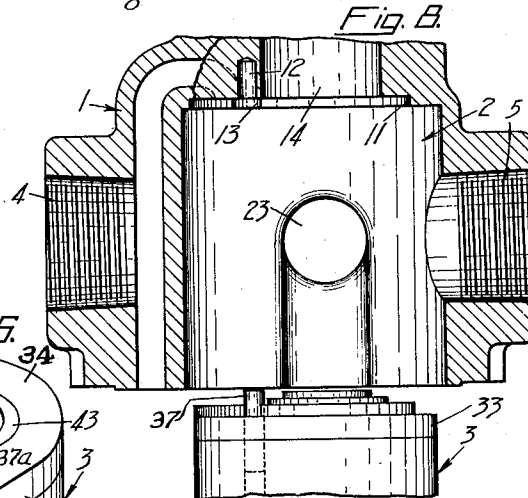
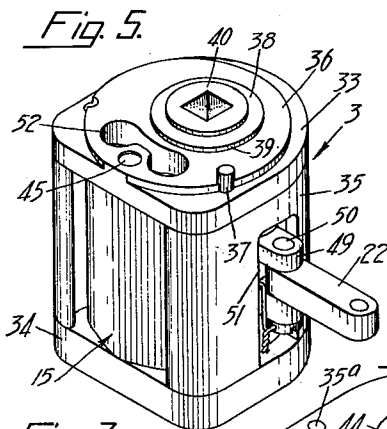
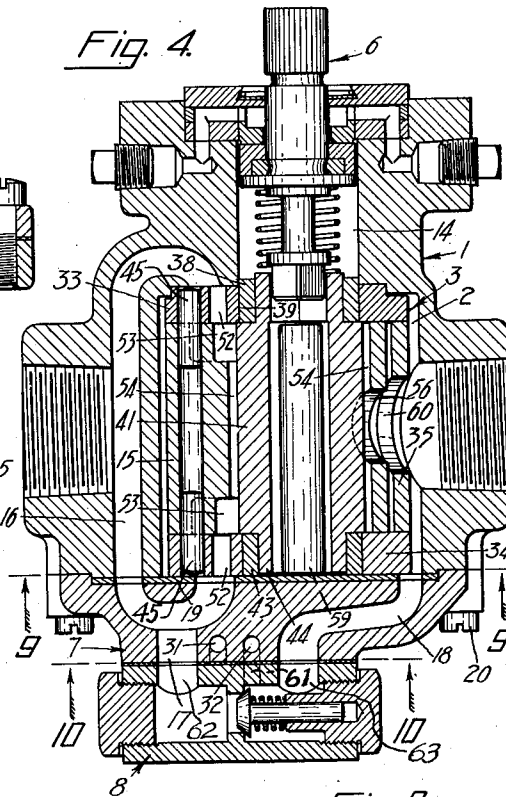
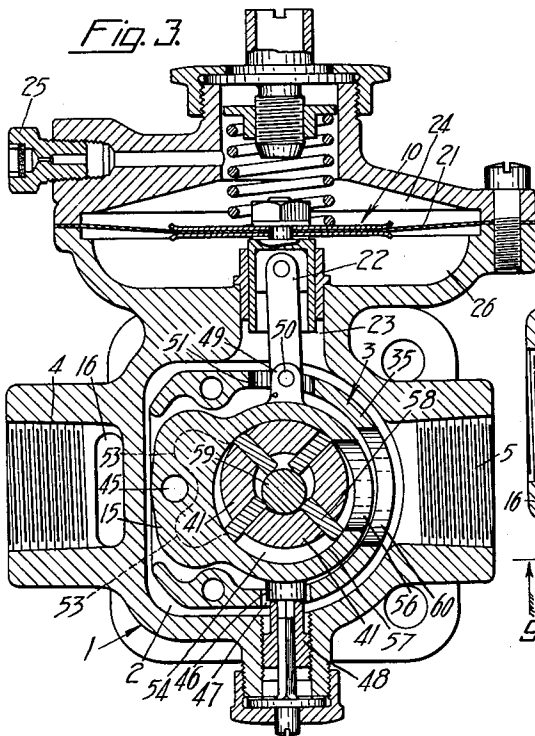
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,318,337

FLUID PUMP

Arthur G. Schlosser, Detroit, Mich., assignor, by
mesne assignments, to Chandler-Evans Corpo-
ration, Meriden, Conn., a corporation of Dela-
ware

Application October 14, 1939, Serial No. 299,567

17 Claims. (Cl. 103—120)

My invention relates to fluid pumps.

It has among its objects to provide an improved fluid pump of the variable capacity type, and, more particularly, such a pump especially adapted to use as a fuel pump for use in airplanes. Further objects of my invention are to provide an improved fuel pump of the type wherein the liner is shifted in the direction of the center of the rotor as the demand for fuel decreases, so that at zero fuel flow the center of the liner is substantially coincident with the center of the rotor, and, more particularly, to provide an improved pump of this type wherein the liner is pivoted, and wherein, through an improved location of the liner pivot, it is made possible to obtain marked advantages as compared with prior constructions of this type. Another object is to provide such an improved pump wherein it is made possible to produce an improved pumping unit adapted to be completed and checked for clearances externally of the pump housing and then inserted in the latter, in such manner as thereby to keep all clearances to a minimum while markedly facilitating manufacture and assembly. A still further object is to provide such an improved pump wherein it is made possible to produce an exceedingly compact pumping unit in such manner as thereby materially to reduce the over-all dimensions of the pump housing and thereby make the same adapted to use within space limits precluding the use of prior constructions. Still other objects of my invention are to provide such an improved pump wherein, while obtaining the above advantages and also making it possible to maintain the movable liner balanced against both inlet suction pressures and outlet pressures, it is also made possible to provide an improved inlet port arrangement disposed in an improved manner relative to my improved pivot, and further to obtain these advantages while requiring only a simple main housing casting which is adapted to be readily machined, and while also enabling my improved pumping unit to be readily assembled and correctly positioned therein with respect to the various ports. Still further objects of my invention are to provide such an improved construction wherein, while obtaining the above advantages, it is also made possible to eliminate objectionable changes in clearance due to changes in temperature, and also made possible readily to provide for operation of the pump in either direction and for by-passing the fluid around the rotor whenever desired while the rotor is not operating. These and other objects

and advantages of my improved construction will, however, hereinafter more fully appear.

In the accompanying drawings, I have shown for purposes of illustration one embodiment 5 which my invention may assume in practice.

In these drawings:

Figure 1 is a side elevation of a fuel pump of my improved construction;

Fig. 2 is a top plan view of the same;

10 Fig. 3 is a vertical section on line 3—3 of Figure 2;

Fig. 4 is a horizontal section on line 4—4 of Figure 1;

15 Fig. 5 is a perspective view of the pumping unit when removed from the housing, showing one end and side of said unit;

Fig. 6 is a similar perspective view showing the other end and side of this unit;

20 Fig. 7 is a detail perspective view of a part of the liner;

Fig. 8 is a view similar to Figure 4 showing the pump housing and also the pumping unit removed therefrom, certain parts of the housing above the unit chamber also being broken away 25 to facilitate illustration;

Fig. 9 is an end view of the pump housing with the end cover and pumping unit removed, the view being on line 9—9 of Figure 4;

30 Fig. 10 is an end elevation of the housing with the end cover thereon and the by-pass valve removed, the view being taken on line 10—10 of Figure 4 looking in the direction of the arrow, and

35 Fig. 11 is a detail sectional view of the by-pass valve on line 11—11 of Figure 2.

In this illustrative construction, I have shown my improved pump as comprising an improved main housing 1 having an improved chamber 2 adapted to receive longitudinally through one end of said chamber, an improved adjustable 40 liner carrying and self contained pumping unit, generally indicated at 3. This pumping unit as shown is adapted to pump fuel supplied through a central lateral inlet 4 to a like oppositely disposed outlet 5, and also has a drive 6 projecting through one end of the housing 1 and adapted to be driven from any suitable rotating part of the engine. The housing 1 also has an improved end 45 cover plate 7 enclosing the opposite end of the unit in chamber 2 and carrying an improved reversible fuel by-passing valve 8, while liner actuating diaphragm mechanism, generally indicated at 10, is carried on the top of the housing 1 and operatively connected to the liner in the 50 unit 3.

The main housing 1 is preferably in the form of a single casting, as usual in standard fuel pumps. However, attention is directed to what may be called the generally D-shaped cross section and opposite open and closed ends of the chamber 2. It will also be observed that an eccentrically disposed bore 11 is provided on the closed inner end wall of this chamber, and that a dowel hole 12 is provided in this bore adjacent the periphery thereof and partially surrounded by a small counter-bore 13. Further, a bore 14 is provided through this end of the housing which is disposed eccentrically relative to the bore 11 to receive the drive shaft 6 and leads into the chamber 2. Herein a liner 15 is also pivoted in the pumping unit 3 in an improved manner as hereinafter described and improved inlet and outlet connections are provided in the housing 1 and this unit 3 and liner 15 which are adapted to balance this liner against both inlet suction pressures and outlet pressures, these connections being of the type described and claimed in a co-pending application of Milton E. Chandler, Serial No. 407,798, filed August 21, 1941. As shown, these connections include branching inlet passages 16 leading from the central inlet 4 to the opposite ends of the liner. However, herein these passages 16 cooperate with improved inlet passages in my improved pumping unit 3, as hereinafter described. Also, it will be observed that the end cover plate 7 herein is provided with ports 17 and 18 communicating with the reversible by-passing valve 8, as hereinafter described, while it will further be noted that when my improved pumping unit 3 is in position in the chamber 2, this end cover plate 7 acts to compress a suitably resilient gasket 19 between said plate and the adjacent ends of the housing 1 and unit 3 and thereby position the pumping unit in operative position in its chamber, the end cover plate 7 being fixed to the housing 1 by suitable peripheral screws 20.

Attention is further directed to the fact that, while the diaphragm mechanism 10 may assume different forms, the same herein includes a spring connected diaphragm 21 having a pivoted link connection 22 to the liner 15 pivoted in the pump unit 3, this link extending through a top passage 23 in the housing 1 into the chamber 2. Further, it will be understood that the chamber 24 above the diaphragm 21 is adapted to be connected in a usual manner, as through a suitable connection 25, to a supercharger, not shown, on the entrance side of the carburetor, so that the pressure in this chamber 24 is the same as the pressure at the entrance of the carburetor. Also, it will be understood that the chamber 26 below the diaphragm 21 communicates with the pressure side of the pump and is always under pressure, the same herein communicating through one or the other of ports 27, 28 which, in turn, communicate through ports 29 and 30 extending longitudinally of the housing 1 and also communicating with ports 31 and 32 communicating with the reversible by-passing valve 8, as hereinafter described. Thus, it will be evident that as the pressure at the entrance side of the carburetor is varied, the diaphragm 21 will be operated in such manner as to operate the link 22, and accordingly adjust the liner 15 in my improved unit 3 in such manner as to vary in the same proportion the discharge pressure of the pump.

Referring more particularly to my improved pumping unit 3, it will be noted that the same is

also of generally D-shaped cross section and adapted to be received longitudinally in chamber 2. More particularly, this pumping unit includes an inner end plate 33, an outer end plate 34, and an intermediate horseshoe-shaped spacer 35 extending longitudinally between and closed at its ends by these plates 33 and 34 and enclosing the liner 15, while as hereinafter described also having an open side along the pivot thereof and an oppositely located central outlet. Herein, these end plates 33, 34 and spacing member 35 are suitably dowelled together by dowels 35a to form an improved unit frame in which the liner 15 is pivoted in an improved manner, and in which the rotor is also suitably journaled in the end plates, all as hereinafter described and in such manner as to produce an improved self contained pumping mechanism. As shown, the inner end plate 33 is provided with an eccentric boss 36 adapted to be received in the bore 11 in the inner end wall of the chamber 2, and this plate 33 also carries a dowel 37 receivable in the dowel hole 12 in that end wall, while a sleeve 38 is disposed in a bore 39 in this end plate and forms a bearing for the protruding end 40 of the pump rotor 41. The outer end plate 34 has a plane inner face and carries a similar bearing sleeve 43 for the opposite protruding end 44 of the rotor 41 and also carries a dowel 37a similar to the dowel 37 receivable in a corresponding dowel hole in end cover plate 7. Between these end plates 33 and 34, the liner 15 is suitably pivoted close to the flat side of the unit 3, herein adjacent the inlet 4, and on short oppositely extending pivot pins 45 seated in the opposite ends of the liner 15 and extending into the opposite end plates 33 and 34. Here it will also be noted that the liner is provided with a boss 46 on its bottom projecting through a corresponding opening 47 midway between the ends of the bottom of the spacer 35 and adapted to cooperate with a suitable adjustable stop 48 projecting through the bottom of the main housing 1 and establishing the maximum capacity position of the liner 15. Moreover, it will be observed that on the top of the liner, spaced bosses 49 are provided having the inner end of the link 22 pivotally mounted therein by a bolt 50, these bosses extending out substantially midway between the ends of a longitudinal slot 51 in the top of the spacing member 35 in such manner as to permit ready access to the bolt and ready wiring thereof, if desired, in the manner usual to Army or Navy requirements.

Referring more particularly to the fluid flow through this pumping unit 3, it will be observed that herein the fuel inlet passages 16 communicate with ports 52 in the end plates 33 and 34 which are enlarged and extend to opposite sides of the pivot pins 45 for the liner, as shown in Figures 5 and 6. These ports 52 also have corresponding registering ports 53 in the opposite ends of the liner 15, one of which is shown at one end thereof in Figure 7, and communicate with the interior 54 of the liner through like peripheral ports 55 in the liner at opposite ends thereof. As shown, the liner is also provided with a central outlet 56 on the side thereof opposite its pivot and with intermediate inner surface portions 57 thereon. Moreover, it will be observed that the rotor 41 herein has four usual reciprocally mounted radial vanes 58 therein having their inner ends cooperating with an axial floating roll member 59 within the rotor 41, these vanes herein also being so spaced from one another that one of these vanes always engages, and acts

as a seal between, the rotor 41 and the liner 15. Further, the D-shaped spacing member 35 is also provided with a central outlet 60 opposite the central outlet 56 in the liner and opposite the flat side of the unit.

In the operation of my improved construction, it will be evident that, depending upon the position of the diaphragm 21 and the resultant demands for fuel through the pumping unit 3, the liner 15 will be so adjusted by the link 22 connected to this diaphragm as to move the liner toward or from the center of the rotor. Thus, as the demand for fuel is decreased, the liner 15 will move about its pivots 45 toward the center of the rotor 41 and in such manner that at zero fuel flow, the center of the liner is practically coincident with the center of the rotor, in such manner as thereby automatically to vary the capacity of the pumping unit 3 as the liner 15 is thus moved about its pivots.

In my improved construction, it will also be noted that the by-passing valve 8 is of an improved construction enabling the same to be readily reversed to reverse the rotation of the pump without requiring changes of any other parts. Herein, a port 61 is provided intermediate the ends of this valve which is adapted to register with either of the ports 31, 32 in the end cover 7. This valve 8 is also provided with a plurality of larger by-pass ports 62, 63 selectively adapted to cooperate with the ports 17 and 18 in the end cover 7. Thus, when the valve is disposed as shown in Figure 4 with the port 61 communicating with the port 32, the pump unit 3 will then rotate in one direction, while when, for any reason, it is desired to by-pass fuel around the pumping unit 3, as when the latter is stationary, fuel will then flow from the inlet passage 16 through the port 17 in the end cover 7, through the port 62 in the by-passing valve 8, and through the latter to the port 63 therein and the port 18 in the end cover 7, to the outlet 5 whenever fuel is supplied under pressure through the inlet 4. However, if the valve 8 is removed and turned through 180° and replaced, it will be observed that the port 61 will then be in position to communicate with the port 31 so that the pump may operate in the opposite direction, and that the ports 62 and 63 will then communicate with ports 18 and 17, respectively, in such manner as suitably to by-pass the pumping unit whenever desired. It will of course be understood that when so reversed the fluid will enter the pump at 5 and passing through the port 56 in the liner will pass out of the latter through the ports 53, 52 and passage 16 to the passage 4 which then becomes the outlet.

As a result of my improved construction, it is made possible for the entire pumping unit 3 to be completed and checked for clearances before it is inserted in the pump housing, in such manner as with certainty to determine that the desired clearances are present, and thereby to insure efficient operation of the pump and prevent leakage and loss of pumping ability at low speeds. Further, by the provision of my improved self-contained and bodily insertable and removable pumping unit 3, it will be observed that the pump is very readily and quickly assembled and serviced, while this unit is readily and definitely located, by its dowel, the eccentric boss thereon, and the end cover 7, in the desired position in the chamber 2 to insure proper registry of the several ports. Attention is also particularly directed to the marked reduction in lateral dimensions made

possible by my improved location of the pivots 45 for the liner, and to the fact that through my improved inlet passages opening through the end plates of the units, sufficient capacity is maintained through the latter while maintaining the liner pivots in their desired location, and while also continuing to maintain the delivery of the fuel at opposite ends of the pumping unit in such manner as effectively to balance the liner. Obviously, upon removal of the plate 7, the whole pumping unit 3 may be withdrawn. Attention is also directed to the facility with which the pumping unit may be disassembled when desired, all of the parts including the liner being readily accessible and removable upon removing the dowels. It will further be noted that wear upon the parts of the pumping unit is minimized and that the only parts thereof in contact with the housing 1 are the end plates 33 and 34. It will also be evident that through my improved construction it is made possible to provide a simple, yet readily machined housing 1, and further to eliminate the need for accurate holding of dimensions in this housing. It will also be apparent that the construction is of such character that all parts, including or excluding the cover 7 as desired, may be made of the same material, in such manner as thereby to minimize changes in clearance arising from changes in temperature. These and other advantages of my improved construction will, however, be apparent to those skilled in the art.

While I have in this application specifically described one embodiment which my invention may assume in practice, it will be understood that this form thereof has been shown for purposes of illustration, and that the invention may be modified and embodied in various forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. A pumping unit for fuel pumps comprising end plates having bearings, spacing means between and connected to said plates and forming a unitary frame, a liner pivoted in said end plates and housed in said frame, and a rotor journaled in the bearings of said end plates and rotatable within said liner having slots therein and vanes sliding in said slots and engaging the inner periphery of said liner, said unit frame and liner having inlet and outlet passage means communicating with said rotor through said liner and having one of said passage means formed in and extending through said end plates and formed in and extending through the ends of said liner adjacent the liner pivot.

2. A pumping unit for fuel pumps comprising end plates having aligned bearings, a spacing member between and connected to said plates and forming a unitary frame, a liner pivoted in said end plates and housed in said frame, said end plates and the ends of said liner having formed therein communicating fluid passage means adjacent the pivot of said liner, a rotor journaled in the bearings of said end plates and rotatable within said liner, said rotor having slots therein and vanes sliding in said slots and engaging the inner periphery of said liner and second fluid passage means extending through the frame and liner communicating with the space between the rotor and the liner on the side thereof opposite to that of said first named fluid passage means, the liner pivot being disposed adjacent the periphery of said unit and said frame having a substantially flat side and an opening in said

spacing member formed in said flat side into which opening the adjacent side wall of said liner projects, and said pivot being disposed adjacent said opening.

3. A pumping unit for fuel pumps comprising end plates having aligned bearings, spacing means between and connected to said plates to form a unitary frame and having an open side, a liner pivoted in said end plates and having its pivot portion projecting into the opening in said side, and a rotor journaled in the bearings of said end plates and rotatable within said liner, said rotor having slots therein and vanes sliding in said slots and engaging the inner periphery of said liner, said frame and liner having fluid inlet and outlet passage means communicating with the rotor.

4. A pumping unit for fuel pumps insertable as a unit in a pump casing and comprising end plates, spacing means between and connected to said plates, a liner housed in said unit and having a pivotal mounted therein, and a rotor journaled in said end plates and rotatable within said liner, said rotor having slots therein and vanes sliding in said slots and engaging the inner periphery of said liner, and said unit having communicating inlet and outlet passage means including fluid passage means communicating with said rotor and formed in and extending through said plates adjacent the liner pivot at opposite ends of said unit and formed in and extending through the opposite ends of said liner adjacent the pivot thereof for subjecting the liner to equal pressures at opposite ends thereof.

5. A pumping unit for fuel pumps comprising end plates, spacing means between and connected to said plates, a liner pivoted in said unit, and a rotor rotatable in said liner, said rotor having slots therein, vanes slidable in said slots and contacting at one end thereof the inner peripheral wall of said liner, said liner having centrally located side fluid passage means and said liner and end plates having enlarged fluid passage means therein communicating with each other at opposite ends of said unit and extending to opposite sides of the liner pivot and leading into said liner.

6. In a fluid pump, a pump housing having a longitudinally extending chamber therein, a self-contained pumping unit insertable as a unit longitudinally in said chamber and having an adjustable liner pivoted in said unit, and means for adjusting said liner about its pivot from the exterior of said pump housing, said housing having fluid passage means therein communicating with said chamber at opposite ends of the latter and adjacent the liner pivot at one side of the longitudinal center line of said chamber and said housing also having fluid passage means communicating with the opposite side of said chamber from said end fluid passage means, and said pumping unit having fluid passage means in its opposite ends adjacent the liner pivot and at one side of the longitudinal center line thereof and fluid passage means in the opposite side thereof and having said end and side fluid passage means in said unit communicating respectively with the end and side fluid passage means in said housing.

7. In a fluid pump, a housing having a longitudinally recessed chamber, a pumping unit receivable longitudinally in said chamber including end members having bearings therein and a rotor journaled in said bearings, means eccentrically disposed around the unit axis, including a

boss eccentric with respect to said axis on one end of said unit and cooperating socket means for receiving said boss and recessed in one end of said chamber, for locating said unit against rotation therein, and cover means for said chamber abutting the other end of said unit also positioning said unit longitudinally therein.

8. In a fluid pump, a housing having a longitudinally recessed chamber, a pumping unit receivable longitudinally in said chamber comprising connected pumping elements operable as a unit prior to insertion into said chamber, means on said unit and in one end of said chamber for locating said unit therein in a predetermined angular relation, and cover means for said chamber also positioning said unit therein in said angular relation against longitudinal displacement, said means on said unit and chamber including a cooperating boss and socket disposed around and eccentrically with respect to said chamber axis, and said unit and pumping elements including a rotor journaled therein eccentrically of said boss and socket and concentrically of said housing chamber.

9. In a fluid pump, a pump housing having a chamber and a cover member therefor, pumping means in said chamber including a frame and rotor and adjustable liner means in said frame, said rotor having slots therein and vanes slidable in said slots and engaging at one end the inner periphery of said liner, inlet and outlet connections for said pump housing and said pumping means including end inlets for the latter and a supply passage for one of said inlets in said pump housing, and reversible by-pass means including a reversible by-pass valve mounted on said cover member, said supply passage extending into said cover member and communicating with the other end inlet and said cover member also having a passage leading to the pump housing outlet and said by-pass valve having port means selectively connectible with said passages in said cover member.

10. In a fluid pump, pumping means including an adjustable liner, fluid inlet and outlet ports for the interior of said liner, a rotor rotatable in said liner having slots therein, vanes slidable in said slots and engaging at one end the inner periphery of said liner, fluid pressure means responsive to changes in pump discharge pressure and operatively connected to adjust said liner and vary the pump output, and reversible by-passing mechanism for use in reverse operations of said pump and in by-passing the latter in either direction of operation thereof including spaced fuel by-passing passages communicating with the interior of said liner at opposite sides of said rotor and a valve casing having a longitudinally extending valve chamber therein ported intermediate its ends and having a valve controlling the flow through the port therein, ports on only one face of said casing including inlet and outlet ports on opposite sides of the intermediate port therein and communicating with said passages, said valve casing having a port in said chamber at one side of the intermediate port and opening through said face, and also having a closed portion on said face on the opposite side of said intermediate port and on the opposite side of the longitudinal center line of said chamber, and passages in constant communication with said fluid pressure responsive means and adapted alternatively to communicate with said last named port in accordance with the position of said reversible by-pass mechanism.

11. In a fluid pump, a pump housing having a chamber therein and opposite inlet and outlet connections thereto, a unit frame disposed in said chamber, means at the opposite ends of said unit frame for supporting said unit frame in said chamber, a rotor journaled in the ends of said unit frame, a liner enclosing said rotor and pivoted in said unit frame between said inlet and outlet connections and spaced from the inner walls of said unit frame, said rotor having slots therein, and vanes slidable in said slots and engaging at one end the inner periphery of said liner, means extending through said unit frame for moving said liner about its pivot from the exterior of said pump housing, and fluid passage means through said pump housing, unit frame and liner, including means for maintaining balancing pressures acting on said liner on opposite sides of its pivot in the space between said liner and said unit frame.

12. In a fluid pump, a pump housing having a chamber therein and opposite inlet and outlet connections thereto, a unit frame disposed in said chamber and spaced from the walls thereof, means at the opposite ends of said unit frame for supporting the same in said spaced relation to the chamber side walls, a rotor journaled in the ends of said unit frame, a liner enclosing said rotor and pivoted in said unit frame between said inlet and outlet connections and spaced from the inner walls of said unit frame, said rotor having slots therein and vanes slidable in said slots and engaging at one end the inner periphery of said liner, means extending through said unit frame for moving said liner about its pivot from the exterior of said pump housing, and fluid passage means through said pump housing, unit frame and liner, including means for maintaining balancing pressures acting on said liner on opposite sides of its pivot in the space between said liner and said unit frame, and also including passage means communicating with said rotor through the ends of said chamber, unit frame and liner, to provide balancing pressures at opposite ends of said liner.

13. In a fluid pump, a pump housing having side and end walls forming a chamber therein, a pump unit insertable as a unit and disposed in said chamber and having a unit frame comprising side frame portions and end walls and having said side portions spaced from the side walls of said chamber, a rotor journaled in the ends of said pump unit, and a liner in said unit surrounding said rotor and adjustable relative to said rotor to vary the capacity of said pump unit, said rotor having slots therein and vanes slidable in said slots and engaging at one end the inner periphery of said liner, inlet and outlet passage means in said pump housing and pump unit communicating with said rotor and vanes through said liner, and means at the opposite ends of said chamber and pump unit for positioning said unit in said chamber while maintaining said frame spaced from the side walls of said chamber.

14. In a fluid pump, a pump housing having side and end walls forming a chamber therein, a pump unit insertable as a unit and disposed in said chamber and having a unit housing comprising side and end walls and spaced from the side walls of said chamber, a rotor journaled in

the ends of said pump unit housing, and a liner in said unit having surrounding said rotor and adjustable relative to said rotor to vary the capacity of said pump unit, said rotor having slots therein and vanes slidable in said slots and engaging at one end the inner periphery of said liner, inlet and outlet passage means in said pump housing and pump unit communicating with said rotor and vanes through said liner, and means at the opposite ends of said chamber and pump unit for positioning said unit in said chamber while maintaining said unit housing spaced from the side walls of said chamber including cooperating projecting and socket means at the same end of said unit housing and chamber and means including a removable pump housing closure member at the opposite end of said chamber and acting on the opposite end of said unit housing for maintaining said cooperating means in operative relation.

15. A fluid pump as claimed in claim 14 and having said cooperating projecting and socket means annular and eccentrically disposed relative to the axis of said rotor, said projecting means being on said unit housing and said socket means being formed in a wall of said chamber, and also having means for fixing said projecting means on said unit housing against rotation relative to the cooperating socket means in the end of said chamber.

16. A pumping unit comprising a frame including end members and means rigidly connecting said members together in spaced relation to form a self-contained unit insertable as a unit in a pump housing, end bearings in said members, a liner pivotally mounted between said end members, a rotor journaled in said end bearings and extending through said liner, said rotor having slots therein and vanes sliding in said slots and engaging the inner periphery of said liner, means for longitudinally balancing said liner including fuel passage means formed in said end members and in the opposite ends of said liner and communicating with one side of said rotor, and means for balancing said liner about its pivot including fuel passage means having free communication with both the outside of said liner and with the opposite side of said rotor in all angular positions of said liner, one of said fuel passage means constituting the pump inlet passage and the other of said fuel passage means constituting the pump outlet passage.

17. A self-contained pumping unit insertable as a unit in a pump housing and including a unitary frame having end plates and means rigidly connecting said plates, end bearings in said plates, a liner pivotally mounted in said frame, and a rotor journaled in said end bearings and extending through said liner, said rotor having slots therein and vanes sliding in said slots engaging the inner periphery of said liner, and said end plates and liner having fluid passages formed therein and extending through said end plates and through said liner between the liner pivot and the rotor axis and communicating with the interior of said liner, and fluid passages extending through said frame and liner and communicating with the space between said rotor and said liner on the side thereof opposite to that of the first-named fluid passages.

ARTHUR G. SCHLOSSER.

CERTIFICATE OF CORRECTION.

Patent No. 2,318,337.

May 4, 1943.

ARTHUR G. SCHLOSSER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 5, second column, line 2, for "having" read --housing--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22nd day of June, A. D. 1943.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.