

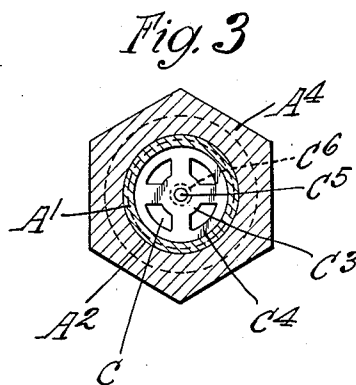
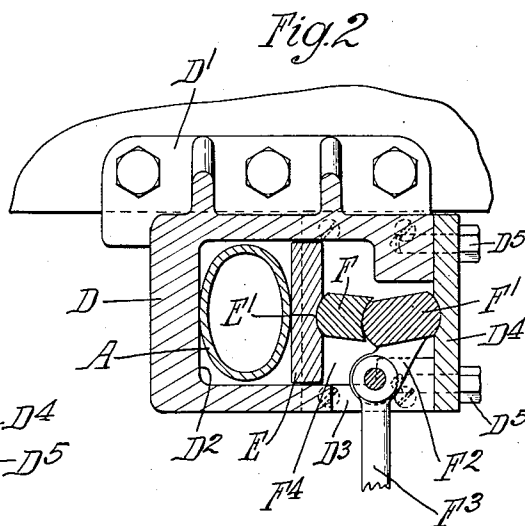
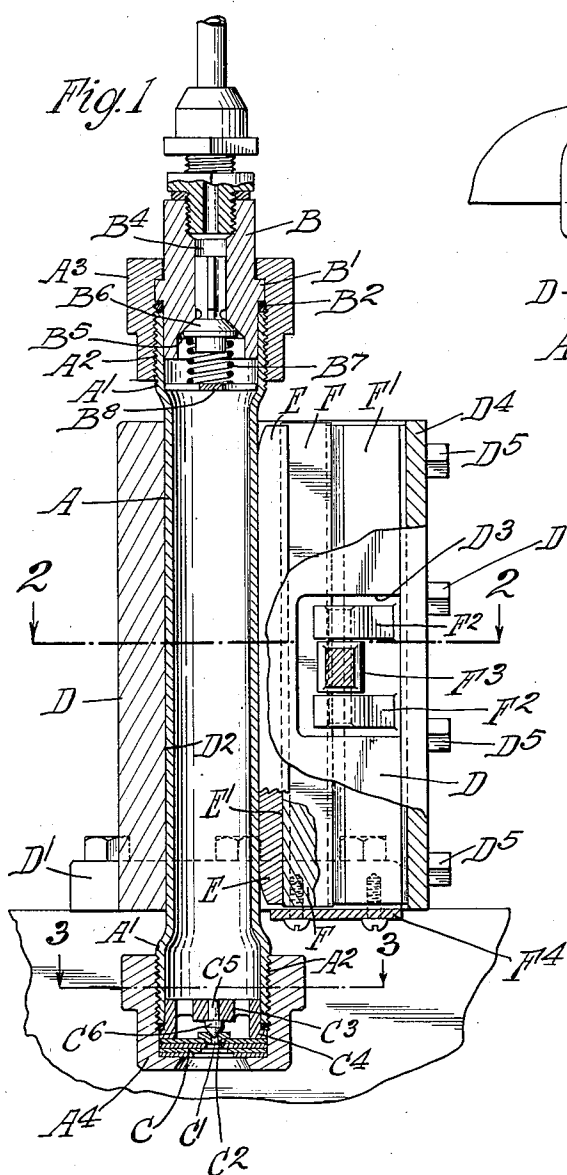
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PUMP

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PUMP

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13 Claims. (Cl. 103—148)

This invention relates to a pump and particularly to a pump adapted to deliver a small quantity of fluid under great pressure and with great speed.

It has for one object to provide a pump in which the mechanical shock due to the movement of the pump and its driving mechanism is reduced to a minimum. Another object is to provide a pump in which sliding surfaces within the pressure chamber are eliminated. Another object is to provide a pump in which the walls or a part of the walls of the pump chamber are elastic.

Other objects will appear from time to time in the specification and claims.

The invention is illustrated more or less diagrammatically in the accompanying drawing, wherein—

Figure 1 is a longitudinal cross section illustrating the pump and the means for operating it;

Figure 2 is a transverse section taken at line 2—2 of Figure 1;

Figure 3 is a transverse cross section taken at line 3—3 of Figure 1.

Like parts are designated by like characters throughout the specification and drawing.

A is a pump tube. It may be made of steel or other suitable material and is preferably of oval cross section throughout the major portion of its length, as indicated in Figure 2. For convenience of attachment, it is preferably rounded adjacent its ends as at A¹ and is exteriorly threaded as at A². Removably mounted upon one end of the tube is a valve housing retaining member A³. Removably mounted on the opposite end of the tube is a second valve housing retaining member A⁴. Normally the member A³ retains an inlet valve housing and the member A⁴ retains a discharge or outlet valve housing.

B is an inlet valve housing provided with an interior cavity and with a laterally extending flange B¹ which is engaged by a collar A³. B² is a gasket or packing designed to prevent leakage. B⁴ is a cavity within the housing B. It is enlarged adjacent its inner end to provide a seat portion B⁵ for a valve B⁶ which is mounted for movement within the valve housing and is normally held on its seat by a spring B⁷ which at one end abuts against the valve B⁶ and at its other end against a spider or similar retaining member B⁸.

The pump of the present invention is of particular importance when used as a fuel injection pump for internal-combustion engines. When so used instead of the conventional outlet or discharge valve in the outlet end of the pump tube,

there may be seated an injection valve from which fuel is injected directly into the engine. Such a valve is indicated in the outlet or discharge end of the pump tube as shown in Figure 1. The inwardly turned edges of the collar A⁴ engage and support a valve disc C which is perforated as at C¹ and which carries about the perforation a seating part C². As indicated, the valve disc C is made up of a plurality of laminations and the seating plug C² is a separately formed member inserted and seated in the upper valve disc. Such an injection or atomizing valve is shown in my prior Patent 1,589,241, issued June 15, 1926. Instead of the laminated valve disc shown a valve disc formed of a single integral member such as that shown in my prior Patent 1,589,245, issued June 15, 1926, might be used. It is a characteristic of these valves, whether they be formed with a single valve disc or with laminations, that the disc, instead of being readily flexible, is extremely rigid, so much so that the valve opening permitted when the disc yields to pressure within the pump or within the valve, is normally from .0001 to .001 inch in width. It will thus be seen that the valve disc is extremely stiff and that the amount which it yields is microscopic and that the size of the opening produced by its yielding is microscopic. This is true even under pressures of many thousands of pounds per square inch. Such discs and valves resist displacement mainly by their resistance to mass deformation and as ordinarily made require a pressure of several thousand pounds per square inch to effect any valve opening. Positioned adjacent the valve disc is a spider or supporting member C³ which may be provided with a downwardly or outwardly projecting flange C⁴, which rest upon the valve disc C adjacent its edges and are engaged between it and the end of the tube A¹ and thus the spider is held with the valve disc by the collar A⁴. Fixed within the spider C³ is a needle valve member C⁵ having a point C⁶ adapted to be seated in and to close the seat member C² which is carried by the valve disc C. As the parts are normally assembled, the valve disc is pressed up against the needle member so that the latter is seated in and closes the opening through the valve disc and the disc is under pressure.

D is a pump clamp or support provided with a flange or base D¹ by means of which it may be secured to any suitable support or foundation. The clamp D is provided with an interior cavity or hollow D² and is open at its ends and closed along its sides, except as at D³, where an opening is provided for the pump drive which will be de-

scribed below. A removable plate D⁴ which is adapted to be bolted into position by bolts D⁵, completes the pump clamp. As indicated in Figures 1 and 2 the pump clamp surrounds the pump tube and contains a plate or compression block E which preferably extends substantially throughout the entire length of the clamp and is, at its longitudinal edges, in sliding contact with the interior of the clamp. It bears against the tube A as indicated in Figures 1 and 2, and has formed in its opposite face a depression or concavity E¹. Within the depression E¹ lies F, which is one of a pair of toggle members F, F¹. Upon the toggle member F¹ are projecting lugs or ears F² to which a connecting rod or pump drive member F³ is attached. F⁴ is a retaining plate.

It will be realized that whereas I have herewith shown and described a practical operative device, nevertheless many changes might be made in the size, shape, number and disposition of parts without departing from the spirit of my invention and I wish, therefore, that my showing be taken as in a sense diagrammatic.

The use and operation of this invention are as follows:

With the parts assembled as shown in Figures 1 and 2, the tube is not under compression from the clamp or from the compression block E and the toggle members which actuate the compression block in the compression direction are in their free angular relation. The tube is assumed to be filled with fluid from a previous suction stroke. The member F³ is moved inward with respect to the clamp and forces the toggle members from the angular position shown in Figure 2 toward a position of alignment. They thus exert a compression upon the block E and force the block against the oval tube, compressing its minor axis slightly, normally not more than a few thousandths of an inch, and thus decreasing its internal volume and building up the pressure within it sufficiently to open the injection valve and to cause fluid discharge.

During this building up of pressure the suction or inlet valve is closed by pressure from within the tube.

As the pressure rises within the pump tube, due to the increasing compression which is applied to it, the heavy diaphragm or disc at the discharge end of the tube is loaded to a point sufficient to overcome its initial tension which was created by its firm seating upon the rigid needle point. The diaphragm or disc then moves away from the needle point a very minute distance, forming an atomizing orifice normally of microscopic size around the needle point and through this orifice the high pressure within the tube escapes into the engine cylinder.

The function of atomization of the fuel as it is thus discharged into the engine cylinder from the pump is performed at the narrow slit between the needle point and the aperture in the diaphragm or disc, since the movement of the disc is not sufficient to withdraw the needle point from it but merely to unseat the needle point or break its contact slightly with the disc. As the fuel issues from the atomizing nozzle or valve it is substantially ready for combustion with the air in the cylinder.

Although the atomizing valve form which is shown herewith and my other valve, which is referred to above, are both peculiarly fitted to be used in co-operation with the pump of the present application, many other mechanisms and many other atomizing valves might be used and

they would all have in common the idea of the substitution of an atomizing valve for the customary discharge or outlet valve of a pump mechanism. For some purposes it would be possible to use both a conventional discharge valve and an atomizing valve.

After discharge from the pump has taken place, due to the building up of pressure within the pump tube because of its compression by the toggle mechanisms, as above set out, the drive moves in the reverse direction, again moving the toggles away from their position of alignment and toward their position of free angular relation and thus removing the compression upon the compression block or plate E and freeing the pump tube from compression. When this occurs the pump tube moves or springs outwardly towards its former position, its minor axis increases to its original dimension, suction within the tube replaces compression, the discharge valve in whatever form it may be closes, the intake or inlet valve opens and a charge of fluid is drawn in. Thus a suction stroke is completed.

The yielding member or members of the pump chamber of this invention is subject to strains well within its elastic limit. The pump chamber is enclosed by walls wholly or in part approximately rigid, capable of minutely yielding and preferably of returning to original position of their own elasticity when free to do so. If parts of the wall are not approximately rigid, they are rigid.

I claim:

1. Means for operating a pump, which pump comprises a hollow member, inlet and outlet means therefor, means for deforming the hollow member to change its volume, said means including a structure fixed with relation thereto, surrounding and in contact with said hollow member, a toggle in contact with the structure and adapted to be moved to exert pressure upon the hollow member and means for moving said toggle.

2. Means for operating a pump, which pump comprises a hollow member, inlet and outlet means therefor, means for deforming the hollow member to change its volume, said means including a structure fixed with relation thereto and in contact with said hollow member, and a movable compression member in contact with said hollow member, a toggle in contact with the compression member, adapted to be moved to exert pressure upon the hollow member through the compression member and means for moving said toggle.

3. In combination in a pump, a hollow member, inlet and outlet means therefor, means for deforming the hollow member to change its volume, said means including a structure fixed with relation thereto and in contact with said hollow member, and a movable compression member in contact with said hollow member, a toggle within the structure, in contact with the compression member, adapted to be moved to exert pressure upon the hollow member through the compression member and means for moving said toggle.

4. In combination in a pump, a hollow member, inlet and outlet means therefor, means for deforming the hollow member to change its volume, said means including a structure fixed with relation thereto, surrounding and in contact with said hollow member, a toggle adapted to be moved to exert pressure upon the hollow member and means for moving said toggle.

5. In combination in a pump, a hollow member, inlet and outlet means therefor, means for deforming the hollow member to change its vol-

ume, said means including a structure fixed with relation thereto, surrounding and in contact with said hollow member, and a compression member in contact with said hollow member, a toggle in contact with the compression member and adapted to be moved to exert pressure upon the hollow member through the compression member, and means for moving said toggle.

6. In combination in a pump, a hollow member, inlet and outlet means therefor, means for deforming the hollow member to change its volume, said means including a structure fixed with relation thereto, surrounding and in contact with said hollow member, and a movable compression member within said structure, in contact with said hollow member, a toggle within the structure, in contact with the compression member and with the structure, and adapted to be moved to exert pressure upon the hollow member through the compression member and means for moving said toggle.

7. In combination in a pump, an approximately rigid hollow member, inlet and outlet means therefor, means for deforming the hollow member to change its volume, said means including a structure fixed with relation thereto and in contact with said hollow member, a toggle in contact with the structure and adapted to be moved to exert pressure upon the hollow member, and means for moving said toggle.

8. In combination in a pump, an approximately rigid hollow member, inlet and outlet means therefor, means for deforming the hollow member to change its volume, said means including a structure fixed with relation thereto, surrounding and in contact with said hollow member, a toggle in contact with the structure and adapted to be moved to exert pressure upon the hollow member and means for moving said toggle.

9. In combination in a pump, an approximately rigid hollow member, inlet and outlet means therefor, means for deforming the hollow member to change its volume, said means including a structure fixed with relation thereto and in contact with said hollow member, and a movable compression member in contact with said hollow member, a toggle in contact with the compression member, adapted to be moved to exert pressure upon the hollow member through the compression member and means for moving said toggle.

sion member and means for moving said toggle.

10. In combination in a pump, an approximately rigid hollow member, inlet and outlet means therefor, means for deforming the hollow member to change its volume, said means including a structure fixed with relation thereto and in contact with said hollow member, and a movable compression member in contact with said hollow member, a toggle within the structure, in contact with the compression member, adapted to be moved to exert pressure upon the hollow member through the compression member and means for moving said toggle.

11. In combination in a pump, an approximately rigid hollow member, inlet and outlet means therefor, means for deforming the hollow member to change its volume, said means including a structure fixed with relation thereto, surrounding and in contact with said hollow member, a toggle adapted to be moved to exert pressure upon the hollow member and means for moving said toggle.

12. In combination in a pump, an approximately rigid hollow member, inlet and outlet means therefor, means for deforming the hollow member to change its volume, said means including a structure fixed with relation thereto, surrounding and in contact with said hollow member, and a movable compression member in contact with said hollow member, a toggle in contact with the compression member and adapted to be moved to exert pressure upon the hollow member through the compression member, and means for moving said toggle.

13. In combination in a pump, an approximately rigid hollow member, inlet and outlet means therefor, means for deforming the hollow member to change its volume, said means including a structure fixed with relation thereto, surrounding and in contact with said hollow member, and a movable compression member within said structure, in contact with said hollow member, a toggle within the structure, in contact with the compression member and with the structure, and adapted to be moved to exert pressure upon the hollow member through the compression member and means for moving said toggle.

PHILIP LANE SCOTT.