Oct. 23, 1934. P. L. SCOTT 1,978,232

PUMP

Filed Oct. 20, 1930

Fig. 1

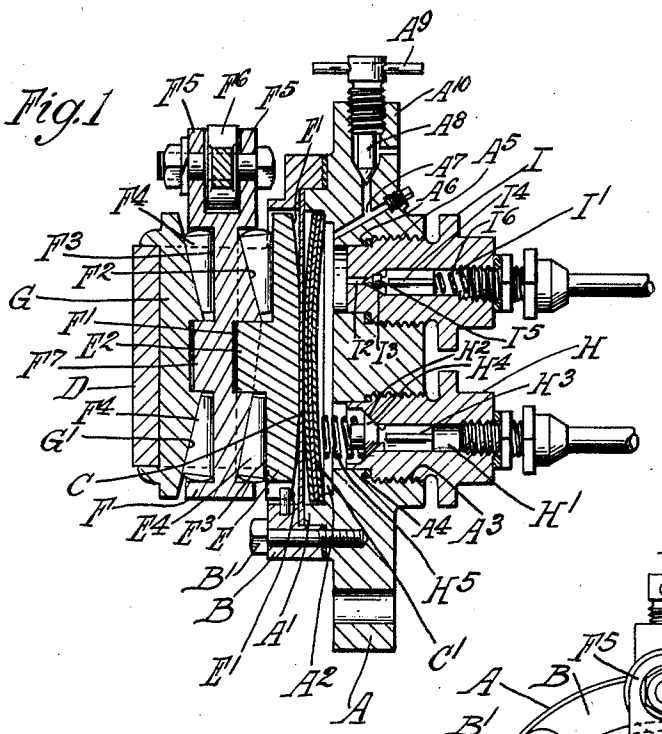
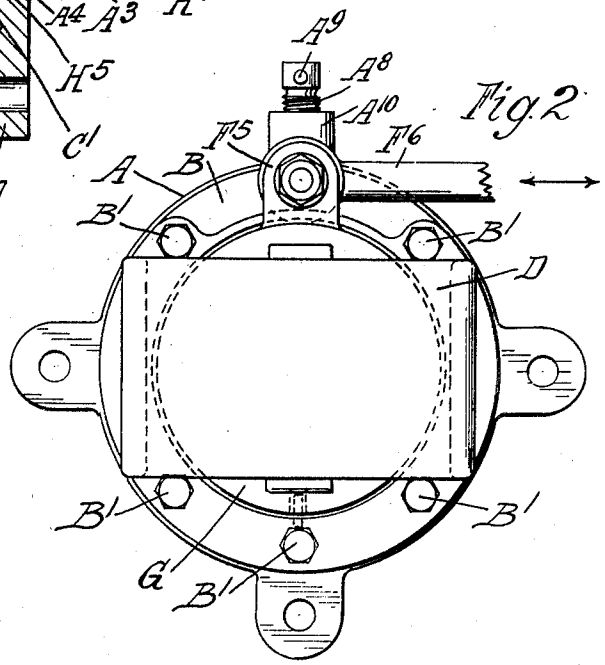


Fig. 2



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16 Claims. (Cl. 103—150)

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 cross section through the pump, showing the inlet and outlet valves;

Figure 2 is an elevation of the pump, showing in part the operating means.

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

A is a pump body or housing that is preferably provided in one face with a raised land A^1 which co-operates to form a depression or pump chamber portion A^2. A^3 is a cavity formed in the pump body A and provided adjacent one end with an inwardly extending shoulder or reduced portion A^4. An inlet valve housing may be seated in the cavity A^3. A^5 is another cavity formed in the body portion A and provided adjacent one end with a shoulder or reduced portion A^6. An outlet valve housing may be positioned within the cavity A^5 and may rest against the shoulder or reduced portion A^6. Extending through the body portion A and communicating with the pump chamber and with the outside of the pump is an air vent A^7. A^8 is a controlling valve therefor, preferably provided with a handle or manipulating part A^9 by means of which it may be moved into and out of position to control the air vent. The air vent, while it may be placed in any suitable location, is preferably in an extension A^{10} formed as a part of the valve body.

Removably secured to the valve body A is a retaining portion B of generally annular shape. It may be fastened to the valve body by screws B^1 or by any other suitable means.

Lying between the pump body A and the retaining member B and compressed against the land A^1 of the pump body is a disc or diaphragm C. It, together with the pump body A, completes the pump chamber A^2. This diaphragm may be made of any suitable material and it serves merely as a sealing or closing member to complete the pump chamber. Positioned within the pump chamber or cavity A^2 and bearing upon the portion A and upon the diaphragm C is a plurality of laminations C^1 which, together, form an internal laminated spring. They are so shaped and proportioned that they tend to force the diaphragm C outward and do so whenever they are free to move.

Supported from and preferably made integral with the retaining member B is a support D. This support is in effect a loop provided with oppositely placed parts which are fastened to the annulus B and provided with a portion joining these two, so that it thus provides a loop over the valve disc or diaphragm.

E is a compression plate positioned against the diaphragm, C. It is provided with one generally flat face which lies against the diaphragm and it is somewhat rounded or tapered away adjacent its edges as at E^1. On its opposite face it carries a boss E^2 and a helical race E^3. Tapered rollers E^4 are mounted to run in the helical race E^3.

F is a rocking member provided with a depression F^1 which is seated upon the boss E^2. The rocking member is provided on one face with a helical race F^2 and on its opposite side with a flat race F^3 within which tapered rollers F^4 are positioned and adapted to move. At one edge and extending outwardly from the rocking member F is a pair of ears F^5, F^5. Positioned between the ears is a drive rod or shaft F^6 which may be moved by any suitable mechanism back and forth, as indicated by the arrow in Figure 2. F^7 is a boss formed on the member F, opposite the depression F^1.

G is a bearing supporting member resting upon the boss F^7 of the member F and provided with a flat bearing race G^1. The member G rests against the support D.

H is an inlet valve housing adapted to be seated in the cavity A^3 in the pump body A. It is provided with a bore H^1 which has at one end a valve seat portion H^2. H^3 is a valve positioned within the bore H^1 and carrying a head H^4 adapted to be seated in the seat H^2. A spring H^5 bearing at one end upon the valve and at the other upon the laminations C^1 tends to hold the valve seated.

I is an outlet valve housing provided with a bore I^1 which terminates in a reduced portion I^2 and has a seat I^3 adjacent the reduced portion. I^4 is a valve formed with a point I^5. The valve is positioned within the bore I^1 and the point is adapted to be seated in the seat I^3. I^6 is a spring

tending normally to hold the valve seated. The valve housings may be held in the position shown by any suitable means, such for example as clamps, or they might be threaded into the valve body.

It will be realized that while 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. Particularly the form of the housing and the means for compressing or moving the diaphragm might be widely changed, as might also particular structural details of the several other parts of the device.

The use and operation of the invention are as follows:

With the parts assembled as shown, it is assumed that the diaphragm or disc C is lying in a flat position and that fluid is within the pump chamber. A heavy and preferably sudden pressure is exerted upon the diaphragm to force it inward against resistance of the laminations C^1 by movement of the shaft or rod F^6, which movement causes the rocking member F to move and the compression member or washer E is forced against the diaphragm as a result of the motion of the rocking member which turns through a portion of a revolution and causes the rollers which engage it to ride upon the helical race formed on the back of the member E and on the face of the rocking member F. The side of the rocking member away from the diaphragm has a flat face which serves merely as a thrust bearing, the other face of which is formed by the member G. This movement of the rocking member F is imparted to the diaphragm C, as explained, and forces it inwardly against the resistance of the laminations C^1, thus reducing the volume of the pump chamber, creating pressure within it and forcing open the outlet valve and discharging fluid from the pump.

After the discharge stroke the rocking member is moved in the reverse direction and the member E is permitted to fall back from the diaphragm as a result of the reverse movement given the rocking member with its helical race. The diaphragm may then spring or move outwardly again under the influence of the laminations C^1, thus increasing the volume of the pump chamber, permitting or causing the outlet valve to close, creating a suction which opens the inlet valve and draws a fuel charge into the pump chamber. Thus a suction stroke is completed and the pump consists of the alternate compression and expansion or inward and outward movement of the diaphragm in response to the wedging action which is communicated to it by the movement of the rocking member F.

I claim:

1. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber, and a resistance member within the pump chamber, adapted to resist movement of the diaphragm and means for moving said diaphragm in opposition to the resistance of said resistance member, said means comprising a wedge, the resistance member comprising a laminated spring.

2. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber, and an approximately rigid resistance member within the pump chamber adapted to resist movement of the diaphragm and means for moving said diaphragm in opposition to the resistance of said approximately rigid resistance member, said means comprising a wedge.

3. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber, and a resistance member within the pump chamber comprising a laminated spring adapted to resist movement of the diaphragm and means for moving said diaphragm in opposition to the resistance of said resistance member, said means comprising a wedge, adapted to be moved to exert pressure upon said diaphragm.

4. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber, and a resistance member within the pump chamber comprising a laminated spring adapted to resist movement of the diaphragm and means for moving said diaphragm in opposition to the resistance of said resistance member, said means comprising a wedge positioned against and adapted to be moved to exert pressure upon said diaphragm.

5. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber, and a resistance member within the pump chamber adapted to resist movement of the diaphragm and means for moving said diaphragm in opposition to the resistance of said resistance member, said means comprising a wedge, said wedge carrying a helical race adapted to receive anti-friction members.

6. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber, and an approximately rigid resistance member within the pump chamber, adapted to resist movement of the diaphragm and means for moving said diaphragm in opposition to the resistance of said approximately rigid resistance member, said means comprising a wedge positioned against said diaphragm, said wedge carrying a helical race adapted to receive anti-friction members.

7. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber, and a resistance member within the pump chamber adapted to resist movement of the diaphragm and means for moving said diaphragm in opposition to the resistance of said resistance member, said means comprising a wedge positioned against and adapted to be moved to exert pressure upon said diaphragm, said wedge carrying a helical race adapted to receive anti-friction members.

8. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber, and an approximately rigid resistance member within the pump chamber adapted to resist movement of the diaphragm and means for moving said diaphragm in opposition to the resistance of said approximately rigid resistance member, said means comprising a wedge positioned against and adapted to be moved to exert pressure upon said diaphragm, said wedge carrying a helical race adapted to receive anti-friction members.

9. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber,

and a resistance member within the pump chamber comprising a laminated spring adapted to resist movement of the diaphragm and means for moving said diaphragm in opposition to the resistance of said resistance member, said means comprising a wedge, and a member fixed with relation to the pump housing and mounted for co-operation with said wedge.

10. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber, and a resistance member within the pump chamber comprising a laminated spring adapted to resist movement of the diaphragm and means for moving said diaphragm in opposition to the resistance of said resistance member, said means comprising a wedge adapted to be moved to exert pressure upon said diaphragm, and a member fixed with relation to the pump housing and mounted for co-operation with said wedge.

11. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber, and a resistance member within the pump chamber adapted to resist movement of the diaphragm and means for moving said diaphragm in opposition to the resistance of said resistance member, said means comprising a wedge adapted to be moved to exert pressure upon said diaphragm, said wedge carrying a helical race adapted to receive anti-friction members, and a member fixed with relation to the pump housing and mounted for co-operation with said wedge.

12. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber, and a resistance member within the pump chamber adapted to resist movement of the diaphragm and means for moving said diaphragm in opposition to the resistance of said resistance member, said means comprising a wedge positioned against and adapted to be moved to exert pressure upon said diaphragm, said wedge carrying a helical race adapted to receive anti-friction members, and a member fixed with relation to the pump housing and mounted for co-operation with said wedge.

13. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber, and a resistance member within the pump chamber comprising a laminated spring adapted to resist movement of the diaphragm and means for moving said diaphragm in opposition to the resistance of said resistance member, said means comprising a wedge and means for moving said wedge.

14. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber, and a resistance member within the pump chamber comprising a laminated spring adapted to resist movement of the diaphragm and means for moving said diaphragm in opposition to the resistance of said resistance member, said means comprising a wedge adapted to be moved to exert pressure upon said diaphragm, and means for moving said wedge.

15. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber, and a resistance member within the pump chamber adapted to resist movement of the diaphragm and means for moving said diaphragm in opposition to the resistance of said resistance member, said means comprising a wedge adapted to be moved to exert pressure upon said diaphragm, said wedge carrying a helical race adapted to receive anti-friction members, and means for moving said wedge.

16. In a pump, a pump housing and a flexible diaphragm fixed to said housing in sealing contact and with it defining a pumping chamber, and an approximately rigid resistance member within the pump chamber adapted to resist movement of the diaphragm, and means for moving said diaphragm in opposition to the resistance of said approximately rigid resistance member, said means comprising a wedge positioned against and adapted to be moved to exert pressure upon said diaphragm, said wedge carrying a helical race adapted to receive anti-friction members, and means for moving said wedge.

PHILIP LANE SCOTT.