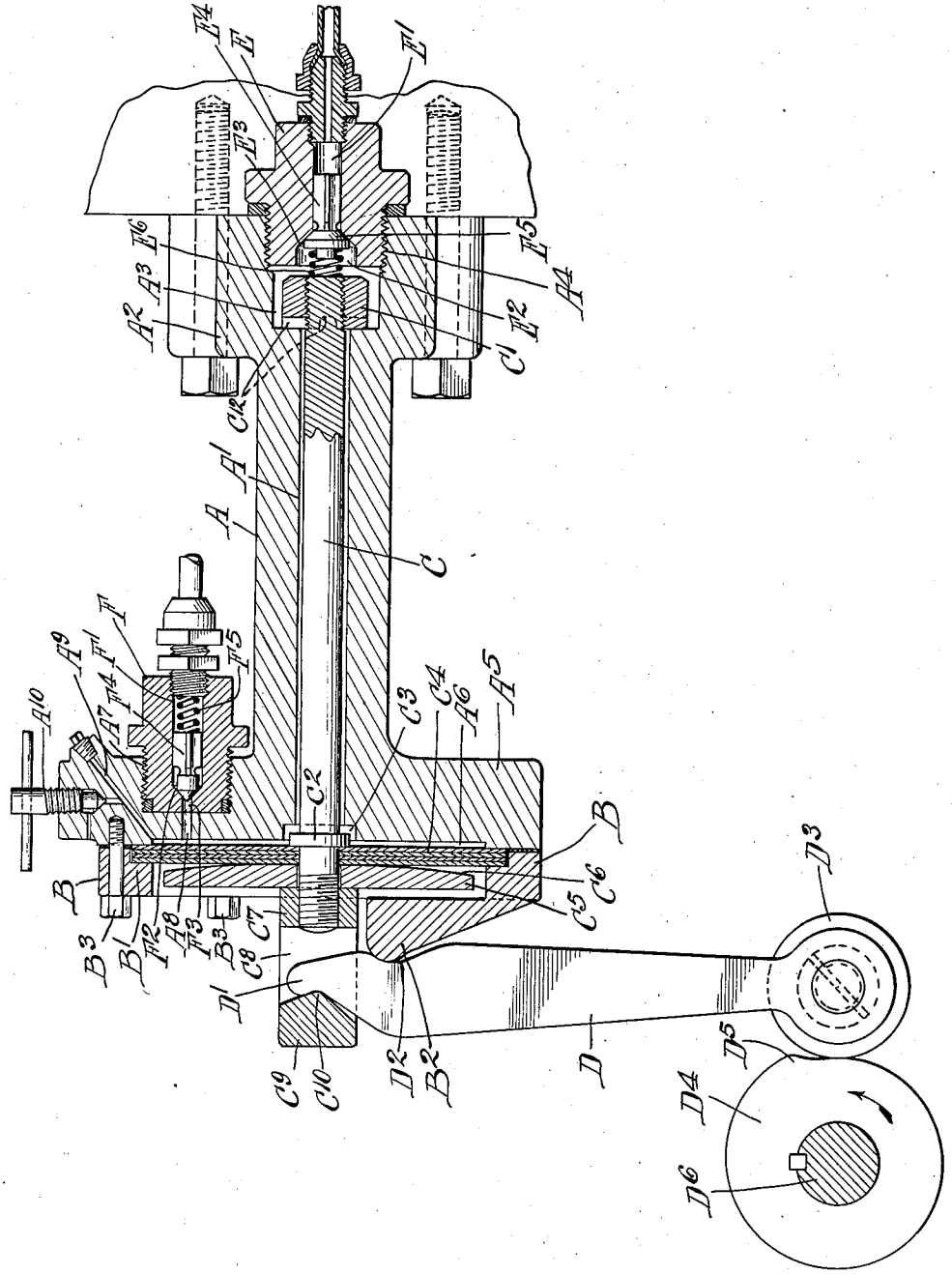
Feb. 5, 1935. P. L. SCOTT 1,990,139

PUMP

Filed Oct. 20, 1930



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Patented Feb. 5, 1935 1,990,139

UNITED STATES PATENT OFFICE

1,990,139

PUMP

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Application October 20, 1930, Serial No. 489,743

24 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.

My invention is illustrated more or less diagrammatically in the accompanying drawing, wherein the figure is a longitudinal section through one form of my pump.

A is a pump housing or barrel, having formed within it a pump bore or chamber A^1. At one end it has an enlargement A^2 with an enlarged cavity A^3 within it in communication with the bore A^1. The cavity A^3 is preferably interiorly threaded adjacent one end as at A^4. At its opposite end the housing A has an enlargement A^5, within the upper side of which is formed a relatively shallow depression or cavity A^6. A second cavity A^7 is formed in the enlargement A^5 and is adapted to receive an outlet valve housing. A^8 is a passage communicating with the cavity A^7 and the depression A^6. An air vent A^9 may be formed in the portion A^5 and will communicate with the depression or chamber A^6 and with the exterior of the pump housing. The air vent is normally closed and controlled by a valve A^{10} which is provided with a suitable handle and means for moving it in or out to open or close the air vent.

B is an end closure plate partially cut away as at B^1 to leave what is in effect largely an annulus. Extending in from the margin of the member B is a lever supporting nose or fulcrum B^2. The member B may be fastened to the portion A^5 of the pump housing by means of screws B^3 or by any other suitable means.

Positioned within the housing and extending through the bore A^1 and beyond it at each end, is a rod C. At one end it projects into the cavity A^3 and at that end it is preferably threaded and has removably and adjustably mounted upon it a nut C^1 which is provided with slots or passages C^{12}. At its other end it projects beyond the end of the enlargement A^5 and beyond the depression A^6. It is preferably threaded at this end and adjacent its end it is provided with a laterally extending flange C^2 which may lie within an annular enlargement C^3 formed in the depression A^6. Positioned about the end of the rod C adjacent one end and bearing against the flange C^2 is a disc C^4. This disc as shown is made up of a plurality of laminations, although for some purposes it might be made of a single member. The edges of the disc are gripped and held in sealing contact by the annular part B^1 of the member B. Positioned on the rod C and bearing against the disc C^4 is a rigid disc C^5. This disc is generally flat but the side which contacts the disc C^4 is tapered away from it adjacent its edges as at C^6. Threaded on the outer or exposed end of the rod C and holding the laminated disc C^4 and the rigid disc C^5 in position upon the rod is a hook nut C^7 which may include a hook or ring C^8 and which has a portion C^9 carrying a downwardly or inwardly facing point C^{10}.

D is a lever provided with a nose D^1 adapted to engage the hook point C^{10} and provided with a depression or notch D^2 adapted to be seated and to move upon the fulcrum B^2. The lever D carries at its free end a roller D^3 which is in contact with a cam D^4. The cam D^4 carries a raised portion or nose D^5 and is itself supported upon a shaft D^6 and rotates in response to rotation of the shaft.

Removably positioned within the cavity A^3 is an inlet valve housing E. This housing is provided with a bore or chamber E^1 which is enlarged at its inner end as at E^2 and preferably formed with an inclined seat portion E^3. E^4 is a valve positioned within the bore E^1 and having a head portion E^5 adapted to be seated upon the seat E^3. A spring E^6 tends normally to hold the valve E^4, E^5 seated, that is, closed.

Seated within the cavity or chamber A^7 is an outlet or discharge valve housing F provided with a bore F^1 which at its inner end is reduced and carries a seating portion F^2 which communicates with a bore F^3 of reduced diameter, which is preferably in communication and in alignment with the passage A^8 in the pump housing. A valve F^4 is positioned within the bore F^1 and is adapted to be seated on the seat F^2. F^5 is a spring which tends normally to hold the valve seated.

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 details of construction of the laminated disc and the means of securing its edge might be almost infinitely varied. It will be understood that the pump rod C is the spring element and it is somewhat stretched during the cycle of pump operation in a manner which will be described below. While it has been shown as being stretched by a lever which is operated by a cam and moves about a fulcrum, almost any means of stretching it might be used and the invention is not at all to be limited to the particular mechanical means shown herewith for operating the spring.

The use and operation of my invention are as follows:

With the parts assembled as shown in figure, the laminated disc is in sealing contact with the portion A^5 of the pump housing and the pump chamber within the housing is thus formed by the cavity A^6 in one face of the portion A^5 and by the clearance about the pump rod C and its associated parts within the pump housing. The pump may be mounted in any association where it is to be used. With the parts in the position shown, a suction stroke is to commence. The cam is set in motion and operates against the roller D^3 in the free end of the lever D. When the nose or raised portion D^5 of the cam contacts the lever it moves the latter to the right, as indicated in the figure. The lever bearing upon the fulcrum and engaging the hook nut which is fixed to the end of the rod C, exerts an extending or stretching effect upon the rod, stretching it a very minute amount. The laminated diaphragm or disc C^4 which is fixed to the rod moves with it and thus moves outward with respect to the housing portion A^5, increases the volume of the space within the pump housing and so creates suction, unseats the inlet valve and draws in a charge of fluid.

As the cam continues to move the high point passes beyond or slips beneath the roller D^3 and the lever D is no longer held out. As soon as the lever is free to move in the reverse direction, that is to say, to the left, as indicated in the figure, the rod C contracts suddenly, drawing the diaphragm in towards its former position, thereby reducing the volume within the pump housing, creating pressure, seating the inlet valve and forcing the outlet valve open and ejecting or discharging a quantity of fluid from that valve.

The diaphragm or disc C^4, whether it be made of a single member or a plurality of laminations, may be for some purposes extremely stiff, so stiff as to be in fact approximately rigid. In that case it would offer resistance to the outward movement caused by the movement of the lever D and the movement of this lever would then be resisted not alone by the resistance of the rod C to stretching but by the resistance of the member C^4 to bending or deformation. The elasticity of the disc C^4 would in that case assist materially in returning the parts to their original position, as soon as the movement of the cam permits the lever D to free the parts for return movement.

I claim:

1. In a pump, a housing defining a pump chamber, a diaphragm, rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield a minute amount and for simultaneously causing said diaphragm to move outwardly to increase the volume of the pump chamber, and inlet and outlet means in communication with said pump chamber.

2. In a pump, a housing defining a pump chamber, a diaphragm, rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield and for simultaneously causing said diaphragm to move minutely outwardly to increase the volume of the pump chamber, and inlet and outlet means in communication with said pump chamber.

3. In a pump, a housing defining a pump chamber, a diaphragm rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield a minute amount and for simultaneously causing said diaphragm to move outwardly to increase the volume of the pump chamber, said member capable of itself alone of returning to its initial position when free to do so, and inlet and outlet means in communication with said pump chamber.

4. In a pump, a housing defining a pump chamber, a diaphragm rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield a minute amount and for simultaneously causing said diaphragm to move outwardly to increase the volume of the pump chamber, said diaphragm capable of itself alone of returning to its initial position when free to do so, and inlet and outlet means in communication with said pump chamber.

5. In a pump, a housing defining a pump chamber, a diaphragm, rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield a minute amount and for simultaneously causing said diaphragm to move outwardly to increase the volume of the pump chamber, said member and said diaphragm capable of themselves alone of returning to their initial position when free to do so, and inlet and outlet means in communication with said pump chamber.

6. In a pump, a housing defining a pump chamber, a diaphragm, rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield in stretching and for simultaneously causing said diaphragm to yield outwardly to increase the volume of the pump chamber, and inlet and outlet means in communication with said pump chamber.

7. In a pump, a housing defining a pump chamber, a diaphragm, rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield minutely in stretching and for simultaneously causing said diaphragm to yield outwardly to increase the vol-

ume of the pump chamber, and inlet and outlet means in communication with said pump chamber.

8. In a pump, a housing defining a pump chamber, a diaphragm, rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield minutely in stretching and for simultaneously causing said diaphragm to move outwardly to increase the volume of the pump chamber, said member capable of itself alone of returning to its initial position when free to do so, and inlet and outlet means in communication with said pump chamber.

9. In a pump, a housing defining a pump chamber, a diaphragm, rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield minutely in stretching and for simultaneously causing said diaphragm to yield outwardly to increase the volume of the pump chamber, said member capable of itself alone of returning to its initial position when free to do so, and inlet and outlet means in communication with said pump chamber.

10. In a pump, a housing defining a pump chamber, a diaphragm, rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield minutely in stretching and for simultaneously causing said diaphragm to yield minutely outwardly to increase the volume of the pump chamber, said member and said diaphragm capable of themselves alone of returning to their initial position when free to do so, and inlet and outlet means in communication with said pump chamber.

11. In a pump, a housing defining a pump chamber, an approximately rigid diaphragm, rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield and for simultaneously causing said diaphragm to yield outwardly to increase the volume of the pump chamber, and inlet and outlet means in communication with said pump chamber.

12. In a pump, a housing defining a pump chamber, an approximately rigid diaphragm, rigidly fixed to said housing, an approximately rigid member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield and for simultaneously causing said diaphragm to yield outwardly to increase the volume of the pump chamber, and inlet and outlet means in communication with said pump chamber.

13. In a pump, a housing defining a pump chamber, an approximately rigid diaphragm, rigidly fixed to said housing, an approximately rigid member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield and for simultaneously causing said diaphragm to yield outwardly minutely to increase the volume of the pump chamber, said member capable of itself alone of returning to its initial position when free to do so, and inlet and outlet means in communication with said pump chamber.

14. In a pump, a housing defining a pump chamber, an approximately rigid diaphragm, rigidly fixed to said housing, an approximately rigid member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield and for simultaneously causing said diaphragm to yield minutely outwardly to increase the volume of the pump chamber, said diaphragm capable of itself alone of returning to its initial position when free to do so, and inlet and outlet means in communication with said pump chamber.

15. In a pump, a housing defining a pump chamber, an approximately rigid diaphragm, rigidly fixed to said housing, an approximately rigid member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield and for simultaneously causing said diaphragm to yield minutely outwardly to increase the volume of the pump chamber, said member and said diaphragm capable of themselves alone of returning to their initial position when free to do so, and inlet and outlet means in communication with said pump chamber.

16. In a pump, a housing defining a pump chamber, a laminated diaphragm, rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield and for simultaneously causing said diaphragm to yield outwardly to increase the volume of the pump chamber, and inlet and outlet means in communication with said pump chamber.

17. In a pump, a housing defining a pump chamber, an approximately rigid laminated diaphragm, rigidly fixed to said housing, an approximately rigid member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield and for simultaneously causing said diaphragm to yield outwardly to increase the volume of the pump chamber, and inlet and outlet means in communication with said pump chamber.

18. In a pump, a housing defining a pump chamber, an approximately rigid laminated diaphragm, rigidly fixed to said housing, an approximately rigid member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield minutely in stretching and for simultaneously causing said diaphragm to yield minutely outwardly to increase the volume of the pump chamber, and inlet and outlet means in communication with said pump chamber.

19. In a pump, a housing defining a pump chamber, an approximately rigid laminated diaphragm, rigidly fixed to said housing and forming a part of the pump chamber wall, an approximately rigid member secured to said dia-

phragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield minutely in stretching and for simultaneously causing said diaphragm to yield minutely outwardly to increase the volume of the pump chamber, said member and said diaphragm capable of themselves alone of returning to their initial position when free to do so, and inlet and outlet means in communication with said pump chamber.

20. In a pump, a rigid housing defining in part a pump chamber, an approximately rigid laminated diaphragm, rigidly fixed to said housing and forming a part of the pump chamber wall, and approximately rigid member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield minutely in stretching and for simultaneously causing said diaphragm to yield minutely outwardly to increase the volume of the pump chamber, said member and said diaphragm capable of themselves alone of returning to their initial position when free to do so, and inlet and outlet means in communication with said pump chamber.

21. In a pump, a housing defining a pump chamber, a laminated diaphragm, rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield a minute amount and for simultaneously causing said diaphragm to move outwardly to increase the volume of the pump chamber, and inlet and outlet means in communication with said pump chamber.

22. In a pump, a housing defining a pump chamber, a laminated diaphragm, rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield and for simultaneously causing said diaphragm to move minutely outwardly to increase the volume of the pump chamber, and inlet and outlet means in communication with said pump chamber.

23. In a pump, a housing defining a pump chamber, an approximately rigid laminated diaphragm, rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield and for simultaneously causing said diaphragm to yield outwardly to increase the volume of the pump chamber, and inlet and outlet means in communication with said pump chamber.

24. In a pump, a housing defining a pump chamber, an approximately rigid laminated diaphragm, rigidly fixed to said housing, a member secured to said diaphragm and bearing against a portion of said housing and tending to prevent outward movement of the diaphragm, and positive mechanical means for causing said member to yield minutely in stretching and for simultaneously causing said diaphragm to yield minutely outwardly to increase the volume of the pump chamber, and inlet and outlet means in communication with said pump chamber.

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