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J. B. PARSONS

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COMPENSATING DEVICE FOR ROTARY PUMPS

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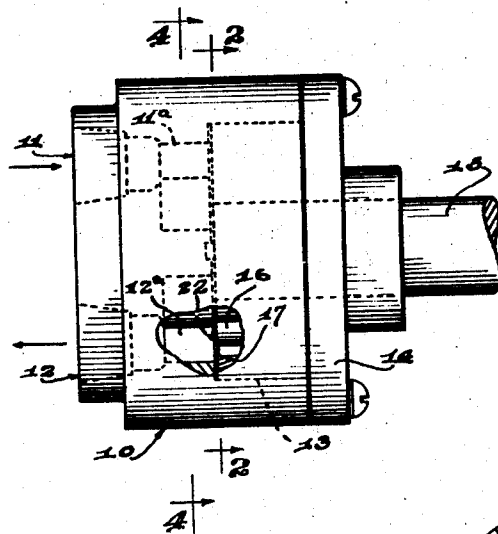


Fig. 1.

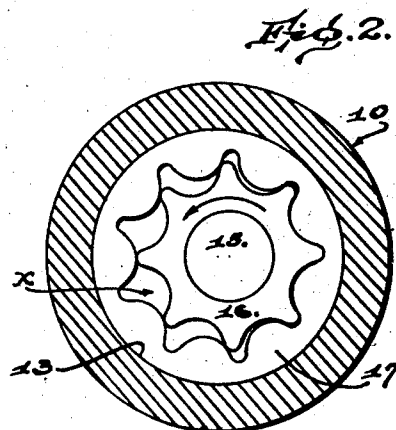


Fig. 2.

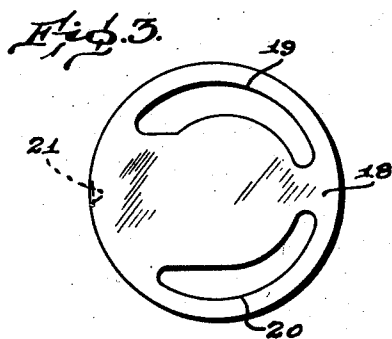


Fig. 3.

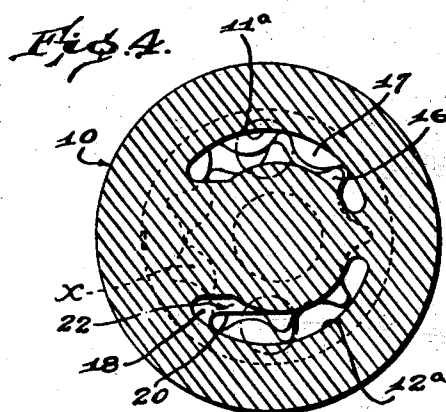


Fig. 4.

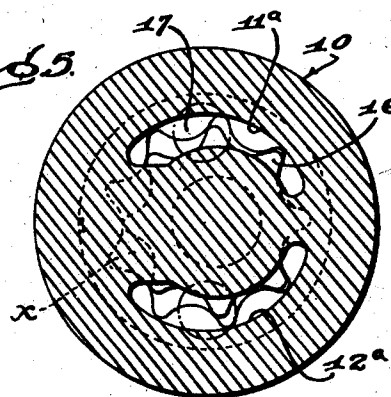


Fig. 5.

INVENTOR.
John B. Parsons

BY

Malcolm W. Brown

ATTORNEY

UNITED STATES PATENT OFFICE

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COMPENSATING DEVICE FOR ROTARY PUMPS

John B. Parsons, Toledo, Ohio

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2 Claims. (Cl. 103—126)

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This invention relates to pumps but more particularly to rotor pumps of the type having two rotors or gears, one of which is within and eccentric to the other, having tooth divisions, with contours on each outlined by the tooth form of the other at regular angular motion.

Pumps of the above character are ordinarily objectionable because of the pulsations created in the discharge line which are noisy and detract from the usefulness of the pump in many situations. These pulsations are particularly noticeable in the event the discharge line, even when in the form of a rubber tube, contacts a metallic surface, which serves as a sounding board. Although attempts have been made to rectify this condition, so far as I am aware no one heretofore has successfully coped with the condition.

An object is to overcome the above difficulties and to produce a pump of the above type in which the discharge line is free from noisy pulsating sounds.

Another object is to produce a compensating device for a pump of the above character for militating against surging action of the pressure fluid in the region of the outlet and effecting substantially uniform continuous flow of fluid from the pump.

A further object is to equip a pump of the above character with a simple and inexpensive device which militates against noisy pulsations in the discharge line by controlling the fluid discharge at the pump in such manner that a more uniform flow of fluid under pressure is obtained.

A still further object is to produce a flexible discharge valve disc for a pump of the so-called "Gerotor" type which not only effects a more uniform fluid flow but also provides a bearing for one end of the pump rotors.

Other objects and advantages of the invention will hereinafter appear and for purposes of illustration but not of limitation, an embodiment of the invention is shown on the accompanying drawings in which

Figure 1 is a side elevation of a pump of the type commercially known as a "Gerotor" pump equipped with a compensating device or valve disc in the region of the discharge port, a portion being broken away to illustrate the latter;

Figure 2 is a transverse section substantially on the line 2—2 of Figure 1 showing the working parts of the pump;

Figure 3 is a plan view of the ported valve disc which serves as the compensating device;

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Figure 4 is a transverse sectional view on the line 4—4 of Figure 1; and

Figure 5 is a view similar to Figure 4 but with the flexible ported plate removed.

The illustrated embodiment of the invention comprises a rotary pump having a housing 10 formed with an inlet 11 and an outlet 12, both of which are at one end of the housing and communicate with arcuate ports 11a and 12a respectively, which open into the pump chamber 13. The opposite end of the housing is closed by a cap 14, which is held in place by screws and is formed with a central aperture through which extends a driving shaft 15. Keyed to the end portion of the driving shaft 15 is a toothed male rotor 16, which is surrounded by a toothed female rotor 17. The rotor 17 has a running fit within the pump chamber 13. The female rotor 17 has one more tooth than the number of complementary shaped teeth on the male rotor, which is mounted eccentrically with respect to the female rotor, moves the same ahead of it progressively and continuously forming suction and compression phases which are timed with respect to the inlet and outlet ports 11a and 12a respectively, thus to provide a substantially continuous flow of fluid under pressure from the pump. The rotors are provided with contours, such that the teeth in theory wipe or make continuous traveling contact over those of the other during rotation. It is to be understood that the above described pump is old in the art, is available on the market under the name "Gerotor" and the above brief description is deemed sufficient for a full understanding of the invention.

As a practical matter a pump of the above description has not been satisfactory for many installations because of the pulsating noise, which it makes in operation. It would appear theoretically possible to overcome this objection if the conditions in all cases were the same. For example, if the pump were operated only at a certain specified speed and if the viscosity of the fluid were always the same, then empirically the proper size of the ports might be determined so that noisy operation would be eliminated. However, that would be most difficult, expensive and troublesome and consequently such objection definitely militates against the wide usefulness of the pump as a general purpose machine and one which can be employed to advantage in regions, where the expense of extended experimental and profound engineering work to determine the correct port area is not feasible.

The cause of the noisy operation of the pump

can best be explained by reference to Figures 4 and 5. In considering Figure 5 in the first instance, it will be noted that at the left hand side of the discharge port 12a, a tooth of the male rotor 16 is passing over a portion of the female rotor 17, the arrangement being such that the fluid trapped in the cavity x is about to be opened to the adjacent edge of the port 12a. If the cavity x were entirely filled with pressure fluid, then the discharge thereof through the port 12a would be as desired and, provided this condition recurrently obtained, then the pump would operate substantially free from objectionable pulsating noise. However, as a practical matter, due to the speed at which the pump operates and the viscosity of the fluid, in particular liquid, being handled, the cavity x and its subsequent counterparts, are often not entirely filled with liquid but have a certain volume of air with it which, when compressed, discharges in a surging manner through the discharge port 12a. On the other hand, these cavities or some of them may have a partial vacuum in which case a reverse action takes place momentarily at the instant the discharge port 12a is encountered. The conditions may alternate but in any event, it is believed that they cause the objectionable surging or throbbing noises incident to the operation of the pump and militate against the creation of a continuous uniform flow of liquid through the discharge pipe or tube.

In order to cope with the above problem, a relatively thin flexible resilient disc 18 of sheet material, preferably metal is placed over the discharge end of the pump. It has approximately the same diameter as the rotor 17 and has arcuately shaped inlet and outlet ports 19 and 20 respectively. The disc is held against rotation by a tab 21 which fits into a suitable notch in the housing 10. The disc 18 is very thin, as for example of the order of .010 inch and since it also serves as a thrust or bearing plate, it is preferably of spring bronze, when the pump parts are of steel.

The inlet port opening 19 is of the same size as the port 11a in the pump housing but the port 20 is smaller than the discharge port 12a. Referring to Figure 4, it will be observed that a portion of the disc 18 covers part of the port 12a in the region of the fluid inlet side. It will be understood that the rotor parts are moving in a counterclockwise direction and the portion of the port 12a at the left of Figure 4 is covered by the spring disc 18. In this manner an exposed portion 22 of the spring disc 18 appears upon looking into the pump housing through the port 12a. The positioning of the portion 22 is such that the discharge of liquid into the port 12a is slightly delayed enabling an approximate

equalization in pressure between the liquid in the cavity x and the cavity directly in advance of it. The exposed portion 22 is sufficiently flexible and resilient so that by a slight flexing movement thereof due to pressure build-up within the cavity, escape of fluid into the discharge line may be delayed so that uniform flow from the pump is effected and surging or flow of fluid from the discharge line to the pump is prevented. Thus in operation the portion 22 of the disc flexes to afford fluid discharge from the pump.

The forward or leading edge of the exposed valve-like portion 22 may be moved ahead or rearwardly for changed conditions. For example, it may be moved rearwardly if the speed of the pump is increased or liquid of greater viscosity is employed. On the other hand, it may be moved forwardly if the pump operates more slowly and the liquid is of less viscosity. However, in the main the important feature is to cover the point of discharge from the indicated cavity x so as to eliminate the recurrent pounding or surging in the discharge line.

It is to be understood that numerous changes in details of construction, arrangement and operation may be effected without departing from the spirit of the invention especially as defined in the appended claims.

What I claim is:

1. Compensating device for a pump having mating toothed pump rotor members arranged one within the other and fluid inlet and outlet ports associated therewith, comprising a relatively thin disc of spring metal abutting one end of said pump rotor parts to provide a bearing therefor, said disc having in an outlet port overlying the pump outlet port, the trailing edge of said disc outlet port being advanced relative to the pump outlet port and with respect to the direction of rotation of the pump rotor members to form a valve-like portion adapted to flex in response to differences in fluid pressure in the adjacent portion of the pump and in the discharge line, and means clamping the peripheral portion of said disc throughout the circumference thereof to hold same from flexing movement.

2. Compensating device as claimed in claim 1, comprising means for holding said disc against turning movements.

JOHN B. PARSONS.

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The following references are of record in the file of this patent:

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