

**Aug. 4, 1942.**

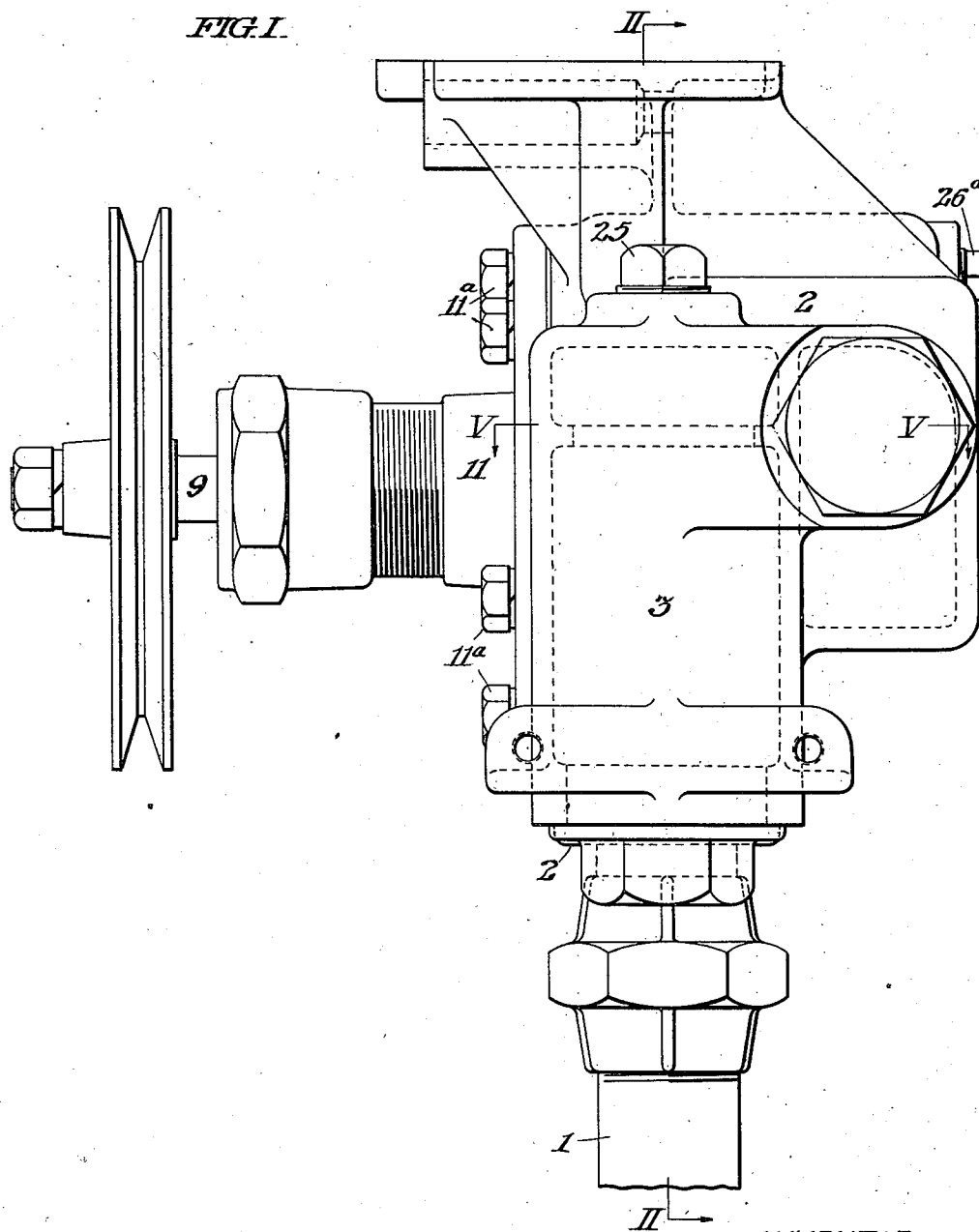
D. S. WILLSON

**2,291,856**

ROTARY PUMP

Filed Dec. 21, 1938

4 Sheets-Sheet 1



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Aug. 4, 1942.

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FIG. II.

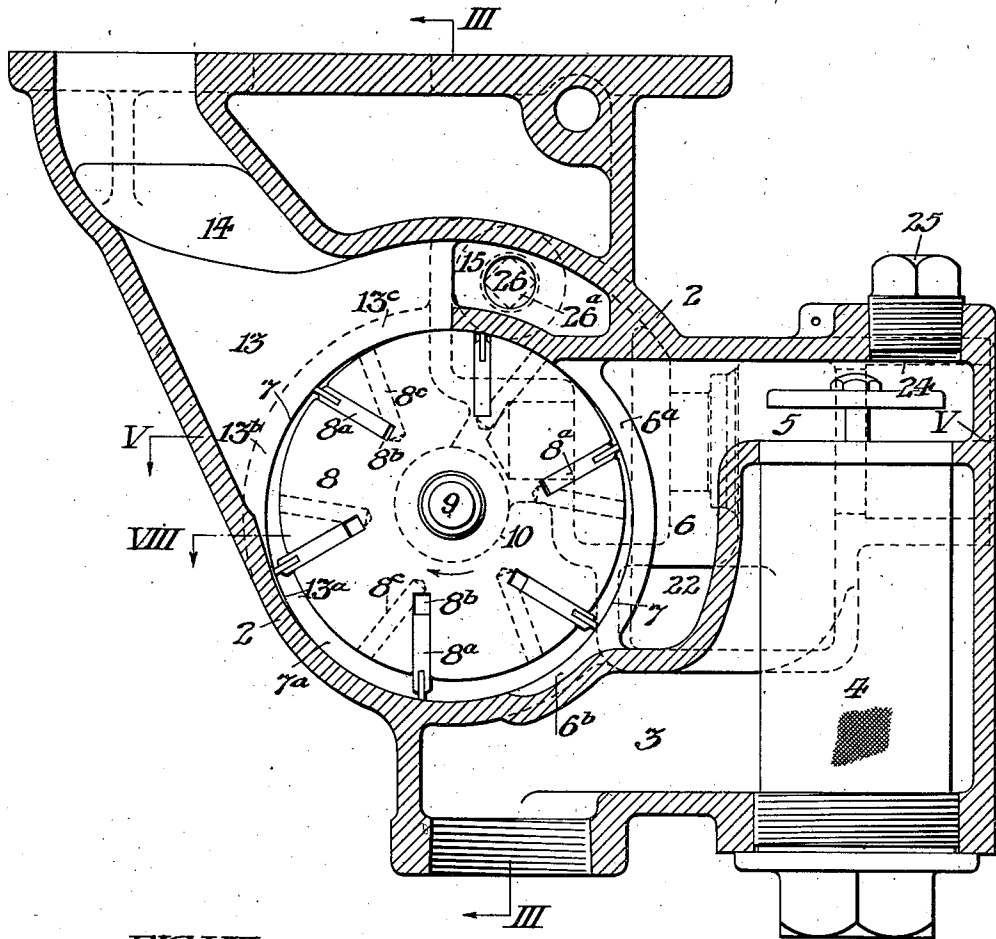
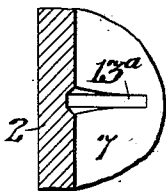


FIG. VIII.



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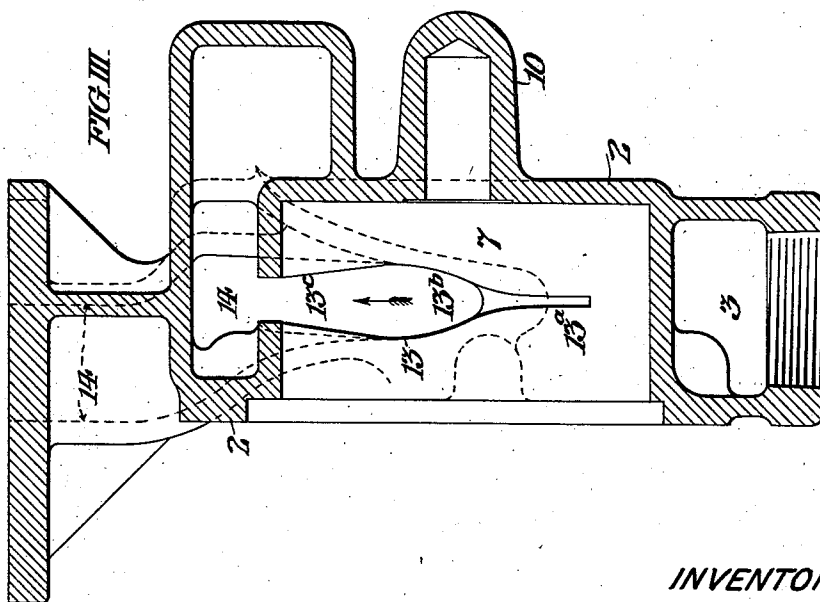
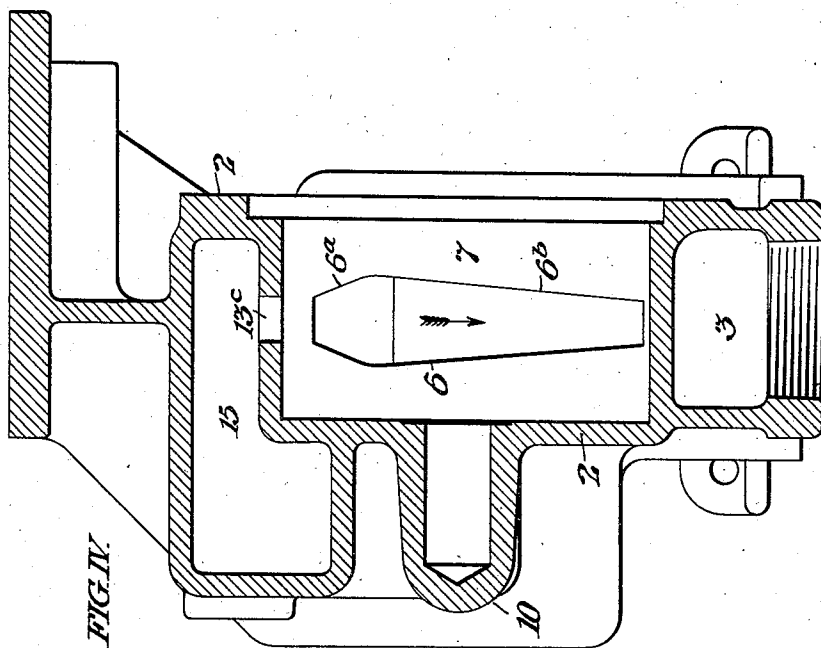
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4 Sheets-Sheet 3



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## ROTARY PUMP

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*FIGV*

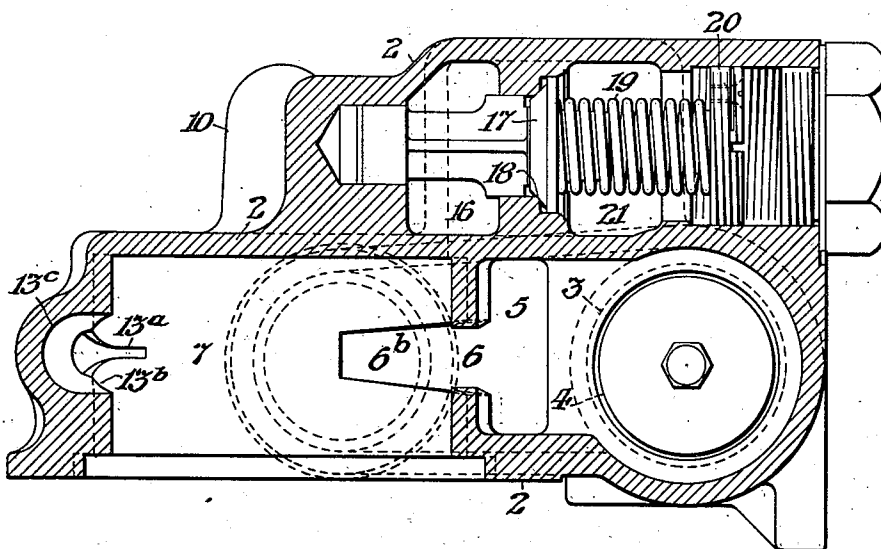


*FIG. VI*

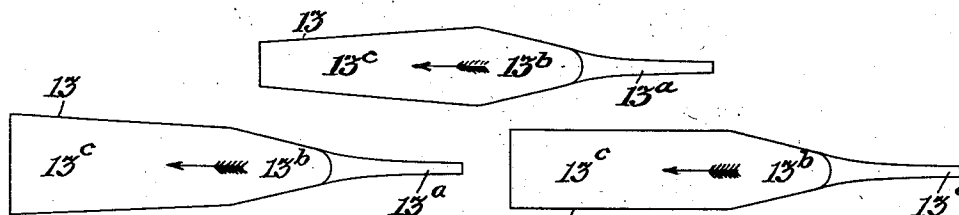


*FIG IX.*

*FIG X.*

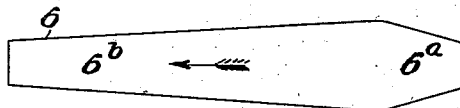


*FIG VII.*

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## UNITED STATES PATENT OFFICE

2,291,856

## ROTARY PUMP

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Application December 21, 1938, Serial No. 247,019

7 Claims. (Cl. 103—135)

My invention relates to pumps of the type including a rotor having a circumferential series of elements projecting substantially radially with respect to its axis of rotation; whereby the fluid pumped is swept from an inlet port to an outlet port, in the casing inclosing the rotor. As hereinafter described, my invention is applicable to a pump wherein the radially projecting elements are blades mounted to reciprocate in slots in the rotor and to project into contact with the cylindrical wall of the casing which is eccentric with respect to the axis of rotation of the rotor, so as to afford a crescent shaped space between the casing and the rotor in the portion of the casing between the inlet and outlet ports. However, my invention may be otherwise embodied, for instance, in a pump of the rotary gear type.

In its rotary movement from the inlet port to the outlet port, each of the blade elements aforesaid sucks liquid into the casing behind it and simultaneously compresses liquid ahead of it. The consequent differential in pressure in a pump used for dispensing gasoline is approximately twenty-five pounds per square inch which, in pumps of ordinary construction, is suddenly equalized upon opposite sides of each blade as it passes the initial end of the outlet port, due to free communication of the liquid ahead and behind the blade. Such action, in an ordinary pump, not only produces a noise level averaging eighty-two decibels, on certain types of installations, but of a disagreeable tone, extremely irritating to some hearers. Therefore, the object and effect of my invention is to not only reduce such noise level, but to so modify the tone thereof as to eliminate the irritating quality of such noise incident to the operation of ordinary pumps.

By a long series of experiments, I have determined that the noise level may be reduced from eighty-two decibels to seventy-five decibels with the improvement in tone aforesaid, by a specific construction and arrangement as to the shape of said ports; particularly the initial end of the outlet port; whereby, instead of the practically instantaneous release of suction and pressure upon each blade at the initial end of the outlet port and projection of load upon the following blade; the equalization effect is gradually attained during the movement of the rotor through a considerable arc. As hereinafter described, such effect is attained by making the initial end of the outlet port extremely narrow and shallow with respect to the maximum width of said port, and gradually increasing its width and radial depth

into mergence with the full width of said outlet port, by a series of gradations which were only determined by the research experiments above contemplated.

5 My invention includes the various novel features of construction and arrangement herein-after more definitely specified.

In said drawings; Fig. I is a side elevation of a pump conveniently embodying my invention.

10 Fig. II is a vertical sectional view of said pump taken on the line II, II in Fig. I, in the direction of the arrows on said line, but showing the rotor and its driving shaft in elevation.

15 Fig. III is a vertical sectional view taken on the line III, III in Fig. II, in the direction of the arrows on said line, but omitting the rotor to show the configuration of the initial end of the outlet port.

20 Fig. IV is a vertical sectional view taken on the line III, III in Fig. II, but looking in the opposite direction.

Fig. V is a plan sectional view taken on the line V, V in Figs. I and II.

25 Fig. VI is a plane development of the outlet port shown in Figs. II and III.

Fig. VII is a plane development of the inlet port shown in Figs. II and IV.

30 Fig. VIII is a fragmentary sectional view taken on the line VIII in Fig. II, showing the cross sectional configuration of the initial end of the outlet port.

Figs. IX and X show modifications of the terminal end of said outlet port.

35 Referring to Figs. I and II; the conduit 1 extends from a subadjacent liquid supply tank to the pump casing 2. Said conduit 1 opens into the screen chamber 3 from which the liquid escapes through the cylindrical screen 4 into the suction chamber 5. Said suction chamber 5 has the inlet port 6 opening into the cylindrical pump chamber 7. Said inlet port is of the configuration shown in Figs. II, IV, V, and VII, wherein the initial end of the port is indicated at 6<sup>a</sup> and the terminal end at 6<sup>b</sup>. As indicated in 45 Figs. II, IV, V, and VII; the terminal end 6<sup>b</sup> of said port is, conveniently, of gradually diminishing width and radial depth and consequent area. However, the terminal end of said port may gradually increase in width, or may have parallel sides.

Said chamber 7 incloses the pump rotor 8 which has the axial shaft 9 journaled in the bearing 10 in said casing 2 and in the bearing 11 in the cover plate which is rigidly connected with said

casing by the circular series of tap bolts 11<sup>a</sup> indicated in Figs. I and II.

Said rotor 8 is turned in the direction of the arrow on Fig. II and carries a circumferential series of blades 8<sup>a</sup> mounted to reciprocate transversely to its circumference in slots 8<sup>b</sup> which communicate at their inner ends with respective drilled holes 8<sup>c</sup> leading to the circumference of said rotor 8 so that the pressure in said chamber 7 is continually in communication with the inner edges of said blades to permit liquid to fill the slots, and thus permit the centrifugal force, during operation, to force them outwardly into contact with the cylindrical wall of said chamber 7.

As shown in Fig. II, said rotor and its shaft are disposed eccentrically with respect to the cylindrical chamber 7 so as to afford a crescent shaped space 7<sup>a</sup> between them extending from said inlet 6 to the outlet 13.

As shown in Figs. II, III, V, and VI, said outlet port 13 includes three respectively different tapered portions, to wit, the initial end portion 13<sup>a</sup>, the intermediate portion 13<sup>b</sup>, and the terminal portion 13<sup>c</sup>. As shown in Fig. VIII, the side walls of the initial portion 13<sup>a</sup> of said outlet port converge radially outward from the axis of the pump chamber 7, and merge into the wider portion 13<sup>c</sup> thereof, which has parallel walls, as shown in Fig. V. However, the terminal portion 13<sup>c</sup> of said outlet port 13 may gradually increase in width, as shown in Fig. IX, or may have parallel edges, as shown in Fig. X.

That is to say, I have found the form of port 13 shown in Fig. VI to be preferable to the forms shown in Figs. IX and X. The form shown in Fig. IX, is like the form shown in Fig. VI in that it includes an initial end portion 13<sup>a</sup>, an intermediate portion 13<sup>b</sup> and a terminal portion 13<sup>c</sup>. It only differs from Fig. VI in that the terminal portion 13<sup>c</sup> gradually increases in width from the intermediate portion 13<sup>b</sup>. The outlet port 13 shown in Fig. X has the initial end portion 13<sup>a</sup>, the intermediate portion 13<sup>b</sup> and the terminal portion 13<sup>c</sup>. It only differs from the port shown in Fig. VI in that the edges of the terminal portion 13<sup>c</sup> are parallel instead of being relatively inclined.

Said outlet port 13 opens into the outlet conduit 14. When embodied in a curbstand for dispensing gasoline, said conduit 14 leads to a meter, from which the liquid passes to a dispensing hose having a normally closed valve in a nozzle at its discharge end which may be opened by the dispensing operator. I have not illustrated such features of installation as they are not herein claimed. However, I note that when the nozzle valve is closed while the pump is operating, it is desirable to by-pass the liquid from the outlet port 13 back to the inlet port 6. Therefore, I provide the passage 15 leading from said outlet port 13 into the valve chamber 16 in which the by-pass valve 17 is mounted to reciprocate to and from its seat 18 in the casing 2. Said valve is normally held on its seat by the spring 19 extending from said valve to the spring seat 20. When said nozzle valve is closed, as above contemplated, the pressure of the liquid forced by the pump rotor blades 8<sup>a</sup> from the inlet port 6 through the outlet port 13 pushes said by-pass valve 17 off its seat 18 against the stress of said spring 19 and permits the liquid to pass through the spring chamber 21, shown in Fig. V, and thence through the passageway 22, shown in Fig. II, into the inlet port 6; with the effect that while said nozzle valve is closed and said by-pass

valve thus opened, the liquid is merely circulated through said by-pass passageways without excess pressure upon said dispensing hose.

The hole 24 which is normally closed by the screw plug 25, as shown in Figs. I and II, is merely for the introduction of liquid to initially prime the pump. I also find it convenient to form the hole 26, indicated in Fig. II, extending into the passage 15, but normally closed by the plug 26<sup>a</sup>.

However, I do not desire to limit myself to the precise details of construction, arrangement, or method of operation above described, as it is obvious that various modifications may be made therein without departing from the essential features of my invention as defined in the appended claims.

I claim:

1. In a rotary pump, the combination with a rotor having a circumferential series of projections adapted to receive fluid between them; of a casing forming a cylindrical pump chamber inclosing said rotor and having fluid inlet and outlet ports in circumferentially spaced relation in the cylindrical wall of said pump chamber; means for rotating said rotor to sweep fluid in said chamber from said inlet to said outlet port, between said projections; whereby, each of said projections sucks fluid into said casing from said inlet port upon the rearward side of the projection with respect to the direction of rotation of said rotor, and compresses fluid upon the forward side of each projection and discharges it through said outlet; the differential pressures upon the forward and rearward sides of each projection being automatically released and equalized at said outlet, with consequent sound vibrations and liquid surges; means extending said outlet port circumferentially in said chamber and so shaping it as to minimize said sound vibrations and soften the tone thereof; the area of said outlet port, at the circumference of said chamber, being gradually greater from substantially zero at the initial end of said port, first reached by the forward side of each of said rotor projections, to the greatest width of said port, which is intermediate of its circumferential length; wherein the outlet port is narrowest at its initial end portion which has walls converged radially outward from the axis of the pump chamber and merging into a wider portion thereof; said wider portion having radially parallel walls and opening into an outlet conduit.

2. In a rotary pump, the combination with a rotor having a circumferential series of projections adapted to receive fluid between them; of a casing forming a cylindrical pump chamber inclosing said rotor and having fluid inlet and outlet ports in circumferentially spaced relation in the cylindrical wall of said pump chamber; means for rotating said rotor to sweep fluid in said chamber from said inlet to said outlet port, between said projections; whereby, each of said projections sucks fluid into said casing from said inlet port upon the rearward side of the projection with respect to the direction of rotation of said rotor, and compresses fluid upon the forward side of each projection and discharges it through said outlet; the differential pressures upon the forward and rearward sides of each projection being automatically released and equalized at said outlet, with consequent sound vibrations and liquid surges; means extending said outlet port circumferentially in said chamber and so shaping it as to minimize said sound vibrations and soften the tone thereof; the area

of said outlet port, at the circumference of said chamber, being gradually greater from substantially zero at the initial end of said port, first reached by the forward side of each of said rotor projections, to the greatest width of said port, which is intermediate of its circumferential length; wherein the configuration of the outlet port includes three distinct regions having opposite walls in acute angular relation, circumferentially, the walls of the initial region being most acute and flaring in the direction of traverse of said projections, the walls of the terminal region being less acute than said initial region and converging in said direction of traverse, and the walls of the intermediate region being less acute than said terminal region, and flaring from said initial region to said terminal region.

3. In a rotary pump, the combination with a rotor having a circumferential series of projections adapted to receive fluid between them; of a casing forming a cylindrical pump chamber inclosing said rotor and having fluid inlet and outlet ports in circumferentially spaced relation; means for rotating said rotor to sweep fluid in said chamber from said inlet to said outlet port, between said projections; whereby, each of said projections sucks fluid into said casing from said inlet port upon the rearward side of the projection with respect to the direction of rotation of said rotor, and compresses fluid upon the forward side of each projection and discharges it through said outlet; the differential pressures upon the forward and rearward sides of each projection being automatically released and equalized at said outlet, with consequent sound vibrations; means so shaping said outlet port as to minimize said sound vibrations and soften the tone thereof; the width of said outlet port, at the circumference of said chamber, being greatest intermediate of its circumferential length, less at its terminal end and least at its initial end, first reached by the forward side of each of said rotor projections, and the width of said outlet port being tapered throughout its circumferential length.

4. A pump as in claim 3; wherein the inlet port is narrower at its initial end than intermediate of its circumferential length.

5. A pump as in claim 3; wherein the outlet port is narrower at its initial end than intermediate of its circumferential length and has a portion with outwardly diverging sides.

6. In a rotary pump, the combination with a rotor having a circumferential series of projections adapted to receive fluid between them; of a casing forming a cylindrical pump chamber inclosing said rotor and having fluid inlet and outlet ports in circumferentially spaced relation

in the cylindrical wall of said pump chamber; means for rotating said rotor to sweep fluid in said chamber from said inlet to said outlet port, between said projections; whereby, each of said projections sucks fluid into said casing from said inlet port upon the rearward side of the projection with respect to the direction of rotation of said rotor, and compresses fluid upon the forward side of each projection and discharges it through said outlet; the differential pressures upon the forward and rearward sides of each projection being automatically released and equalized at said outlet, with consequent sound vibrations; means so shaping said outlet port as to minimize said sound vibrations and soften the tone thereof; the width of said outlet port, at the circumference of said chamber, being greatest intermediate of its circumferential length, less at its terminal end, and least at its initial end, first reached by the forward side of each of said rotor projections, and the width of said outlet port being tapered throughout its circumferential length; wherein the outlet port is of less area at its initial end than elsewhere and has a portion with radially parallel sides.

7. In a rotary pump, the combination with a rotor having a circumferential series of projections adapted to receive fluid between them; of a casing forming a cylindrical pump chamber inclosing said rotor and having fluid inlet and outlet ports in circumferentially spaced relation in the cylindrical wall of said pump chamber; means for rotating said rotor to sweep fluid in said chamber from said inlet to said outlet port, between said projections; whereby, each of said projections sucks fluid into said casing from said inlet port upon the rearward side of the projection with respect to the direction of rotation of said rotor, and compresses fluid upon the forward side of each projection and discharges it through said outlet; the differential pressures upon the forward and rearward sides of each projection being automatically released and equalized at said outlet, with consequent sound vibrations; means so shaping said outlet port as to minimize said sound vibrations and soften the tone thereof; the width of said outlet port, at the circumference of said chamber, being greatest intermediate of its circumferential length, less at its terminal end, and least at its initial end, first reached by the forward side of each of said rotor projections, and the width of said outlet port being tapered throughout its circumferential length; wherein the outlet port is of less area at its initial end than elsewhere, and both ends thereof are parallel with the axis of the pump chamber.

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