Jan. 8, 1929.

1,698,235

A. MATHIS

ROTARY PUMP

Filed Dec. 20, 1924

2 Sheets-Sheet 1

FIG. 1

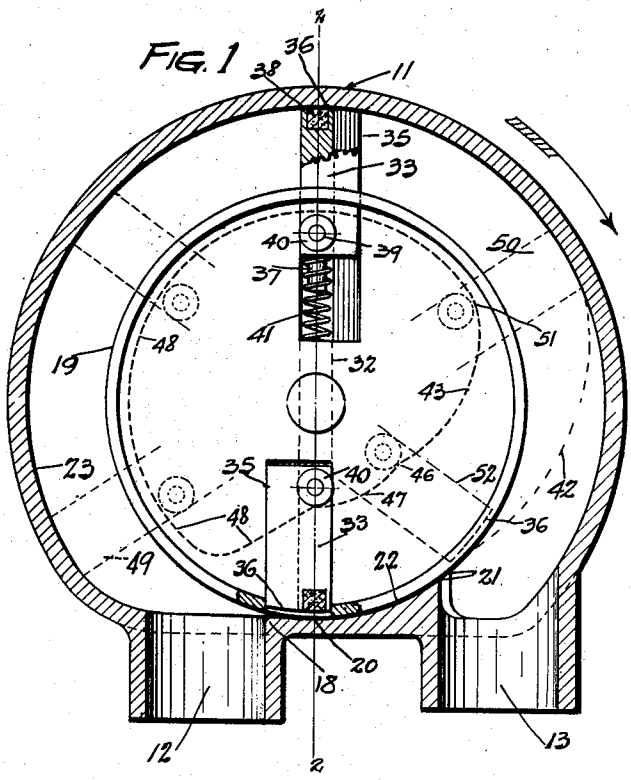


FIG. 2

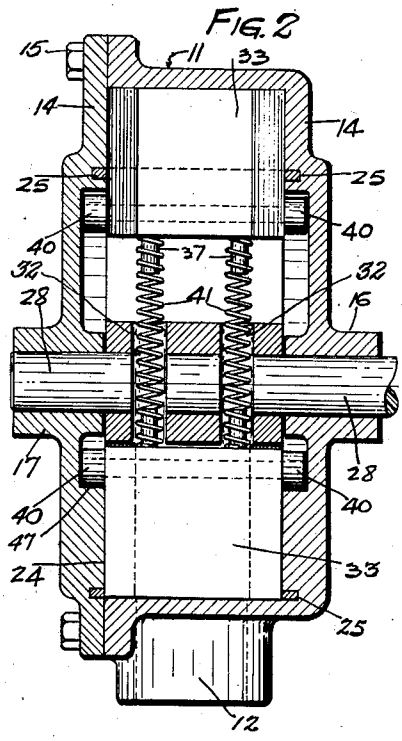
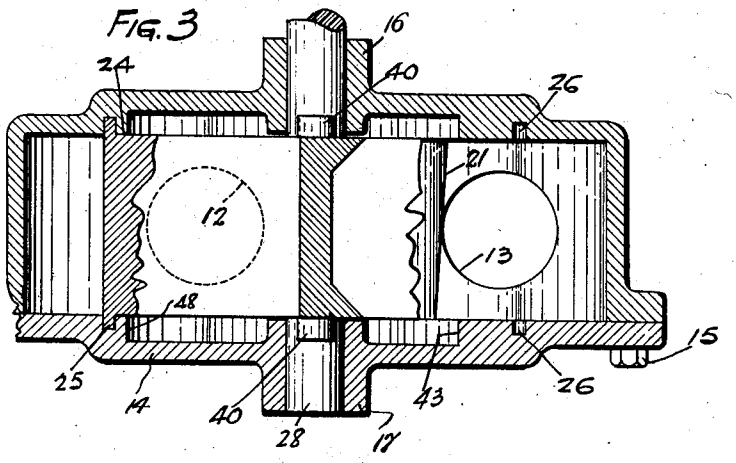


FIG. 3



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FIG. 4

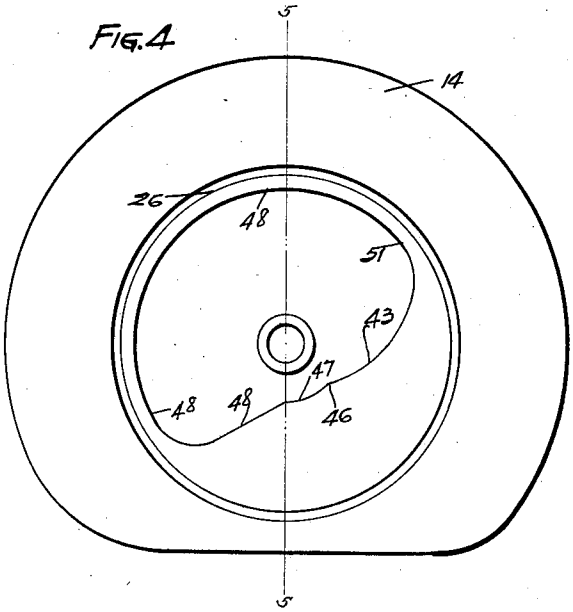


FIG. 5

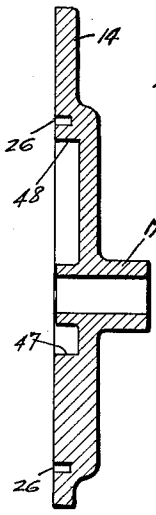


FIG. 6

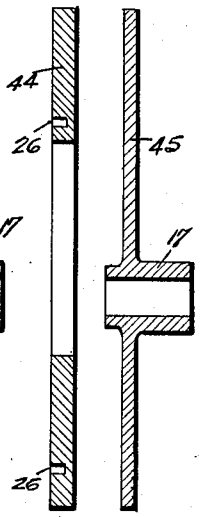


FIG. 7

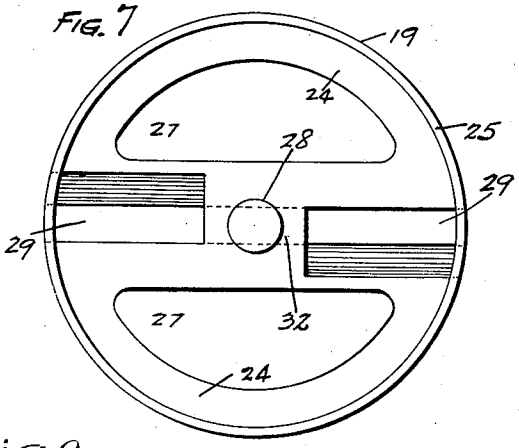


FIG. 8

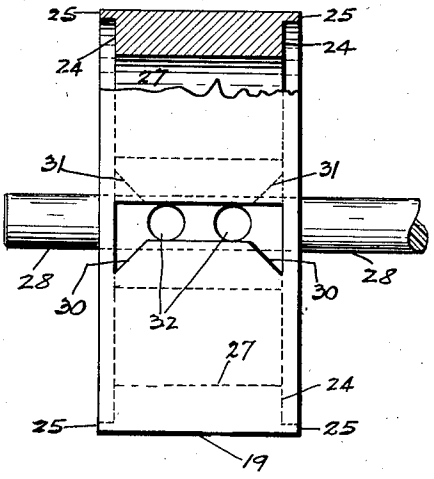


Fig. 9.

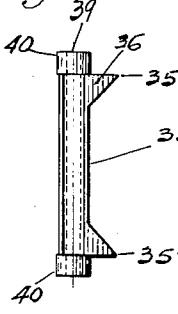
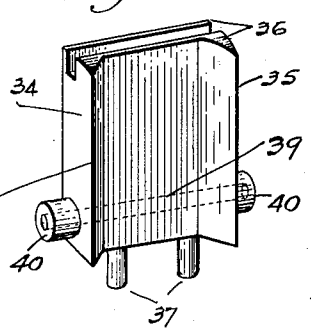


Fig. 10.



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UNITED STATES PATENT OFFICE.

ALEXANDER MATHIS, OF NEW ORLEANS, LOUISIANA, ASSIGNOR TO MATHIS R-S PUMP COMPANY, OF DENVER, COLORADO, A CORPORATION OF COLORADO.

ROTARY PUMP.

Application filed December 20, 1924. Serial No. 757,182.

The present invention relates to rotary pumps of single or multiple reciprocating piston, or vane, types; said vanes alternately obtruding and receding during each cycle of the rotor.

Objects of the invention are to provide a mechanism of simple construction specially adapted to low rotor speeds and capable of producing a high vacuum, which may be operated by manual or mechanical means and which has the elements thereof so organized that the largest power turn is produced with each revolution of the rotor; to provide a casing of special and novel construction and have rotatably mounted therein a rotor, also of special and novel construction; to set in or flatten the periphery of a segmental section of this casing and bring it into substantial contact with the periphery of the rotor, abruptly creating and terminating the power chamber and effectively separating the suction from the compression chambers; to provide easy egress of the pistons on the suction stroke and a knife edge scraper at the inner end of the discharge port or chamber, which will effectively deflect all the fluids and any incidental foreign solid matter towards the discharge opening; to so position the ports in the casing as to facilitate a suction intake with the least possible friction losses due to the ingress of the fluids, and to augment the facility of discharge of not only the fluids but also and automatically, of all incidental solid foreign matter; to provide pistons of special and novel construction which, while acting in conjunction with elements hereinafter set forth, reduce frictional resistance to a minimum, yet form an air seal of superior efficiency with the inner periphery of the rotor and the casing on all sides and prevent adherence of foreign particles to the casing; to provide a special and suitably designed cam, or cams, for automatically, and with the greatest possible abruptness, terminating the power cycle of the vanes and relieving the important sections of the mechanism from all avoidable wear; to provide a pump which operates with facility and is characterized by a minimum number of simply constructed parts which are capable of withstanding the strain necessarily imposed thereon.

Other objects of the invention will be apparent from the following description of the present preferred form of the invention taken in connection with the accompanying drawings wherein:—

Fig. 1 is a vertical sectional view of a typical pump constructed in accordance with this invention, showing the case, rotor and vanes, the section being taken through the ports of the casing but outside of the rotor and vanes;

Fig. 2 is a sectional view of the invention taken approximately along the vertical center line 2—2 of Fig. 1;

Fig. 3 is a horizontal sectional view of the pump showing a portion of the rotor broken away to disclose details;

Fig. 4 is an inside elevation view of one of the casing heads showing the cam formed therein;

Fig. 5 is a vertical sectional view taken on the line 5—5 of Fig. 4;

Fig. 6 is a vertical sectional view of a modified form of casing head showing the cam formed separate from the head per se;

Fig. 7 is an end elevational view of the rotor;

Fig. 8 is an elevational view of the rotor looking at the periphery and showing a part thereof broken away to disclose details;

Fig. 9 is an end elevational view of one of the vanes; and

Fig. 10 is a perspective view of the same.

The device of this invention consists of a hollow casing 11, of partly circular configuration equipped with an intake port 12, and an exhaust port 13, located at the respective ends of the power chamber. The heads or ends 14 of this casing may be made solid therewith or detachable and bolted thereto as at 15. Both sides or heads are formed to have bearings 16 and 17 concentric with the cylindrical part of the casing 11, and in axial alignment with each other. The casing is set in or flattened on the side of the intake and discharge ports, as indicated at 18, and its inner

face rises into contact with the rotor 19, the inception of the point of contact being at 20. The portion of the casing which rises upwardly is of arcuate configuration and terminates at 21 thereby providing a breast 22 which conforms to the shape of the rotor 19 and is in intimate contact therewith. This construction will effectively prevent the compression at 13 from reducing the suction at 12, thereby increasing the efficiency of performance. At 21 the breast is abruptly terminated in a sharp wedge preferably slightly diagonal, which, in effect, provides a volute knife edge scraper in continuous sliding engagement with the periphery of the rotor, thus, not only deflecting towards the discharge port all the pumpage but also effectively removing from the surface of the rotor all incidental particles of foreign matter. Furthermore, lodgement of particles between the breast 22 and rotor 19 is prevented.

The general configuration of the casing between point 20 and inner periphery 23 of the casing may be either as shown in Fig. 1 or any suitable combination of lines, arcs or both, calculated to more or less abruptly bring the vanes into full normal engagement with inner periphery 23 of the casing.

The rotor 19, illustrated in Figs. 7 and 8, is made relatively smaller in diameter than the inside diameter of the casing 11, the difference in these diameters being controlled by considerations of design of the mechanism as a whole. The side faces 24 of the rotor are made to maintain a close sliding contact with the inside surfaces of the heads 14 of the casing. To further augment the air sealing features of the rotor an annular flange 25 is provided on each side of the rotor which form the closest possible sliding fit on any or all sides within the grooved recesses 26 of casing heads 14.

Portions of the rotor are removed to provide spaces 27 and thereby reduce the weight of the rotor. A shaft 28 is rotatably mounted in the bearings 16 and 17 of the casing and may have either one or both of its terminals extended to permit the application of power thereto. Vane receiving slots 29 are formed in the rotor and are so arranged that the longitudinal axes thereof, when vertically arranged as shown in Fig. 1 will be parallel to a vertical line drawn through the axis of the rotor. These slots 29 are placed in communication through openings 32 which extend through the center of the rotor. The slots 29, at their outer ends may open through the side of both rings 25, or may leave these rings intact as shown in Fig. 8.

Each of the slots 29 has a vane or piston 33, as shown in Fig. 9, fitted and reciprocably mounted therein, said vanes being oblong in shape and equipped with outstanding wings 35 on their advancing faces, the outer terminals 36 conforming to the arc on the inner periphery 23 of the casing 11. The inner terminals of the vanes are equipped with pins 37 which are movable into the openings 32 when the vanes are retracted in their slots. The outer ends of these vanes may be slotted to receive some form of suitable, wear resisting anti-friction packing 38.

Arranged through each vane, in proximity to its inner terminal is a pin 39 which is secured to the vanes and the terminals of which project beyond the lateral margins of the vane and have guide rollers 40 rotatably mounted thereon. The vanes are normally held apart by helical springs 41 which encircle the pins 37 and impinge against the inner ends of the vanes to urge the outer ends of the latter against the inner periphery 23 of casing 11. The springs 41 extend through the openings 32 as shown in Fig. 2.

To abruptly terminate compression strokes of the vanes 33, as illustrated by dotted line 42 in Fig. 1, the rollers 40 are mounted to ride on a cam 43. This cam in its entirety, (see Fig. 4) may be formed within the casing heads 14 as illustrated by Fig. 5. If desired, however, the cam and casing head may be made in two separate parts, 44 and 45 respectively, as illustrated by Fig. 6. The inner terminal points 46 of actuating cams 43 are so located as to not only withdraw the vanes along the dotted line 42 of Fig. 1 but also to withdraw the outer terminals of the vanes 36, so as to effectively prevent them from impinging on the knife edge 21 of the casing and destroy its maximum effectiveness, as set forth.

The balance of the cam actuating surface 47 is so shaped as to hold the terminals 36 of the vanes from coming into contact with the breast 22 of the casing, thus preventing any undue wear on this very important section of the casing and inevitably reducing the curvature of the terminal ends 36 of the vanes which would bring about a reduction in their performance, efficiency and wearing qualities.

The cam surface over the remaining portion of its magnitude 48 is so shaped as to permit unhindered egress of the vanes from within the rotor on the suction stroke side and to leave the outer terminals 36 of the vanes in full, unrestrained contact with the casing periphery 23, against which it is gently pressed by the springs 41 until the full power turn is completed.

In Fig. 1 the arrow to the upper right hand indicates the direction of the power turn. The lower of the vanes 33 is shown ready to be released from the restraint of the cam surface 47 and ready to go into position shown by the dotted lines 49. In this position the space from the vane towards the port 12 will constitute the suction, or vacuum side, the

arcuate distance of travel from dotted lines 49 to dotted lines 50 constituting an approximate power turn. When the vane reaches the point indicated by the dotted lines 50 it is withdrawn into the rotor by reason of the configuration of the cam upon which the rollers 40 of the vane ride. Point 51 of Fig. 4, representing the beginning of the cam actuating surface, is so positioned as to cause the vanes to begin to withdraw from contact with casing periphery 23 only after the opposite vane, emerging from the rotor on the suction side, has come into engagement with periphery 23, as illustrated by the relative positions of 49 and 50 of Fig. 1.

The position indicated by the dotted lines 52 of Fig. 1 represents the vane 50 completely withdrawn and ready to pass the breast or seal 22, the space between the dotted arc of its terminus 36 and the breast 22 illustrating the safeguard essential to the proper protection of the surface 22 against undue wear. This latter is very important as the entire efficiency of the mechanism largely depends on the maintained closeness of the sliding contact between the rotor and this arc 22.

It is apparent that various changes may be made in this device especially in its details of construction, proportion and arrangement of parts, within the scope of the appended claims. The device may also function without the specific provisions of the rollers 40, and cams 43, 47 and 48 by merely shaping the casing on the discharge side 13 approximately along the dotted line 42 and permitting the outer terminals 36 of the vanes to be actuated thereby on their receding strokes.

Therefore, the specific formation of the casing and the arrangement of the ports, especially with reference to that part of the casing between the ports making a concentric arc contact with the rotor, and the position of the discharge port with its specific provisions, alone are deemed of importance to produce effective results. Taken in conjunction with rotor, vanes and actuating cams as herein set forth, the efficiency of the performance and capacity to resist wear, become very materially enhanced. These features are therefore considered of paramount importance to the production of an efficient, economical and thoroughly dependable device of this kind.

It is also to be understood that although this device is herein described as a rotary pump, it may likewise capacitate as an engine by the induction thereinto of fluids under pressure.

What is claimed is:—

1. A rotary pump consisting of a casing, a breast mounted in the casing, a rotor mounted within the casing in intimate contact with the breast, said casing being provided on one side of said breast with a suction port and on the other side thereof with a discharge port, radially opposed vanes slidably mounted within the rotor and equipped with cam rollers, an inwardly inclined cam formed in each end of the casing the terminals of which are so proportioned along the arc of travel of the aforesaid cam rollers that the outer ends of the advancing vane will not break contact with the inner periphery of the casing on the discharge side of the stroke before the following vane has been restored to contact with the casing periphery and closed the suction port.

2. A rotary pump consisting of a casing, a rotor equipped with slidably fitted vanes and cradling breast formed within the casing and in intimate contact with the periphery of the rotor, the terminal edge of said breast on the advancing side of the rotor periphery being terminated abruptly and formed diagonally with reference to the longitudinal axis of the rotor, to provide a volute edge scraper in contact with the advancing periphery of said rotor.

3. A rotary pump including a casing with a breast formed therein, a cam formed in each end of the casing, a rotor revolubly mounted in the casing in contact with said breast and provided with vane slots, vanes slidably mounted in said slots and equipped with cam engaging rollers, springs urging the vanes from within the rotor on the release side of the cam and along the outer terminals of the vanes against the casing during the power stroke, said springs providing a cushion at the inner limit of the sliding travel of the vanes for absorbing the momentum occasioned by the withdrawal of the vanes through the action of the cam on the cam rollers.

4. A rotary pump including a casing provided with inlet and outlet ports, a rotor revolubly mounted in said casing and equipped with vanes having outstanding wings formed thereon for impingement against the casing, said rotor having slots formed therein which complement and slidably receive said vanes.

5. A rotary pump including a casing having a cam formed in each end thereof, a breast formed in the casing, the latter being provided with inlet and outlet ports, a rotor revolubly mounted in said casing in contact with said breast, and provided with vane slots, vanes mounted in said slots and equipped with rollers which impinge said cams for retracting the vanes into the rotor while passing over the casing breast, and springs interposed between the inner end of each vane and the bottom of its slot to urge the vane outwardly after the latter passes over the breast.

6. A rotary pump including a casing equipped with a breast provided with an inlet port on one side of the breast and an outlet port on the opposite side of the breast, a rotor revolubly mounted in the casing in contact with the breast, means to withdraw the vanes into the rotor when passing over

the breast, and independent means to urge the vanes outwardly after the latter have passed over the breast.

7. A rotary pump including a casing provided with inlet and outlet ports, the inner face of each end of the casing having a recess formed therein, the wall of which is arcuate on one side and deformed on the opposite side to define a cam, a rotor revolubly mounted in the casing and equipped with rollers projecting into the casing recesses, and springs urging the vanes outwardly to yieldingly maintain the rollers engaged with the walls of the recesses.

In testimony whereof I affix my signature.

ALEXANDER MATHIS.