J. D. CARROLL.

PUMP.

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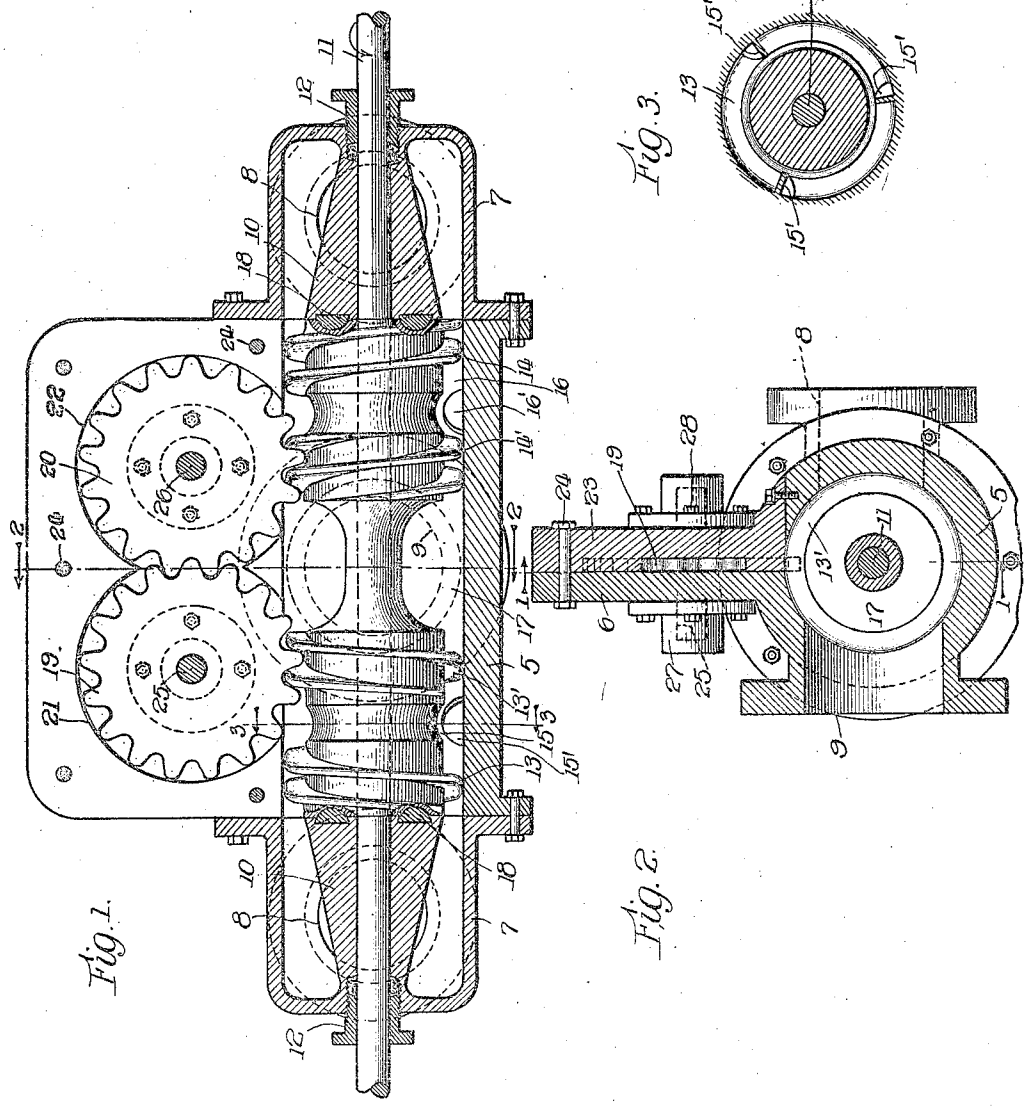


Fig. 1.

Fig. 3.

Fig. 2.

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UNITED STATES PATENT OFFICE.

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PUMP.

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To all whom it may concern:

Be it known that I, JOHN D. CARROLL, a subject of the King of Great Britain, residing at West Lafayette, in the county of Tippecanoe and State of Indiana, have invented certain new and useful Improvements in Pumps, of which the following is a specification.

This invention relates to hydraulic pumps, and has reference more particularly to hydraulic pumps which are constructed and operated on the screw principle.

The chief objects of the invention are, first, to provide a simple, inexpensive, and efficient pump of the screw type capable of forcing liquids at high pressure in a uniform and continuous flow and with an economy of power consumption in operation; to provide an improved screw pump wherein the end thrusts on the screw shaft are neutralized; to provide in a screw pump means for checking a whirling movement of the liquid; and to provide a screw pump including an automatic cut-off or check valve in the screw itself to automatically arrest the back-flow of the liquid when the operation of the pump ceases, thus avoiding the necessity of providing a check valve in the out-flow main or pipe.

Other objects and advantages of the invention will be apparent to those skilled in the art as the same becomes better understood by reference to the following detailed description, taken in connection with the accompanying drawing wherein I have illustrated a practical and approved embodiment of the invention, and in which—

Fig. 1 is a longitudinal section of my improved pump taken on the line 1—1 of Fig. 2;

Fig. 2 is a transverse section of the same taken on the line 2—2 of Fig. 1; and,

Fig. 3 is a cross-section on the line 3—3 of Fig. 1.

Referring to the drawing, 5 designates a cylinder of uniform diameter formed with an integral upstanding radial plate 6 that constitutes one side member of a gear casing. To the two ends of the cylinder 5 are bolted hollow cylinder heads 7 that are formed with lateral intake openings 8 to which the in-flow pipes (not shown) are connected. The cylinder 5 is provided on the side thereof opposite the intake openings 8 with a central out-flow or discharge port 9, the area of which is approximately equal to the combined areas of the intake openings 8.

The two cylinder heads 7 are formed with central shaft bearings 10 which are preferably of the conical form shown, being widest at their inner ends. In the bearing members 8 is journaled a pump shaft 11 that extends entirely through the cylinder and its heads, and is provided with suitable packing glands 12 in the end walls of the cylinder heads 7. Fast on the shaft 11 is the rotary screw element of the pump which, in the instance herein shown, comprises a pair of spaced spirals 13 and 13′ on one longitudinal half of the screw element and a similar pair of spaced spirals 14 and 14′ on the other half of the screw element, the pitch of the two pairs of spirals being opposed; that is, as shown, the spirals 13 and 13′ have a "left hand" pitch and the spirals 14 and 14′ have a "right hand" pitch. Between the spirals 13 and 13′ is an annular chamber or reservoir 15, and between the spirals 14 and 14′ is a similar annular chamber or reservoir 16, thereby providing a two-stage type of pump. Between the spirals 13′ and 14′ is a central annular chamber 17 that is in free communication with the out-flow or delivery port 9.

The outer ends of the hubs on which the spirals of the two series are formed abut against the inner ends of the cone-shaped bearing members 10, and between the abutting surfaces are preferably located packing rings 18 which form a water tight joint between the relatively moving contacting surfaces.

The rapid rotation of the screws has a tendency to impart a whirling movement to the body of water in the same direction; and to check this movement, I provide on the inner surface of the cylinder 5 in the chambers 15 and 16, a series of deflectors 15′ and 16′, best shown in Fig. 3, these deflectors preferably lying in planes slightly oblique to the longitudinal axis of the cylinder, and so inclined that the whirling body of water striking them is arrested and deflected in a direction opposite to the direction of rotation.

With the construction described, the shaft 11 is rapidly rotated by an electric motor or other source of power in the direction indicated by the arrow in Fig. 1, by which water is drawn through both of the intake ports 8

and is forced by the two pairs of spirals into the central chamber 17, from which it is expelled through the out-flow port 9 in a continuous stream. The back pressure of the water in the central chamber 17 acts equally in opposite directions on the spirals on opposite sides of said central chamber, so that end thrusts on the bearing members 10 are neutralized, thus reducing wear at the joints to a negligible amount, the packing rings 18 cooperating with the packing glands 12 to prevent leakage around the shaft 11.

In association with the mechanism above described, I preferably provide, and have herein shown, a mechanism designed to prevent whirling and back slippage while running and also to partially check back-flow of the liquid when the operation of the pump ceases. This mechanism comprises a pair of intermeshing worm gears 19 and 20 that are housed within circular recesses 21 and 22, respectively, formed in the inner face of a separable casing plate 23 that is united to the inner face of the integral casing plate 6 as by bolts 24. The gears 19 and 20 are fast on spindles 25 and 26 that, as indicated in Fig. 2, are journaled in opposed openings in the casing plates 6 and 23 and in suitable caps 27 and 28 attached to the outer sides of the casing plates 6 and 23 and enclosing the ends of the spindles 25 and 26.

As clearly shown in Fig. 1, the teeth of the gears 19 and 20, which are in the nature of worm gear teeth, are continuously in mesh with the inner pump shaft spirals 13′ and 14′, so that one tooth of each gear is always located in and practically dams the groove or channel of the spiral, thereby checking the whirling tendency of the liquid and also serving as a check valve to prevent back-flow of the liquid when the pump stops. The teeth of the two gears mesh with each other at a point directly above the central chamber 14 so that they cooperate to prevent any substantial leakage of water past the peripheries of said gears. Such slight leakage as may escape merely flows around through the gear chambers 21 and 22 and is returned into the intermediate chambers 15 and 16. It is manifest that by driving the screw shaft in the opposite direction, the direction of flow of the liquid through the pump may be reversed.

It is believed that the structure, mode of action, and advantages of my invention will be apparent to those familiar with liquid forcing devices of this type without further description. Manifestly, the structural details shown and described, may be modified to suit varying conditions of service without involving any departure from the substance of the invention or sacrificing any of the advantages thereof. Hence, I reserve all such variations and modifications as fall within the spirit and purview of the appended claims.

I claim:—

1. In a screw pump, the combination of a cylinder having end intake ports and a central discharge port, a radial gear casing on said cylinder, a shaft journaled in and coaxial with said cylinder, right and left hand spirals on said shaft between said end ports and said central port respectively, and a pair of worm gears journaled in fixed bearings in said gear casing, said gears meshing with said spirals respectively and with each other and serving to check whirling of the liquid and as check valves to prevent back-flow of liquid through said spirals and around said gears.

2. In a screw pump, the combination of a cylinder having end intake ports and a central discharge port, a radial gear casing on said cylinder, a shaft journaled in and coaxial with said cylinder, a pair of spaced right hand spirals on said shaft between one of said end ports and said central port, a pair of spaced left hand spirals on said shaft between the other end port and said central port, obliquely disposed deflectors on the interior wall of said cylinder located between the two spirals of each pair, and a pair of worm gears journaled in said gear casing, said gears meshing with the inner spirals of each pair respectively and with each other and serving as check-valves and also to prevent whirling of the liquid.

3. In a screw pump, the combination of a cylinder of uniform diameter having a central discharge port, hollow cylindrical heads of the same internal diameter as said cylinder attached to the ends of the latter and formed with central inwardly extending cone-shaped bearings having their wide ends innermost, and lateral intake ports, a shaft journaled in said bearings, right and left hand screws fast on said shaft on opposite sides respectively of said central discharge port, and annular packing rings between the inner ends of said bearings and the outer ends of said screws.

JOHN D. CARROLL.