F. W. KROGH.

CENTRIFUGAL PUMP.

APPLICATION FILED JUNE 14, 1905.

948,228.

Patented Feb. 1, 1910.

4 SHEETS—SHEET 1.

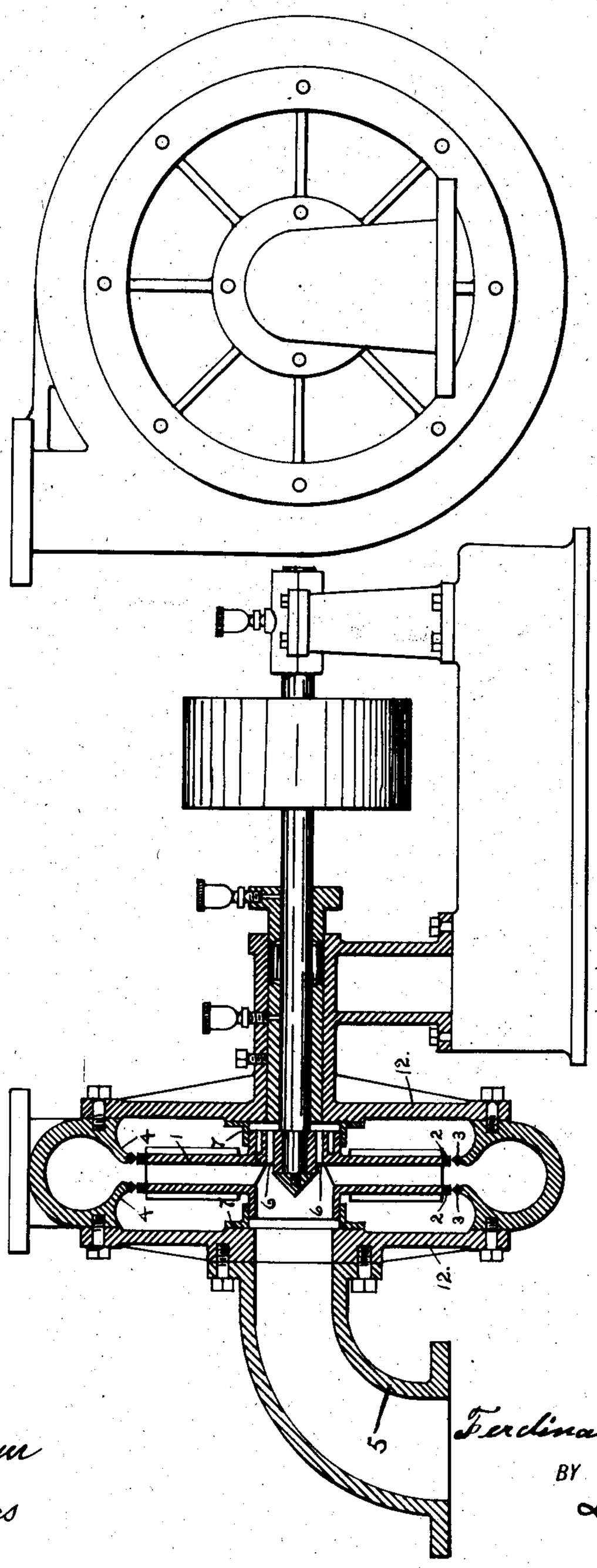

Fig. 1.

Fig. 2.

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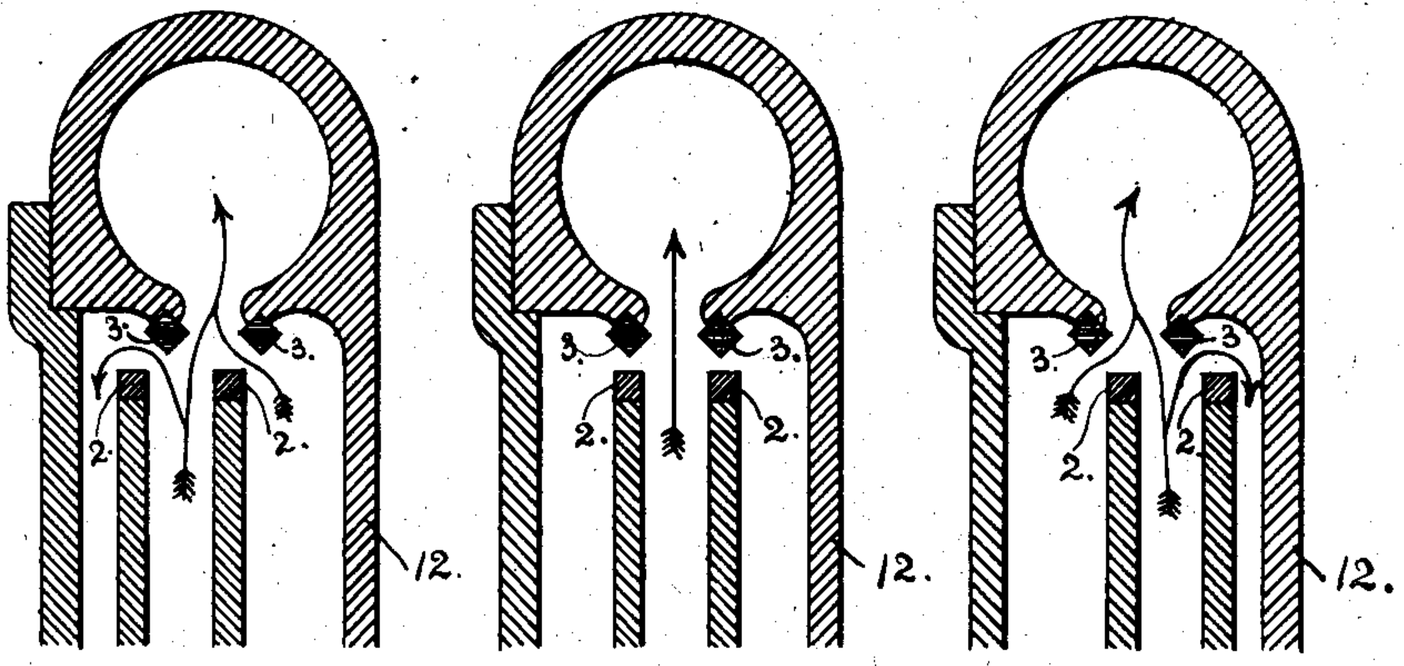

Fig. 4.

Fig. 5.

Fig. 6.

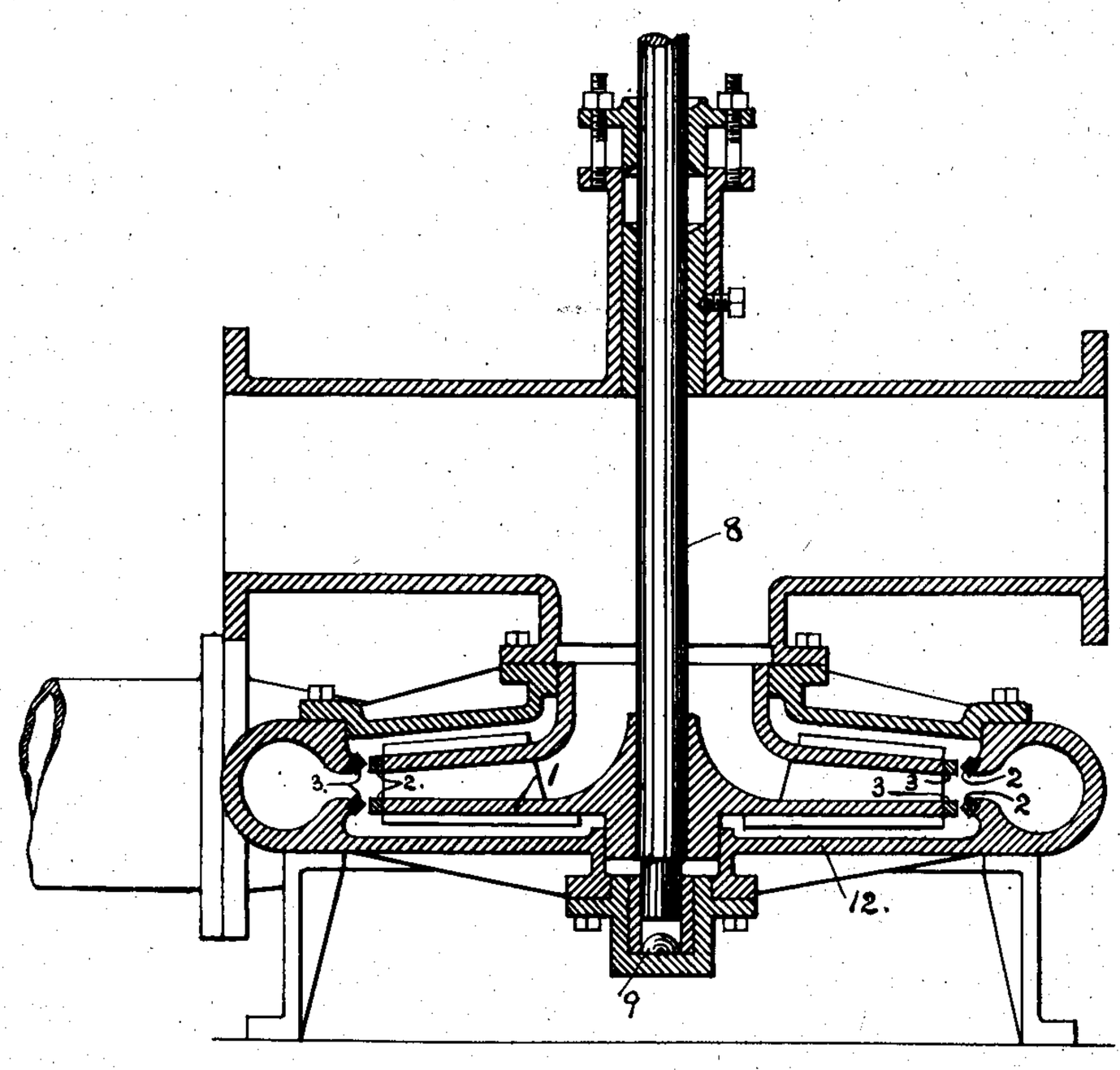

Fig. 3.

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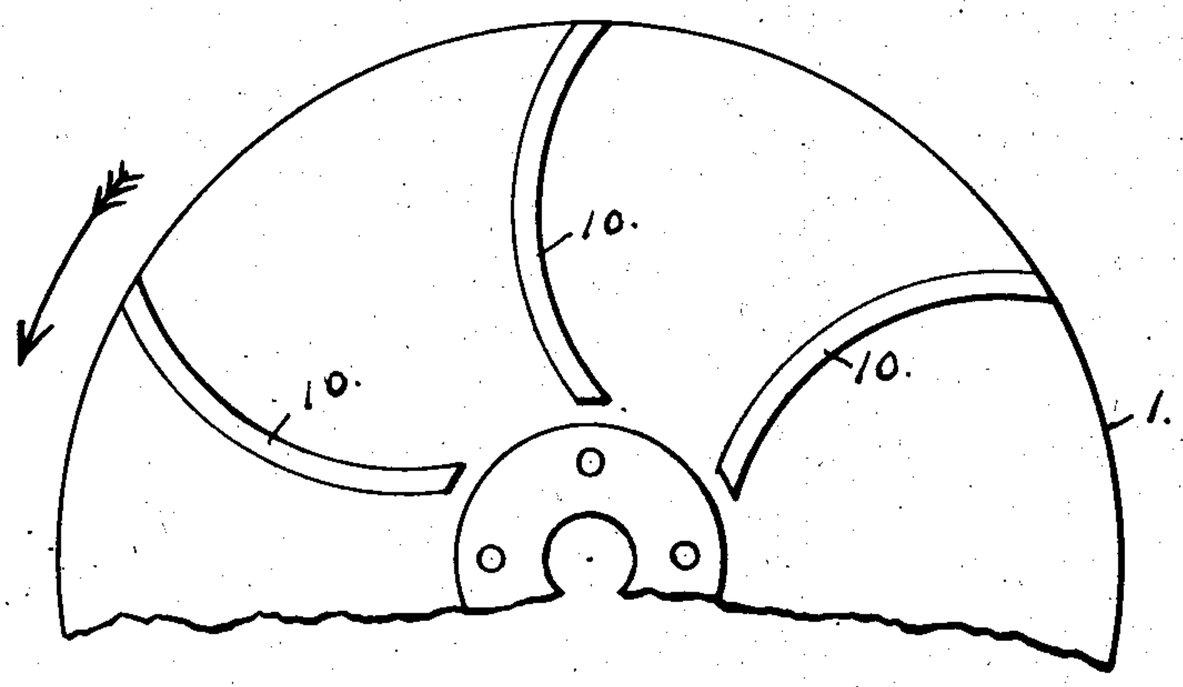

Fig. 7.

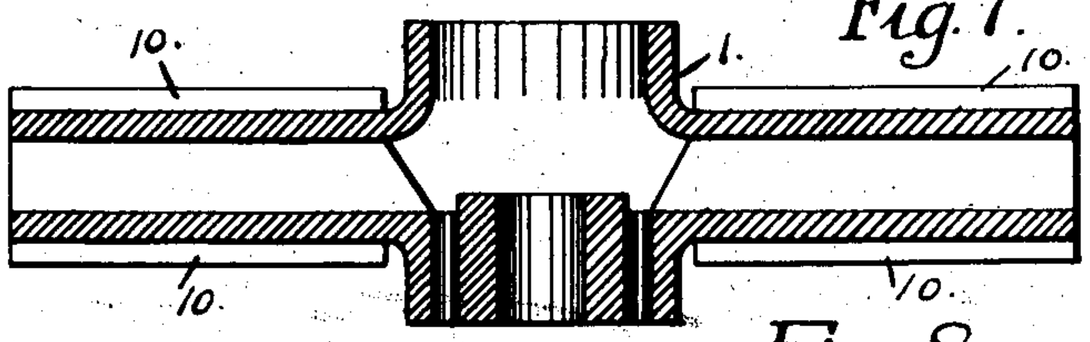

Fig. 8.

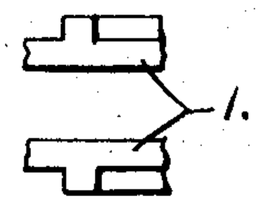

Fig. 9.

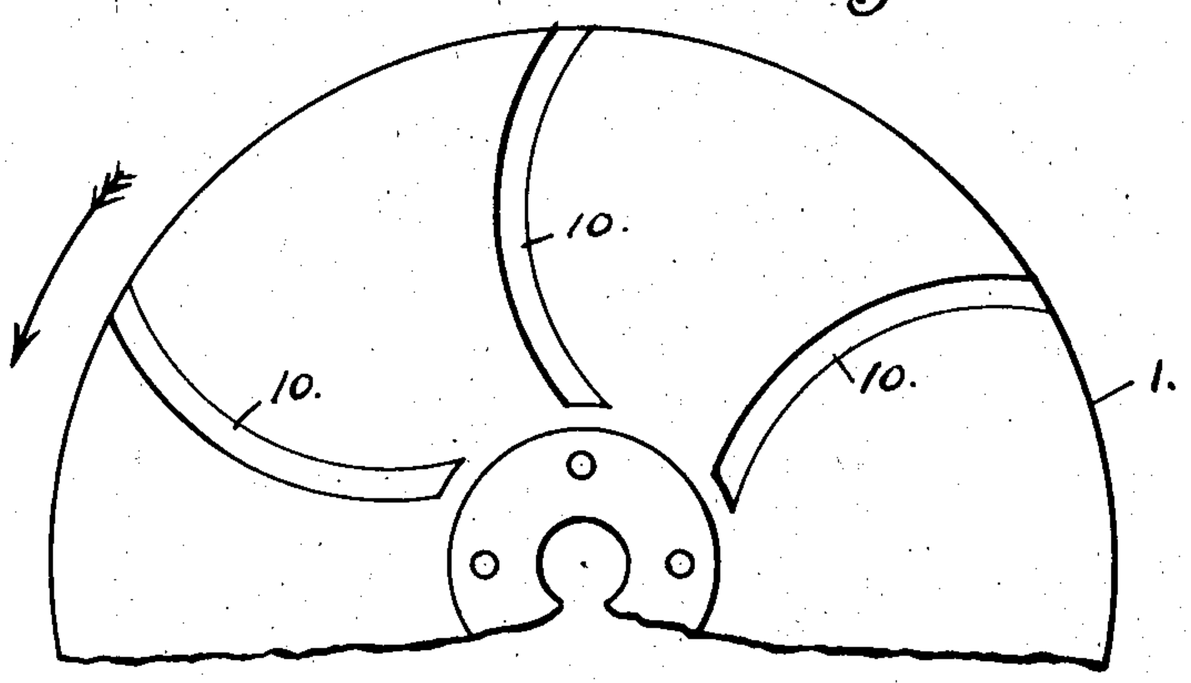

Fig. 10.

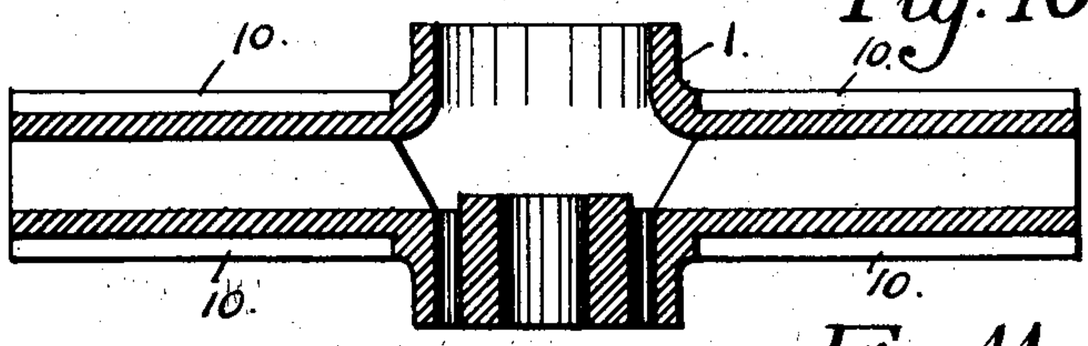

Fig. 11.

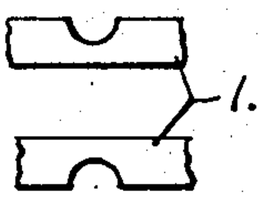

Fig. 12.

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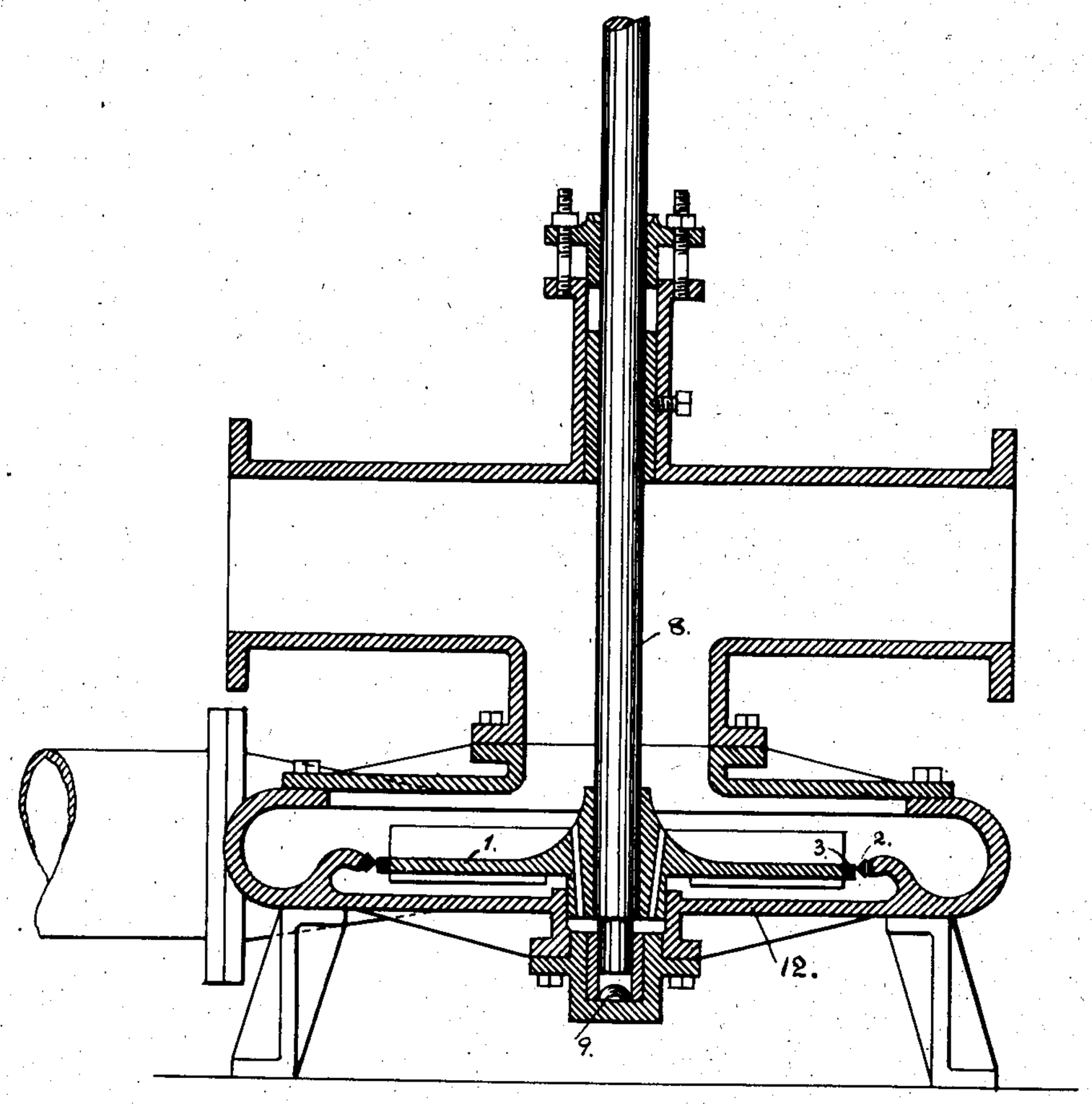

Fig. 13.

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CENTRIFUGAL PUMP.

948,228. Specification of Letters Patent. Patented Feb. 1, 1910.

Application filed June 14, 1905. Serial No. 265,135.

To all whom it may concern:

Be it known that I, FERDINAND W. KROGH, a citizen of the United States, residing at No. 2506 Sutter street, San Francisco, in the county of San Francisco and State of California, have invented certain new and useful improvements in the construction of centrifugal pumps, in which the impellers are caused to maintain a central and correct running position within the pump by reason of the force of water or other liquid being pumped getting on the reverse side of impeller and causing the same to return to its central or middle position whenever it departs from the same.

My invention consists in the peculiar and novel construction of the interior of pump casing so arranged as to meet the circumference of impeller, causing, by its deviation from middle or true running position, the discharged water or liquid to force the impeller to return to its correct position, as will be further described, and pointed out in the claims. I attain this object in the manner illustrated in accompanying drawings, in which—

Figure 1 is a side elevation of a horizontal type of pump, partly in section; Fig. 2 is an end elevation of the same; Fig. 3 shows a vertical type of the same pump partly in section; Figs. 4, 5, and 6 show a partly enlarged view of impeller, in relation to pump casing and how the discharged water or liquid would have its course partly diverted. Fig. 7 and Fig. 8 are part plans and sectional elevations, respectively showing the curved volutes, 10, in form of ribs on the outside of impeller, 1; Fig. 9 is a part elevation of impeller, 1, showing these same volutes or ribs, 10, in end view; Fig. 10 and Fig. 11 are part plan and sectional elevation, respectively showing the curved volutes, 10, in form of half-round grooves on the outside of impeller 1; and Fig. 12 is a part elevation of impeller showing these same volutes, 10, as half-round grooves in end view; Fig. 13 shows an elevation of a vertical type of the same pump, having a single impeller and otherwise containing the same features as Fig. 3.

Similar numbers refer to similar parts throughout the several views.

Fig. 1 shows the general construction of the horizontal type of centrifugal pump, the impeller 1, which is here shown, of the inclosed or hollow type, allowing the water or liquid pumped to pass through its hollow or central part and discharge at its periphery or extreme circumference, as is usual. The periphery or circumference of impeller is as shown reinforced by a ring or rings 2, 2, preferably of steel or other durable material, shrunk on or otherwise securely fastened; coincident with this ring or rings 2, 2, the pump casing has also ring or rings 3, 3, sprung in and securely fastened to projecting ribs 4, 4, extending all around the interior of casing, and forming a running joint with rings 2, 2. The rings 3, 3, are preferably of same material as those used on impeller 1, and they might be placed in the position as shown in drawing, which is better adapted for the purpose intended; these rings might also have other shapes than square; and should be securely fastened to the casing with screws or rivets.

It is clear in referring to Fig. 1, that as the water or liquid is drawn in through the suction elbow, 5, forming part of suction pipe, and the impeller is drawn over toward the suction side of pump, although this movement is partly arrested by the communicating passages, 6, 6, allowing the suction or vacuum effort to equalize on both sides of impeller underneath or inside the packing rings, 7, 7, yet as this equalizing effort is only partial, however, and does not prevent the impeller 1, moving from its true and central running position, it is clear, as more fully set forth in views 4, 5 and 6, that the movement of impeller from its central position will cause the water or liquid, as discharged to be partly thrown against the inner walls of pump casing, 12, thus forcing the impeller over toward its true position, whereas, simultaneously, the water or liquid which may be inclosed on the other side of impeller will be drawn out and pass away with the discharged water or liquid; thus the discharge action of pump has a natural equalizing effort on impeller, as well as the suction action.

Referring to Fig. 3 and Fig. 13, in which a vertical type of pump is shown and where the weight of impeller 1, with shaft 8, may be quite considerable and where a pump of this type is working as is usual against considerable heads, it is very essential that a reliable equalizing medium should obtain. Should the impeller 1, with its shaft 8, owing to their weight, fall below the central running position of said impeller 1, it is

clear that the discharged water exerting a material force and getting on the reverse lower side of said impeller, will cause a material lifting force seeking to sustain the weight of moving parts.

In drawings, Fig. 3 and Fig. 13, a half ball 9, is shown at the lower extremity of driving shaft 8. This half ball will serve as a support for the weight of impeller with shaft 8, etc., when at rest, but it is not intended to sustain the weight of above parts when running. The rim of impeller 1, together with the corresponding portion of pump casing, 12, being protected in the manner shown by rings 2, 2, and 3, 3, form a very durable innovation from wear owing to the gravelly sandy and impure state of water generally pumped.

Referring to Figs. 7, 8, 9, 10, 11, and 12, in which the volutes 10,—ribs or half-round grooves are shown in detail, they will in conjunction with the central volutes, or webs of impeller 1, form a very potent factor in the before explained balancing of impeller, tending to apply with great force the reactionary force of the discharged water or liquid; the construction of these volutes, 10, in the form of ribs or grooves, I know to be old, and I do not claim the same broadly, but by the application of the same in connection with the peculiar and novel construction of inside of casing, where the steel protected circular ribs (4, 4) of same meet the steel protected disks of impeller 1, forming a running joint efficient results are obtained. Where the hollow or inclosed type of the impeller is used, 3 distinct chambers are thus formed, the central one between disks of impeller, the other two, one on each side of impeller, and within the casing 12. The central chamber formed by the disks of impeller, operates as the discharge medium of pump, and the two outer ones on each side of the impeller 1, being the field in which the balancing means on impeller 1, exert their force. Where the single impeller is used, as in Fig. 13, two chambers only are formed, as it is believed that the same will suffice in this class of pumps, and it is plain that similar working conditions will obtain as with the double or inclosed impeller.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a centrifugal pump, an impeller having protection on the discharge edge thereof, said protection consisting of a metal ring detachably secured to said discharge edge of the impeller, in combination with a stationary casing having a circumferential rib on the inside of the same, and said rib having protection on its edge, said protection consisting of a metal ring detachably secured to the edge of the rib for the purpose specified.

2. In a centrifugal pump, the combination of a casing provided with an annular rib on its interior surface, a metal ring secured to said annular rib, an impeller mounted to revolve in said casing, bearings for the said impeller, a metal ring surrounding the said impeller arranged to form a running joint with the ring of the annular rib, and separate means for causing the impeller to run in its central or normal position in said bearings.

3. In a centrifugal pump, the combination of a casing provided with an annular rib on its interior surface, an impeller arranged to revolve therein, bearings for the impeller arranged to permit the impeller to move laterally to allow water to flow to the back side thereof to equalize the pressure on the said impeller and cause the same to run centrally in the casing, and means on the back side of the impeller for increasing the reactionary effect of the water thereon.

4. A centrifugal, turbine or similar pump or motor having an inclosed impeller mounted to permit sidewise movement of the impeller under lateral pressure, and with the side walls of the impeller and of the delivery passage surrounding the impeller constructed and arranged to open the impeller at its periphery to one of the chambers on the opposite sides of the impeller when the impeller is moved sidewise from its normal position.

5. In a centrifugal, turbine or similar pump or motor, the combination with an inclosed impeller, of a shaft carrying said impeller and mounted to move sidewise of the impeller under lateral pressure, the side walls of the impeller and the delivery passage surrounding the impeller being constructed and arranged to open the impeller at its periphery to one of the chambers on the opposite sides of the impeller when the shaft is moved from its normal position.

6. In a centrifugal pump, the combination of a casing provided with chambers on its opposite inner sides, a water discharge passage leading from the casing, a laterally sliding impeller adapted to rotate in the casing and close communication between the said chambers and the delivery passage, when running in its normal position, but to open communication therebetween when moved laterally out of said normal position.

7. In a centrifugal pump, the combination of a casing, an impeller therein, said casing having chambers formed therein at each side of the impeller near its periphery, passageways leading from said chambers and merging into the passageway for the jet of water issuing from the impellers, and means for controlling the said passage-ways so as to counteract the end thrust.

8. In a centrifugal pump, the combination of a casing, an impeller in the casing,

said casing having a chamber formed therein at each side of the impeller, said chambers being in communication with the discharge of the impeller, and means for governing the pressure in each of said chambers to counteract the end thrust.

9. In a centrifugal, turbine, or similar pump or motor, the combination with an impeller shaft mounted to move endwise under unbalanced pressure, a casing having chambers on opposite sides of the impeller, of balancing means controlled by said endwise movement to increase the pressure in one or the other of the side chambers on opposite sides of the impeller according to the direction of the endwise movement of the shaft.

10. A centrifugal, turbine, or similar pump or motor having an inclosed impeller mounted to permit sidewise movement under lateral pressure, a casing having chambers on opposite sides of the impeller, and means controlled by said sidewise movement for varying the pressures in the chambers on opposite sides of the impeller to balance the pump.

In witness whereof, I have signed my name to this specification in the presence of two subscribing witnesses.

FERDINAND W. KROGH.

Witnesses:
HENRY P. TRICOU,
C. A. KROGH.