No. 805,019. PATENTED NOV. 21, 1905.

F. W. KROGH.

CENTRIFUGAL PUMP.

APPLICATION FILED APR. 3, 1905.

3 SHEETS—SHEET 1.

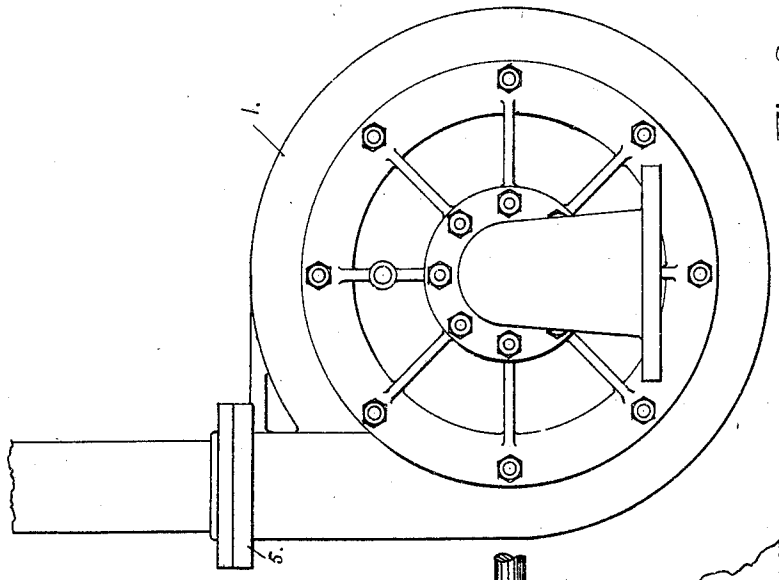


Fig. 2.



Fig. 4.

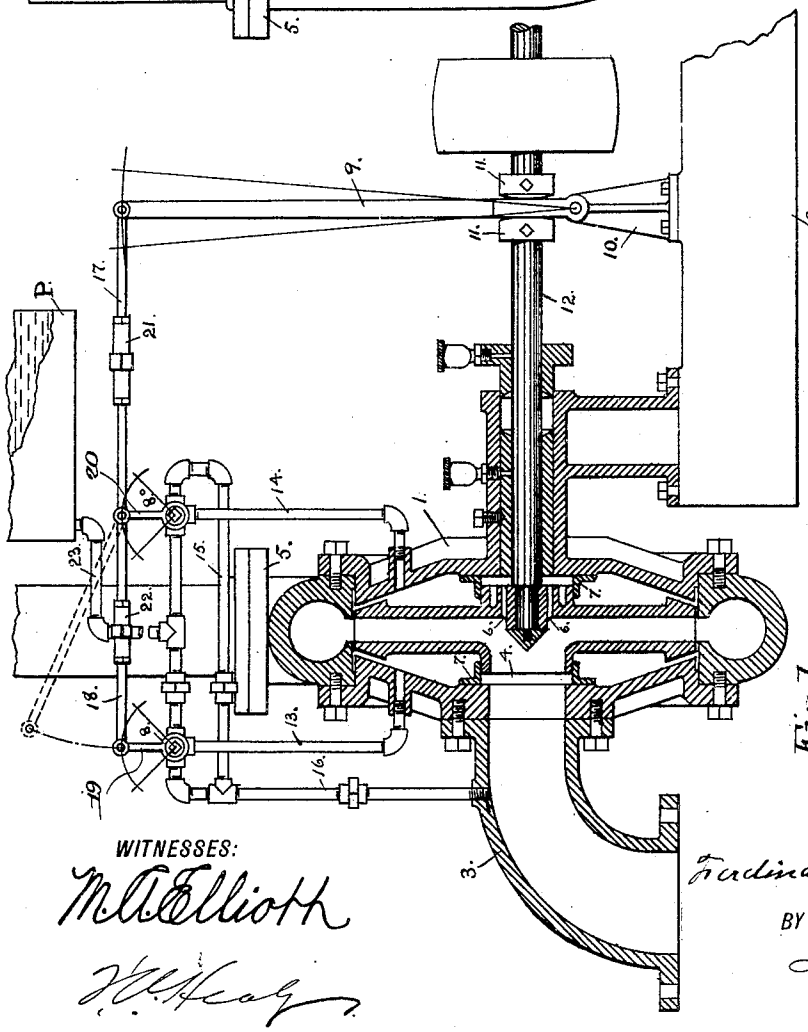


Fig. 1.

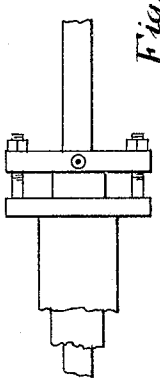


Fig. 3.

WITNESSES:

M. A. Elliott

H. C. Keay

INVENTOR

Ferdinand W. Krogh.

BY

L. C. Christie.

ATTORNEY

No. 805,019. PATENTED NOV. 21, 1905.

F. W. KROGH.

CENTRIFUGAL PUMP.

APPLICATION FILED APR. 3, 1905.

3 SHEETS—SHEET 2.

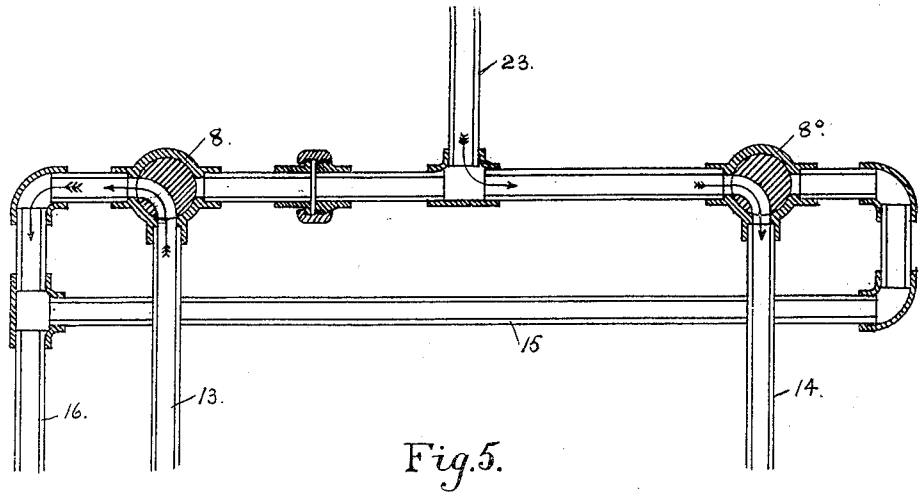


Fig. 5.

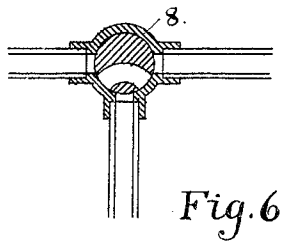


Fig. 6.

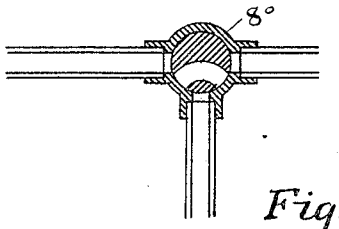


Fig. 6.

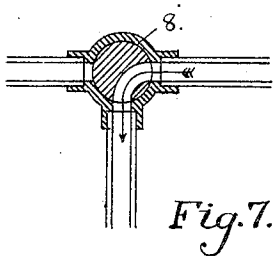


Fig. 7.

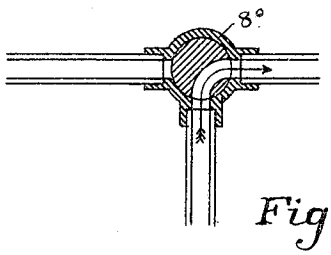


Fig. 7.

WITNESSES:

M. A. Elliott

H. A. Healy

INVENTOR

Ferdinand W. Krogh.

BY

L. C. Christie.

ATTORNEY

No. 805,019. PATENTED NOV. 21, 1905.

F. W. KROGH.

CENTRIFUGAL PUMP.

APPLICATION FILED APR. 3, 1905.

3 SHEETS—SHEET 3.

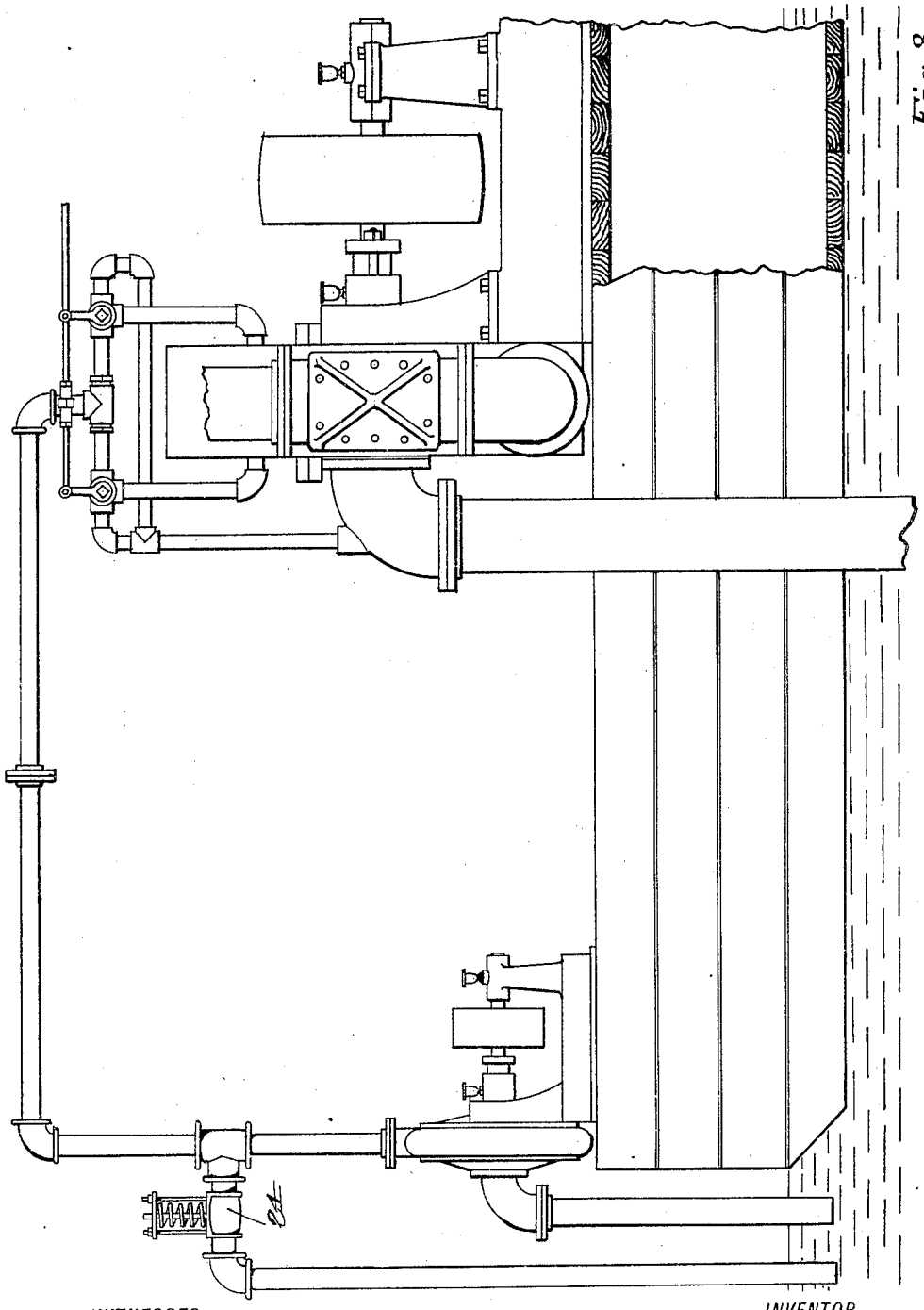


Fig. 8.

WITNESSES:

M. A. Elliott

W. W. Healy

INVENTOR

Ferdinand W. Krogh

BY

L. C. Christie

ATTORNEY

UNITED STATES PATENT OFFICE.

FERDINAND W. KROGH, OF SAN FRANCISCO, CALIFORNIA.

CENTRIFUGAL PUMP.

No. 805,019. Specification of Letters Patent. Patented Nov. 21, 1905.

Application filed April 3, 1905. Serial No. 253,395.

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 Centrifugal Pumps, of which the following is a specification.

In a pump of this character the tendency of the impeller under the influence of the suction produced on one side of the casing is to run more closely to or against the walls or surfaces of the casing inclosing the impeller, with the effect to set up greater frictional contact and a consequent greater wear between the impeller and the contiguous surfaces of the casing. To obviate this defect in the operation of pumps of the character mentioned, I provide means for maintaining an equilibrium of pressure on both sides of the impeller, and thereby balancing the impeller under the varying conditions and inequality of pressure on opposite sides, and in addition thereto a means for controlling automatically from the driving-shaft the pressure in the casing on both sides of the impeller and for varying the same from the thrust of the impeller.

My invention may be said to consist, therefore, in novel means for varying and controlling the pressure in the casing on both sides of the impeller, as hereinafter described, and pointed out in the claims at the end of this specification.

The following description explains at length the nature of the invention, and the manner in which I proceed to produce, apply, and carry out the same, the accompanying drawings being referred to by figures.

Figure 1 illustrates the application of the invention to a centrifugal pump of well-known construction, the same showing the pump-casing and the impeller in transverse section. Fig. 2 is an end elevation taken from the left side of Fig. 1. Figs. 3 and 4 are details, respectively, of the stuffing-box and the actuating-lever of the valves. Fig. 5 shows an enlarged view in section of valves and pipe connections. Figs. 6, 6 show the same valves in their middle position, and Figs. 7, 7 show the same valves in the reverse position to that of Fig. 5. Fig. 8 illustrates in a general way how this same principle can be applied to this class of pumps known as "dredging-pumps."

Similar characters refer to similar parts throughout the several views.

The centrifugal pump 1, mounted on base 2, is in the general construction and appearance the same as is usual. The water or liquid to be pumped is drawn in through the suction-nozzle 3, forming part of suction-pipe, and by the impeller 4 forced out through the discharge-nozzle 5, forming part of the discharge-pipe. Now as the pump starts running then the suction effect on impeller 4 is such as to draw the same over to the suction side of the pump, and although this effect is to some extent reduced by means of the communicating passages 6 6 allowing the same vacuum to exist on both sides of impeller 4 underneath the packing-rings 7 7 yet to effect this balancing in a perfect way the present invention comes in.

The invention consists of valves 8 8°, having a passage through the same by means of which they are alternately in communication with suction side through pipe 16 or pressure source P through communication-pipe 23. These valves are caused to effect this communication by means of the lever 9, pivoted to bracket 10, attached to base 2 and actuated by collars 11 11, firmly attached to driving-shaft 12. This driving-shaft 12, having impeller 4 mounted on same, will of course move with the said impeller 4 as the suction effect draws the impeller 4, with driving-shaft 12, over against the suction side of pump. The effect will be to open valve 8 to the pressure-supply communicating through pipe 13 to the corresponding side of impeller 4, forcing the impeller 4 back. At the same time the valve 8° is made to communicate with the other side of impeller 4 through pipe 14, drawing the water or liquid out and sending it back through pipes 15 and 16 to suction side of pump. If the impeller 4 reaches the other extreme through above effect, the reverse action will take place and the middle or thorough balancing effect will be attained as the valves attain the position as illustrated in Figs. 6, 6. The least divergence from this position will cause an alternate communication to either side of the impeller 4, thus effectually tending to retain the impeller 4 in its true and free-running central position. It is further clear that as the automatic operating-lever 9, which, through the connecting-links 17 and 18, is directly connected to valves 8 and 8° by means of levers 19 and 20, and these links, through turnbuckles 21 and 22, are readily adjusted in length, should the connecting-link 18 be disconnected, as indicated

by the dotted lines, and only one valve be in operation then this valve being set to communicate with suction side of pump will cause the same effect on both sides of impeller 4 to be automatically maintained. It is further clear that where this class of pumps are used for dredging purposes the same system of valves and pipes can be used. It is preferable that a connection be made to discharge-pipe of small auxiliary pump, which pump in pumping clean water will effectually cause the impeller to be maintained in its true and central running position. This can be done automatically by connection to driving-shaft, as before explained, and illustrated in Fig. 1, or the valves may be set in such a manner as to cause a perfect equalizing effect, one valve being more open than the other. Referring to Fig. 8, it is seen that the discharge-pipe of small auxiliary pump is provided with a relief-valve 24. The function of this valve is that when valves 8 8° are in the position shown in Fig. 6 and no outlet for discharge exists then this relief-valve will open and allow the discharge-water to escape as the pressure in discharge-pipe exceeds the compression of the spring. Another function which in this class of pumps is necessary is the forcing of clean water on both sides of the impeller, thus washing away sand, gravel, or other material tending to injure packing-rings, shaft-bearings, and walls of pump.

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

1. In combination with a centrifugal pump, a source of hydrostatic pressure, pipes separately connecting the space between the impeller and the casing on both sides of the impeller with said source of pressure, valves in said pipes for controlling the communication between said source of pressure and the casing, and valve-controlled means for connecting at will the space on either side of the impeller with the suction side of the pump.

2. The combination with a centrifugal pump, of a source of hydrostatic pressure, valve-controlled means for connecting the space between the impeller and the casing on either side of the impeller with said source of pressure, and valve-controlled means for establishing communication between the space on the opposite side of the impeller and the suction side of the pump.

3. In combination with a centrifugal pump, a source of hydrostatic pressure, and means actuated from the driving-shaft of the pump for establishing communication between said source of pressure and the space between the impeller and the casing on the suction side of the pump under a predetermined speed of the pump, and simultaneously setting up communication between the suction-chamber and the space in the casing on the opposite side of the impeller.

4. In combination with a centrifugal pump, a source of hydrostatic pressure, valve-controlled means for establishing communication between the space on either side of the casing and said source of pressure, valve-controlled means for establishing communication between the space on the remaining side of the impeller and the suction side of the pump, and means operatively connecting said valves with the driver of the impeller, and adapted to produce a reciprocal variation in the pressure on opposite sides of the impeller, in proportion to the variation taking place in the thrust of the impeller.

5. In a centrifugal pump, the combination of the impeller and its casing, with means for balancing the impeller, comprising a source of hydrostatic pressure, means separately connecting the space between the impeller and the casing on both sides of the impeller, with said source of pressure, and also suction of the pump, valves controlling the communication of the spaces between the impeller and the casing and the said source of pressure, and also suction of the pump, and mechanism actuated by the variations in the thrust of the impeller, reciprocally connecting the casing-space on one side of the impeller with the source of pressure, and the space on the opposite side of the impeller with the suction of the pump, according to the thrust of the impeller, while in operation.

6. The combination with a centrifugal pump, of a source of hydrostatic pressure, pipes separately connecting with said source of pressure the casing-spaces on both sides of the impeller, pipes separately connecting said spaces with the suction side of the pump, valves in said pipe adapted by adjustment to control communication between the casing-spaces on opposite sides of the impeller, and the said sources of pressure and suction and to reciprocally vary the same in proportion to the thrust of the impeller, comprising collars on the impeller-actuating shaft, a lever engaging said collars, and a rod connecting said lever with the controlling-valves in the pipes.

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

FERDINAND W. KROGH.

Witnesses:

M. A. ELLIOTT,

F. U. HEALY.