

1,337,659.

C. V. KERR.
CENTRIFUGAL PUMP.
APPLICATION FILED SEPT. 10, 1917.

Patented Apr. 20, 1920.

3 SHEETS—SHEET 1.

Fig. 1.

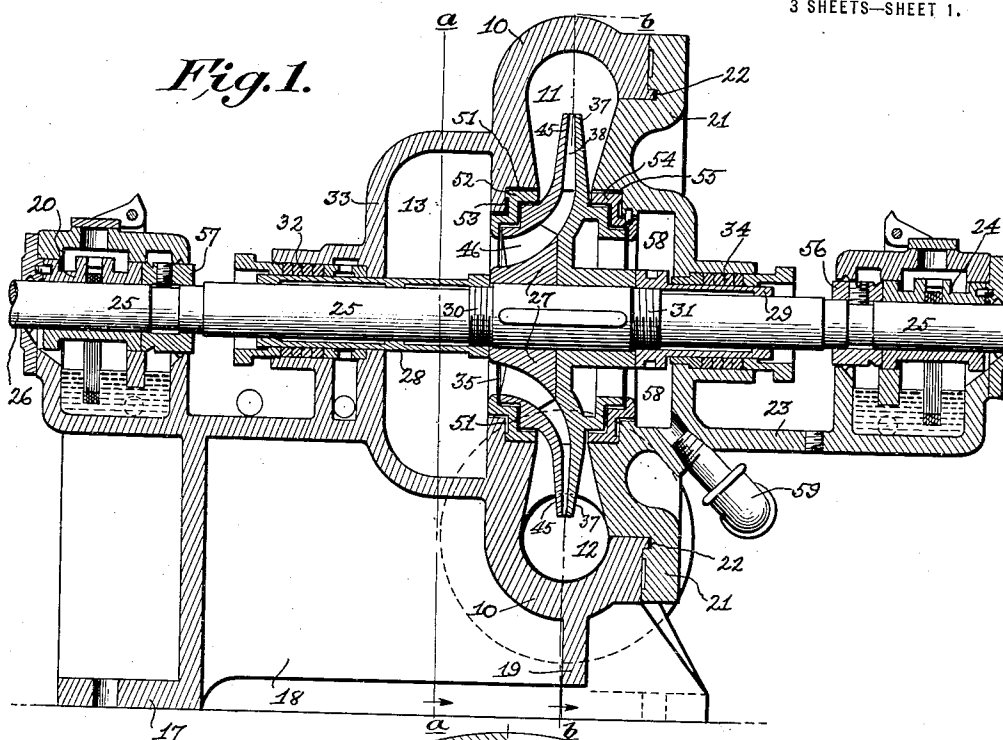
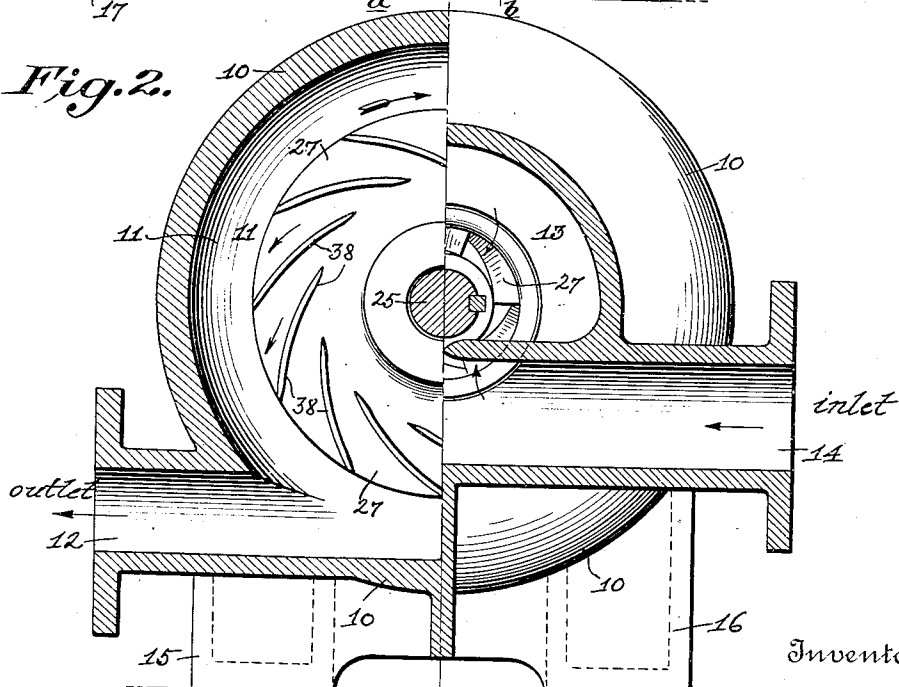


Fig. 2.



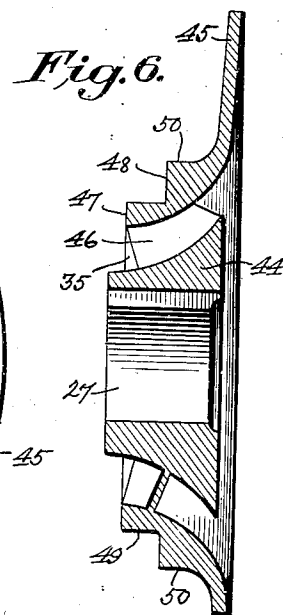
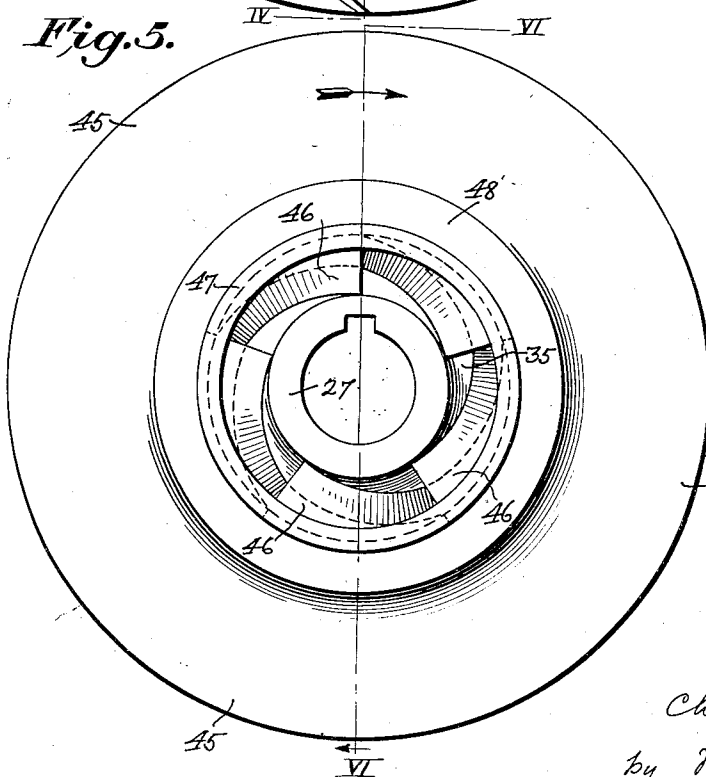
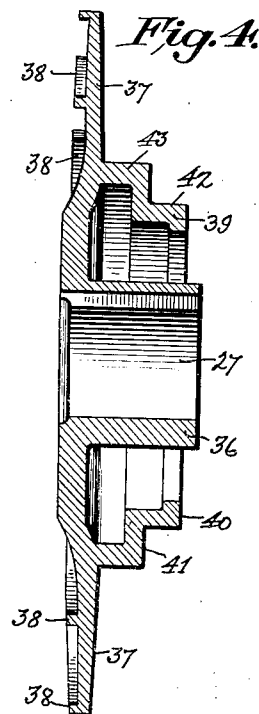
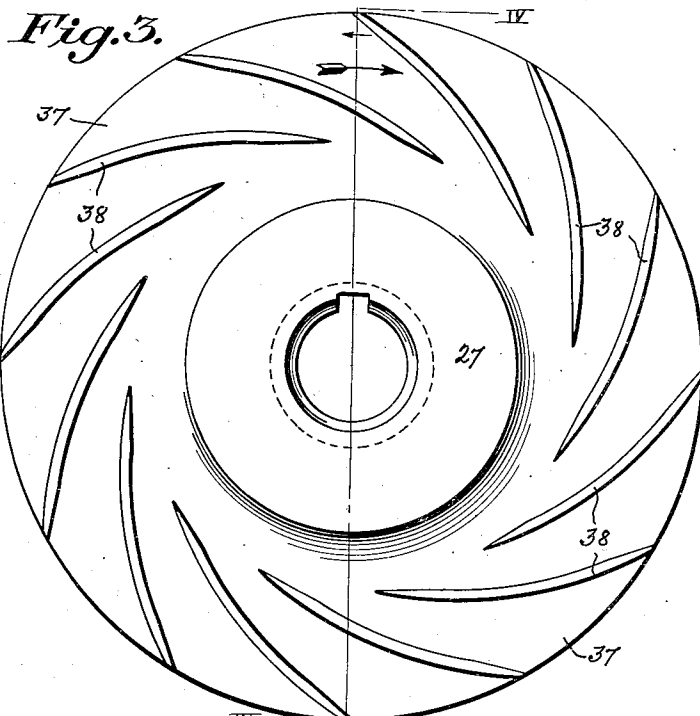
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 9.

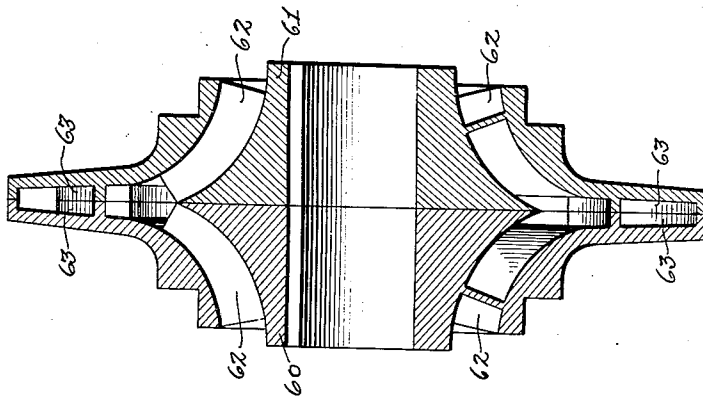


Fig. 8.

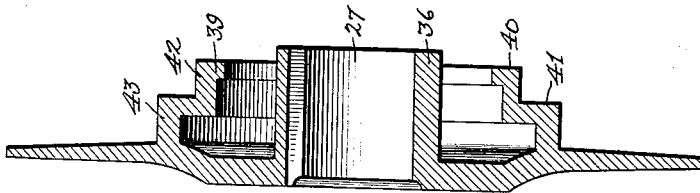
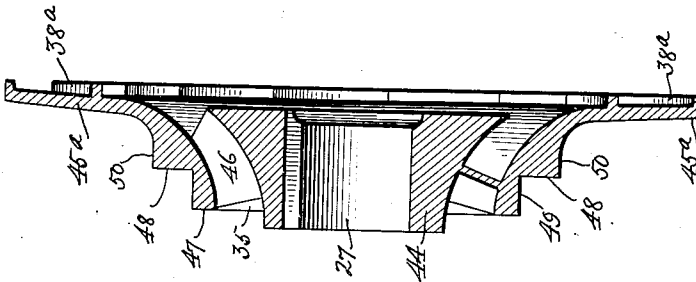


Fig. 7.



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By

UNITED STATES PATENT OFFICE.

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CENTRIFUGAL PUMP.

1,337,659.

Specification of Letters Patent.

Patented Apr. 20, 1920.

Application filed September 10, 1917. Serial No. 190,524.

To all whom it may concern:

Be it known that I, CHARLES V. KERR, a citizen of the United States, residing at Aurora, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in Centrifugal Pumps, of which the following is a specification.

This invention relates to centrifugal pumps in general and has for its salient objects to simplify the construction of the casing and impeller and more particularly with reference to single impeller pumps.

The invention also is an improvement in the construction described and claimed in my earlier Patent No. 1,129,038, granted February 16, 1915.

In the accompanying three sheets of drawings, I have illustrated certain preferred constructions which embody the invention, similar reference characters indicating the same parts throughout the several figures of the drawings.

The invention will be hereinafter more fully and clearly described, and particularly pointed out in the appended claims.

In the drawings:

Figure 1, is a longitudinal section of a centrifugal pump;

Fig. 2, is a composite view, the right hand half of which represents a partial section on the line *a-a* of Fig. 1, and the left hand half of the figure representing a partial section on the line *b-b* of Fig. 1;

Fig. 3, is a side elevation of one part of the impeller shown in Fig. 1;

Fig. 4, is a section on the line IV—IV of Fig. 3;

Fig. 5, is a side elevation of the other part of the impeller shown in Fig. 1;

Fig. 6, is a section on the line VI—VI of Fig. 5;

Fig. 7, is a view similar to Fig. 6, but showing a modification;

Fig. 8, is a view similar to Fig. 4, but showing the modification which accompanies that shown in Fig. 7; and

Fig. 9, is a longitudinal section through a double-suction impeller.

Referring to the drawings, 10 is a casing provided with an annular discharge chamber 11, preferably in the form of a volute, the outlet from which is at 12. On one side of the chamber 11 is a suction chamber which is also preferably in the form of a volute with the intake at 14. The casing 10 is

supported by legs 15, 16 and 17, which are suitably braced by the webs 18 and 19. Above the leg 17 is a bearing 20, of any suitable construction, but preferably of the ring-oiling type illustrated. On the opposite side of the chamber 11, from the chamber 13, the casing has a removable cover or side plate 21 which is bolted to the casing proper, and a tight joint formed therebetween by means of packing 22. The plate 21 has a bracket 23 which carries a bearing 24, similar to the bearing 20.

A shaft 25 is mounted in the bearings 20, 24, and the end 26 thereof may be extended and provided with any suitable form of driving means. The impeller indicated generally by the numeral 27 is keyed on shaft 25 and secured against axial movement as a whole, by the sleeves 28 and 29, which about the ends of the impeller hub and are respectively secured to the shaft by the threaded connections 30 and 31. A stuffing-box 32 of the usual construction is arranged in the wall 33 of the chamber and prevents leakage along the surface of sleeve 28. A similar stuffing-box 34 is arranged in the plate 21 and prevents leakage along the surface of sleeve 29.

Referring to Figs. 3 to 6, it will be seen that the impeller 27 consists of two parts, each of which is an integral structure and when assembled form an impeller having a single suction or intake which is shown at 35 in Figs. 5 and 6. The part shown in Figs. 3 and 4 comprises a hub 36 and a side plate 37, blades 38 being arranged on the latter. This part also has a flange or collar 39, surrounding the hub 36, and the outer surface of which is stepped to provide shoulders 40 and 41 and the cylindrical surfaces 42 and 43. The part shown in Figs. 5 and 6 consists of a hub 44 and side plate 45 which are connected by the blades 46 which constitute the first of the two stages of the impeller and are commonly known as "pick-up" blades. The central portion of the plate 45 has a stepped exterior to provide shoulders 47 and 48 and the cylindrical surfaces 49 and 50. From Fig. 1, it will be seen that when the parts of the impeller are assembled the plate 45 abuts the centrifugal or booster blades 38, the latter forming the second stage of the impeller. It should also be observed that a considerable part of the impeller is arranged in the discharge cham-

ber 11 and the discharge pressure acting on the exterior of the side plates of the impeller produces a clamping effect that over-balances the internal pressure and holds the parts of the impeller together.

The casing 10 has an annular recess 51 for the wearing ring 52, a ground joint being maintained between the ring and casing on the surface 53 and the ring being seated by the discharge pressure acting on its inner surfaces. The interior of the ring 52 is stepped to correspond to the stepped arrangement of the surfaces 47, 48, 49 and 50 of the impeller. The construction, however, is such that the surface 47 will contact with the opposing surface of the ring 52 and prevent the surface 48 from contacting with the surface opposed thereto. This stepped foundation of the impeller and of the ring 52 provides a tortuous passage through which small quantities of water may flow from the discharge chamber 11 to the suction chamber 13, this water forming a fluid packing which reduces wear to a minimum and cushions endwise movements of the impeller. On the other side of the impeller a similar ring 54 is provided, this ring seating in a recess 55 in the plate 21 and having a stepped interior to correspond to the stepped arrangement of the surfaces 40, 41, 42 and 43 of the impeller. As in the case of the ring 52, the inner surface 40 will contact with the opposing surface of the ring 54 and prevent the surface 41 from contacting with the surface of the ring opposed thereto. These rings 52 and 54 are given a radial clearance in casing 10 and plate 21 to permit self-centering with the impeller 27 as the shaft 25 sinks in consequence of wear in the bearings 20 and 24, whereby leakage backward from discharge suction chambers is reduced.

When the pump is in operation the water is drawn from chamber 13 and discharged into chamber 11, as is well known. The pressure in chamber 11 forces water through the tortuous passages on the interior of the rings 52 and 54. The collars 56 and 57 are set for bearing contact by means of set screws or otherwise to permit the surfaces 40 and 47 of the impeller to contact simultaneously with the opposing surfaces on the wearing rings to reduce wear and then any unbalanced axial pressure on the impeller will move the latter and the shaft 25. Assuming this movement to be toward the right in Fig. 1, then the surface 40 will contact with the opposing surface on the ring 54 and close the passage along the interior of the latter. At the same time the passage along the interior of the ring 52 is enlarged and a larger flow of water permitted, this resulting in a reduction of the pressure on the surfaces 47 and 48 and an increase of the pressure on the surface 41,

thereby equalizing the end pressures on the impeller. If the excess of pressure is toward the left the operations will be reversed.

In order to substantially balance the pressures on the impeller, a leakage chamber 58 is provided in the plate 21 and communication with the suction chamber 13 established by means of a pipe 59; or by a cored passage around the discharge chamber 11. The central portions of both sides of the impeller are thus subjected to the suction pressure.

Referring to Fig. 7, it will be observed that the construction differs from that shown in Fig. 6, in that the blades 38^a, of the second stage are on the plate 45^a, instead of being on the plate 37 of the other part of the impeller. Thus both sets of blades are on the same part. The other part of the impeller, in this form, is illustrated in Fig. 8, and is similar to the construction shown in Fig. 4, except for the omission of the blades 38.

Referring to Fig. 9, the construction shown represents a double suction two-part impeller, the parts 60 and 61 being substantially alike except for a reverse arrangement of the blades. It will be noted that the parts 60 and 61 are generally similar to the part shown in Fig. 7. Each of the parts 60 and 61, has a set of first-stage or "pick-up" blades 62, and coöperating second-stage or "booster" blades 63. This impeller may be used in a casing similar to that illustrated in my earlier patent hereinabove referred to.

What I claim is:

1. A two-part two-stage impeller, for centrifugal pumps in which each part is an integral structure and comprises a hub and a side plate, and each of the parts has one of the two sets of blades which constitute the two stages.

2. A two-stage impeller for centrifugal pumps composed of a plurality of parts, the first stage or pick-up blades being integral with one of the parts and the second stage or booster blades being integral with the other part.

3. A two-part two-stage impeller for centrifugal pumps, in which each part is an integral structure and comprises a hub and a side plate, a set of blades for the first stage between the hub and the side plate of one part, and the side plates having between them coöperating blades constituting the second stage.

4. A two-part two-stage impeller, for centrifugal pumps in which each part is an integral structure and comprises a hub and a side plate and carries a set of blades, said sets constructed and arranged to coöperate with each other, whereby one set of blades picks up the liquid to be pumped and delivers it to the other set, the resulting action being that of a two-stage pump.

5 5. A two-part two-stage impeller for centrifugal pumps in which each part is an integral structure and comprises a hub and a side plate, a set of blades of the helical type for the first stage between the hub and the side plate of one part, and the side plates having between them cooperating blades of the centrifugal type, constituting the second stage.

10 6. In a centrifugal pump, the combination of a casing having suction and discharge connections, a rotary shaft, a two part two-stage impeller thereon, stuffing boxes in said casing, and sleeves on said shaft projecting in said stuffing boxes and having right hand and left hand threads so disposed with regard to direction of rotation of the impeller as to press together the parts of said impeller and to maintain contact in a required position by friction of rotation in said stuffing boxes.

25 7. In a centrifugal pump, the combination of a casing having suction and discharge chambers, a rotary shaft supported in said casing, a two-part impeller carried by said shaft and rotatively mounted in said casing, the rim of said impeller projecting into said discharge chamber, whereby the fluid pressure of discharge is utilized to force and hold the parts of said impeller firmly together during the operation of the pump.

8. In a centrifugal pump, the combination of a casing having suction and discharge chambers, a rotary shaft supported centrally in said casing, a two part impeller divided in a plane normal to said shaft and mounted thereon, mechanical means for holding said impeller parts in contact axially, and the rim of said two part impeller projecting into said discharge chamber, whereby the fluid pressure of discharge is utilized in cooperation with said mechanical means for holding said parts of the impeller firmly together.

9. In a centrifugal pump, the combination of a casing having suction and discharge connections, bearings in said casing, a rotary shaft supported in said bearings and having adjustable collars adjacent to said bearings, an impeller mounted on the shaft and having lateral contact surfaces for securing an axial pressure balance, wearing rings seated in said casing and having contact surfaces corresponding to said contact surfaces in said impeller, and means for adjusting and locating said collars for contact with said bearings at instant of contact between the surfaces of said wearing rings and impeller for reducing the wear of said rings and impeller.

In testimony whereof I affix my signature.

CHARLES V. KERR.