

940,257.

C. V. KERR.
CENTRIFUGAL PUMP.
APPLICATION FILED FEB. 18, 1907.

Patented Nov. 16, 1909.
3 SHEETS—SHEET 1.

Fig. 1.

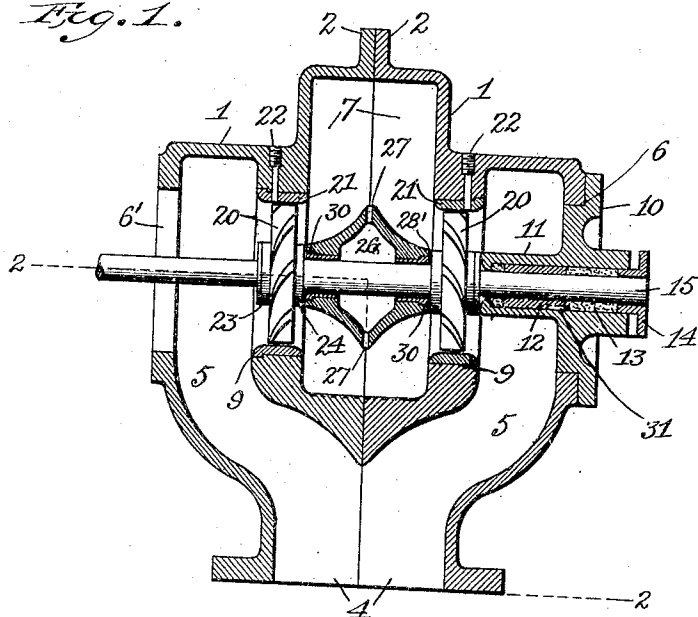
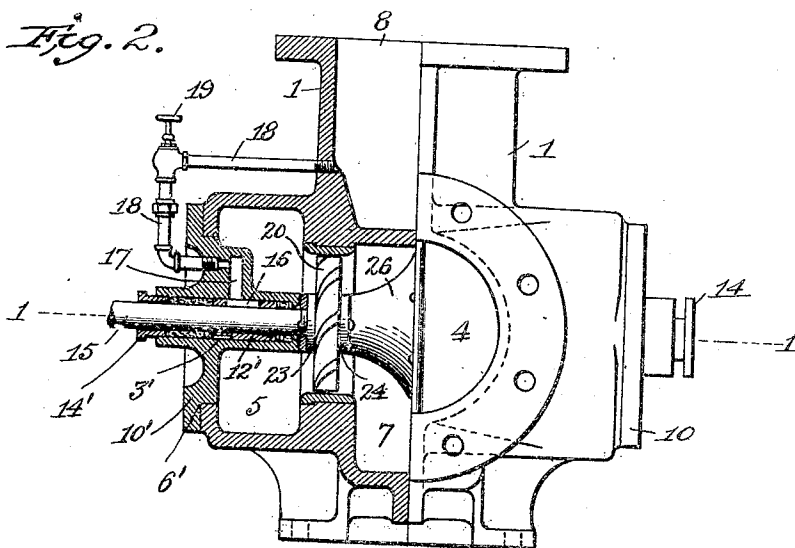


Fig. 2.



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Fig. 3.

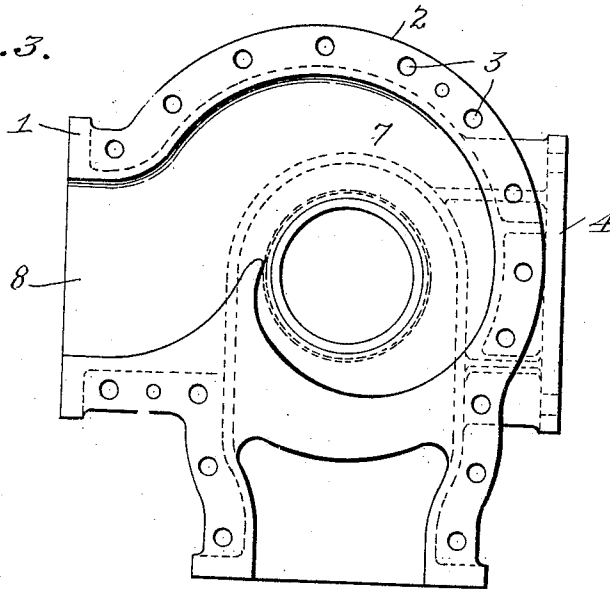


Fig. 4.

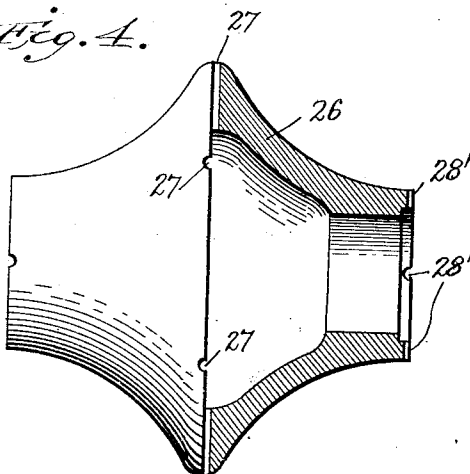


Fig. 5.

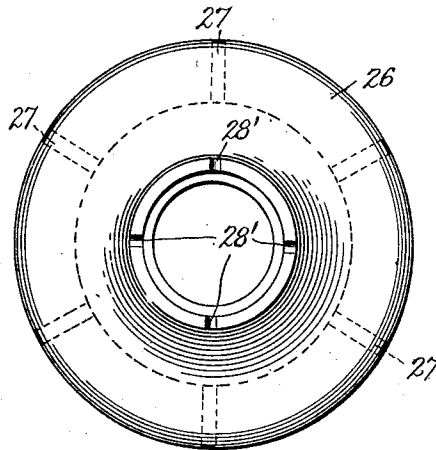


Fig. 6.

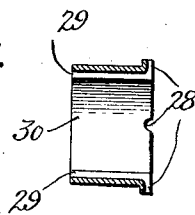
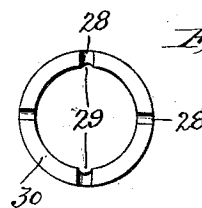


Fig. 7.

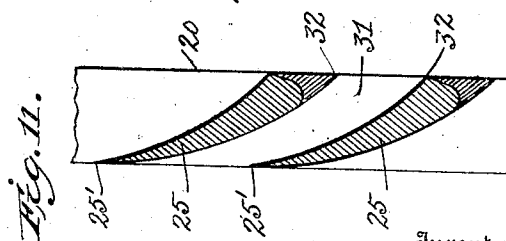
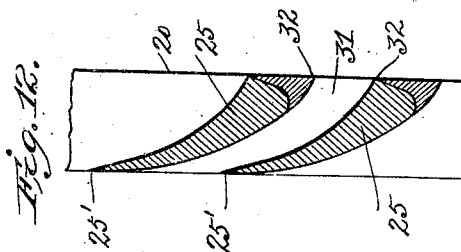
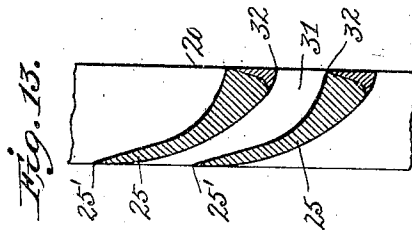
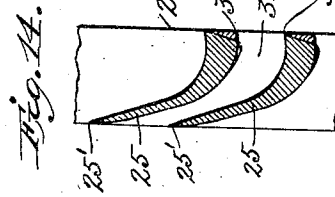
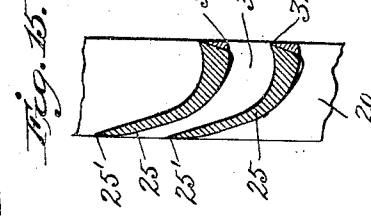
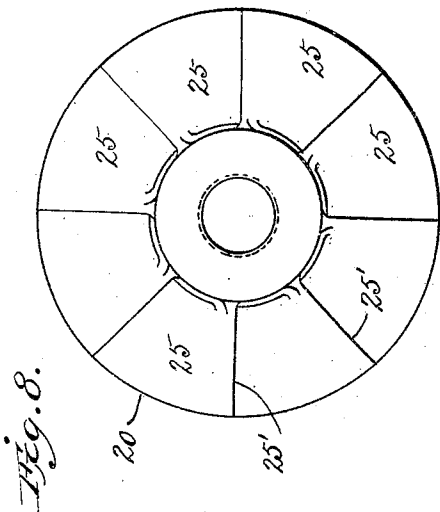
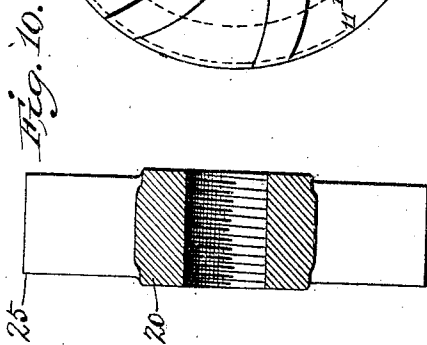
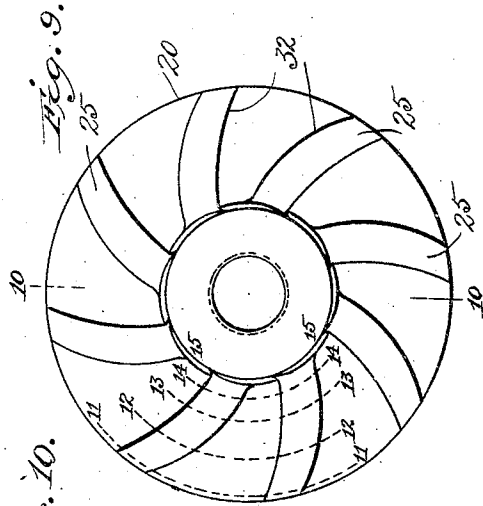


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3 SHEETS—SHEET 3.



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UNITED STATES PATENT OFFICE.

CHARLES V. KERR, OF WELLSVILLE, NEW YORK.

CENTRIFUGAL PUMP.

940,257.

Specification of Letters Patent.

Patented Nov. 16, 1909.

Application filed February 18, 1907. Serial No. 357,924.

To all whom it may concern:

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

My invention relates to an improved centrifugal or similar pump.

The objects of my invention are; First, to construct a centrifugal pump that will operate at a high speed and give a high efficiency while delivering a large volume of water at a low head. Second, to construct a centrifugal pump of high speed which is essentially adapted for use in combination with hot wells and condensing power plants. Third, to construct and arrange the propellers or runners of the pump so that there will be no endwise or lateral thrust on the shaft and at the same time double the delivery of water with a given rotative speed. Fourth, to construct a centrifugal pump so that the rotative element may be withdrawn without disturbing any of the pipe connections or separating the sections of the casing. Fifth, to construct and arrange bearings for the rotary shaft which may be easily removed and also means whereby a circulation of water is provided for cooling the frictional bearing surfaces. Sixth, to provide a diffusing cone which floats freely on the shaft between the propellers or runners and prevents the forming of eddies and properly deflects the annular stream of water coming through the runners or propellers into the spiral discharge leading to the outlet of the pump. Seventh, to construct and arrange the contour of and angles of the vanes or blades of the propellers or runners so that the water enters by or is received by a radial cutting edge on the extreme side of the runners and leaves the same parallel to the axis of the shaft and utilizing the force of impulse and reaction. Eighth, other evident advantages of construction and relation of parts comprising the apparatus which will hereinafter appear from the detailed description of the apparatus and the manner of using the same.

My invention consists of structural features and relative arrangements of the parts which will be hereinafter more fully and

clearly described and pointed out in the appended claims.

Referring to those sheets of drawings in which similar characters indicate the same parts in the several figures,—Figure 1, is a longitudinal section of my improved centrifugal pump, on line 1—1 of Fig. 2; with one of the bearings for the shaft removed; Fig. 2, is a section on line 2—2 of Fig. 1, with the removed bearing in place. Fig. 3, is an end elevation of one of the halves of the pump casing with the rotating elements of the pump removed therefrom; Fig. 4, is an enlarged view of the diffusing cone, showing one half in elevation and the other half in section; Fig. 5, is an end elevation and enlarged view of the diffusing cone; Fig. 6, is an enlarged and longitudinally sectional view of the bushing used between the diffusing cone and the rotary shaft; Fig. 7, is an end elevation of the bushing shown in Fig. 6; Fig. 8, is an enlarged end elevation of the entrance side of one of the propellers or runners of the pump; Fig. 9, is an enlarged end elevation of the discharge side of one of the propellers or runners; Fig. 10, is a section on line 10—10 of Fig. 9; Fig. 11, shows a development of a cylindrical section on line 11—11 of Fig. 9; Fig. 12, is a similar development on line 12—12 of Fig. 9; Fig. 13, is a similar development on line 13—13 of Fig. 9; Fig. 14, is a development on line 14—14 of Fig. 9; and Fig. 15, is a development on line 15—15 of Fig. 9, with the fillets on the hub disregarded.

Referring to Figs. 1, 2, and 3, 1, 1, are the two hollow sections of the pump casing which are provided at their inner or meeting faces with flanges 2, 2, said flanges having suitably spaced openings, 3, 3, through which bolts may be passed for securely holding the sections together. Each of the two sections 1, 1, is so formed or cast as to provide a water inlet 4, passage 5, shaft openings 6 or 6', a chamber 7, and outlet 8, and annular passageway 9.

Supported within and closing the shaft opening 6, is a closing plate or head 10, which forms a shaft bearing and consists of an inner hollow cylindrical extension 11 within which is a bearing shell 12 having a longitudinal movement and yet non-rotatable by means of dowel pins 3', 3'.

13 is any suitable packing and 14 is a fol-

lower for properly adjusting the packing about the rotary shaft 15, supported on the shell 12. The shaft opening 6' (see Fig. 2) is provided with a similarly constructed closing plate or head 10' and bearing but instead the bearing shell 12' is provided with a slot 16 with which communicates a passage 17 cored or formed in the plate or head 10'.

18 is a suitable bent or shaped pipe one end of which communicates with the discharge passage in chamber 7, while the other end connects with the passage 17 and the slot 16 in the bearing shell 12'. 19 is a regulating valve in said pipe 18 for controlling the water flowing from the discharge chamber 7 to the bearing shell 12' for the purposes to be hereinafter explained. It will be readily understood while I have shown and described only one bearing with the pipe 18 and valve 19 attachment both bearings may be supplied with the same if so desired.

Fixed to and rotating with the rotary shaft 15 are the runners or propellers 20, and arranged so that when the shaft is properly supported in its bearing shells 12 and 12', each of the runners or propellers will register and center within the annular passageway 9 in each half of the casing.

21 is a removable bushing secured by set screws 22 to the annular wall forming the passageway 9 and is for the purpose of securing a close running contact between the rim of the runner or propeller and this passageway 9 and thereby prevent leakage backward from the discharge to the suction side of the runner or propeller.

23 and 24 are lock nuts for securing the runners or propellers to the shaft and properly preserving the relation with the passageways 9.

The vanes on each of the runners or propellers are oppositely disposed so that each one will take the water from a passage 5 and force it into a common chamber 7. As will be seen from an examination of Figs. 8-15 the vanes 25, 25, are so constructed and arranged on each runner or propeller so that the water is received on the entrance side of the runner or propeller by radial cutting edges 25' and is made to pass through the passageways 31 of the runners or propellers nearly parallel to the axis of the shaft and leave the propellers or runners at their discharge edges 32 in this direction and hence be thrown only gradually against the casing. It will be seen therefore, that the entrance angle is such that, when the pump is operating at maximum capacity, the water will enter with very slight impulse, while at lower capacity the water will have a greater impulse at entrance. The action of the runner on the water is such as to combine reaction with the impulse, or in other words to act upon the water almost exactly the same as the water acts on the vanes of

the ordinary water turbines. The two propellers arranged as described are used for the purpose of balancing the pump against endwise thrust and also to double the delivery of water with a given rotative speed.

Between the propellers is placed a diffusing cone 26 which floats freely on the shaft so far as rotation is concerned, but is held from longitudinal movement by engagement with the runners at either end. Its purpose is to deflect the annular stream of water coming through the propellers into the spiral form shown in the end half of the pump casing. As the water comes from the propeller it will have a slight component in the direction of rotation which is utilized in securing a smooth entrance into the spiral discharge leading up to the discharge pipe. The diffusing cone is intended to distribute the water in the form of layers into the spiral passage so as to prevent to the greatest possible extent the formation of eddies in the discharge. The actual movement of this diffusing cone on the shaft will be a compromise between the driving friction exerted by the shaft itself, on the cone bearing and that of the annular stream of water flowing over this surface.

In Figs. 1, 2, 4, 6, and 7, it will be noticed that there are several holes 27 drilled in the peripheral ridge of the cone 26 and that the bushings 30 by which the cone is mounted upon the shaft have grooves 28 cut across their faces registering with like grooves 28' in the cone (see Fig. 4) and other grooves 29 forming continuations thereof on the inside of said bushings and opening into the hollow interior of the cone. The purpose of this construction is to secure a slight circulation of water through the cone to reduce friction where it rotates on the shaft. In other words I propose to make it lubricate itself by centrifugal action.

The purpose of pipe 18 with its regulating valve 19 is to put water into the bearing under pressure and allow it to work on through the bearing and leak out into the suction thus serving as a substitute for oil or like lubricant. The rate of flow through the bearing can be regulated not only at the valve 19 but also by varying the amount of packing used and the pressure put on it by means of the follower 14'.

In escaping from the bearing the water is made to flow out between the end of the bearing head and the lock nut used to secure the propeller in place. This arrangement is used to limit the endwise movement of the pump and also to put a cooling and lubricating medium between the collar and the end of the bearing head.

The above described provision for water lubrication is only illustrated in Figs. 2 *et seq.*, the bearing in Fig. 1, not being shown as provided with this feature.

The pump casing as shown is made in two parts from right and left patterns. The diameters of the propellers, diffusing cone and the bearing heads are such that when either bearing head is removed the rotative parts may be withdrawn without disturbing the pipe connections or separating the two halves 1, 1, of the casing.

From the foregoing description of the structural features, mode of assembling the different parts and manner of operation, it is thought the utilities of my improved construction will be readily apparent. The difficulty with the ordinary centrifugal pump when running at high speeds is that the peripheral speed of the runner makes it difficult to get down to a low head which is required for pumps handling a large volume of water under ordinary or low heads and this objection my invention effectually obviates.

Various changes may be made in the specific construction of the parts of the pump from the specific embodiment illustrated and while said embodiment shows what I now consider my preferred form, I do not care to limit myself to these specific arrangements as they could be modified in many ways without departing from the spirit of my invention and still accomplish the same results.

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

1. A centrifugal pump comprising a shaft mounted for rotation, a propeller fixed on said shaft, suction and discharge passages leading to and from said propeller respectively and a diffusing member loosely mounted on said shaft adjacent said propeller in said discharge passage.

2. A centrifugal pump comprising a shaft mounted for rotation, a propeller fixed on said shaft, a suction passage leading to said propeller, a discharge passage of spiral form leading from said propeller, and a diffusing cone loosely mounted on said shaft adjacent said propeller in said discharge passage.

3. A centrifugal pump comprising a rotary shaft, a pair of opposed propellers fixed thereon, a supply passage for each of said propellers, a common discharge passage of spiral form between said propellers and a diffusing member consisting of a double cone loosely mounted on said shaft and held between said propellers.

4. A centrifugal pump comprising a rotary shaft, a propeller fixed thereon, supply and discharge passages therefor and a hollow conical diffusing member in said discharge passage, loose upon said shaft and adjacent said propeller, said member being provided with an axial passage to its hollow interior and a peripheral passage therefrom.

5. A centrifugal pump comprising a rotary shaft, opposed propellers fixed thereon, supply passages therefor, a common discharge passage between said propellers and a hollow diffusing member consisting of a double cone, said cone having ports at its axis and other ports at its peripheral ridge both opening into its hollow interior.

6. A centrifugal pump comprising a rotary shaft, suction and discharge passages, and a propeller fixed on said shaft, said propeller having a series of blades thereon with cutting edges substantially on a line radial from the center adjacent the suction side, said blades being at an angle to the axis and merging into a direction substantially parallel with the axis of the propeller adjacent the discharge side thereof, and a diffusing member loosely mounted on said shaft adjacent said propeller in said discharge passage.

7. A centrifugal pump comprising a rotary shaft, supply and discharge passages, and a pair of opposed propellers fixed on said shaft, said propellers having each a series of blades thereon with cutting edges substantially radial to the shaft adjacent the supply, said blades being at an angle to the axis adjacent to their cutting edges and merging into a direction substantially parallel with the axis of the propeller adjacent the discharge passage, and a diffuser member consisting of a double cone loosely mounted on said shaft and held between said propellers.

8. A propeller for centrifugal pumps comprising supply and discharge passages, a rotary shaft, a hub on said shaft, and a series of blades thereon, said blades being curved so as to present faces substantially on a line radial from a center adjacent the supply passage, and faces substantially parallel to the axis of the propeller adjacent the discharge passages, and a diffusing member loosely mounted on the shaft in said discharge passages.

9. A centrifugal pump comprising a casing having a discharge and lateral openings, bearing heads removably secured in said openings, a shaft mounted in said bearing heads, a loose diffusing cone, and a fixed propeller on each side of said cone mounted on said shaft, the diameters of said propellers and cone being not greater than that of said lateral openings, whereby upon the removal of a head, said rotative parts may be removed.

10. A centrifugal pump, comprising a casing, having a discharge and openings in the sides thereof, bearing heads removably mounted in said openings, a shaft journaled in said bearing heads, and operative elements consisting of a loose diffusing cone and a fixed propeller on each side of said cone mounted on said shaft, the exterior diameter

of said elements being not greater than that of said lateral openings whereby upon the removal of a head, said elements may be removed.

11. A centrifugal pump comprising a casing, a shaft mounted for rotation in said casing, a loose diffusing cone, and a propeller fixed on each side of said cone and shaft, supply and discharge passages for
10 said propellers and an annular ring closely

fitting the periphery of said propellers and secured in said casing between the supply and discharge passages, whereby leakage backward is prevented.

In testimony whereof I affix my signature 15
in presence of two witnesses.

CHARLES V. KERR.

Witnesses:

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ELSIE E. GOULD.