No. 885,108. PATENTED APR. 21, 1908.

S. V. TRENT.

CENTRIFUGAL PUMP.

APPLICATION FILED JAN. 21, 1907.

2 SHEETS—SHEET 1.

Fig. 1.

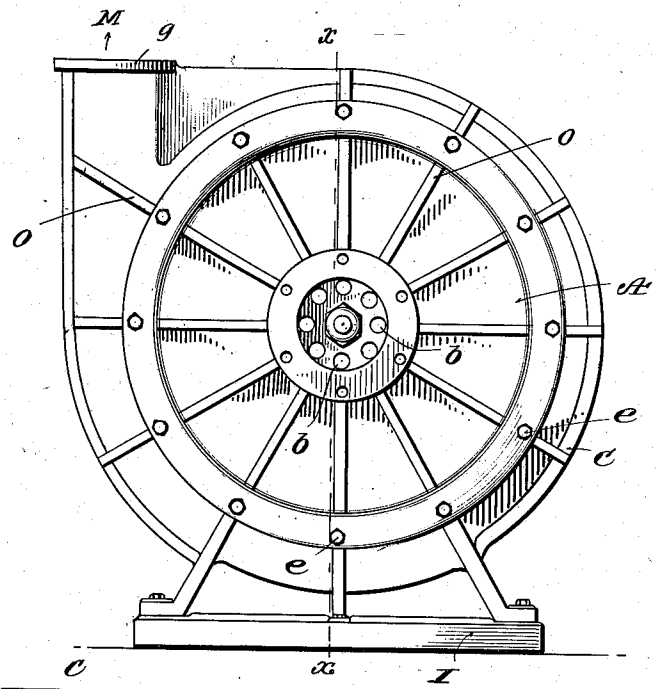
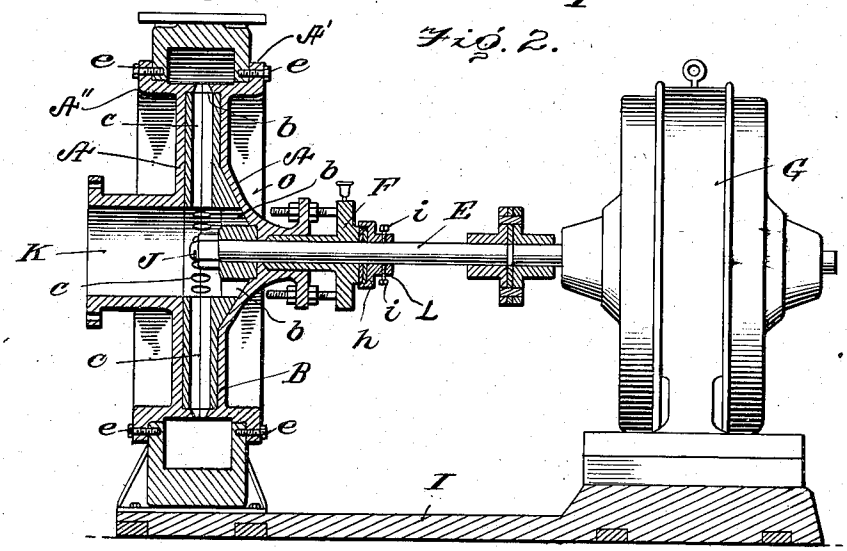


Fig. 2.



Witnesses

H. E. Sutherland

S. E. Dodge.

Inventor

S. V. Trent,

By Becker & Cobb

Attorneys

No. 885,108. PATENTED APR. 21, 1908.

S. V. TRENT.

CENTRIFUGAL PUMP.

APPLICATION FILED JAN. 21, 1907.

2 SHEETS—SHEET 2.

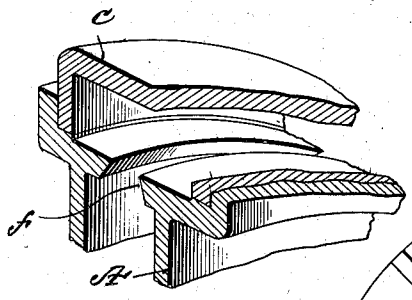
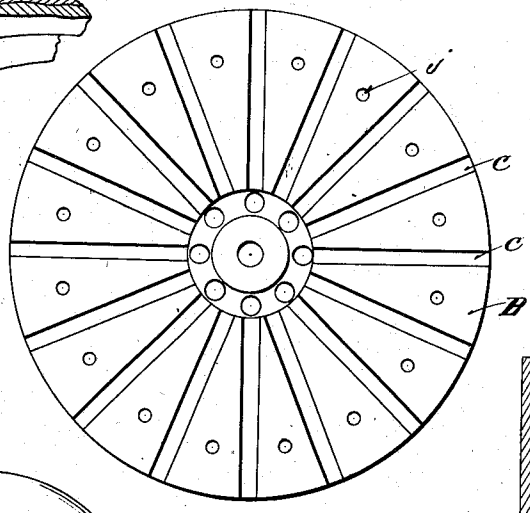


Fig. 7.

Fig. 4.



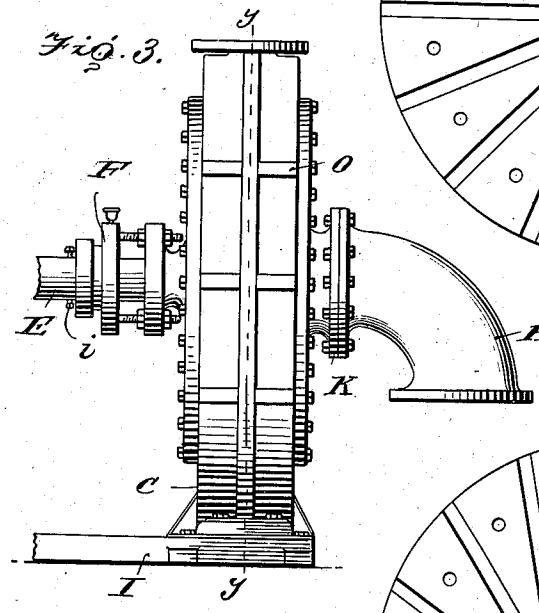


Fig. 3.

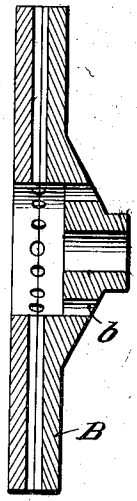


Fig. 6.

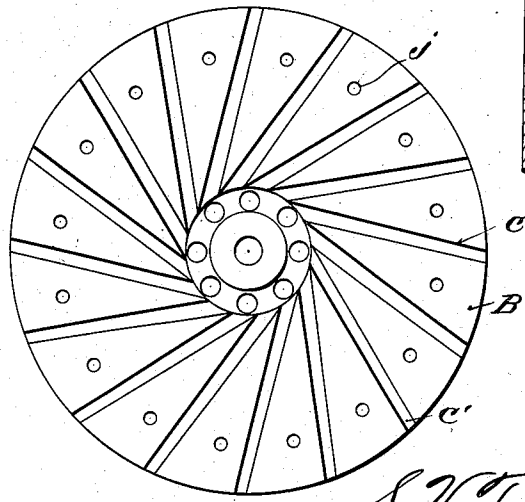


Fig. 5.

Witnesses

H. E. Dodge.

S. E. Dodge.

Inventor

S. V. Trent.

By Peelet & Robb

Attorneys

UNITED STATES PATENT OFFICE.

SIMEON V. TRENT, OF SALT LAKE CITY, UTAH.

CENTRIFUGAL PUMP.

No. 885,108. Specification of Letters Patent. Patented April 21, 1908.

Application filed January 21, 1907. Serial No. 353,379.

To all whom it may concern:

Be it known that I, SIMEON V. TRENT, a resident of Salt Lake City, Salt Lake county, State of Utah, have invented a new and useful Improvement in Centrifugal Pumps Used for Pumping Liquids, of which the following is a specification.

My invention relates to improvements in pumps of the style or type known as centrifugal, the purpose being to modify the usual construction of this form of pump so as to attain a higher degree of efficiency or economy. First, by applying the force or power for the propulsion of water through the pump in such a way as to not only produce a greater useful effect, but also, as a consequence thereof, to produce a higher pressure with a given peripheral velocity. Second, to so devise the passage through which the water is forced into the volute, or pressure chamber, by the impeller, as to absolutely prevent any back pressure or reaction on the impeller, or any possibility of the exterior of the impeller revolving in contact with the liquid passing through the pump. Third, by the use of the side-suction form of impeller, whereby more than one bearing for the pump shaft is obviated, and any occasion for a stuffing-box joint through the suction passage becomes unnecessary. This result is attained with my side-suction form of impeller by making openings or passages through the main part of the impeller, near its hub or center, to the driving side or side opposite to the suction. In this way the tendency to cause a vacuum on the suction side, that is set up by the operation of the pump when in action, is caused to assert itself on both sides of the impeller, whereby the tendency to end thrust toward the suction side, that is characteristic of the ordinary construction of side suction impellers, is eliminated, with the result that the impeller revolves almost completely in balance.

As regards the first named of the three above novel features, as far as I know, all existing types of centrifugal pumps, whether using impellers with side or central water ways, or impellers of the central web pattern, are invariably constructed either upon the direct radial principle, or with arms or partitions approaching more or less to the involute curve. The consequence of this construction is to produce water ways or passages of cross section expanding or increasing toward the periphery of the impeller. My construction is diametrically opposed to this, and provides at least for forming water passages of uniform cross section or area, or by an extension of the same principle, to make them of constantly contracting cross section or area as they approach the periphery of the impeller.

Seeing that the cross section of any stream of water is necessarily reduced as its velocity increases, and that the velocity of a stream of water through a pump impeller is necessarily increased as that stream approaches the periphery of the impeller and in an exact and well determined ratio, it is apparent that the passing of a stream of water through a passage larger in area or cross section than itself must set up a tendency to cause a vacuum, which tendency represents a wasteful counter-force to be overcome by the power used in the pump's operation.

I attain these objects by the improvements shown in the accompanying drawings, in which similar letters of reference, indicate like parts throughout the several figures.

Figure 1. is an end elevation of the pump. Fig. 2. is a vertical section, on line *x x*, of Fig. 1. Fig. 3. is a side elevation of the pump, with the discharge elbow. Fig. 4. is a front elevation of a section or part of the impeller, with the water passages located in a radial sense, from the suction chamber. Fig. 5. is a front elevation of a section or part of the impeller, with the water passages located in a tangential sense from the suction chamber. Fig. 6. is a vertical section of the impeller, on line *x x*, of Fig. 1. Fig. 7. is a fragmentary view showing more clearly the formation of the contracted discharge throat leading from the impeller to the volute.

The cylinder is formed by the two heads A, A, made of suitable material and braced with the radial ribs *o o o* etc. It is bisected parallel to the ends, and is securely held together with the bolts *e e e* etc. and made to inclose the impeller B. It is so constructed on one end, that a suction elbow H, may be attached, and on the other end is provided a stuffing-box F, that is fitted on the operating, or power, shaft E. The shaft is rotated and the impeller is driven by the motor G.

To the periphery of the cylinder is secured the volute C. The cylinder is so constructed as to form a contracted opening, or throat, as shown at *f, f*, Fig. 2.

The impeller B, is attached to the end of the power shaft E, by the nut J, and key-

ways, and is provided with passage-ways *c*, *c*, *c*, etc. located in a tangential sense, as shown in Fig. 5, or in a radial sense, as shown in Fig. 4, and is provided with balancing chambers *b*, *b*, *b*, etc.

For convenience in construction, in cutting the passage-ways *c*, *c*, *c*, the impeller is cut on line *y y*, Fig. 3, and fastened together again by bolts, or like fastenings, passing through openings *j*, *j*, *j*, etc.

The cylinder A, A, is so built, that a suction chamber K, is provided on one end, which chamber extends into and partially through the impeller B, as shown in Figs. 2, 4, 5, 6, and leading from this part of the suction chamber are the passage-ways *c*, *c*, *c*, etc.

The pump and motor are securely set on the bed I, by bolts.

The suction necessary to draw the liquid into the suction chamber K tends to draw the impeller horizontally and away from the power. To counteract this tendency, and to balance the impeller B, balancing chambers *b*, *b*, *b*, etc. are provided, and also the shaft E is fitted with an end thrust bearing L, and friction rings *h*, *h*. The bearing L is secured on the shaft E by the set screws *i*, *i*.

The passage-ways *c*, *c*, *c*, etc., whether formed as shown, as a circle at any cross-section, or as an ellipse square or rectangle, are uniform in size from the suction chamber K to the throat, and at that point they deliver the fluid through the contracted throat so devised as to prevent back pressure on the impeller, or if desired the form may be used of a gradual contraction of the passage ways (as at *c'*, *c'* in Fig. 5) from the suction chamber K, to and corresponding with the contraction of the throat at *f*, *f*, so that the total area of discharge, of all the passage ways is equal to the area of the outlet of the contracting throat.

More fully describing the function and advantages of the discharge throat *f f*, and flanges overlapping the peripheral portion of the impeller B, it may be stated that under the form of impeller construction incorporated in the present invention, the impeller is made to discharge a series of round streams or jets of water somewhat in the form of a star. The round form is given to these jets at the point where they leave the impeller on account of the lesser resistance of a round passage and the further advantage of greater facility and ease in making such a passage absolutely smooth and true. The wide stream thus delivered by the impeller and the width of which is, of course, equal to the diameter of the round jets, is, by means of my contracting throat, narrowed down to a thin continuous stream or circular sheet of water, sufficiently so in fact, to make this thin stream a continuous and unbroken one, whereby the pressure or reactive effect of the water pressure set up in the volute is kept away from the periphery of the impeller. Evidently, so long as the impeller is able to force water into the volute it can only be done by reason of the pressure at the periphery of the impeller overcoming water pressure in the volute. The pressure thus acting in a radial sense, is prevented from acting upon the impeller. This is an all important feature as in those cases where the impeller periphery is caused to revolve against the delivery pressure or against the pressure in the volute, a wasteful resistance to the action of the impeller is set up with a corresponding waste of power.

My construction is particularly directed to preventing any such resistance or reactive effect upon the impeller, and this is accomplished by the use of the contracting throat which is shown as provided in the impeller casing or cylinder, and which is utilized to so thin down the stream of water delivered from the impeller, that all opportunity for the pressure in the volute to assert itself on the impeller is entirely prevented. The contracting throat has the further effect of entraining from the pump cylinder all air or idle water that may accumulate therein, thereby relieving the impeller from the friction even of the ordinary atmospheric pressure, in other words, causing the impeller to rotate in an almost perfect vacuum, and at the same time avoiding the reactive effect of the water set up by the pump.

Motion having been imparted to the impeller B, by the power driven shaft E, the liquid is drawn into the suction chamber K, and by centrifugal force thrown out of the passages *c*, *c*, *c*, etc. through the contracted throat *f*, *f*, into the volute or pressure chamber C, and discharged at outlet *g*, as shown by arrow M.

From the foregoing it will be understood that the casing or cylinder heads A, A, have outwardly extending flanges A' receiving therebetween, and secured to, the volute C. Also, said heads A, A, are formed with inwardly extending flanges A'', the edges of which are spaced to provide the contracted throat *f*, said flanges A'' engaging the outer periphery of the impeller B. The inner end of the throat *f* is equal in width to the diameter of the outer ends of the discharge passages of the impeller, said throat contracting toward its outer end, and the advantages for which construction have been pointed out.

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

1. A centrifugal pump comprising a rotary impeller having a central suction recess and discharge passages leading therefrom to its periphery, a volute, and a casing inclosing the impeller and provided with an annular discharge throat extending from the outer ends of the discharge passages of the impeller to the interior of the volute, said throat being

of a width at its inner end equal to that of the outer ends of the discharge passages and thence contracting toward its outer end so as to be less in width than the outer ends of the said passages.

2. In a centrifugal pump, the combination of a casing comprising heads, one head having a central suction chamber and both heads having at the outer portions outwardly extending flanges, a volute secured to said flanges, an impeller having a suction recess in one side and located between the heads of the cylinder and made in sections having contacting sides in which are formed a plurality of discharge passages leading from the suction recess to the periphery of the impeller, the heads of the casing also having inwardly extending flanges between the periphery of the impeller and the volute chamber and said flanges being spaced apart to provide an annular discharge throat, the said throat being of a width at its inner end equal to that of the outer ends of the discharge passages aforesaid and thence contracting to a lesser width toward a point of communication thereof with the interior of the volute as described.

SIMEON V. TRENT.

Witnesses:
R. D. HUMPHREY,
THOS. MURDOCH.