R. BOWEN.

CENTRIFUGAL PUMP.

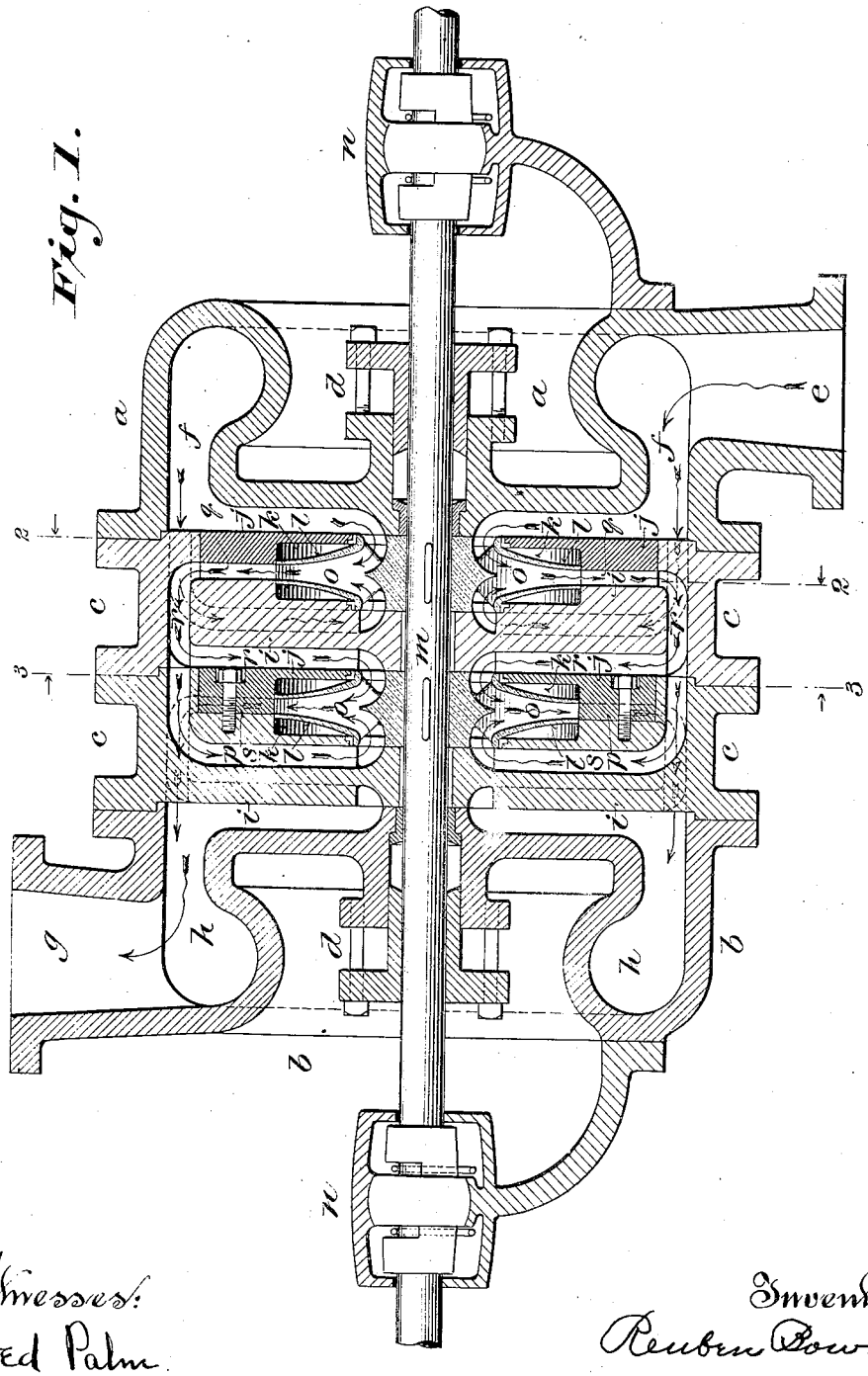
APPLICATION FILED MAR. 10, 1906.

1,067,399.

Patented July 15, 1913.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

Fig. 3.

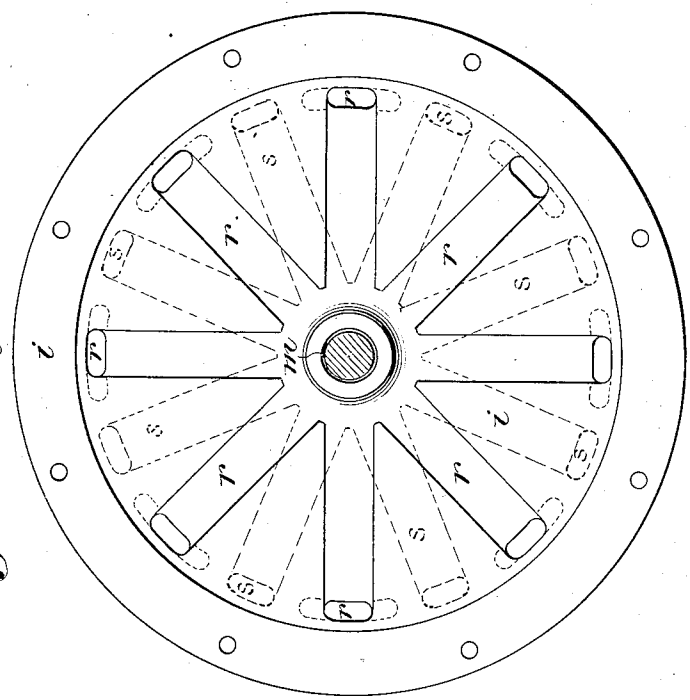
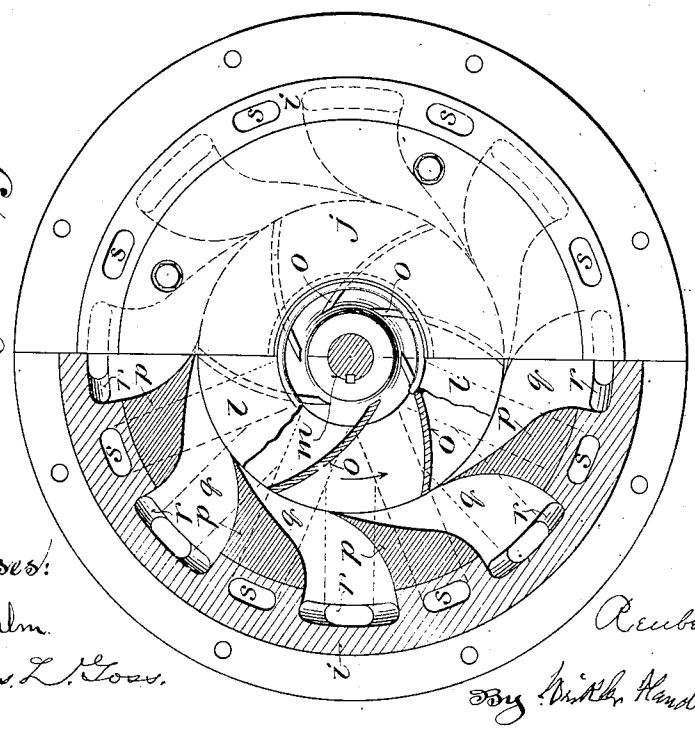


Fig. 2.



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UNITED STATES PATENT OFFICE.

REUBEN BOWEN, OF MILWAUKEE, WISCONSIN, ASSIGNOR, BY MESNE ASSIGNMENTS, TO INTERNATIONAL STEAM PUMP COMPANY, A CORPORATION OF NEW JERSEY.

CENTRIFUGAL PUMP.

1,067,399. Specification of Letters Patent. Patented July 15, 1913.

Application filed March 10, 1906. Serial No. 305,197.

To all whom it may concern:

Be it known that I, REUBEN BOWEN, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Centrifugal Pumps, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

This invention relates more particularly to high duty multistage or multicellular turbine pumps.

The main objects of the invention are to avoid end thrust on the impeller shaft and to produce a balanced pump of this type without resorting to a balancing piston or other extra device for the purpose, to provide for readily varying the number of stages for different heads or pressures and generally to improve the construction and operation of pumps of this class.

It consists in certain novel features of construction and in the peculiar arrangement and combinations of parts as hereinafter particularly set forth and defined in the claims.

In the accompanying drawing like characters designate the same parts in the several figures.

Figure 1 is a central vertical section of a two-stage centrifugal pump embodying the present invention; Fig. 2 is a cross section of the same on the broken line 2 2, Fig. 1, the right half of the section being in a plane coinciding with the division plane between the suction end section and the adjoining intermediate section of the case, and the left half being in a plane cutting an impeller and associated diffusion vanes centrally; and Fig. 3 is a cross section on the line 3 3, Fig. 1, in a plane coinciding with the plane of division between intermediate sections of the case.

For the purpose of illustration a two-stage pump is shown, but the number of stages or sections may be varied, and ordinarily a greater number than that shown will be employed.

The casing of the pump is composed of end sections *a* and *b* and intermediate sections *c*, which are flanged and bolted or otherwise secured together. The end section *a* is provided centrally with a stuffing box *d* and is formed with a suction connection *e* and an annular chamber *f* communicating with the suction connection and surrounding the stuffing box. The end section *b*, which may be like or similar to the section *a*, is in like manner provided with a central stuffing box *d*, and formed with a discharge connection *g* and an annular chamber *h* communicating therewith. Each intermediate section of the casing comprises a recessed body *i* and a cover plate or distributer *j* fitted into and bolted or otherwise secured to the body and forming therewith a cell or chamber *k* for a single impeller the hub of which has a running fit adjacent to its inlet openings with said body *i* on one side, and with said cover plate or distributer *j* on the other side.

A number of coaxial impellers *l*, fitted to run in the cells or chambers *k*, are mounted on a common shaft *m*, which passes through the stuffing boxes *d* in the end sections of the casing and is supported outside of the casing by bearings *n*. The impellers as herein shown are of the closed type, having closed sides and intervening vanes *o*, with inlet openings on opposite sides at the inner ends of the vanes and peripheral outlet openings at the outer ends of the vanes. Each cover plate *j* is formed on one side next to the body *i* to which it is attached, with diffusion or guide vanes *p* and intervening channels *q*, with which the outlet openings of the impellers communicate, as shown in Figs. 1 and 2. The body *i* of each intermediate section of the casing is formed with passages *r* which register with the outer ends of the channels *q* of the adjoining cover plate and lead therefrom to the opposite face of the body and thence inwardly to the inlet openings on the near side of the impeller of the next succeeding section.

Alternating with the passages *r*, each body is formed with passages *s*, which register at their outer ends with the passages *r* in the preceding section and lead therefrom around the intervening impeller to the inlet openings on the opposite thereof. The cross sectional area of the passages *s* and of the radial portions of the passages *r* is about one-half that of those portions of the passages *r* between the channels *q* and the outer ends of the passages *s*, the water discharged from each impeller through the channels *q* being divided into two equal

parts at the junction of the passages *r* and *s*, and flowing therefrom through said passages to the inlets on opposite sides of the intervening impeller.

The chamber *f* in the end section *a* of the casing extends inwardly so as to communicate with the inlet openings on the adjacent side of the first impeller, but the chamber *h* in section *b* at the discharge end of the pump need not extend as far inward, since it has to communicate only with the openings of the passages *r* in the outer part of the adjacent face of the body *i* in the last section.

The pump herein shown and described operates as follows: Water is drawn by the action of the impellers through the suction connection *e* into the chamber *f*, from which it passes inwardly directly into the inlet openings on the adjacent side of the first impeller and through the passages *s* in the body *i* of the first section into the inlet openings on the opposite side of the same impeller, thereby balancing it and preventing it from exerting any end thrust on the shaft *m*. From the first impeller the water is discharged at its periphery through the channels *q* between the diffusion or guide vanes *p* and through the passages *r* of the same section and the passages *s* of the next succeeding section, and is delivered by said passages to the inlet openings on opposite sides of the next succeeding impeller, as indicated by arrows on Fig. 1. From the second impeller the water is discharged and conducted in like manner to the inlet openings on opposite sides of the third impeller, if the pump has more than two stages or sections, and so on to the last stage or section, from which it is discharged through the passages *r* in the body of the last section into the chamber *h* of section *b* at the discharge end of the pump, the water discharged from each impeller being divided and delivered by the passages *r* and *s* to the inlet openings on opposite sides of the next succeeding impeller, thereby balancing each of the several impellers and avoiding end thrust on the impeller shaft.

It will be observed that the water passages connecting the several sections of the pump are all within the main casing, and that by the simple construction and arrangement of parts as herein shown and described, end thrust on the impeller shaft is prevented, and a perfectly balanced as well as a self-contained pump is produced.

It will be understood that the number of stages or sections will be varied according to the head or pressure to be maintained or produced by the pump by simply assembling more or less of the like interchangeable casing sections *c* with a corresponding number of impellers *l* between the end sections *a* and *b*.

Various changes in the details of construction and arrangement of parts may be made without departing from the principle and intended scope of the invention.

I claim:

1. In a centrifugal pump the combination with a rotary impeller having closed sides and intervening vanes with inlet openings at their inner ends, of a recessed body and a cover plate attached thereto and forming therewith a cell or chamber for said impeller, one of said parts being formed on one side next to the other part with diffusion vanes and intervening channels and the body having inlet passages leading to inlet openings in the impeller and discharge passages registering with the channels between the diffusion vanes, substantially as described.

2. In a centrifugal pump the combination with a rotary impeller having closed sides and intervening vanes with inlet openings at their inner ends, of a recessed body and a recessed cover plate attached thereto and forming therewith a cell or chamber for said impeller, said cover plate being formed on one side next to said body with diffusion vanes and intervening channels and the body having inlet passages leading to inlet openings in the impeller and discharge passages registering with the channels in the cover plate, substantially as described.

3. In a centrifugal pump the combination of a number of coaxial impellers each having inlets on opposite sides thereof, a casing composed of end sections having suction and discharge connections and annular chambers communicating therewith and of intermediate sections each comprising two parts, a recessed body and a cover plate, forming a cell or chamber for a single impeller, one of said parts being formed next to the other with diffusion vanes and intervening channels and each body having passages leading to the inlet on one side of its impeller from the preceding section, and passages registering with the channels between the associated diffusion vanes and leading therefrom to the inlet on one side of the impeller in the succeeding section and to passages which lead in that section to the inlet on the opposite side of the impeller therein, substantially as described.

4. In a centrifugal pump the combination of a number of coaxial impellers each having inlets on opposite sides thereof, a casing composed of end sections having suction and discharge connections and annular chambers communicating therewith and of intermediate sections each comprising two parts, a recessed body and cover plate, forming a cell or chamber for a single impeller, each cover plate being formed on one side next to the body with diffusion vanes and intervening channels and each body having pas-

sages leading to the inlet on one side of its impeller from the preceding section, and passages registering with the channels in the associated cover plate and leading to the inlet on one side of the impeller in the succeeding section and registering with passages in that section which lead to the inlet on the opposite side of the impeller therein, substantially as described.

5. In a centrifugal pump or the like, the combination with a pump casing, of an impeller, and an independent distributer supported by said pump casing, said distributer intervening between said casing and the intake of said impeller.

6. In a centrifugal pump or the like, the combination with the pump casing, of a discharge passage therein, an impeller, and an independent distributer embracing said impeller and intervening between said impeller and said discharge passage.

7. In a centrifugal pump or the like, the combination with a pump casing, of an impeller, and an independent distributer supported by said casing, said impeller having a running fit with said distributer.

8. In a centrifugal pump or the like, the combination with a pump casing, of an impeller, and an independent distributer embracing said impeller, said impeller having a running fit with said distributer.

9. In a centrifugal pump or the like, the combination with a pump casing having a discharge passage therein, of an impeller, and a distributer, said impeller having a running fit with said distributer approximate the impeller intake.

10. In a centrifugal pump or the like, the combination with the pump casing, of an impeller, and an independent distributer, said distributer intervening between said impeller and said casing at the impeller intake, said impeller having a running fit with said distributer.

11. In a centrifugal pump or the like, the combination of a rotary impeller, and a body section forming with the impeller a pump unit complete in itself and capable of assemblage and coöperation with like units on each side thereof, said body section being composed of two parts, one part recessed and forming a chamber open on one side for the reception of the impeller and the other part forming a cover plate detachably secured to said recessed part over said chamber, one of said parts being provided next to the other with diffusion vanes.

In witness whereof I hereto affix my signature in presence of two witnesses.

REUBEN BOWEN.

Witnesses:
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E. P. WORDEN.