A. V. MUELLER.

MULTISTAGE CENTRIFUGAL PUMP.

APPLICATION FILED APR. 16, 1914.

1,130,422.

Patented Mar. 2, 1915.

2 SHEETS—SHEET 1.

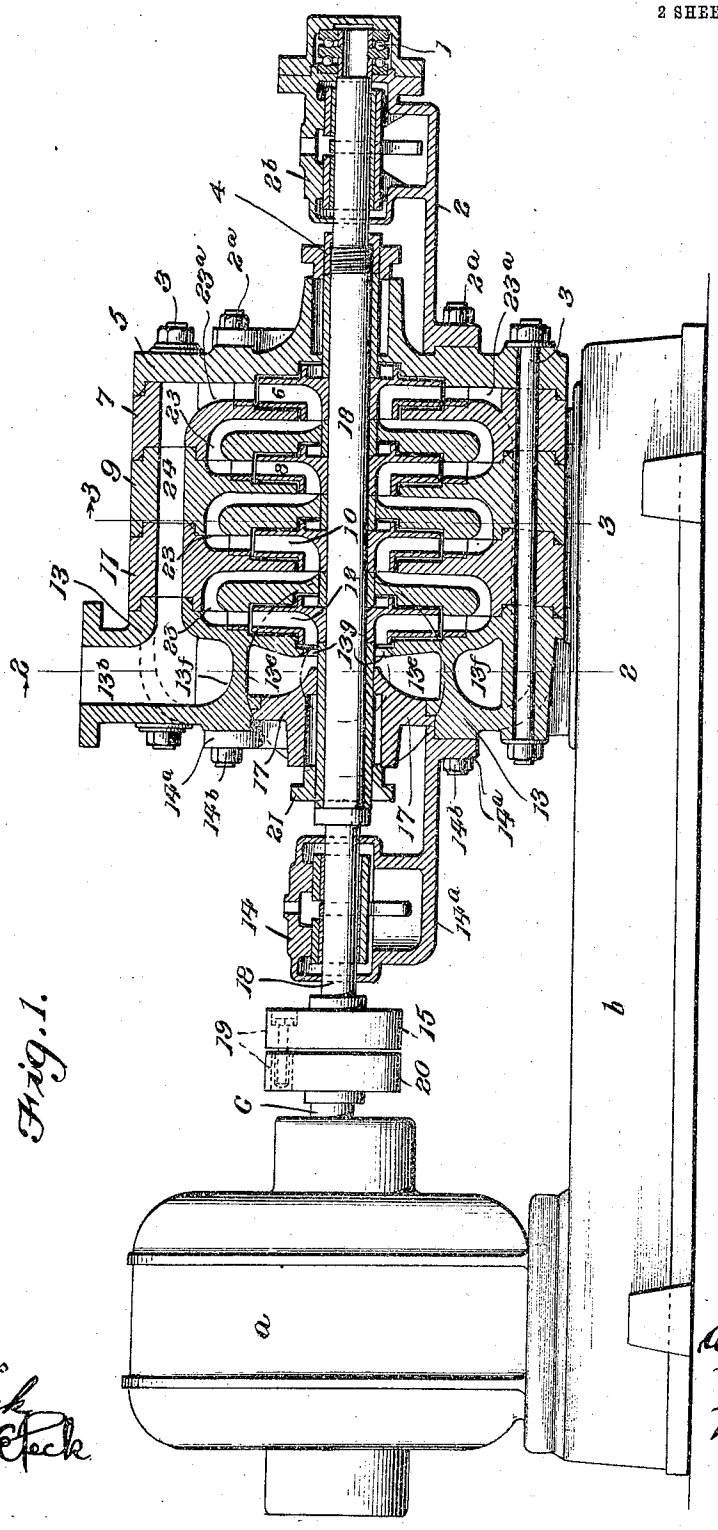


Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 3.

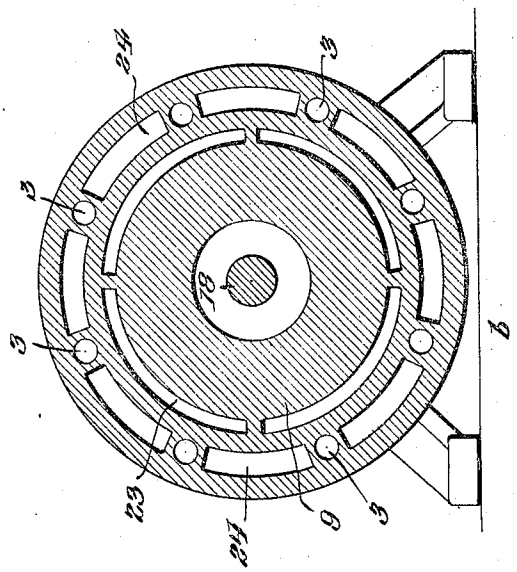
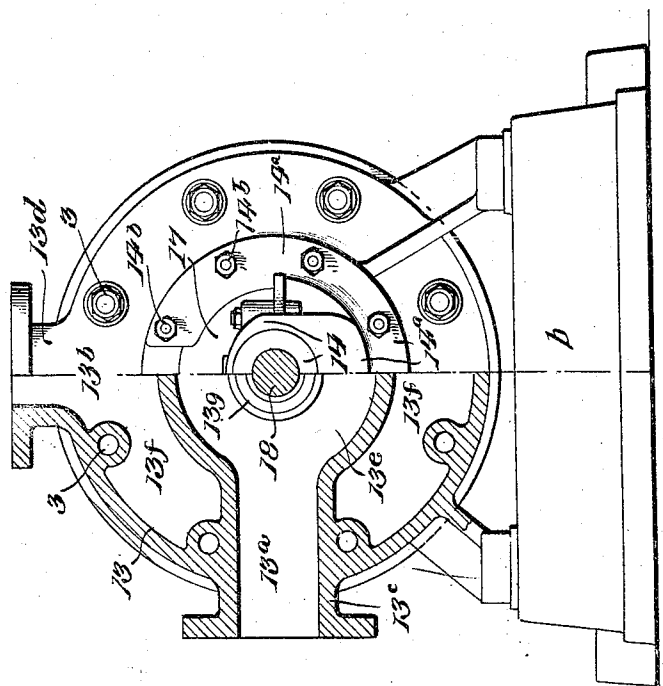


Fig. 2.



Witnesses

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UNITED STATES PATENT OFFICE.

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MULTISTAGE CENTRIFUGAL PUMP.

1,130,422. Specification of Letters Patent. Patented Mar. 2, 1915.

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To all whom it may concern:

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

This invention relates to certain improvements in and relating to centrifugal pumping machinery; and the objects and nature of the invention will be readily understood by those skilled in the art in the light of the following explanation of the accompanying drawings illustrating what I now believe to be the preferred embodiment or mechanical expression of my invention from among other formations, constructions, arrangements and combinations within the spirit and scope of the invention.

An object of the invention is to provide improvements in turbine pumps, and the like, of the vertically split type, whereby such pumps can be dismantled without breaking or disconnecting the suction and discharge connections.

A further object of the invention is to provide a turbine or multi-stage centrifugal pump composed of parallel vertical or transverse stages and sections capable of being separated or taken apart without breaking the suction and discharge connections, and whereby the pump can be dismantled within an exceedingly restricted space.

A further object of the invention is to provide a turbine or multi-stage centrifugal pump of the vertically split type having the suction and discharge connections at the same end of the pump, whereby the pump can be dismantled within a restricted space extending a minimum distance beyond the pump end, and without disturbing the suction and discharge connections.

A further object of the invention is to provide certain improvements in vertically split turbine or multi-stage centrifugal pumps to attain the advantages of the horizontally split turbine pumps and avoid the serious disadvantages thereof and to render it possible to dismantle such vertically split pumps in close quarters where end room of only a few inches is allowed.

A further object of the invention is to provide a vertically split turbine or multistage pump wherein the suction and discharge connections are at the same end of the pump and the discharge liquid is returned to said end of the pump without the employment of outside piping or substantial additional parts.

A further object of the invention is to provide a turbine or multi-stage pump wherein one end head or casting is formed with both the suction and discharge openings of the pump.

The invention consists in certain novel features in construction, in combinations and in arrangements as more fully and particularly set forth and specified hereinafter.

Referring to the accompanying drawings;—Figure 1, is a vertical longitudinal section of an example of a turbine or multistage pump embodying my invention. Fig. 2, is a partial transverse section on the line 2—2, Fig. 1. Fig. 3, is a transverse section on the line 3—3, Fig. 1.

In the particular example illustrated, I show a multi-stage pump and a driving motor *a*, therefor approximately alined and arranged end to end and both mounted on a common base or bed *b*, with the motor-shaft *c*, operatively connected with the pump shaft 18, to drive the same, through the medium of a separable shaft coupling consisting of female member 20, fixed on the motor shaft end, and male member 15, fixed on the pump shaft end and having one or more coupling pins 19, removably entering member 20, and whereby the coupling members are operatively connected. However, my invention is not restricted to the particular arrangements, and structures described, nor to any particular pump shaft driving means.

The particular pump example illustrated, comprises a vertical hollow end head 13, preferably composed of a single casting having the pump suction inlet 13^a, and the pump discharge or outlet 13^b. The casting is formed with a flanged exterior nipple 13^c, projecting horizontally and radially from the peripheral portion of said head to provide means for the attachment of the pump suction pipe in direct communication with and opening into the suction inlet 13^a. Said casting is also formed with a flanged exterior nipple 13^d, projecting upwardly from the top edge or peripheral portion of said head to provide means for the attachment of the pump discharge pipe opening into the discharge outlet 13^b. However, I do not wish to limit my invention to any par-

ticular arrangement of the suction and discharge openings in said head or to any particular means to provide for the attachment of suction and discharge pipes. In this instance, the suction inlet is in the form of a horizontal radial passage at its inner end opening into the annular suction chamber 13^e, arranged within the center of the casting and having an inlet opening 13^g, at the inner side of said casting, and around the pump shaft, while the discharge outlet 13^b, is in the form of a vertical radial passage, shorter than passage 13^a, and at its inner end opening into approximately annular discharge or pressure chamber 13^f, exteriorly surrounding suction chamber 13^e, and within said casting shut off from communication therewith. The pressure chamber 13^f, has side inlet openings through the inner vertical face of the casting. The outer side wall of the central chamber 13^e, is preferably formed by a casting 17, centrally receiving the pump shaft and removably and snugly fitted in a central opening through the outer side of the end head 13, and forming a stuffing box for said shaft provided with gland 21, although my invention is not so limited. If so desired this stuffing box can be normally fixedly (although removably) held in the opening in the end head by the bracket 14^a, removably clamped and secured to the outer side of the end head by nuts 14^b, on bolts or studs projecting outwardly from the end head removably through said bracket. This bracket 14^a, carries the pump shaft bearing or journal box 14, arranged between the stuffing box gland 21, and the shaft coupling member 15, and spaced from both.

Any suitable number of vertical stages or casing sections are arranged side by side at the inner face of the suction and discharge or end head 13, and alined therewith and between the same and the outside or opposite end head 5, which usually forms the closed outer end wall of the pump through which the pump shaft passes centrally and which is usually provided with a stuffing box for the shaft. A suitable outwardly projecting bracket 2, is usually removably secured to the end 5, by nuts 2^a, on bolts or studs fixed to said head and this bracket carries a suitable journal box or bearing 2^b, and also a thrust bearing 1, for the pump shaft, although of course my invention is not limited to these bearings or to any particular construction, arrangement or location thereof or other means for taking care of end thrust, or to any particular construction of the end head 5, or other means that might be employed for closing the outer end of the pump casing. In the particular example illustrated, I show vertical parallel casing sections or stages 7, 9, 11, arranged between the two end heads with their side faces tightly yet removably fitted together and with side faces of sections 7, and 11, removably and tightly fitting the inner faces of the heads 5 and 13, respectively, and these heads and sections are held together by any suitable means, for instance, they can be clamped together by the longitudinal bolts 3, extending removably therethrough and having clamping nuts at the outer sides of the end heads as will be readily understood by those skilled in the art. On the pump shaft within these sections and the heads, I arrange the runners or impellers 12, 10, 8 and 6, and these runners are removably mounted on and normally clamped to rotate with said shaft in any usual or suitable manner. The suction inlet of the impeller 12, registers with the annular outlet 13^g, of the suction chamber in the head 13, and the casing sections and head 13, form any suitable or usual passages 23, by which the discharge from each impeller is carried inwardly to the inlet of the next impeller. However, the last section 7, and the outer end head 5 form one or more pressure or discharge passages 23^a, to receive the discharge from the last impeller 6, and deliver the same outwardly tangentially or radially to the receiving or rear end or ends of the longitudinal return passage or passages 24, extending through the pump casing to the pump discharge chamber 13^f, in the casing section having the pump suction and discharge openings. The front or discharge ends of these longitudinal passages 24, register with the side inlet openings of the discharge chamber 13^f, and into which passages 24, discharge. The rear head 5, forms a rear wall for the receiving ends of passages 24, while the sections 7, 9, 11, are formed with annular series of transverse openings through their outer peripheral portions shut off from passages 23, and these openings register when the sections are clamped tightly together and between the heads and form the return or longitudinal passages 24.

So far as I am aware, it has not been heretofore possible to dismantle a vertically split multistage or turbine pump, in whole or in part, without disconnecting or breaking either the pump suction connection or the pump discharge connection and encountering other objections and difficulties. However, by providing one section of the pump with both the suction and discharge outlets, I am enabled to remove the remaining sections, and in fact, the shaft and impellers without disturbing said one section and the pump suction and discharge connections, and in fact, this dismantling can be done without utilizing more than a few inches of room beyond the outer or rear end of the pump, whereby I overcome the serious faults

of turbine pumps having horizontally split casings while producing a turbine pump having the advantages of both the horizontally split casing type, and the vertically split casing type.

While my invention is not restricted to the section and impeller formation and arrangement illustrated, or to the particular pump shown, yet to give an illustration of how a pump according to my invention, can be dismantled, I might say that in the construction illustrated, the dismantling operation begins at the rear or outer end of the pump, and hence the bracket 2 will first be released from the end head 5, and removed from the pump shaft with bearings 2^b, 1. The through or clamping bolt 3 are then removed. The nut 4, on the pump shaft is then removed so that the head 5, impeller 6, section 7, impeller 8, section 9, impeller 10, section 11, and impeller 12, can then be removed in the order named. The maximum end room required beyond the rear end of the shaft, to permit the removal of these parts, is equal to the thickness longitudinally of the shaft of the widest part but in any case it is but a few inches. With the parts just mentioned dismantled or removed, there is ordinarily no additional dismantling necessary as access can then be had to all parts removed and remaining set up. However, should it be necesary to remove the pump shaft it is even then not necessary to disturb the casting 13, and the suction and discharge connections. If it is necessary after the casing sections and impellers have been removed, to remove the shaft, the bearing bracket 14^a, is released from the casting 13 by removing the nuts 14^b, and the bearing of journal box 14 is then removed from the shaft as said box is usually provided with a removable top cap and hence end room is not under such circumstances needed for the removal of this bearing or box, and the space between bearing or box and the coupling member 15, is sufficient to permit the movement of the bracket 14^a, to clear said bracket from the bolts or studs receiving the nuts 14^b. The stuffing box 17, which was held in place by bearing bracket 14^a, may now be moved longitudinally on the pump shaft from the casting 13, toward the coupling member 15, so that the pump shaft can be moved toward the right to disengage the coupling pin or pins 19, from the coupling member 20, and thus enable the shaft to be swung laterally clear of the coupling member 20, and removed longitudinally and toward the left from the casting 13. This swinging movement of the shaft is permitted by reason of the enlarged diameter of the outlet opening 13^g, with respect to the diameter of the shaft. After this explanation of the method which can be followed in dismantling a pump embodying my invention, those skilled in the art will readily understand how the pump parts can be assembled and how sections can be added thereto or removed therefrom to increase or decrease the capacity of the pump.

Peculiar advantages are attained by constructing the pump casing or shell to permit lateral swing of the pump shaft, after the pump has been dismantled, as I am thereby enabled to remove the shaft longitudinally from the combined suction and discharge casing section remaining set up, without disturbing the motor and its shaft, and without disturbing the fastening means between the coupling members 15, 20, and the shafts and in fact without disturbing the positions of said members on said shafts. The pump shaft can be as readily again inserted in the fixed section and then swung to place in alinement with the motor shaft so that the two coupling members can be brought into operative engagement.

It is evident that various changes, variations, and modifications might be resorted to, that features might be omitted and elements might be added without departing from the spirit and scope of my invention, and hence I do not wish to limit myself to the exact disclosure hereof.

Desiring to protect my invention as broadly as is legally possible, what I claim is:—

1. A multi-stage centrifugal pump comprising end heads, vertical transverse casing sections, said heads and sections being removably secured together, a pump shaft, and removable impellers, one of said heads being provided with the suction inlet and the discharge outlet of the pump, whereby the other end head and said sections and impellers can be removed without disconnecting the suction and discharge pipes coupled to said inlet and outlet.

2. A multistage centrifugal pump of the vertically split type having one casting forming a section thereof and provided with the pump suction inlet and the pump discharge outlet.

3. A multistage centrifugal pump embodying a series of vertical sections arranged side by side and vertical end heads, one end head provided with the pump suction inlet and with the pump discharge outlet, substantially as described.

4. A multistage centrifugal pump comprising removable parallel sections clamped together end to end and removable longitudinally of the pump shaft, one end section provided with the pump suction inlet and the pump discharge outlet, said sections providing a longitudinal return passage from the opposite end of the pump to said section provided with said outlet.

5. A multistage centrifugal pump comprising parallel casing sections secured re-

movably together end to end and removable longitudinally of the pump shaft and providing passages for the flow of the liquid operated on by the pump from the pump suction inlet at one end of the pump to the opposite end of the pump and providing a return discharge passage longitudinally of the pump and to the pump discharge outlet at said end of the pump provided with the suction inlet.

6. A multistage centrifugal pump of the vertically split type having one of its casing sections provided with the pump suction and discharge openings, whereby the remaining casing sections of the pump can be removed without disturbing the pump suction and discharge connections.

7. A multistage centrifugal pump of the vertically split type having its suction and discharge openings both arranged at the same end of the pump to permit dismantling of the pump without disturbing the pump suction and discharge connections.

8. A multistage centrifugal pump of the transversely split or annular section type, having its impellers and passages arranged to drive the fluid from the suction end of the pump to the opposite end thereof and to return the same longitudinally within the pump casing to the suction end of the pump, said suction end of the pump being provided with the pump discharge outlet.

9. A multistage centrifugal pump having its casing built up of transverse parallel sections secured together end to end, said sections comprising a casting having a suction chamber with a suction inlet extending to the exterior of the casting and a discharge chamber having a discharge outlet extending to the exterior of the casting.

10. A multistage centrifugal pump having its casing composed of transverse hollow sections secured together end to end and providing passages for the liquid from the suction end of the pump to the opposite end thereof and back to the suction end, said suction end of the pump having the pump suction inlet to a suction chamber, and having an independent discharge chamber receiving said return flow and provided with the pump discharge outlet.

11. A multistage centrifugal pump having an end head formed with central openings enlarged with respect to the pump shaft to permit lateral swing of the shaft therein and longitudinal withdrawal of the shaft therefrom when the pump is otherwise dismantled.

12. A multi-stage centrifugal pump comprising removable parallel transverse casing sections, one of which is adapted to remain set up when the pump is otherwise dismantled, and a pump shaft, said shaft being laterally swingable in said one section when the pump is otherwise dismantled to throw the members of the coupling uniting said shaft and an alined power shaft out of alinement so that said pump shaft can be removed longitudinally from said one section without disturbing said coupling members on their respective shafts.

13. A multi-stage centrifugal pump comprising removable transverse casing sections, one of which is arranged to remain set up when the pump is otherwise dismantled, and a pump shaft laterally swingable in and longitudinally removable forwardly from said one section when the pump is dismantled.

14. A multi-stage centrifugal pump comprising a pump shaft, parallel removable transverse casing sections, one of said sections adapted to remain set up when the casing is otherwise dismantled, said section having enlarged central openings through which said shaft extends, and a stuffing box for said shaft and removably secured to said section and occupying one of said openings.

15. A multi-stage pump comprising removable casing sections, one of which is adapted to remain set up when the casing is otherwise dismantled, a longitudinal pump shaft, a driving shaft alined with said pump shaft, and a separable coupling operatively connecting the ends of said shafts, said pump shaft being removable from said one section and toward said driving shaft when the casing is dismantled and while the coupling remains fixed to said shafts.

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

ALEXANDER V. MUELLER.

Witnesses:
AVERY SWIGOTT,
JOHN C. HENRY.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."