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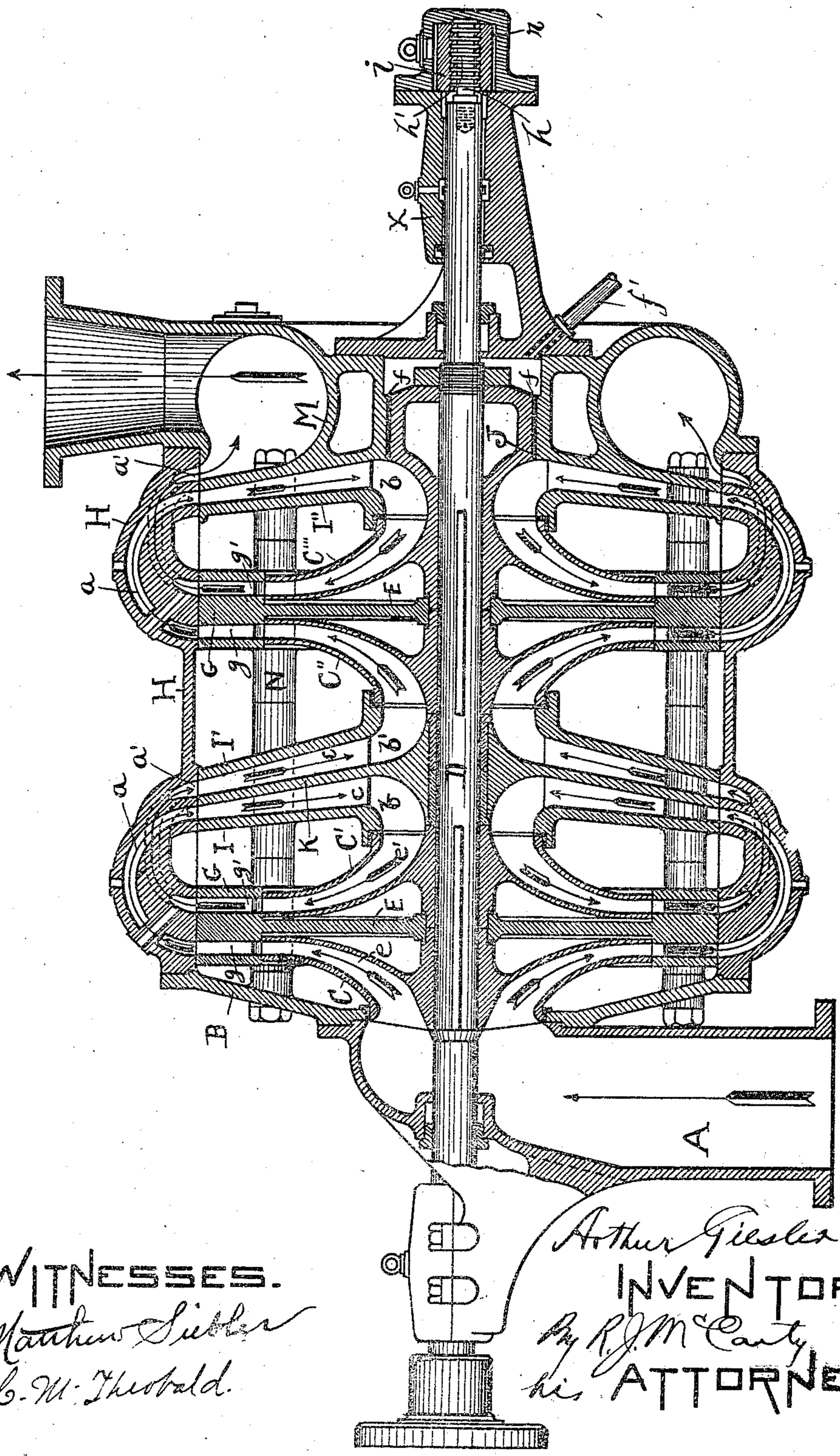
MULTISTAGE CENTRIFUGAL PUMP.

APPLICATION FILED MAY 8, 1905.

948,292. Patented Feb. 1, 1910.



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UNITED STATES PATENT OFFICE.

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MULTISTAGE CENTRIFUGAL PUMP.

948,292. Specification of Letters Patent. Patented Feb. 1, 1910.

Application filed May 8, 1905. Serial No. 259,304.

To all whom it may concern:

Be it known that I, ARTHUR GIESLER, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Multistage Centrifugal Pumps; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in centrifugal pumps, especially of the multiple-stage type, and the object of the invention generally speaking, is to improve the efficiency and simplify the construction thereof.

In obtaining the desired efficiency, I balance the end thrust of the pump, which is always toward the suction end, as near as possible, by a proper construction, and for the fractional unbalanced part of the end thrust that cannot be balanced without making experiments with every pump, I provide a positive collar bearing which prevents the least possible friction and thus increases the useful efficiency of the pump. The efficiency is also due to other structural features, among which may be mentioned the construction of the ports. Short curves which cause much frictional resistance are avoided by constructing the ports in the pump casing where ample space for large ports is allowed. As a consequence, the flow of water is even and at low speed. The many parts found in centrifugal pumps, demand a great many joints and fits, which are when new, subject to leakage and thus decrease the efficiency. After a period of usage these joints are subject to corrosion and the parts therefore, become difficult to dismantle. To avoid these difficulties, I have endeavored to have as few individual pieces as is compatible with good design.

A further object of the invention is to so construct a pump of the above type that the suction end thereof may remain unbroken or undisturbed after the pump is installed. In other words, the coupling by which the pump is connected to the motor, for example, electrical, steam gas or water motor, is on the suction side of the pump, and if repairing of the working parts should become necessary, the connection to the suction pipe need not be broken to take the entire pump apart. This is an important item in the installation of all pumps and especially pumps of this type. All parts of the pump, stationary as well as rotary may be removed from the discharge end.

In a detailed description of my invention, the drawing is referred to, the same being a sectional view of a four stage pump.

In the following description, similar reference characters will indicate corresponding parts.

A is the suction pipe connected to the pump cover —B— which closes the suction end of the pump. The cover B is connected to the pump casing H which is of cylindrical form and is made in one casting from end to end. The swelled portions of said casing are provided with a multiplicity of cross ports *a*—*a'* which register with ports *b*—*b'* in a double port plate I—I'. In this double port plate there is a diaphragm or divison plate K which separates the ports *b*—*b'*, the said double port plate and the diaphragm being in a single casting joined by a suitable number of vanes —*c*—. The vanes *c* form ports between them; and the ports *b*—*b'* are continuations of said ports to conduct the liquid to be pumped, to the right and left impellers.

I'' is a single port plate at the delivery end of the pump, and the same in construction as the double port plate, with the exception that it is single, and conducts the water or liquid to the last impeller. For simplicity of manufacture and as affording the advantages of strength, etc., this single port plate and the delivery pipe M are made in one casting.

C—C'—C'' and C''' are a series of four impellers on pump shaft D with a multiplicity of ports *e*—*e'* between the impeller vanes and which ports, discharge into stationary ports *g*—*g'* in rings G, when the pump is rotating. Separating the impellers are divison plates E which have the peripheral guide rings G which guide the water or liquid from the impellers in a radial direction into the ports *a*—*a'* in the pump casing. It is obvious that any desired number of impellers may be employed by lengthening the pump casing to accommodate the number. The drawing shows four, the last

one being at the delivery end of the pump and discharging into the delivery pipe M. The water in its exit passes from the last impeller into the cross ports *a'* in the pump casing, and thence into the delivery pipe. The number of ports *a*—*a'* in the pump casing increases according to the diameter of the pump.

Theoretically, each impeller is balanced by entering the water from opposite directions or in pairs, but in practice there is an unbalanced thrust toward the suction pipe, which may be caused either in the suction pipe or by leakage between the runners. This unbalanced thrust is balanced through the medium of a hub J which is constructed integrally with the last impeller and has its inner surface concaved to direct the water to said last impeller. This hub J, when properly dimensioned, will balance the pump toward the suction end, and any liquid that may leak through the running joint *f* will discharge through a pipe *f'*. Owing to the difficulty in obtaining the proper dimensions of the hub J, an end thrust bearing for the pump shaft is provided to keep the pump in an exact path of rotation and to take up any minus or over-balancing. This end thrust bearing consists of a stud shaft *h* which is screwed or otherwise rigidly secured to the end of the pump shaft, and has upon it a multiplicity of rigid collars *h'*. Fitting around these collars is a split bushing —*i*— consisting of two halves and over which is placed a cast iron cap *r* which keeps the bushing in place and also provides a rigid end connection by being bolted to the flange of the main box —*x*—. The bushing engages the collars *h'* and is itself engaged on all sides by the cap *r* and the box —*x*—. The bearing thus constructed can be replaced at small expense without dismantling any part of the pump.

N is a bolt of which there may be any desired number employed for uniting the parts of the pump. The drawing was prepared with a view to having five bolts, the lower bolt being in a correct position and on the line of the section, while the upper bolt is shown in the distance, away from the line of the section. These bolts pass through the cover B at the suction end of the pump, and through the guide rings G and the double and single port plates I—I' and I''. The bolts are not an essential part of the construction, as other means may be employed for uniting the parts of the pump.

The numerous arrows clearly illustrate the course of the water entering the suction end of the pump. It passes under suction pressure between the vanes of the first impeller, thence through the ring ports *g* into the cross ports *a* in the pump casing. From ports *a* it passes into ports *b* in the double port plates and thence into ports *e'* of the second impeller and into the cross ports *a'* in the pump casing. This circuit is repeated according to the number of impellers until the delivery end of the pump is reached.

Having described my invention, I claim:

1. In a multi-stage centrifugal pump, two impellers arranged with their inlets facing in opposite directions, passage ways adapted to conduct the fluid from one impeller to the other, and means mounted at the intermediate inlet of the last impeller for balancing the thrust of the pump.

2. In a multi-stage centrifugal pump, two sets of impellers, each set consisting of two impellers arranged with their inlets facing in opposite directions, passage ways adapted to conduct the fluid from one impeller to the next, and means mounted at the intermediate inlet of the last impeller for balancing the thrust of the pump.

3. In a multi-stage centrifugal pump, a pump casing having cross ports therein, a port plate and a delivery pipe registering respectively with said cross ports, impellers arranged with their inlets facing in opposite directions, and a balancing hub at the inlet of one of said impellers and forming a guide to the entrance of said impeller.

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

ARTHUR GIESLER.

Witnesses:
R. J. McCarty,
C. M. Theobald.