A. E. GUY.

MULTIPLE IMPELLER PUMP.

APPLICATION FILED APR. 30, 1908.

912,954.

Patented Feb. 16, 1909.

3 SHEETS—SHEET 1.

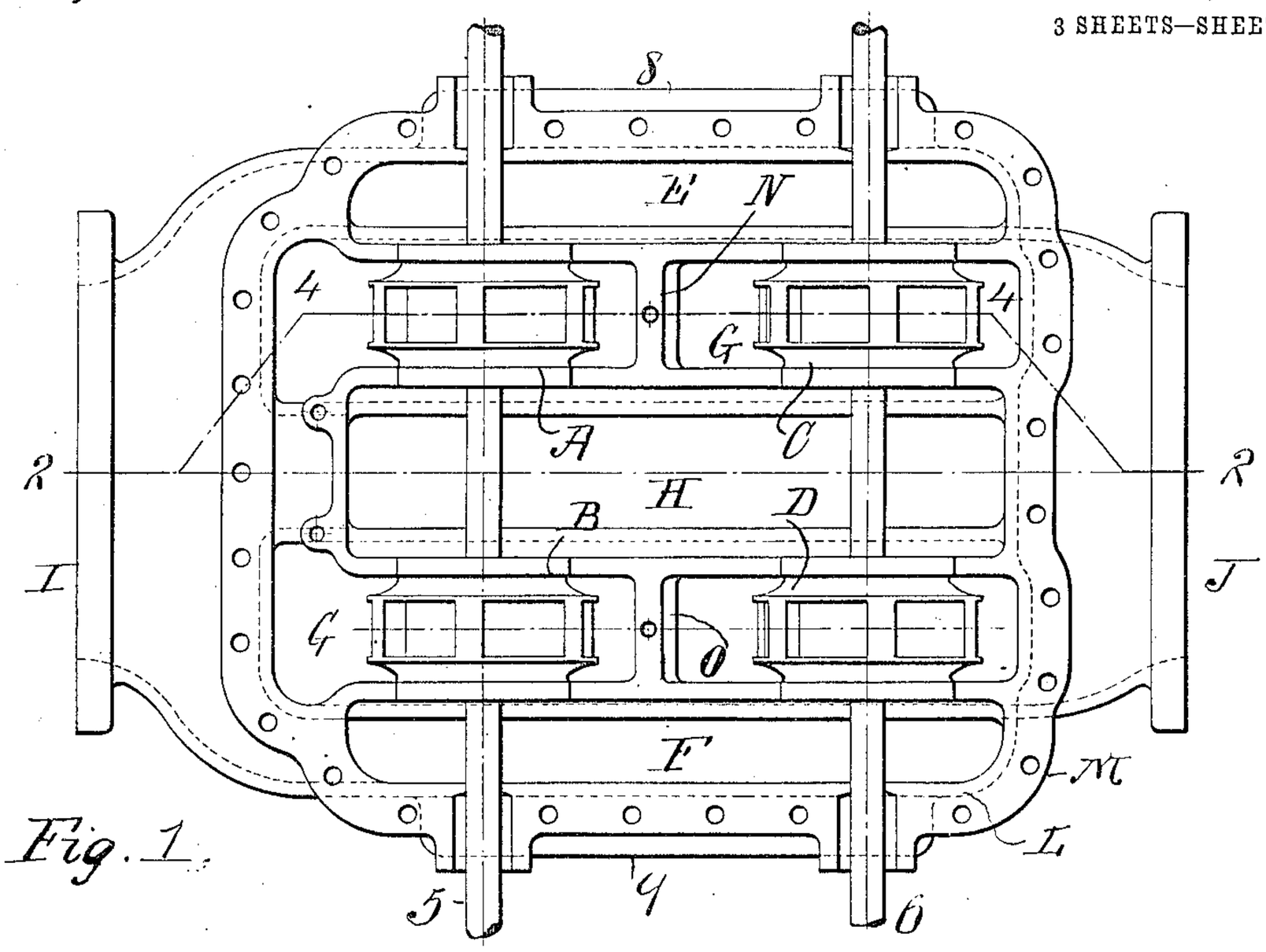

Fig. 1.

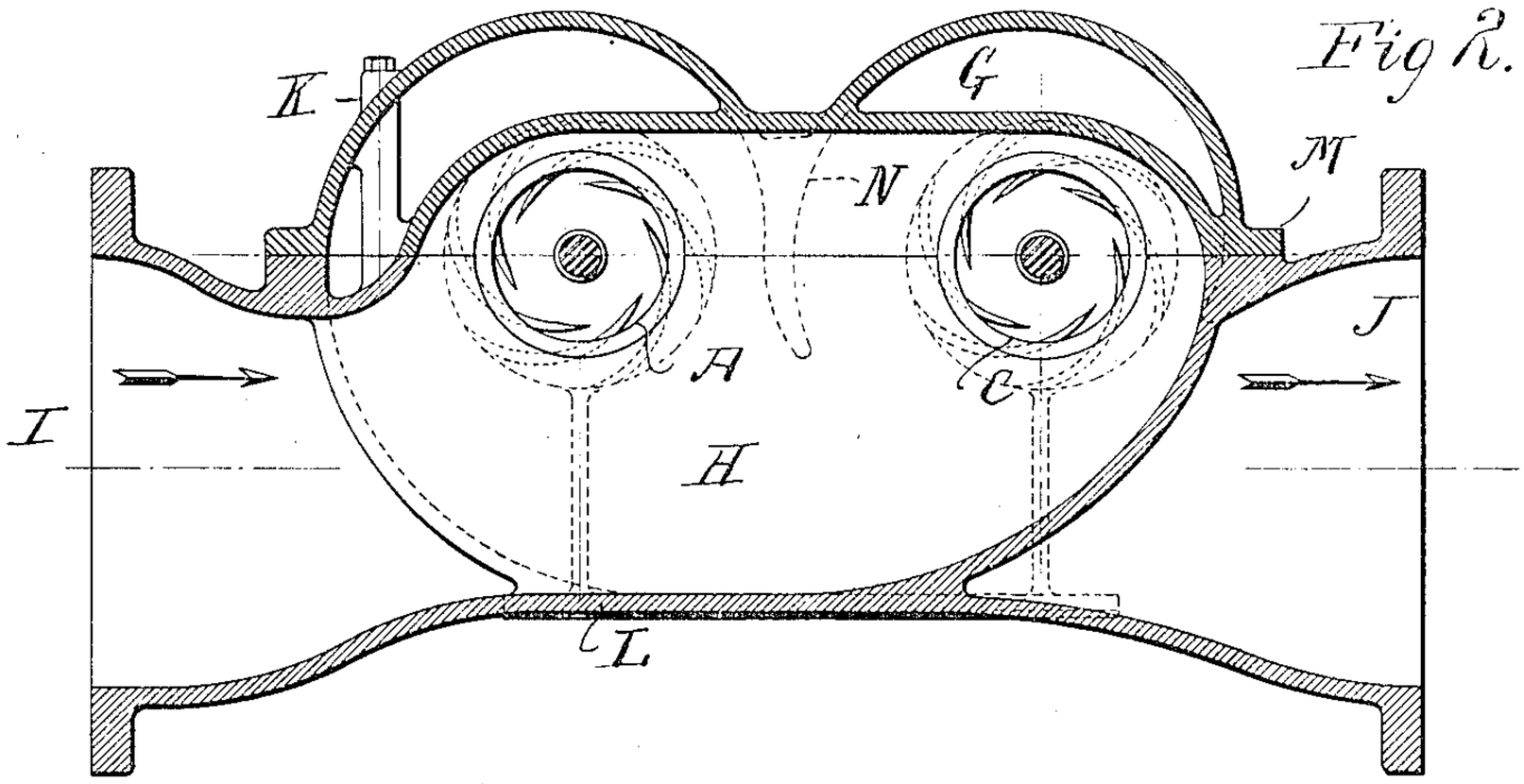

Fig 2.

Witnesses.

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3 SHEETS—SHEET 2.

Fig. 3.

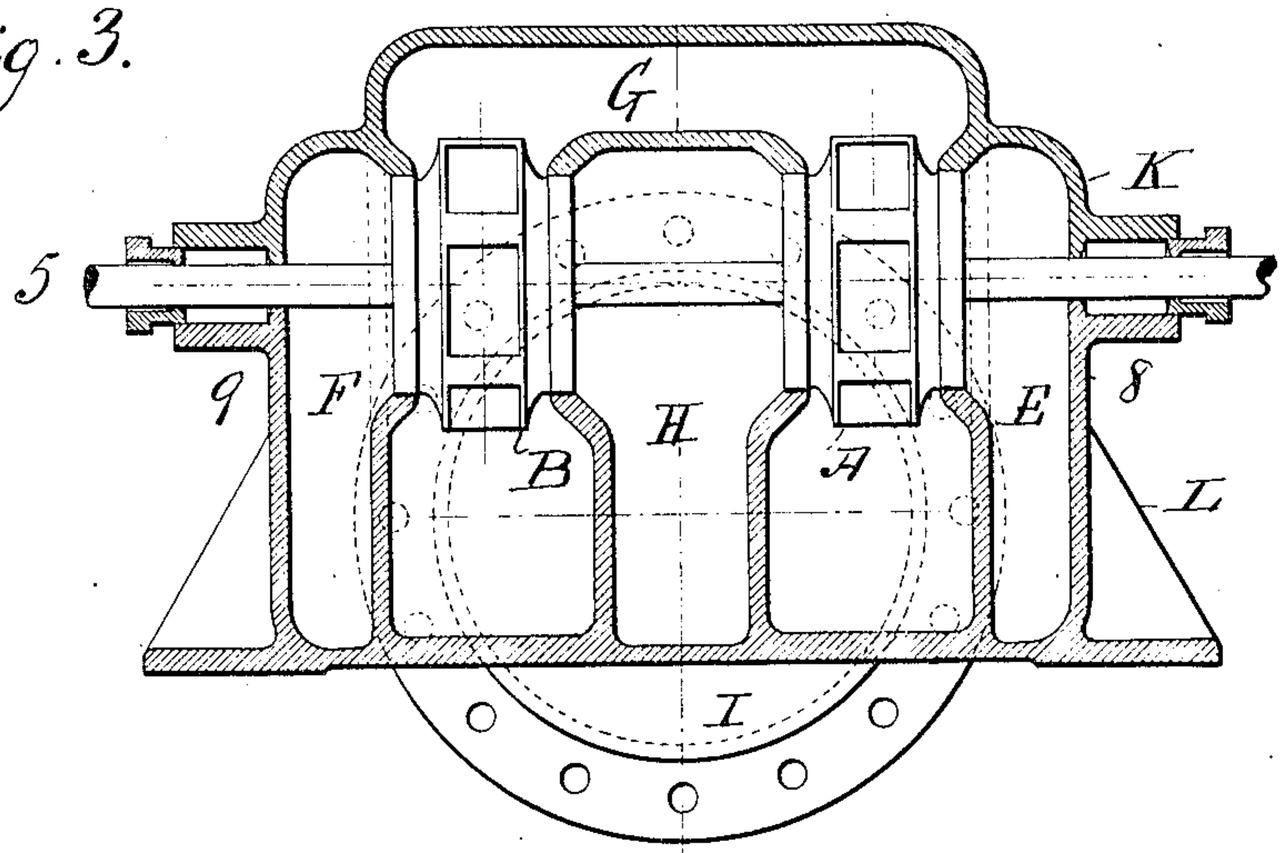


Fig. 4.

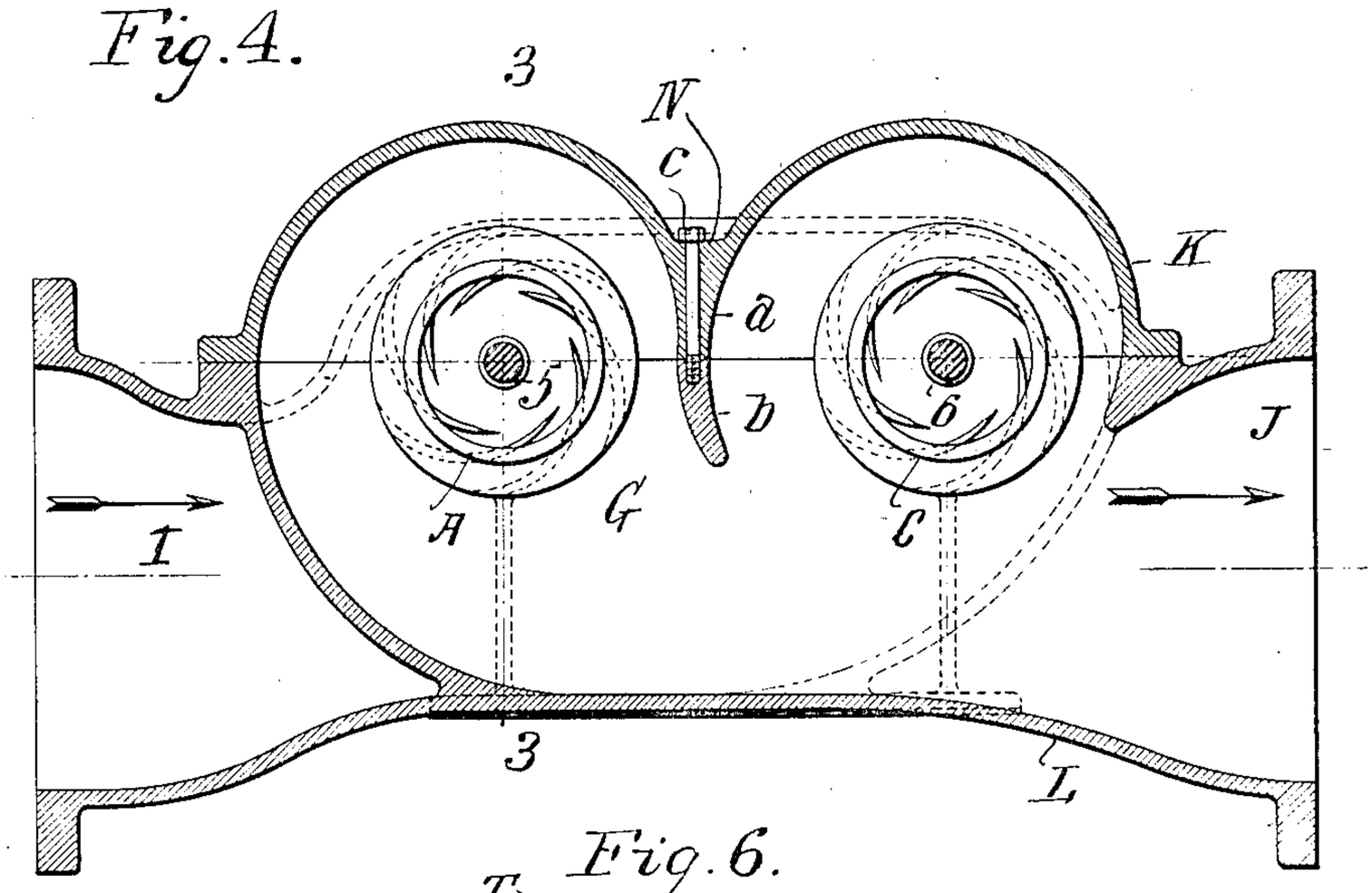
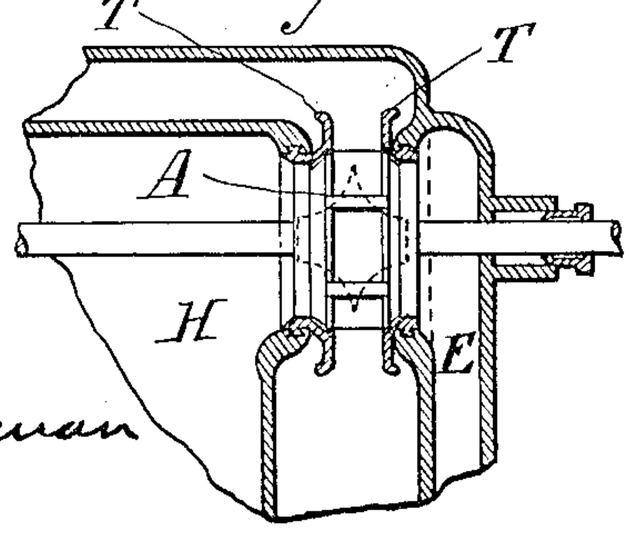


Fig. 6.



Witnesses.

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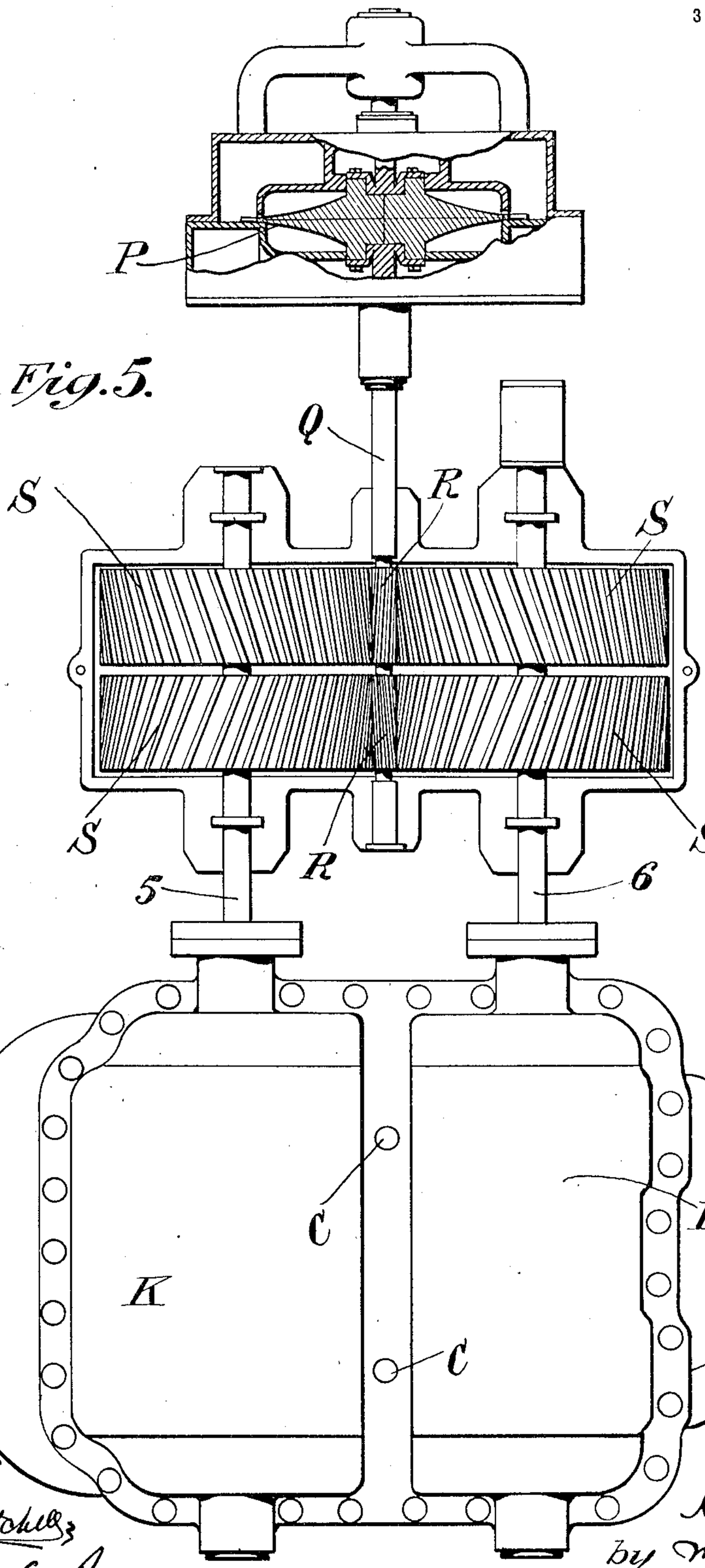
3 SHEETS—SHEET 3.

Fig. 5.



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UNITED STATES PATENT OFFICE.

ALBERT E. GUY, OF TRENTON, NEW JERSEY, ASSIGNOR TO DE LAVAL STEAM TURBINE COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

MULTIPLE-IMPELLER PUMP.

No. 912,954. Specification of Letters Patent. Patented Feb. 16, 1909.

Application filed April 30, 1908. Serial No. 430,045.

To all whom it may concern:

Be it known that I, ALBERT E. GUY, a citizen of the United States of America, and a resident of Trenton, county of Mercer, and State of New Jersey, have invented certain new and useful Improvements in Multiple-Impeller Pumps, of which the following is a specification.

This invention relates to multiple impeller pumps and combined multiple impeller pumps and turbine motors, and comprises twin driving shafts, each carrying one or more impellers, all impellers drawing from the same source and revolving in and delivering into the same receiving chamber.

My invention also comprises means preventing the current delivered by the impeller or impellers on one shaft from opposing the current delivered by the impeller or impellers on the other shaft.

In application Sr. No. 401,929, filed November 13, 1907, I have illustrated and described a multiple impeller pump, wherein a single driving shaft has upon it a plurality of impellers operating in parallel within a common delivery chamber; and I have there pointed out how such arrangement of the impellers and the corresponding arrangement of the supply and delivery chambers of the casing, simplifies the construction of multiple-impeller pumps and how according to this construction the casings of such pumps may be made of standard sizes and construction, the pumps being adapted to different conditions by mere substitution of different impellers. In application Sr. No. 401,930 filed November 13, 1907, I have shown how such pumps may be adapted readily to different conditions by the provision of diffuser rings which may be of different forms according to different conditions to be met, all forms of a particular series adapted, however, for use in the same casing and with the same or different impellers.

Instead of having the impellers on the same shaft it is often convenient to have them on different shafts, these shafts being usually parallel. This is particularly true where it is desirable to use more than two impellers operating in parallel. To provide more than two impellers on the same shaft, all operating within the same delivery chamber and all drawing directly from the same source, would involve considerable complications in the arrangement of passage within the casing; whereas the arrangement of passages required by two impellers on the same shaft is exceedingly simple. Where there are to be two or more parallel shafts each carrying but two impellers, these impellers intended all to work in parallel, substantially the same arrangement of passages may be employed as when there is only one shaft with two impellers thereon, the form only of the passages or chambers requiring to be changed to provide room for the reception of two or more parallel shafts and the impellers thereon. Furthermore, the use of two or more driving shafts each carrying impellers is particularly desirable when the pump is of such size as to require considerable power to drive it, and it is to be driven by axial flow turbines. In such turbines it is common to employ speed reduction gearing, the turbine shaft carrying a pinion and the pinion driving a gear on the driving shaft of the machine; and where the turbine is of large size it is customary to provide two such driving shafts on opposite sides of the turbine shaft and each carrying a gear driven by the pinion on the turbine shaft; side pressure on the shafts being thereby counterbalanced. And where very large powers are desired, two turbines may be employed arranged side by side, the turbine shafts carrying pinions which drive three driving shafts, as explained in a companion application of even date. It is convenient in such cases to mount the impellers of the pump on these driving shafts or on other shafts directly coupled thereto; hence it is particularly true of pumps to be driven by such turbine motors, that it is desirable to provide the pump with two or more impeller shafts each of which shafts is provided with an impeller or impellers, these impellers all revolving within the same receiving chamber.

Where the pump is to be driven at high speed, (as where it is to be directly connected to a turbine motor) it is preferable to provide a number of relatively small impellers rather than to employ one or two larger impellers, as the smaller impellers can be driven at higher rotative speeds and operate with less friction.

In the accompanying drawings I illustrate a pump such as referred to, also said pump combined with a turbine motor having two driving shafts.

In said drawings: Figure 1 shows a top

view of a two-shaft pump such as described, the upper section of the pump casing containing the main portion of the delivery chamber, having been removed. Fig. 2 shows a vertical section of the pump on the line 2 2 of Fig. 2, being a line through the centers of the supply and delivery openings and the central suction duct H. Fig. 3 shows a transverse section on the line 3—3 of Fig. 4, that is to say, on a plane through the axis of one of the shafts. Fig. 4 shows a vertical section on the irregular line 2—4—4—2 of Fig. 1. Fig. 5 shows a top view of the pump combined with a two-shaft turbine motor, the upper portion of the pump casing having been removed as in Fig. 1, the upper portion of the gear casing of the turbine having been removed and the turbine being shown in central horizontal section and more or less diagrammatically. Fig. 6 shows a detail top view of an impeller and the portions of the casing in immediate proximity thereto, the upper section of the casing having been removed, and shows in section certain diffuser rings surrounding the impeller and hereinafter referred to.

Referring first to Figs. 1—4 inclusive, A and B designate like impellers mounted upon a driving shaft 5, and C and D designate other like impellers mounted upon the parallel shaft 6; said shafts are journaled in the outer walls 8 and 9 of the suction ducts or supply passages E and F. Between these suction ducts there is a third suction duct H; and between ducts E and H, and F and H, are parts of the delivery chamber G, another portion of which, connecting these portions with each other, is in the upper part of the casing, and which is provided with an outlet J. I designates the common inlet to the three suction ducts E, F and H.

The impellers are seated and rotate in circular openings formed respectively in the walls of duct H and in the inner walls of ducts E and F. It will be seen that, shafts 5 and 6 being in rotation, the impellers A and C draw liquid from ducts E and H and deliver into chamber G; end thrust being obviated by the fact that water is drawn equally from both sides of the impeller. Similarly, impellers B and D draw from ducts F and H and deliver into chamber G.

In the delivery chamber G is a depending guide N between impellers A and C, and a similar guide O between impellers B and D, the upper portion *a* of each guide being integral with the upper section K of the casing of the pump, the lower portion *b* being integral with the lower section L of the casing; and screw bolts *c* serve to connect the sections K and L at this point. The sections K and L also have the customary meeting flanges as shown for example at M, and are provided with the usual bolt holes for fastening the sections together. The guides N and O serve to prevent conflict between the stream of fluid discharged by impellers A and C and by impellers B and D and are suitably curved to that end.

In Fig. 5, which shows the combined turbine and pump, P designates a steam turbine of well known type, Q a turbine shaft, R—R reverse spiral pinions on said shaft, and S—S corresponding reverse spiral gears on shafts 5 and 6 respectively which are the same shafts which carry the pump impellers.

Since, in the case of turbines of large power, it is desirable to have gears such as S—S on both sides of the turbine pinions R, to avoid side pressure upon the pinions and turbine shaft, it is particularly advantageous, in the case of a pump to be driven by such a turbine, to have impellers mounted upon both said shafts and within a common casing, as shown.

If desired, the turbine casing may be provided with diffuser rings forming between them passages through which the fluid discharged from the impellers passes to the delivery chamber G and in which the kinetic energy of the rapidly moving stream of fluid discharged from the impeller is converted into pressure in the delivery chamber. Fig. 6 shows this construction, being the same construction shown in my said application Sr. No. 401,930. T—T designate two such diffuser rings which surround the hubs of the impeller, here designated by letter A, and seated in the orifices of adjacent walls of passages E and H; the impeller revolving in these rings, instead of in bearings in the walls of chambers E and H, as in the construction shown in Fig. 1. By employing diffuser rings of different forms, with or without changing the form of the impeller, the pump may be adapted, without change of the casing, to operate most efficiently under a great variety of different conditions. While Fig. 6 shows only one impeller and the parts of the casing immediately adjacent thereto, and the diffuser rings, it will be obvious that all of the impellers may be provided with such rings and will commonly be so provided when for any reason the diffuser rings are desired.

What I claim is:

1. A multiple impeller pump comprising in combination a plurality of impeller shafts, and impellers thereon and a casing having suction passages for the said impellers and a common delivery chamber for all of said impellers inclosing them and receiving their simultaneous discharge.

2. A multiple impeller pump comprising in combination a plurality of impeller shafts, each provided with a plurality of impellers, all said impellers constructed to operate in parallel, and a casing having suction passages for said impellers and a common delivery chamber for all of said impellers inclosing

them and receiving their simultaneous discharge.

3. A multiple impeller pump comprising in combination a plurality of impeller shafts each having two impellers thereon, said impellers all arranged to operate in parallel, and a pump casing having three suction passages, one of which is intermediate the impellers of each shaft and the others of which are outside of the impellers of each shaft, said casing having also a common delivery chamber for all of said impellers inclosing them and receiving their simultaneous discharge, the portions of said delivery chamber within which said impellers revolve being between the intermediate suction passage and the outside suction passages.

4. A multiple impeller pump comprising in combination a plurality of impeller shafts and impellers thereon, a casing having suction passages for said impellers, and a common delivery chamber for said impellers inclosing them and receiving their simultaneous discharge, and having also guiding means between the impellers of different shafts, serving to reduce conflict between the streams from such impellers.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

ALBERT E. GUY.

Witnesses:
H. M. MARBLE,
FRANK E. ROFFMAN.