H. KELLER.

CENTRIFUGAL BLOWER, PUMP, COMPRESSOR, &c.

APPLICATION FILED NOV. 27, 1907.

996,859. Patented July 4, 1911.

Fig. 1.

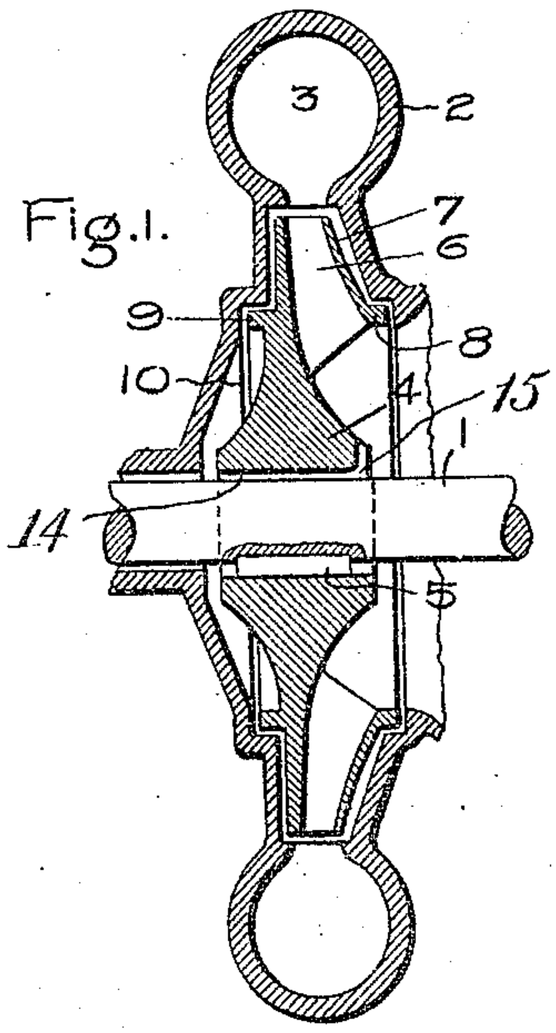


Fig. 2.

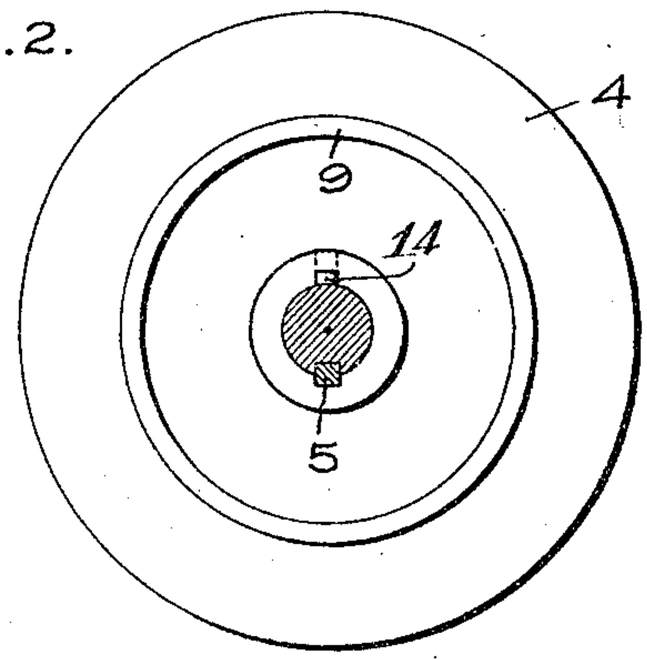


Fig. 3.

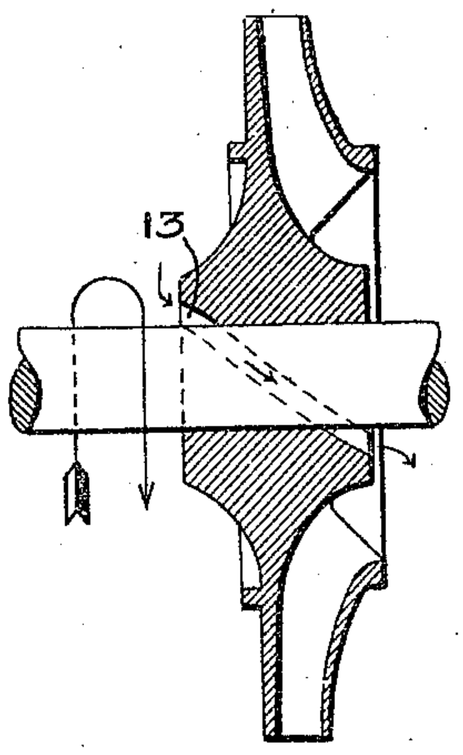


Fig. 4.

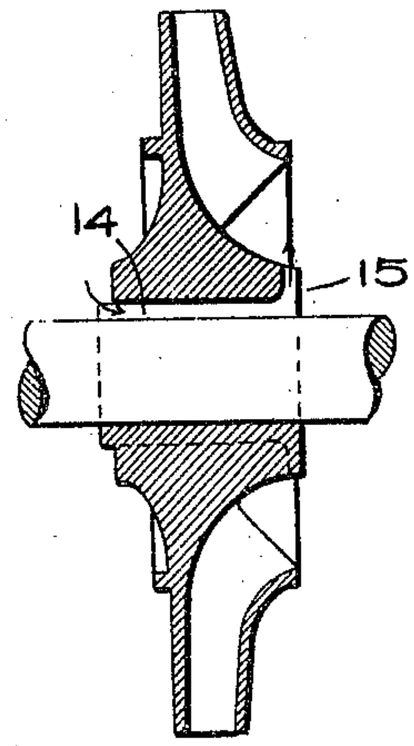
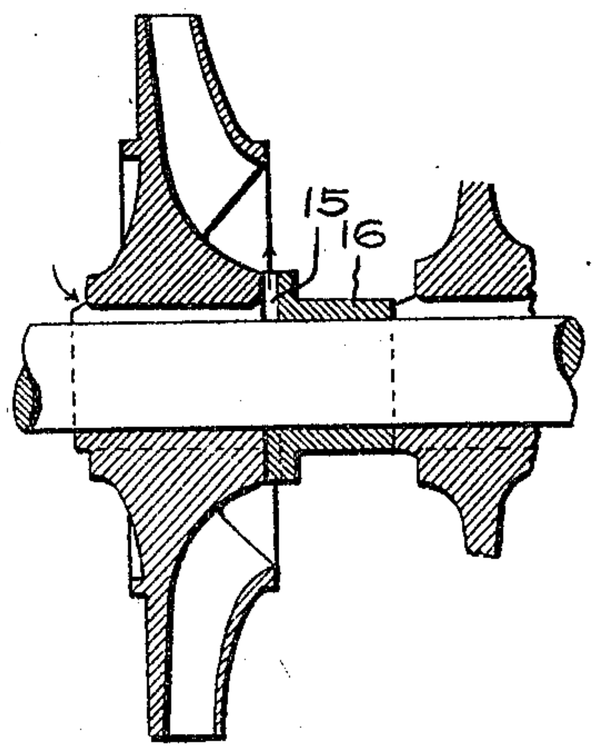


Fig. 5.



Witnesses:
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Att'y.

UNITED STATES PATENT OFFICE.

HULDREICH KELLER, OF BERLIN, GERMANY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CENTRIFUGAL BLOWER, PUMP, COMPRESSOR, &c.

996,859. Specification of Letters Patent. Patented July 4, 1911.

Application filed November 27, 1907. Serial No. 404,058.

To all whom it may concern:

Be it known that I, HULDREICH KELLER, a citizen of Switzerland, residing at Berlin, Germany, have invented certain new and useful Improvements in Centrifugal Blowers, Pumps, Compressors, &c., of which the following is a specification.

The present invention relates to centrifugal blowers, pumps, compressors, etc., and more especially to those having an impeller with a uni-lateral inlet and rotating at high speed. In such an apparatus when operating there is an ultimate accumulation of pressure on one side of the impeller which exerts a longitudinal thrust on the shaft that is highly objectionable.

My invention has for its object to provide means for equalizing the pressures on opposite sides of the impeller to avoid the thrust, and this without unduly weakening the structure on one hand or making it excessively heavy on the other.

In the accompanying drawing, which shows structures illustrative of the invention, Figure 1 is an axial section of a centrifugal pump with a part of the casing broken away; Fig. 2 is a side elevation of the impeller; Fig. 3 is a sectional view of a modification showing a spiral groove in the impeller hub for equalizing pressures; and Figs. 4 and 5 are views showing grooves similar to that of Fig. 1.

1 indicates the high-speed shaft of a pump, and 2 the inclosing casing having a conduit 3 that is connected to the system receiving fluid from the pump. The bearings, packings, etc., have been omitted for the sake of clearness. Mounted on the shaft is an impeller 4 of the uni-lateral inlet type. This impeller is secured to the shaft by a key 5 seated in a groove in the shaft and also in a comparatively shallow groove in the impeller. The impeller is provided with suitably shaped vanes 6 located on one side thereof. The vanes have a covering 7 extending substantially perpendicular to the shaft, the said covering having a shoulder 8 located opposite one on the casing to prevent the free return to the inlet of fluid discharged by the impeller. The opposite side of the impeller is provided with a similar shoulder 9 coöperating with the casing for the same purpose. In such a construction there will ultimately be a pressure in the chamber 10 opposite the inlet tending to force the impeller to one side. To avoid this one or more grooves, passages or conduits are provided which communicate with both sides of the impeller. It or they are made as close to the shaft axis as possible so as not to weaken the stock of which the parts are composed, and so that the rotation of the impeller will produce the minimum retarding effect on the passage of fluid. It is necessary to provide a groove in the hub of the impeller to receive the key, and since this groove has to cut the fiber of the metal, it follows that to cut another groove or passage will not further weaken it to any material extent, providing the groove is not essentially deeper. Since the shaft is grooved to receive the key, it follows that it may also be grooved to form an equalizing passage without undue weakening. From this it will be seen that the weight of the rotating element does not have to be increased nor the shaft enlarged to provide additional strength to compensate for the passages. By locating the grooves as shown, the walls have a relatively low surface speed and hence the opposition to flow of the fluid is reduced to a minimum. The passage of the working fluid from the rear to the front of the impeller is facilitated if the groove is formed spirally, the radial height of the groove being less at the entrance than at the exit, so that the point of entrance will oppose slight resistance to the passage of the fluid, while the exit portion will exert a throwing effect at the point of discharge and a suction effect on the fluid column. This is shown at 13 in Fig. 3. In this illustration the groove extends in the direction opposite to that of rotation. For the same purpose, the generating lines of the groove might be inclined forwardly at the entrance and rearwardly at the exit, and thus act as water-wheel or throwing buckets.

Figs. 1 and 4 represent an impeller in which the entrance portion 14 of the hub groove is made low and the exit portion 15 made intentionally high so that the former offers but slight resistance to the entrance of fluid, and the latter exerts a suction effect. As in Fig. 5, the radial prolongation of the groove may be located in a sleeve or spacer 16 placed against the impeller hub. This is useful where a number of impellers are placed on the same shaft.

The above described pressure-equalizing

means can be employed for other purposes, as for example in turbine wheels. I may also combine various features of the invention in the same structure.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is,—

1. In an apparatus of the character described, the combination of a rotating element having a curved pressure-equalizing groove communicating with the bore thereof and open at both ends, with a shaft that extends through the bore and supports the element.

2. In an apparatus of the character described, the combination of a rotating element having a pressure-equalizing groove in the hub which has a greater radial depth on the discharge than on the inlet side, with a shaft which carries the element.

3. In an apparatus of the character described, the combination of a rotating element having a pressure equalizing groove that opens into its bore and is inclined to the axis of the element, with a shaft therefor which engages said bore and drives the element.

4. In an apparatus of the character described, the combination of a rotating element having a spiral pressure-equalizing groove opening into its bore, with a shaft for supporting the element.

5. In an apparatus of the character described, the combination of a rotating element having a spiral pressure-equalizing groove in its hub which extends in the opposite direction to that of its rotation, with a shaft for supporting the element.

6. In an apparatus of the character described, the combination of a rotating element having a spiral pressure-equalizing passage in its hub which has an inlet that is smaller than its outlet, with a shaft for supporting and rotating the element.

In witness whereof, I have hereunto set my hand this 11th day of November, 1907.

HULDREICH KELLER.

Witnesses:
MARTIN KRAUSS,
HANS REINECKE.