

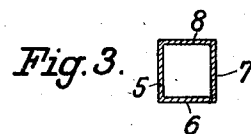
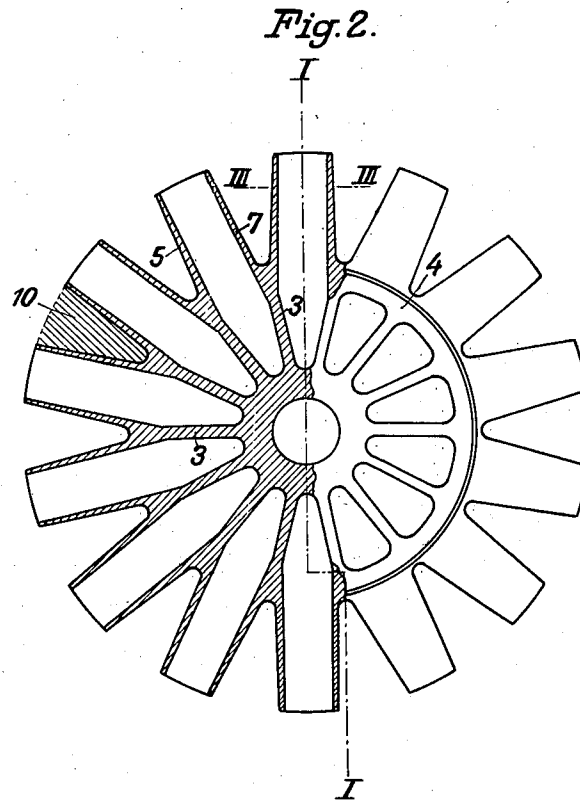
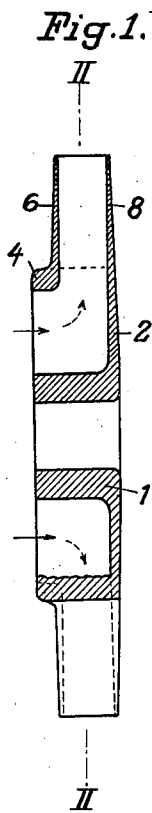
July 5, 1932.

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1,865,918

IMPELLER AND METHOD OF MAKING SAME

Filed May 28, 1929



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UNITED STATES PATENT OFFICE

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IMPELLER AND METHOD OF MAKING SAME

Application filed May 28, 1929, Serial No. 366,635, and in Germany June 30, 1928.

My invention relates to impellers, more particularly for centrifugal machines, such as rotary compressors. It is an object of my invention to so design an impeller of the type referred to that its vanes are only subjected to tensile stress by centrifugal action. To this end, instead of vanes inserted between end plates in the usual manner, which plates may rotate with the impeller or be stationary, I provide vanes constituting radial passages which are closed on all sides and only open at the inlet and outlet, and project freely from the boss of the impeller at their outlet ends.

In centrifugal machines, and more particularly in rotary multi-stage compressors, high velocities are desirable in order to obtain a maximum increase of pressure per impeller, and the peripheral velocities are high in proportion. Curved vanes as usually provided are subjected to such high stresses by the centrifugal forces tending to bend them into radial form, that they cannot be designed so as to afford any reliability. Therefore, considerations of favourable directions at the inlets and outlets of the vanes were set aside and the vanes were designed extending radially from a boss. The passages formed by such vanes are open at the sides so that the vanes are free to yield resiliently to any forces, and stationary end plates are arranged at the ends of the impeller. Obviously such impellers and their stationary end plates require very exact machining and assembling as on the one hand the clearance should be a minimum in order to reduce the leakage, and, on the other hand, contact of the vanes and end plates should be absolutely eliminated as it would lead to immediate destruction of the impeller. Besides, the vanes are further apart at the outlet than at the inlet which is unfavourable with respect to the flow of the fluid, and the flat resilient vanes have a tendency to vibrate which may cause unsteady rotation and, under certain conditions, failure of vanes.

According to my invention the liability to vibration is much reduced and the flow conditions are improved. My novel impeller is made from a single blank by machining and

is equipped with a hollow boss having radial vanes and passages extending radially from the spaces between the vanes. Preferably the point where two passages adjoin is arranged at the end of one of the radial vanes in the boss so that the centrifugal forces acting on the walls of the passages are directly transmitted to the centre of the impeller, and preferably the thickness of the walls is reduced toward the perimeter so that the centrifugal stress is equal throughout the walls. The walls of such radial passages—like radial vanes—only undergo substantially tensile stress under centrifugal action and therefore the thickness of the walls is easy to calculate. The passages are comparatively rigid so that there is practically no tendency to vibrate, leakage as in the aforesaid impellers with stationary end plates is eliminated and the flow conditions are much more favourable than with radial vanes.

In the drawing affixed to this specification and forming part thereof an impeller embodying my invention is illustrated diagrammatically by way of example.

In the drawing

Fig. 1 is an axial section of the impeller on the line I—I in Fig. 2,

Fig. 2 is an elevation of the impeller viewed from the left in Fig. 1, and partly in section on the line II—II in Fig. 1, and

Fig. 3 is a section on the line III—III in Fig. 2.

Referring now to the drawing, 1 is the central sleeve of the impeller, 3, 3 are radial vanes extending from the sleeve, and 4 is a rim connecting the outer ends of the vanes. These parts make up the boss of the impeller. The spaces between the vanes in the boss are open at one end and closed at the other by a web 2 the thickness of which is gradually reduced toward the rim 4, for the reasons stated. Extending radially from the boss in continuation of the spaces between its vanes 3 are radial passages each having four walls 5, 6, 7, 8, as shown in Fig. 3, the thickness of such walls being also reduced toward the perimeter of the impeller. Preferably the section of the passages is square or rectangular and uniform throughout their length, and

their side walls 5 and 7 extend fork-fashion from the ends of the vanes 3 in the boss. Their front end walls 6 are integral with the rim 4, and their rear end walls 8 form the continuation of the web 2. In this manner the centrifugal forces from the several passages are absorbed under very favourable conditions. Another advantage of the system is that the walls are readily machined to the sections required in view of centrifugal action.

Instead of admitting the fluid at the front end of the impeller only as shown it may be admitted at either end in which case the web 2 is dispensed with altogether or is placed in the central plane of the impeller as a partition which may extend as far as the inner ends of the passages, or partly into the passages, or throughout their length.

Impellers of this type may be machined—casting is out of the question as castings will not stand the tensile stresses—in a comparatively simple manner notwithstanding their complicated configuration. A blank is turned to the outer diameter of the impeller, the radial passages are drilled or milled as far as the boss, for instance by means of drills for making square holes, the spaces between the vanes 3 in the boss are machined with end mills, and finally the sectors 10, Fig. 2, between the side walls 5, 7 of the passages are removed.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described for obvious modifications will occur to a person skilled in the art.

In the claim affixed to this specification no selection of any particular modification of the invention is intended to the exclusion of other modifications thereof and the right to subsequently make claim to any modification not covered by this claim is expressly reserved.

I claim:

An impeller comprising a hub having radial webs defining axial passages therein, and straight radial tubes connected with said passages, the side walls of each adjacent pair of tubes being integrally connected with one of said webs at their inner end, and projecting freely from where they are thus connected.

In testimony whereof I affix my signature.

HUGO JUNKERS.

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