G. W. McKEE.

IMPELLER FOR CENTRIFUGAL COMPRESSORS.

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1,426,581.

Patented Aug. 22, 1922.

Fig. 1.

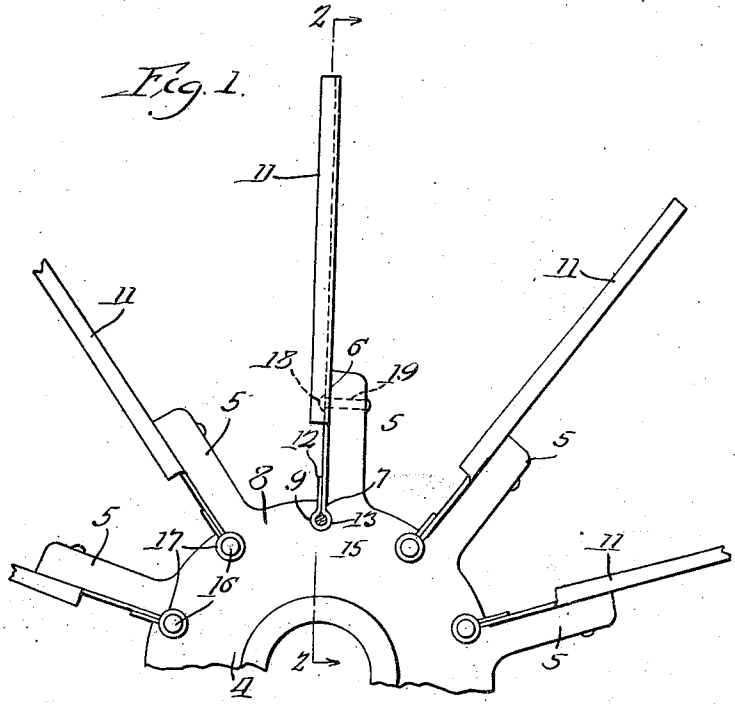


Fig. 2.

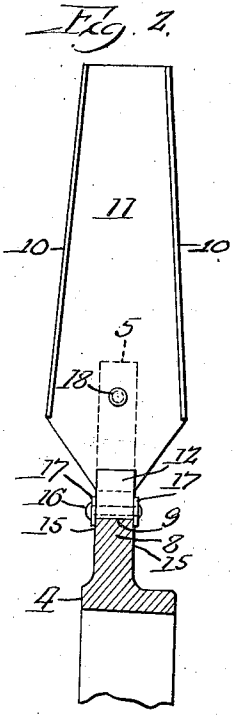
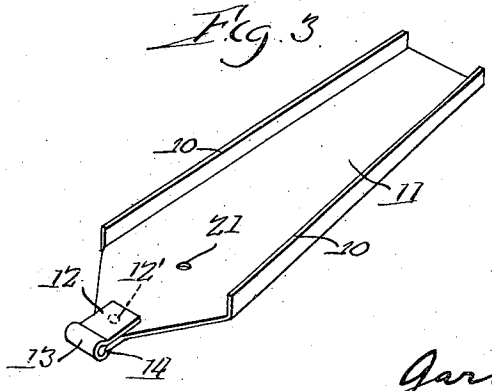


Fig. 3.



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UNITED STATES PATENT OFFICE.

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To all whom it may concern:

Be it known that I, GARNET W. McKEE, a subject of Great Britain, residing at Rockford, in the county of Winnebago and State of Illinois, have invented certain new and useful Improvements in Impellers for Centrifugal Compressors, of which the following is a specification.

This invention pertaining in general to fan blowers of the centrifugal compressor type, has more particular reference to the impeller construction.

It is desirable in the manufacture of centrifugal compressors for commercial purposes to provide an impeller structure which will be economical to manufacture and which will produce when in operation, a high degree of volumetric and manometric efficiency. In view of the high speed at which the impellers are revolved, the weight, shape and proportions of the impeller hub and blades are important factors in securing the requisite degree of efficiency and economy. With the foregoing in mind, I have aimed, primarily, to provide an impeller which may be produced at a comparatively low cost and which will develop the desired degree of efficiency.

My invention contemplates so proportioning and shaping the blades and connecting them to the hub as to dispose the weight and strength of these parts in accordance with the distribution of the centrifugal stresses resulting from high speeds of rotation.

Another object is to provide an impeller of novel construction which shall enable the blades to be quickly assembled on the hub with the blades in accurate alignment, thereby eliminating the necessity of subsequently trueing the blades either by resetting or machining.

In furtherance of the foregoing, my invention contemplates primarily, the provision of blades having enlarged inner ends insertible edgewise into correspondingly shaped slots in the hub and means for retaining them therein against lateral displacement by engagement with both sides of the hub, whereby the blades are accurately secured in alignment and effectually anchored so as to withstand with a sufficient factor of safety the centrifugal stresses at very high speeds. My invention further contemplates the provision of a bracing element for the back of each blade, integral with the hub and extending outwardly therefrom, so as to afford a substantial yet light, brace for the blades in the vicinity of the greatest thrust and strains thereon.

More particularly, I have provided a blade structure especially adapted for, though not necessarily limited to, sheet material formation. In its preferred embodiment, the body of the blade is of channel shape in cross-section for the purpose of strengthening the blade and promoting its efficiency, and the inner end is bent back upon itself forming an enlarged head, provided with a transverse opening. The headed end is insertible edgewise into a correspondingly shaped slot in the hub and a rivet is passed through said opening and secured with a washer interposed between each end of the rivet and the adjacent side of the hub. The rivet is thus brought tight against the washers and the latter against the sides of the hub so that there is no tendency in the act of assembling, to disalign the blade. By means of a single rivet through the body of the blade and the brace element mentioned above, the blade will be finally secured in the proper alignment. The advantages of this construction are that it is especially economical in production compared with other methods now in practice; it promotes efficiency by reason of the high degree of accuracy and precision in alignment of the blades; and the blades may be exceptionally light and the hub of the proper weight so that the stresses at the roots of the blades are lessened; and the blades are effectually anchored to the hub and possess the proper strength at their inner ends where the centrifugal stresses are greatest.

Other objects and attendant advantages will be appreciated by those familiar with this art as the invention becomes better understood by reference to the following description when considered in connection with the accompanying drawings, in which—

Figure 1 is a fragmentary side elevation of an impeller, embodying my invention;

Fig. 2, a sectional view taken on the line 2—2 of Fig. 1; and

Fig. 3, a perspective view of one of the blades.

Since my present improvements have reference only to the impeller construction, I have deemed it unnecessary to illustrate the casing and impeller shaft. The impeller consists of a hub designated generally by character 4, and a plurality of radially dis-

posed blades or vanes. The hub which may be of either cast or forged construction is shaped to provide a series of integral, radially extending braces or arms 5, which are machined flat on their front faces 6. At the base of each face a radial slot 7 is formed in the web 8 of the hub which is then bored transversely at 9 so as to provide a circular hole intersecting the inner end of each slot 7 as shown plainly in Fig. 1.

The blades may be of suitable material and may be pressed or die-cast to shape, so as to embody the characteristics shown in Fig. 3. The body 11 of each blade is preferably widest near its base and tapers toward its outer end, its longitudinal edges being provided with forwardly projecting flanges 10 so as to provide a blade which is channel shape in cross-section. The inner or root end of the blade is preferably narrowed and terminates in a narrow tongue or end 12 which is turned back upon itself and preferably spot-welded together as indicated at 12′ to form an enlarged head 13 provided with an eye or opening 14. The head and shank of this tongue fit snugly in the hole 9 and slot 8 respectively, into which they are inserted edgewise. The sides 15 of the web 18 are machined to a width corresponding to the width of the narrow end of the blade, so that by passing a rivet through the opening 14 and interposing a washer 17 between each end of the rivet and the machined surface of the hub and upsetting the proper end of the rivet, the inner end of each blade will be rigidly and permanently anchored to the hub in accurate alignment with respect to the remaining blades. Inasmuch as the compression in upsetting the rivet is taken by the washers against the sides of the hub, the position of the blade will not be disturbed as might be occasioned if the rivet were upset directly against the blade. It should be noted, however, that my invention contemplates the use of any suitable fastening means through the openings 14 for securing the blades in alignment and against displacement, and that it further contemplates in the event that the head 13 is of other than sheet metal construction, the provision of suitable means operative between the ends of the head and the contiguous side walls of the hub for retaining the blades in alignment and against lateral displacement. Suitable means may be provided for securing the body of the blade to the brace 5, such for example as a rivet 18. When the rivet holes 19 are accurately drilled by placing the hub in a suitable fixture and the complemental holes 21 in the blade properly punched, the assembling operation may be quickly performed and the blades thereby secured in the desired alignment.

It is believed that the foregoing conveys a clear understanding of the principles and objects prefaced above, and while I have shown in the drawing but a single working embodiment of my improvements, it should be understood that the same are susceptible of considerable change in details of design and construction without departing from the spirit and scope of the invention as expressed in the appended claims.

I claim:

1. An impeller of the character described, comprising a hub having a series of circumferentially arranged radially projecting arms and provided forwardly of and at the base of each arm with a key-hole shaped slot, a series of channel-shaped blades each tapering laterally toward the outer end and having its inner end reduced in width and bent backward upon itself to form an eye connected by a reduced shank with the body of the blade, the eye and shank of each blade being engaged in one of said key-hole slots with the back of the blade disposed against the front face of one of said arms, means for securing each blade intermediate its ends to its respective arm, and means extending through said eye and engaging with said hub at each side thereof for holding the inner end of the blade against displacement.

2. An impeller of the character described comprising a hub provided with radially extending arms and a key-hole slot adjacent the base of each arm, an outwardly tapered channel-shaped blade secured to each arm, the inner end of each blade being bent back upon itself to form an eye connected with the blade body by a relatively thin shank, said eye and shank being engaged in one of said key-hole slots, and a rivet extending through each eye and having a head at each end, whereby the eye is held against displacement from said slot.

GARNET W. McKEE.