

March 30, 1948.

A. M. ROCKWELL ET AL

2,438,867

METHOD OF ASSEMBLING SHROUDS ON IMPELLERS

Filed June 1, 1945

2 Sheets-Sheet 1

Fig. 1.

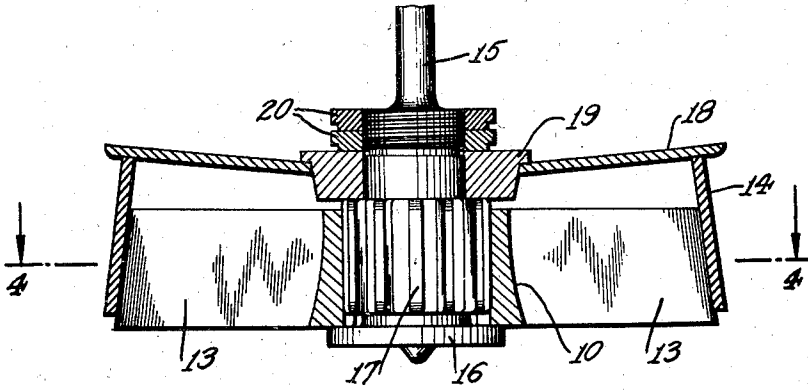


Fig. 2.

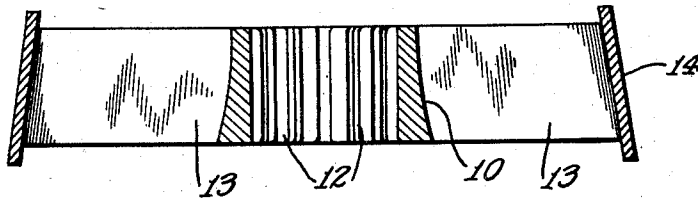
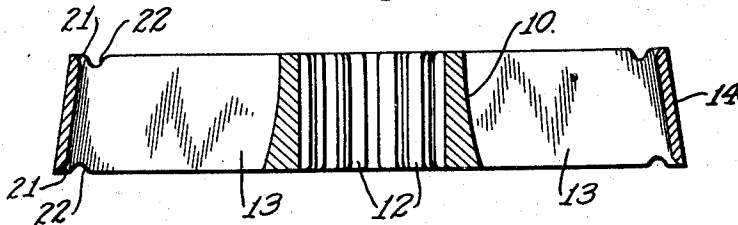


Fig. 3.



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Fig. 4.

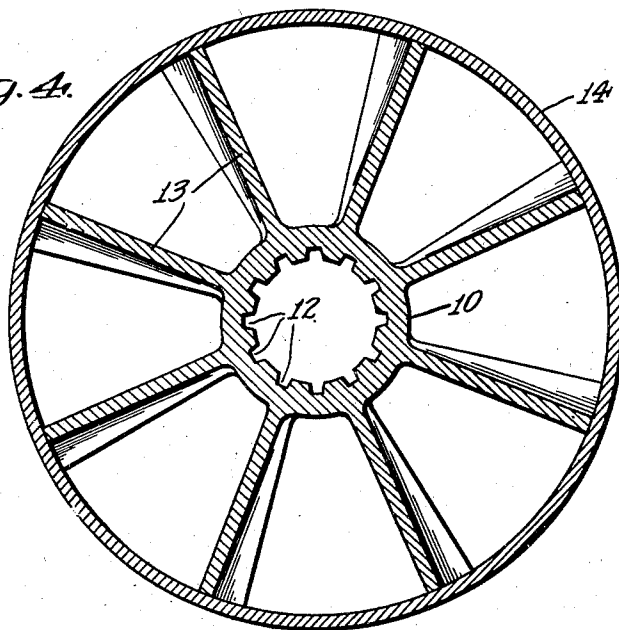
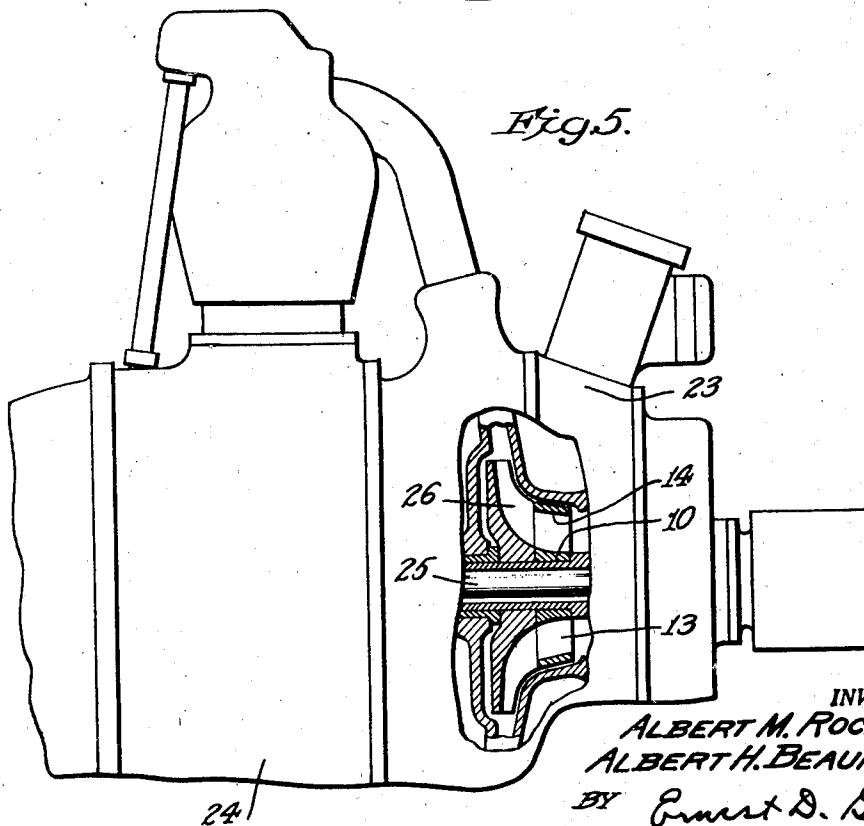


Fig. 5.



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METHOD OF ASSEMBLING SHROUDS
ON IMPELLERS

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Application June 1, 1945; Serial No. 597,130

2 Claims. (Cl. 29-156.8)

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This invention relates to inducers for the superchargers of internal combustion engines and has for its object to strengthen such devices and enable them to operate more efficiently and at higher speeds than heretofore.

This application is related to a copending application Ser. No. 597,129, filed June 1, 1945, by the same inventors who are the applicants in the present application. The line of division between these two applications is as follows: Application Ser. No. 597,129 is the broader case and carries claims generic to that application and the present one and also claims specific to the disclosure of that application. The present application is restricted in its claim subject matter to that which is disclosed in the present application and cannot adequately be supported by applicants' copending application Ser. No. 597,129.

Another object of the invention is to provide a novel and improved method of installing shrouds on inducers of the type referred to.

Another object is to provide an inducer for superchargers having a shroud shrunk thereon by rotating the shroud and the inducer at a speed greater than the maximum expected service speed during the assembling operation.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

The invention will be described in its application to an inducer of conventional design, comprising a hub which is splined or otherwise secured to a driving shaft and contains a plurality of outwardly-extending radial blades which are fitted into an annular retaining band or shroud similar to the outer rim of a spoked wheel, although the invention is also applicable to other rotating elements requiring a shroud.

When a shroud is fitted to an inducer of the above type by conventional means, and the inducer is later subjected to excessive service speeds such as are encountered in diving-types of aircraft, the diametral stretch of the shroud is greater than that of the inducer itself, and this results in weakening or even bursting the bond between the shroud and the inducer.

Our invention overcomes the foregoing difficulty by spin-fitting a shroud upon an inducer by overspeeding the shroud and the inducer above the maximum expected service speed during assembly. In the specific embodiment hereinafter described, the annular band constituting the shroud is made in the shape of a truncated cone substantially wider than the ends of the inducer blades to be encompassed thereby, and

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the outer ends of said blades are correspondingly tapered to fit the inner annulus of the shroud.

In assembling the parts, the shroud is placed over the inducer blades so that the aforementioned tapered portions match, and the inducer and shroud are then rotated at a speed greater than the maximum expected service speed, so that the shroud, either due to its own thrust or with the aid of external means such as hereinafter described, is caused to climb along the tapered ends of the inducer blades and to be shrunk thereon at a position corresponding with a speed which is greater than the maximum expected service speed. The excess width of the shroud is then faced off to complete the assembly.

Although the novel features which are characteristic of this invention are set forth more in detail in the claims appended hereto, the nature and scope of the invention may be better understood by referring to the following description, taken in connection with the accompanying drawings forming a part thereof, in which a specific embodiment has been set forth for purposes of illustration.

In the drawings:

Fig. 1 is a diagrammatic view, partly in section, illustrating the first stage in the operation of spinning the shroud on a supercharger inducer, according to the present invention;

Fig. 2 is a similar view, with the spinning rig removed, illustrating the relative positions of the inducer and shroud at the conclusion of the spinning operation;

Fig. 3 is a transverse section through the finished article;

Fig. 4 is a sectional plan view thereof; and

Fig. 5 is a diagrammatic view, partly in section, illustrating the mounting of the inducer in the supercharger of an internal combustion engine.

In the following description certain specific terms are used for convenience in referring to the various details of the invention. These terms, however, are to be interpreted as broadly as the state of the art will permit.

The inducer shown in the drawings comprises a hub 10 which is internally splined at 12 for fastening to a driving shaft and contains outwardly-extending radial blades 13 which are fitted into an annular shroud 14 of circular cross-section. These parts are preferably made of aluminum or other ductile material.

The shroud 14 is in the form of a truncated cone and it is initially made substantially wider than the ends of the inducer blades 13, and the

outer ends of these blades 13 are correspondingly tapered, as illustrated, to prescribe a conical surface and fit the inner annulus of the shroud 14.

Fig. 1 illustrates diagrammatically the first stage in the operation of spinning the shroud on the inducer. The shroud 14 is first telescoped over the inducer blades 13 so that the corresponding tapered portions match, as shown in Fig. 1. The inducer is then placed on a suitable spinning rig such as that shown in Fig. 1, comprising a rotatable arbor 15, an end disc or flange 16 which supports the hub 10 of the inducer, a toothed or splined bushing 17 which meshes with splines 12 of hub 10 for the purpose of driving same, and a Bellville spring 18 carried by a collar 19 which is slidably mounted on the arbor 15 and is clamped in position by nuts 20 threaded on the arbor 15, as shown in Fig. 1.

The arbor 15 is then rotated at high speed, and the thrust of the shroud 14, together with the resilient pressure constantly exerted on the shroud by the Bellville spring 18, causes the shroud to climb along the tapered ends of the blades 13 and frictionally grip the same by relative axial movement of the parts. The speed of rotation is increased to a point greater than the maximum expected service speed of the inducer, with the result that the shroud is centrifugally expanded and may then be moved axially of the blade ends to the position shown in the drawing, Figs. 2 and 3. When the shroud is shrunk on the inducer in this manner, it will remain tight when subsequently operated at ordinary service speeds.

The inducer, containing the shroud shrunk thereon as described above, is removed from the rig, as shown in Fig. 2, and the excess portions of the shroud on both sides of the blades 13 are then trimmed or faced off in any suitable manner. If desired, the inside edges of the shroud may be chamfered at 21 and the corners of the blades 13 staked or swaged at 22 to insure permanent location of the shroud.

Fig. 5 shows the supercharger 23 of an internal combustion engine 24, in which an inducer constructed in the foregoing manner is secured to the engine shaft 25 in advance of the impeller 26.

Although a specific embodiment has been shown and described herein for purposes of illustration, it will be evident to those skilled in the art that the invention is capable of various modifications and adaptations within the scope of the appended claims.

What is claimed is:

1. The method of assembling a supercharger impeller adapted for rotation up to a predetermined high service speed having an inner member provided with a plurality of substantially

radially extending blades, the radial outer end surface portions of which all lie in a single smooth frusto-conical surface, and an outer member forming a shroud for said blades and having an inner complementary frusto-conical surface intended frictionally to engage the first-named frusto-conical surface so as to hold said members together solely by said frictional engagement, and wherein the internal diameter of said outer member prior to the assembly of said members is less than the outer diameter of said inner member at a corresponding plane in respect to said members after assembly, comprising the steps of positioning said members in coaxial relation and as close to their final assembled position as is permitted by their relative dimensions aforesaid, rotating said members about their common axis at a speed substantially in excess of said service speed to expand said outer member uniformly by centrifugal force, relatively axially moving said members while they are rotating at said excess speed to bring them to a final desired relative axial position, and thereafter reducing and stopping the rotation of said members so as to permit said outer member to shrink upon said inner member.

2. The method of assembling a supercharger impeller in accordance with claim 1, wherein said shroud as initially formed and prior to the assembly thereof with said inner member has greater axial dimensions than that finally desired for the shroud portion of the complete supercharger inducer, and comprising the additional step of mechanically trimming said shroud to predetermined desired axial dimensions subsequent to the assembly thereof as aforesaid.

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