Oct. 2, 1962 A. W. ROTH 3,056,369

APPARATUS FOR FABRICATING FAN HUBS

Filed Sept. 4, 1956 2 Sheets-Sheet 1

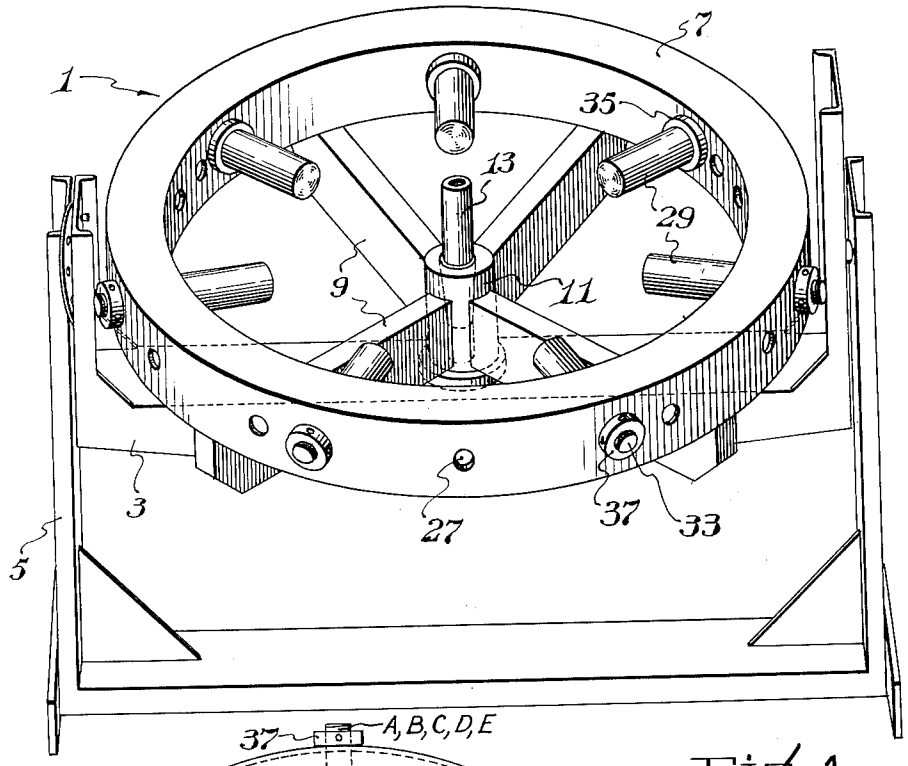


Fig. 1

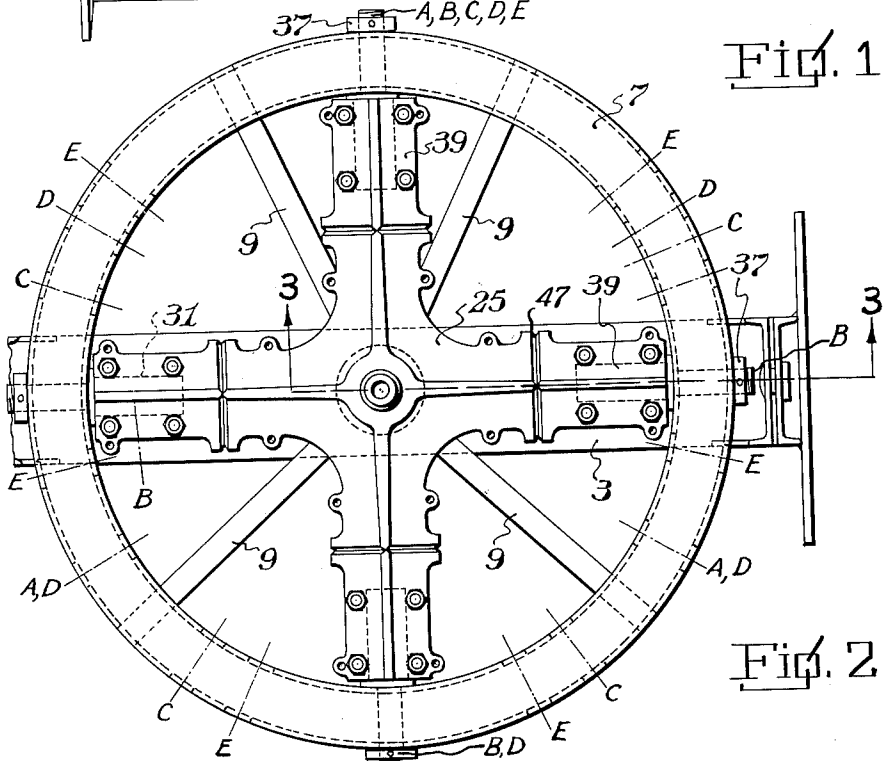


Fig. 2

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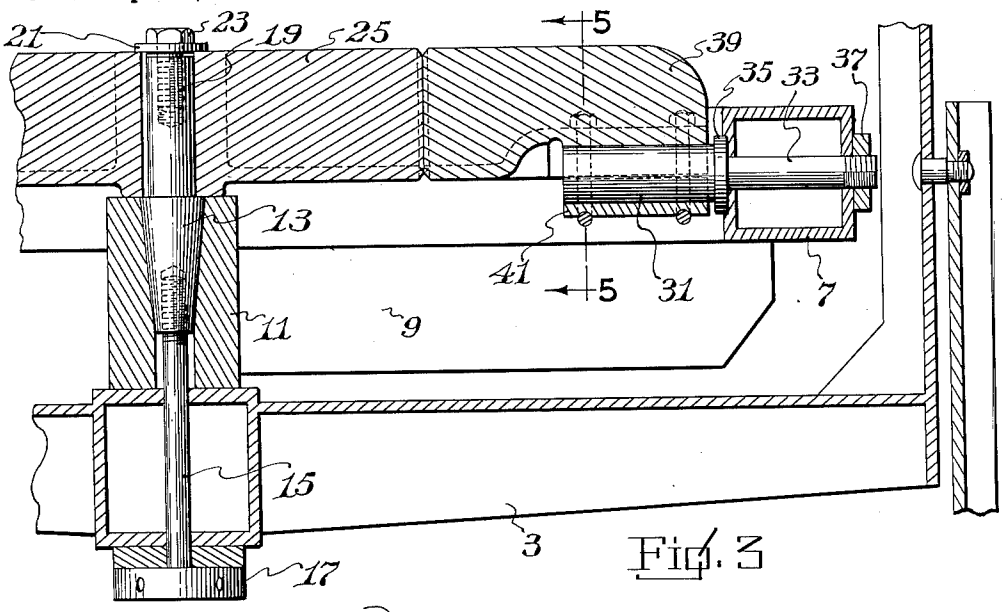


Fig. 3

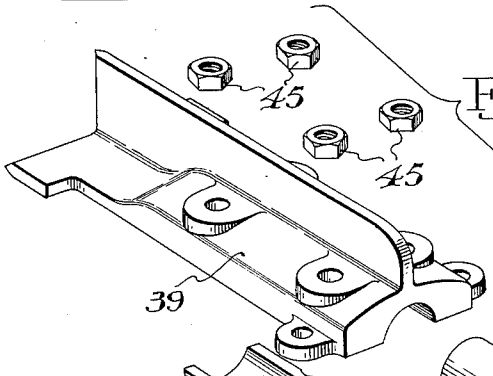


Fig. 4

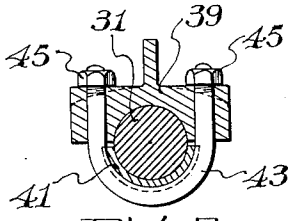


Fig. 5

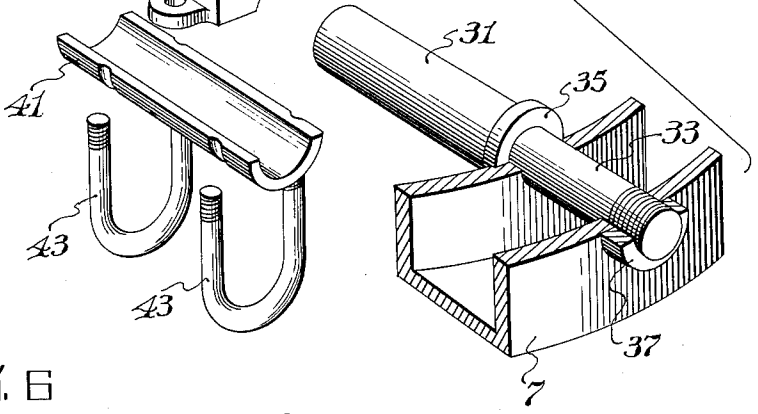
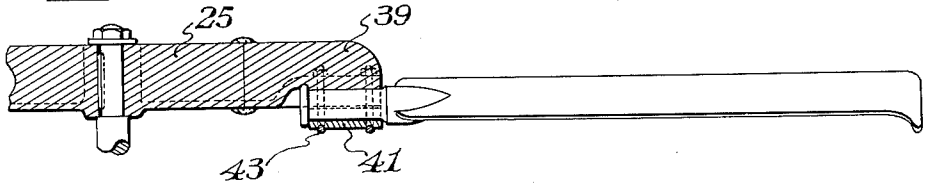


Fig. 6



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APPARATUS FOR FABRICATING FAN HUBS

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2 Claims. (Cl. 113—99)

The present invention relates to methods and apparatus for fabricating fan hubs, and more particularly for fabricating large cast fan hubs.

For purposes of this specification, the term "fan hub" is defined as including the central fan hub portion and the radially extending fan arms thereon, but not as including the fan blades or fan blade shanks carried by the outer ends of the fan arms, nor the fan shaft on which the fan hub is mounted.

Large fan hubs are ordinarily metallic castings. According to the fabrication procedures of the prior art, great difficulty has arisen in casting large fan hubs, because of shrinkage and distortion and cracking during cooling of the casting before the casting can be heat treated as by normalizing for stress relief. A partial solution to the problem has been sought by machining the fan hubs; but this procedure has obviously been quite time consuming and expensive.

Accordingly, it is an object of the present invention to provide methods and apparatus for fabricating fan hubs whereby cast fan hubs may be produced which are larger than could be readily produced by a single casting operation.

A further object of the invention is the provision of methods and apparatus for fabricating large cast fan hubs which will be substantially free of destructive stresses prior to normalizing.

The invention also contemplates the provision of methods for fabricating fan hubs which will be simple and inexpensive to practice and which may be carried out by relatively unskilled labor.

Finally, the invention also contemplates the provision of apparatus for fabricating fan hubs, simple and inexpensive to construct, quick and easy to use, and rugged and durable in operation.

Other objects and advantages of the present invention will become apparent from a consideration of the following specification, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a perspective view of a fan hub welding jig according to the invention, with the mandrels in place;

FIGURE 2 is a top plan view of a welding jig according to the invention, with the fan hub in place and ready for welding;

FIGURE 3 is an elevational partial cross-sectional view taken on the line 3—3 of FIGURE 2;

FIGURE 4 is an exploded perspective assembly view of a fan arm and mandrel assembly;

FIGURE 5 is an elevational cross-sectional view taken on the line 5—5 of FIGURE 3; and

FIGURE 6 is a view similar to FIGURE 3 but showing the relationship of a completed fan hub in an assembled fan.

Referring now to the drawings in greater detail, there is shown a fan hub welding jig indicated generally at 1 comprising a cradle 3 mounted for bodily rotation about a horizontal axis on base 5. Supported on cradle 3 is a circular jig ring 7 in unitary assembly with a plurality of radial jig ring spokes 9 extending outwardly from a jig ring hub 11 coaxial with jig ring 7. A tapered shank mandrel 13 engages with a complementary tapered interior surface of hub 11 and has screw-threaded engagement with a threaded pintle 15 having at its opposite end an apertured pintle head 17 whereby tapered mandrel 13 is drawn downwardly as seen in FIGURE 3 to clamp the mounting of jig ring 7 firmly to cradle 3. An upright central fan hub mandrel 19, which will be seen by comparison with FIGURE 6 to be of the same size as the fan shaft in the completed fan, is integral with tapered mandrel 13 and carries at its upper end a washer 21 held on by bolts 23 to retain thereon a casting 25 comprising the central portion of a fan hub.

Jig ring 7 has a plurality of radially extending horizontal holes 27 extending therethrough; and as best seen by comparison of FIGURES 1 and 2, these holes are arranged in a plurality of sets, each set consisting of a different number of equally circularly spaced holes, and the holes of each set being designated in the drawings by various capital letters: the holes of the 3-hole set by the letter A, the 4-hole set by B, the 5-hole set by C, the 6-hole set by D and the 7-hole set by E. Detachably mounted on jig ring 7 in only one set of holes 27 is a plurality of horizontal, equally circularly spaced fan arm mandrels 29. As seen in FIGURE 1 of the drawings, mandrels 29 are mounted in the E set. Mandrels 29 have inner cylindrical mandrel portions 31 which extend radially inwardly toward but terminate short of upright mandrel 19 and which will be seen by comparison with FIGURE 6 to be of the same size as the shank of the blades of the assembled fan. Mandrels 29 also have base portions 33 separated from mandrel portions 31 by annular abutment shoulders 35 disposed against the inner side of ring 7 when the base portions 33 are disposed through holes 27. Base portions 33 are screw-threaded at their radially outer ends for the reception of screw-threaded locking collars 37, so that mandrels 29 are firmly held on ring 7 between abutment shoulders 35 and locking collars 37.

Each cylindrical mandrel portion 31 is adapted to receive a casting 39 comprising a fan arm, held on portion 31 by a half sleeve clamp 41 which is in turn held by U-bolts 43 locked in place by nuts 45, so that casting 39 will endwise abut casting 25 in the position shown in FIGURE 2 to form therebetween a joint 47 at which the welding operation is conducted.

In practice, a plurality of mandrels 29 of the same size as the shanks of the fan blades carried by the fan hub are rigidly mounted in radial assembly in the same positions as the fan blade shanks will occupy in the assembled fan. FIGURE 1 shows the mandrel assembly for a seven blade fan with the fan arm mandrels 29 in the E set of holes; and FIGURE 2 shows the mandrel arrangement for a four blade fan with the mandrels 29 in the B hole set. A fan hub central portion casting 25 is placed on upright mandrel 19 and secured thereon by washer 21 and bolt 23 in the same position as it will occupy in the assembled fan relative to the fan blade shanks, which at this stage of fabrication are represented by mandrels 29. A fan arm casting 39 is mounted on each mandrel 29 in the same position as it will occupy in the assembled fan relative to casting 25. Thereafter, joints 47 are welded to produce a unitary fan hub of a size larger than could be readily produced by a single casting operation. It is of course contemplated that a conventional normalizing heat treatment will be conducted after welding; but this forms no part of my invention.

Although the present invention has been described in conjunction with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit and scope of the invention, as those skilled in the art will readily understand. Such modifications and variations are considered to be within the purview and scope of the invention and appended claims.

I claim:

1. Apparatus for fabricating fan hubs, comprising in combination a central fan hub mandrel, a coaxial circular jig ring surrounding the central mandrel, and a plurality of equally circularly spaced fan arm mandrels rigidly but detachably mounted on the jig ring, the fan arm mandrels having outer end portions slidable through the jig ring and terminating outward in screw-threaded ends disposed radially outward of the jig ring, lock nuts screw-threadedly mounted on the outer ends of the fan arm mandrels and bearing against the outer side of the jig ring, abutment shoulders on the fan arm mandrels and bearing against the radially inner side of the jig ring so that the fan arm mandrels are releasably locked on the jig ring between said lock nuts and said abutment shoulders, the fan arm mandrels being elongated and extending lengthwise from the inner periphery of the jig ring radially inwardly toward but terminating short of the central mandrel, the fan arm mandrels being disposed in a common plane perpendicular to the axis of the central mandrel and the jig ring, and means securing the central mandrel and the jig ring in unitary assembly with each other, said means being spaced substantial distances from said radially inwardly extending portions of all the fan arm mandrels.

2. Apparatus for fabricating fan hubs, comprising in combination a central fan hub mandrel, a coaxial circular jig ring surrounding and in unitary assembly with the central mandrel, the jig ring having a plurality of holes therein extending radially of the common axis of the jig ring and fan hub mandrel, there being a plurality of sets of said holes, each said set consisting of a different number of equally circumferentially spaced holes, the holes of pairs of adjacent holes being spaced apart various distances about the jig ring and the spacing between adjacent holes being such that the number of holes in each of a plurality of said sets of holes is unevenly divisible by the number of holes in a plurality of other sets of said plurality of sets of holes and the total number of holes is unevenly divisible by the number of holes in at least one said set of holes, and a plurality of equally circularly spaced fan arm mandrels rigidly but detachably mounted on the jig ring in only one said set of holes and extending from the inner periphery of the jig ring radially inwardly toward but terminating short of the central mandrel.

References Cited in the file of this patent

UNITED STATES PATENTS

974,798	Jacoby et al.	Nov. 8, 1910
1,349,633	Staley	Aug. 17, 1920
1,429,575	Fiscus	Sept. 19, 1922
1,638,180	Bates et al.	Aug. 9, 1927
1,661,342	Pabst	Mar. 6, 1928
1,838,322	Murray	Dec. 29, 1931
1,861,025	Pavlecka	May 31, 1932
2,396,452	Widmark et al.	Mar. 12, 1946
2,399,536	Baum	Apr. 30, 1946
2,450,660	Hardy	Oct. 5, 1948
2,475,772	Allen et al.	July 12, 1949
2,486,378	Amiot	Nov. 1, 1949
2,664,843	Turner	Jan. 5, 1954
2,759,530	Herr	Aug. 21, 1956