Dec. 1, 1942. L. B. BERG 2,303,719

METHOD OF MAKING WASHING MACHINE AGITATORS

Original Filed Oct. 22, 1938 2 Sheets-Sheet 1

Fig. 1

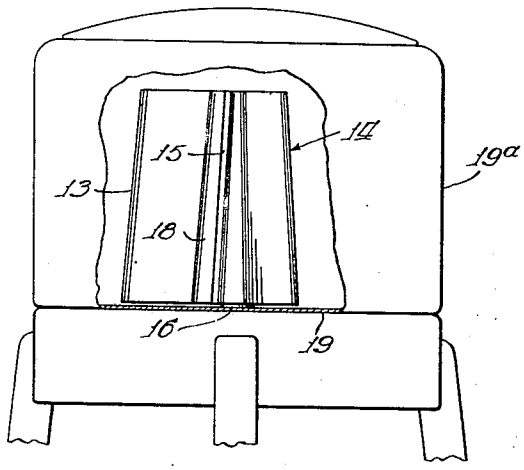


Fig. 4

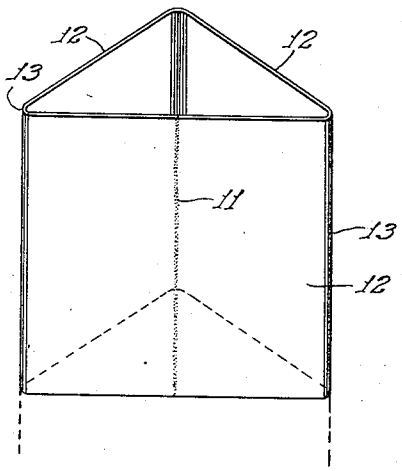


Fig. 2

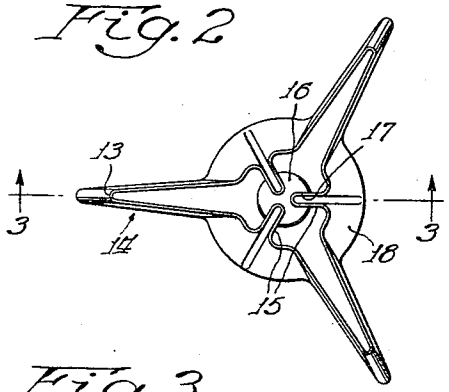


Fig. 5

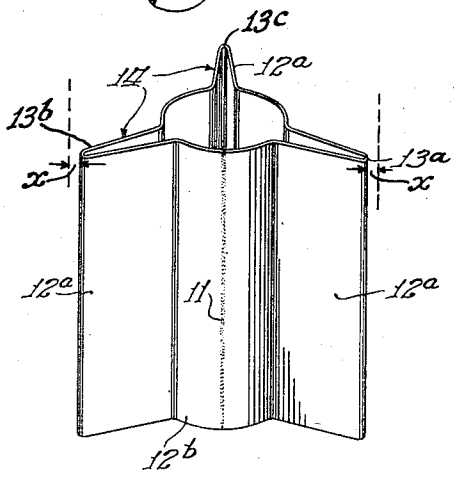
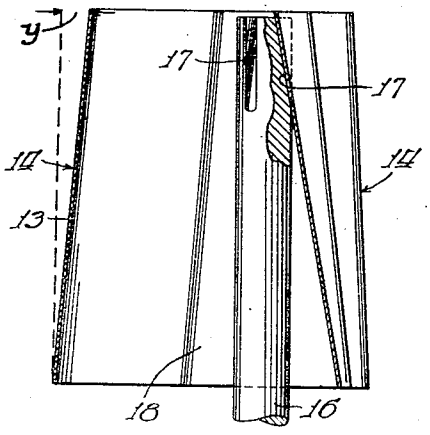


Fig. 3



Inventor

Louis B. Berg

By Edward C. Gritzbaugh

Attorney

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METHOD OF MAKING WASHING MACHINE AGITATORS

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Fig. 6

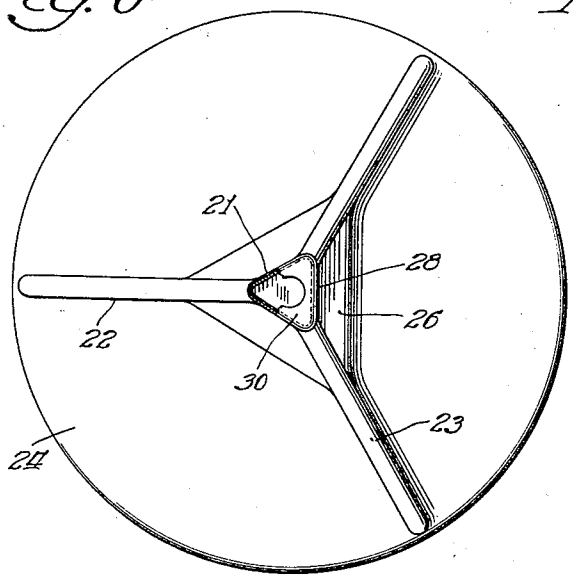


Fig. 9

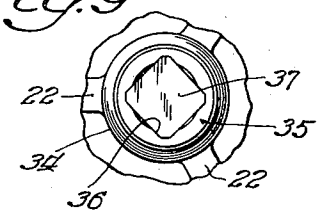


Fig. 10

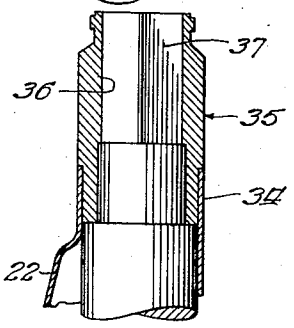


Fig. 7

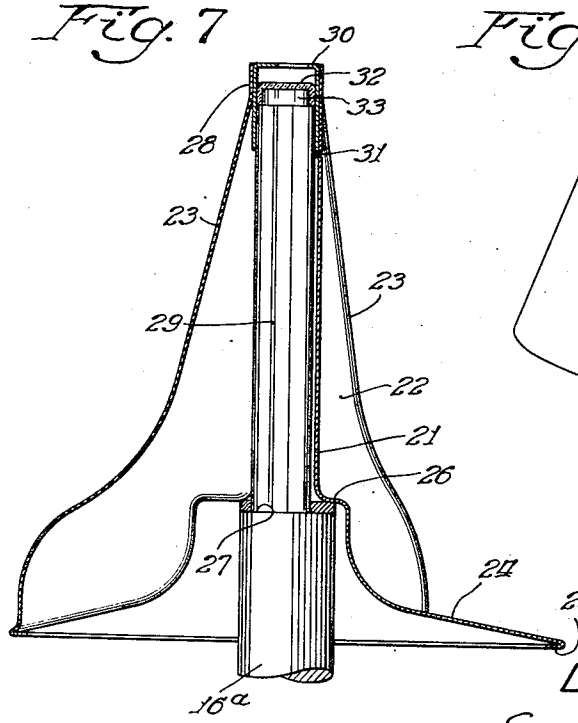
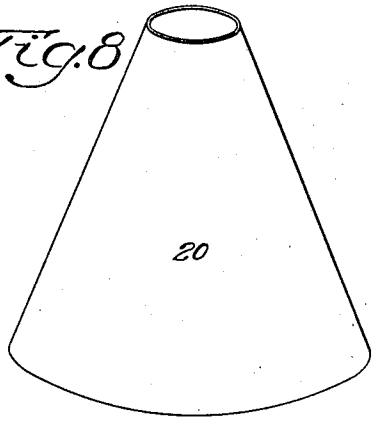


Fig. 8



Inventor

Louis B. Berg

By Edward C. Gritzbaugh

Attorney

Patented Dec. 1, 1942 2,303,719

UNITED STATES PATENT OFFICE

2,303,719

METHOD OF MAKING WASHING MACHINE AGITATORS

Louis B. Berg, Chicago, Ill., assignor to Borg-Warner Corporation, Chicago, Ill., a corporation of Illinois

Original application October 22, 1938, Serial No. 236,415. Divided and this application April 4, 1939, Serial No. 265,979

2 Claims. (Cl. 153—2)

This invention relates to the art of making articles such as washing machine agitators, incorporating a plurality of vanes radiating from a common axis. The primary object of the invention is to provide a method by means of which such agitators or similar articles can be made of sheet metal.

A further object of the invention is to provide a method of making agitators inexpensively.

Another object of the invention is to provide a method of making an agitator of large dimension of sheet metal, which is possessed of more than ample sturdiness and durability under the severe conditions of usage met with in washing machines.

Another object of the invention is to provide a method of making such an agitator which, in spite of the fact that the material used is sheet metal, provides an agitator having vanes which are formed, in the regions which contact the clothes with smooth broadly rounded edges incapable of injuring the clothes.

Another object of the invention is to provide a method of making an agitator without wasting sheet metal stock.

Another object of the invention is to provide a method of making an agitator which may be finished with an enameled surface. In this respect, the invention deals with a very definite problem. Enameling of agitator vanes has not been considered practical. I have discovered that where enameling is applied to a surface of sheet metal which has been stretched in the drawing or forming process, the coat of enamel will tend to disintegrate as a result of strains existing in the metal, arising from the drawing process. I have also discovered that by forming the sheet metal without drawing, the coating of enamel will endure for a much greater length of time.

Another object of the invention is, therefore, to provide a method of forming an agitator without drawing the sheet metal composing it.

Another object of the invention is to provide a method of forming a sheet metal agitator with integral splines or keys for securing it to the drive shaft of a washing machine.

Another object of the invention is to provide a method of making, from sheet metal, an agitator including a hub member for attachment to a drive shaft of a washing machine, a plurality of circumferentially spaced radial vanes, and a downwardly flaring skirt member, all formed integrally of a single body of sheet metal.

Other objects, the advantages and uses of the invention will become apparent after reading the following specification and claims, and after consideration of the drawings forming a part of the specification, wherein:

Fig. 1 is a side elevation of a washing machine embodying the invention, a portion of the side wall of the tub being broken away to illustrate the agitator therein;

Fig. 2 is a plan view of the agitator according to one form which the invention may take;

Fig. 3 is a vertical sectional view of the agitator taken as indicated by the line 3—3 of Fig. 2;

Fig. 4 is a perspective view of the agitator in an initial stage of formation;

Fig. 5 is a perspective view of the agitator in an intermediate stage of formation;

Fig. 6 is a plan view of a modified form of the agitator;

Fig. 7 is a vertical longitudinal sectional view of the agitator shown in Fig. 6;

Fig. 8 is a perspective view of the agitator of Fig. 6, in an initial stage of formation;

Fig. 9 is a plan view of the hub portion of a further modified form of the agitator; and

Fig. 10 is an axial sectional view of the agitator of Fig. 9 and the associated drive shaft.

The agitator shown in Figs. 1 to 5 inclusive, is constructed from a single rectangular strip of sheet metal, such as sheet steel. This strip of metal is bent in any suitable bending die, along lines parallel to its ends, to a prism shape, as shown in Fig. 4, and the ends of the strip are butt-welded together, as at 11, so as to form three sides 12 of uniform shape and dimensions. The sides 12 are joined by integral rounded channels 13 forming the corners of the prism-shaped body.

In the next step of the process, the prism-shaped body is subjected to the action of a suitable forming die which collapses the sides 12 inwardly, so as to form the sides 12*a* of the agitator vanes 14, and so as to form web portions 12*b* joining the side wall 12*a* of each vane 14 to an adjacent side wall 12*a* of an adjacent vane 14. The web portions 12*b* collectively form a roughly cylindrical sleeve which is adapted to be further deformed in the next step of the operation. The vanes, 14, in this first forming operation, are given their final cross sectional form. The radius of curvature of the rounded channels is sufficiently large in proportion to the thickness of the metal to cause a negligible amount of flow in the metal as a result of the bending operations.

It will thus appear that the structure of Figure

5 is shaped from the initial structure shown in Figure 4, primarily by bending operations, there being no appreciable drawing or other severe movement of the metal. Reference to these figures of the drawing will show that the metal necessary to provide the shape of Figure 5 from that of Figure 4 is contributed in a large part by the movement of edges 13 in Figure 4 radially inwardly to the position of these edges shown in Figure 5, this distance being indicated roughly at X. In other words, the over-all diameter of the structure in Figure 5 is less than that of Figure 4 by substantially the amount necessary to effect the regular contour of surface represented in Figure 5.

In the next step of the operation, the agitator is subjected to pressure preferably in another die (not shown), which forces the upper regions of the vanes 14 radially inwardly toward each other, until the vanes 14 assume the converging relationship shown in Figs. 1 and 4. During this forming operation, the excess metal which is developed in the upper regions of the web portions 12b, is pushed radially inwardly toward the axis of the agitator by suitable portions of the die (not shown), so as to form keys 15 for securing the agitator to the drive shaft 16 of the washing machine. The keys 15 are adapted to be received in triangular shaped key slots 17 formed in the upper end of the shaft 16, as shown. The remainder of the metal of the web portions 12b is formed into a trunco-conical skirt member 18. The apparatus used to form the agitator forms no part of this invention and hence is not disclosed herein. It is understood that any well known means either mechanical or hydraulic such as may be devised by any skilled tool designer will suffice.

It will appear that the metal necessary for the formation of keys 15 and 17 is supplied primarily by the movement of the upper corners 13a, b and c of the assembly of Figure 5 radially inwardly an amount indicated at Y in Figure 3, thus resulting in the additional feature of inclining the edges 13 the desired amount with reference to the general axis of the agitator.

The upper and lower ends of the agitator remain open. The agitator is arranged and proportioned with respect to the shaft 16 so that its lower end will be spaced just above the bottom 19 of the washing machine 19a in which it is installed.

The forming operations above described are carried out without drawing the metal of the agitator. The metal thus being formed without drawing, the coating of enamel, which is applied to it after the completion of certain finishing operations, such as grinding the edges, will endure for a much greater length of time without chipping or peeling than it would if the metal were drawn.

In the form of the invention shown in Figs. 6 and 7, the agitator is constructed by first forming a conical sheet metal body as indicated at 20 in Fig. 8. The body 20 is then subjected to pressure preferably in a suitable die (not shown), whereby circumferentially spaced side regions thereof are collapsed inwardly so as to form the web portions 21, joining together the vanes 22, each of which comprises a pair of spaced side walls, as in the form of the invention previously described, joined by rounded channels 23 forming the edges of the vanes. The web portions 21, at their lower regions, merge into a conical, nearly flat disc-like skirt member 24, the rim of which may be rolled as at 25, so that all surfaces of the agitator in contact with the clothes, will be smooth and rounded. Intermediate the skirt 24 and the shaft receiving hub formed by the collective web portion 21, are a series of offset shoulders 26, by means of which the agitator may be supported upon the shoulder 27 of the shaft 16a. The upper regions of the web portions 21 merge into a hub 28.

In this form of the invention, the upper end of the shaft 16a is formed, above the shoulder 27, with an extension 29, triangular in cross section, which fits in the hub 28, and is drivingly joined thereto at its upper end by means of an insert sleeve 30, which likewise is triangular in cross section. The sleeve 30 is pressed into the hub and located against internal beads 31 formed in the hub. In order to exclude moisture from the interior of the agitator, a cap 32 of rubber or the like may be fitted over a reduced end 33 of the shaft 16a, and arranged to fit snugly within the sleeve 30.

The form of the invention shown in Figs. 9 and 10, is substantially the same as that shown in Figs. 6 and 7 with the exception that the hub 34 at its upper end is provided with an insert sleeve 35 which has an opening 36 that does not conform to the shape of the hub 34. This construction may be employed where the drive shaft has an upper end 37 which is, for example, squared. Thus the shaft, instead of being specially constructed to fit the agitator, as in the other forms of the invention, may be a conventional shaft of any type now in use.

The insert 35 in this case, instead of being made of sheet metal, is in the form of a casting having relatively thick walls, as shown. Furthermore, the upper end of the hub 34 may in this case be cylindrical.

In all forms disclosed, the final operation is an enameling operation in which the exposed surfaces of the sheet metal are coated with vitreous enamel. The enameling operation follows the usual procedure employed in applying such a coating to sheet metal.

This application is a division of my copending application No. 236,415, filed October 22, 1938, now Patent No. 2,260,822.

I claim:

1. The method of fabricating a hollow sheet metal member adapted to be externally coated with a vitreous enamel and to be driven in opposition to changing external forces, such, for example, as the external forces to which a washing machine agitator is subjected, said method comprising employing a section of sheet metal tubular stock in the shape of a prism having three generally flat sides converging along edges which extend generally parallel to the principal axis of said prism, said prism being open at both ends, the steps including moving a portion of each of the sides of said prism intermediate said edges radially inwardly along lines generally parallel to said axis by applying radially inwardly directed bending forces only, resulting in forming a plurality of arcuate segmental portions joining a plurality of radially outwardly directed V-shaped vane defining portions, and moving a portion of at least one of said arcuate portions still further radially inwardly intermediate the extremities thereof along a line extending generally parallel to said axis by applying a radially inwardly directed bending force only to form a driving key adapted to cooperate with a driving member, whereby to produce a structure containing no severe internal

stresses which if present would result in movement of the metal when subjected to said changing external forces with the consequent breakdown of the vitreous enamel coating.

2. The method of fabricating a hollow sheet metal member adapted to be externally coated with a vitreous enamel and to be driven in opposition to changing external forces, such, for example, as the external forces to which a washing machine agitator is subjected, said method comprising employing a section of sheet metal tubular stock in the shape of a prism having three generally flat sides converging along edges which extend in a direction generally parallel to the principal axis of said prism, said prism being open at both ends, the steps including moving a portion of each of the sides of said prism intermediate said edges radially inwardly along lines extending generally parallel to said principal axis by applying radially inwardly directed bending forces only, resulting in forming a plurality of arcuate segmental portions joining a plurality of radially outwardly directed V-shaped vane defining portions, and moving a portion of each of said arcuate portions still further radially inwardly intermediate the respective extremities thereof by applying radially inwardly directed bending forces only to form driving keys inclined toward said principal axis, said keys being adapted to cooperate with a driving member, the formation of said driving keys being further effective to move said converging portions of said vanes radially inwardly toward the axis of said member an amount which decreases from a maximum at one extremity of said converging edges, decreasing in the opposite axial direction thus causing said converging portions of said vanes to be inclined to said principal axis, whereby to produce a structure containing only internal stresses of a value sufficiently small as not to result in movement of the metal when subjected to said changing external forces which would otherwise occur with the consequent breakdown of the vitreous enamel coating.

LOUIS B. BERG.