

Jan. 14, 1936.

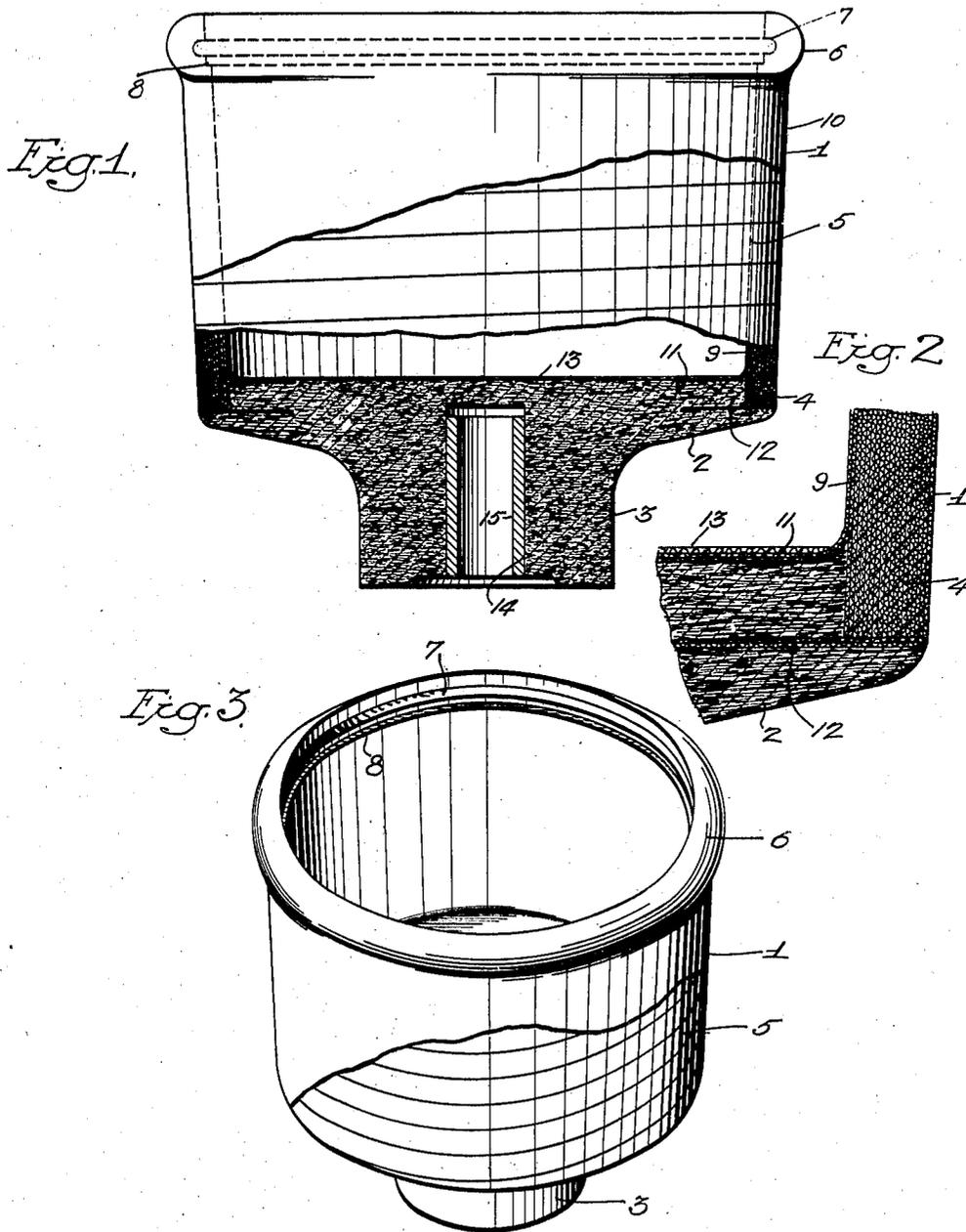
F. H. BENGE

2,028,040

SPINNING BUCKET

Filed March 14, 1933

2 Sheets-Sheet 1



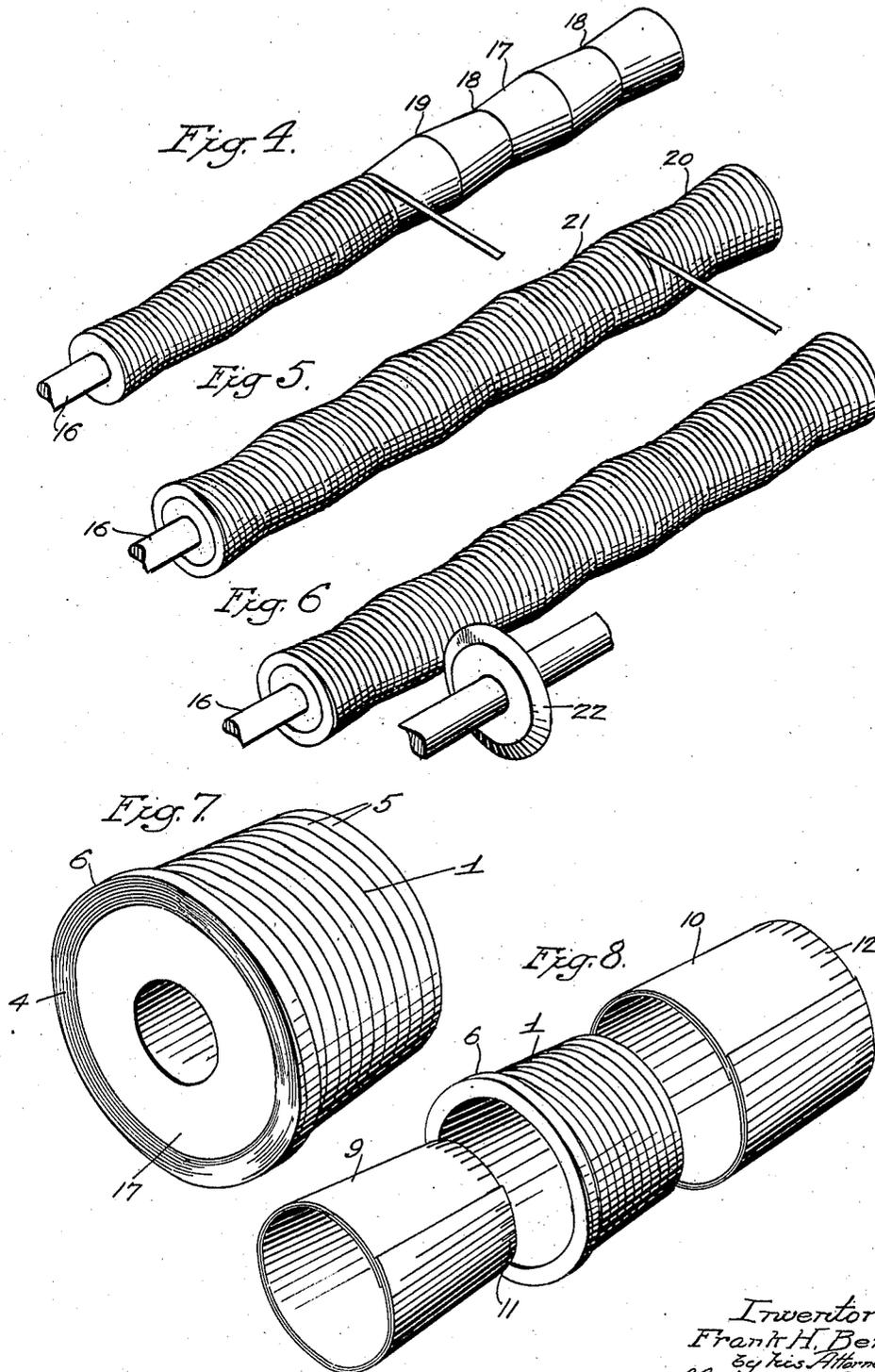
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UNITED STATES PATENT OFFICE

2,028,040

SPINNING BUCKET

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Application March 14, 1933, Serial No. 660,749

2 Claims. (Cl. 117—27.5)

This invention relates to the manufacture of hollow articles of composite material with an improved wall construction, and more particularly it relates to rayon or artificial silk spinning buckets, and to methods of making such articles, the general object being to provide an improved article of novel construction as well as a novel method of making the same.

A more specific object of the invention is to provide a novel and improved wall formation in a hollow article of general cylindrical form which during use is subjected to excessive strains and stresses, due to centrifugal force, that tend to break, crack or disintegrate the wall structure and also tend to deform the structure and to render it unbalanced. As is well known, spinning buckets, for example, are revolved at high speed during use and, owing to the excessive centrifugal force to which they are subjected, it is essential that the wall structure of the buckets be as strong and as nearly balanced as possible and that their strength and balanced condition be maintained as far as is possible.

Heretofore in the manufacture of articles of this class, it has been the practice to build up the wall of the bucket by wrapping sheet material impregnated with a binder about a mandrel, several layers being used to build up the wall to the proper thickness. When thus formed, however, the wall has a tendency to wrinkle and become unbalanced due to the high speeds at which these buckets are run. After a time, the unbalanced condition will render the bucket useless for practical purposes.

By means of this invention, a construction is provided which insures a balanced condition thereof at all times and eliminates entirely the inherent defects common to prior art devices. In accordance with the invention, the wall of the bucket is built up of superposed reverse spirals or helices of fibrous strip material and an associated binder. This results in what might be termed a "lattice" winding or one in which the strands of adjacent layers are non-parallel. By means of this procedure, it is possible to control the density of the material of the bucket wall very accurately, which is impossible in the prior art methods. Although I have chosen, for the purpose of disclosure, to illustrate the invention herein in connection with rayon spinning buckets, it is to be understood that it is in no way limited to such article, and is capable of practice in connection with any hollow article manufactured from composite material. The composite material as employed herein contemplates the

use of fibrous material associated with a binder, particularly of a synthetic resinous nature.

The invention will be more fully understood from the following detailed description and the accompanying drawings, in which:

Figure 1 is an elevational view of the finished bucket of the invention with the lower portion thereof shown in section;

Fig. 2 is a fragmentary enlarged detail view of a portion of the bucket;

Fig. 3 is a perspective view of the bucket; and Figs. 4 to 8 are perspective views illustrating various successive steps of the method preferably employed in the manufacture of the bucket.

Referring particularly to Figs. 1 to 3 of the drawings, the bucket comprises in general a circular wall 1, a base 2 and a hub 3. Wall 1 is slightly tapered toward the bottom of the bucket so that it resembles an inverted truncated cone, but its taper is so slight that it may be said to be generally cylindrical in form. As to its general shape, the improved bucket of the invention is substantially the same as prior articles of this class.

The essential parts of the article are formed of fibrous material and an associated binder. While the invention contemplates broadly the use of any materials which may be found suitable, I prefer to use canvas impregnated with a synthetic resin, especially of the phenolic type, such as phenol formaldehyde resin. Other fibrous materials, however, such as paper, cotton cloth, etc., may be used. As well known, phenolic resins exist in an initial or soluble and fusible stage and in a final or insoluble and infusible stage. The conversion of the resin from the initial to the final stage may be effected by heat or by heat and pressure. Although the several parts of my improved article are formed of fibrous material in different physical form, these parts are formed from the fibrous material with synthetic resin in its initial or soluble stage carried by or mixed with the fibrous material, and the resin is later converted to its final stage.

Wall 1 is built up of superposed layers of resin-impregnated fibrous strip material. Each layer takes the form of a spiral or helix of the impregnated strip material. The adjacent turns or strands of each layer may overlap slightly, if desired. In winding the spiral or helical layers to form the wall, the direction of winding adjacent layers is varied, resulting in what may be termed reverse spirals or helices superposed one upon another. As will be apparent if there are more than two layers, and in practice there

will be, alternate layers will have their constituent strands or turns substantially parallel. The pitch of the wound spirals or helices may vary in different instances, it being only essential that the reverse spiral arrangement be used so that the strands or turns of adjacent layers intersect at some angle. Although this general construction is particularly adapted for the wall of a spinning bucket, and the invention is primarily concerned with such article, the invention is not thus limited but is applicable to the manufacture and construction of any article having a wall similar to that of a spinning bucket, and particularly one which is rotated at high speeds and, therefore, subjected to excessive centrifugal force and the stresses and strains set up thereby.

The rim portion 6 of wall 1 is enlarged by winding additional turns of the impregnated fibrous strip material at this point, the purpose of the enlarged rim being to provide ample material for the formation of the annular groove 7 that is commonly provided in such articles and is adapted to seat a retaining ring to secure the usual cover in place. As is also customary, an annular shoulder 8 is formed upon which the cover is adapted to seat, and the enlargement of the rim portion of the wall also accommodates the formation of the shoulder. Wall 1 also comprises inner and outer facing sheets 9 and 10, respectively, which give the bucket a finished appearance and serve another purpose described below. As shown in Fig. 8, each of the facing sheets preferably comprises several turns. If desired, several sheets may be used to form each facing sheet compositely. The facing sheets may be composed of the fibrous material above mentioned impregnated, of course, with resin. The lower edges of the sheets are extended and are folded or bent as illustrated at 11 and 12 into the base of the bucket. The specific manner in which this is accomplished will be fully explained hereinafter. A disk 13 composed of the resin-impregnated material above mentioned is positioned within the bucket at the bottom thereof. The folded edge 11 of facing sheet 9 lies adjacent disk 13 immediately beneath the same. The purpose of disk 13 is to give the bottom interior of the bucket a finished appearance and also to securely hold edge 11.

The base 2 and the hub 3 of the bucket are preferably formed of small pieces of resin-impregnated fibrous material such as above mentioned. These pieces may vary widely in size, generally varying from one-eighth inch at the smallest width up to one inch at the greatest width. Advantageously the small pieces are obtained from scrap material cut to suitable size resulting from the manufacture of laminated composite products. The manner in which these parts of the article are formed and assembled will be fully set forth hereinafter. As is customary, a central longitudinal recess 14 is provided in the hub and a metallic bushing 15 is securely disposed within the recess. The purpose of this is to enable mounting of the bucket upon a rotating shaft or spindle during use thereof.

Referring now to Figs. 4 to 8 for a clearer understanding of the preferred method of making the improved article of the invention, there is provided a long spindle or shaft 16 upon which are mounted a plurality of frusto-conical mandrel sections 17 corresponding in shape and size to the inside of the bucket to be produced. Spindle 16 forms a part of the apparatus which is used in the manufacture of the article and this spin-

dle is arranged for rotation and is adapted to be driven by any suitable source of power. The tubular frusto-conical mandrel sections 17 are preferably metallic members but may, of course, be composed of any suitable material. These sections are placed upon spindle 16 so that adjacent sections are disposed in reversed or opposed relation. The sections are identical in size and shape and the particular manner of assembling them upon spindle 16 results in the provision of a composite mandrel having spaced points of minimum diameter as indicated at 18, and alternate spaced points of maximum diameter, as indicated at 19.

Having provided the sectional mandrel, the strip material is wound thereon. This material preferably takes the form of resin-impregnated seventeen-ounce canvas having a width of approximately three-fourths of an inch. The strip form of the material may be provided in any desired manner. The strip is heated prior to winding thereof sufficiently to render the gum-like resin sticky as, for example, by passing the strip over a heated drum. As spindle 16 and the mandrel carried thereby rotates at the desired speed, the strip is fed to the mandrel and, at the same time, is moved back and forth laterally in a manner to cause winding of the reverse superposed spirals or helices described above. Although the strip material may be fed in the desired manner to the rotating mandrel by hand, a suitable power-actuated device is preferably provided for this purpose, this device being under complete control of the operator. The reversed direction of the superposed spirals or helices is clearly illustrated in Fig. 5, one spiral being shown at 20 wound in one direction, while a superposed spiral 21 is shown in the process of being wound in a direction at an angle to the first-named spiral. In order to provide the enlarged rim of the spinning bucket above described, the operator may control the winding of the strip material to cause extra turns to be wound at the points 19 of maximum diameter of the mandrel. Generally speaking, several additional turns at these points will serve the purpose. If the winding is performed by means of a power-actuated winding device, it is essential to this purpose, of course, that the operator have such control over the device as to enable him to wind the extra turns at the indicated points. The extra turns may be wound at any stage of the winding operation.

The winding operation is continued until the desired wall thickness is built up which in general is about one-half inch, except at the enlarged portions where it will be about three-quarter inch. The long spirally wound tubular article thus formed is then cut into sections to form the individual circular walls of a plurality of buckets. As illustrated in Fig. 6, this may be accomplished by means of a circular rotating cutter 22 which is manipulated so as to cut the long tubular member at the planes of abutment of the adjacent mandrel sections. The cutting device also preferably takes the form of a power-actuated device which may be readily manipulated by the operator, although it will be apparent that the cutting operation may be carried out by any suitable tool, such as a manually operable one.

The individual walls on their individual mandrel sections are removed from spindle 16, one of these walls and its associated mandrel section being shown in Fig. 7. Considering the treat-

ment of one of the walls to form a finished bucket, the mandrel section is removed from the tubular wall and the facing cloths 9 and 10 above mentioned are applied as illustrated in Fig. 8. These cloths are of longer longitudinal length than the circular wall in order to provide the extended ends 11 and 12 above mentioned. These ends are provided with spaced slits 23 and 24, respectively, the purpose of this being to enable the ends to be readily folded or bent without wrinkling. While it is preferred to slit the ends, any other manner of treating them, such as notching, may be resorted to which will serve the intended purpose.

The composite circular wall is now ready to be assembled with the other parts of the bucket. In order to accomplish this, I prefer to use a simple press or mold which comprises a movable plug or male die member, a stationary female die member, and a movable die-ram. The male member is of such size and shape that the circular wall of the bucket may be invertedly placed thereover. This being done, the male member is forced into a cooperative relation with the female die member and, due to the tapered shape of the circular wall, the die members serve to compress the wall and render it more compact. The disk 13, which has been previously formed, is placed upon the head of the plug-like male member and the extended end 11 of the facing sheet 9 is bent or folded inwardly over the peripheral portion of the disk. Some of the resin-impregnated pieces of fibrous material making up the base 2 of the bucket are then spread upon disk 13 and the overlapped end 11, these pieces filling the space between ends 11 and 12 of the facing sheets and generally covering the disk 13. The extended end 12 of facing sheet 10 is then bent or folded over the deposited fibrous pieces and the remainder of the small resin-impregnated fibrous pieces forming the base are deposited, these latter pieces covering ends 12. The hub 3 is preformed of the small pieces of resin-impregnated fibrous pieces and the preformed hub is placed in the movable die-ram which is adapted to form the hub and base to the desired shape. The die-ram is lowered carrying the preformed hub with it until it comes in contact with the small fibrous pieces of the base, and thereafter pressure is applied, preferably hydraulic, and the formed article is heated, thereby consolidating the article into a unitary structure and converting the resin to the final insoluble, infusible stage. I prefer to use a pressure of approximately 2000 pounds per square inch and to heat the material of the article at a temperature of approximately 275° F. for a time, depending upon the thickness of the material. A bucket having a wall one-half inch thick may be heated at the stated temperature for about an hour. During the pressing treatment, the bucket is compressed about one-eighth of an inch in diameter. It will be obvious that the use of the facing cloths in the manner above described not only gives the finished bucket a desirable appearance, but also enables a more secure bonding of the bucket base and the circular wall thereof. The overlapping tab-like portions of the extended ends of the sheets interlock with the small pieces of fibrous material to accomplish this purpose.

After the bucket is removed from the press, it is preferably placed upon a metal form of substantially the same size and shape as the

interior of the bucket. The form and bucket are then placed in a normalizing oven and kept there for about twelve hours under heat treatment at a temperature of approximately 220° F. The purpose of this is to equalize the constituency of the bucket and to remove any internal strains. After the bucket on its supporting form is removed from the normalizing oven, it is allowed to remain on the form until cooled to approximately room temperature. The bucket is then removed from the form and machined to provide a smooth exterior surface at the base and also to provide the cover seating shoulder and retainer ring groove, as well as the recess for bushing 15. The bucket is preferably placed on a tapered form having a shape generally similar to the interior of the bucket and adapted for mounting in a lathe. After the form has been thus mounted, the recess 14 for the bushing is drilled and the surface of the base and hub are machined to give a smooth surface and at the same time remove any excess fibrous material. The form is then removed from the lathe, the metal bushing is inserted and the retaining ring groove and cover seating shoulder are machined concentrically with respect to the bushing and its recess. The bucket is then entirely completed and is ready for use.

It will be apparent from the above description that the invention provides a novel construction of the bucket as a whole, and of its circular wall in particular, that imparts to the bucket the desired characteristics previously mentioned. By forming the cylindrical wall of the bucket in the manner illustrated and described, it is possible to obtain uniform density of the wall throughout and this results in substantially perfect balancing of the bucket. The specific construction of the bucket wall has greater inherent strength than have the walls of prior devices formed as previously mentioned.

Although the invention has been illustrated and described herein with reference to a preferred embodiment and a preferred method of manufacture, it will be apparent that various changes and modifications in the details may be made. Any such changes or modifications, therefore, as fall within the scope of the appended claims are deemed to be a part of the invention.

I claim:

1. A hollow article, such is a spinning bucket, which may be subjected to excessive stress during use, comprising a base, and a generally cylindrical wall extending from said base formed of superposed reverse spirals or helices of binder-treated fibrous flat strip material with the turns of each spiral overlapping one another, whereby the fibrous strip portions are tied in or interlocked with one another in a strong balanced structure having uniform density.

2. A hollow article, such as a spinning bucket, which may be subjected to excessive stress during use, comprising a base formed of interspersed small pieces of resin-impregnated fibrous material, and a generally cylindrical wall extending from said base formed of superposed reverse spirals or helices of resin-impregnated fibrous flat strip material with the turns of each spiral overlapping one another, whereby the fibrous strip portions are tied in or interlocked with one another in a strong balanced structure having uniform density.

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