March 24, 1959 V. L. NICHOLS ET AL 2,878,514

APPARATUS FOR CURLING PLASTIC YARN

Original Filed Dec. 22, 1955 2 Sheets-Sheet 1

FIG. 1

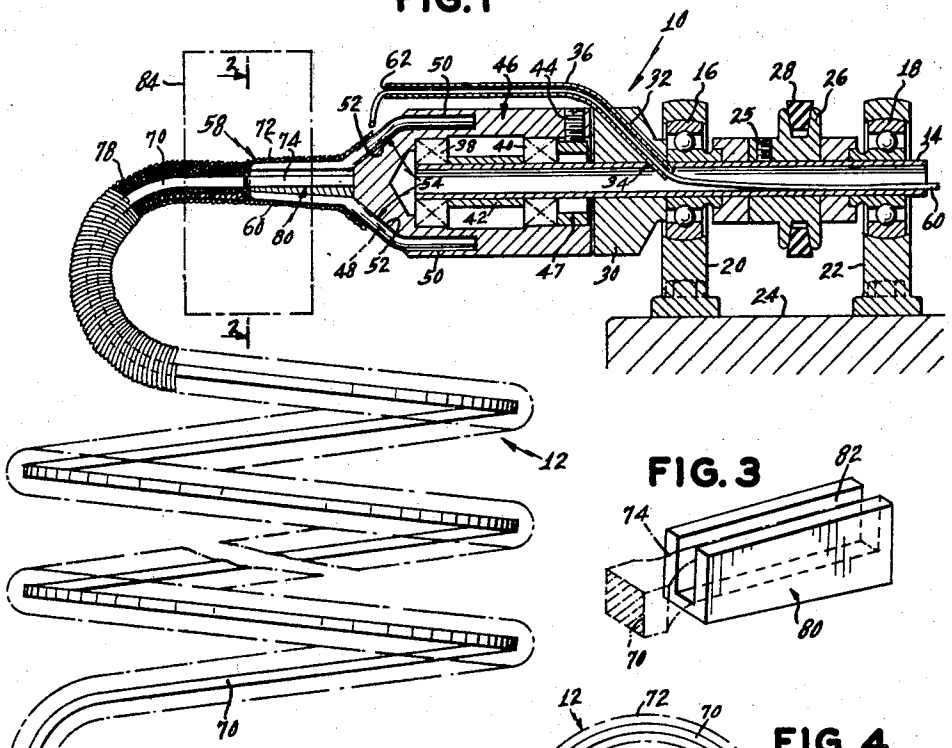


FIG. 3

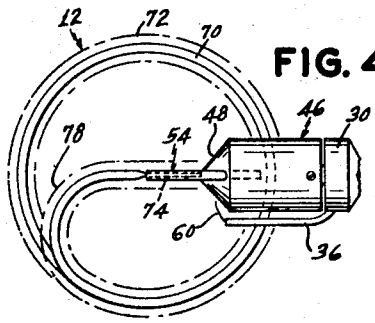


FIG. 4

FIG. 5



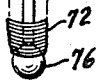
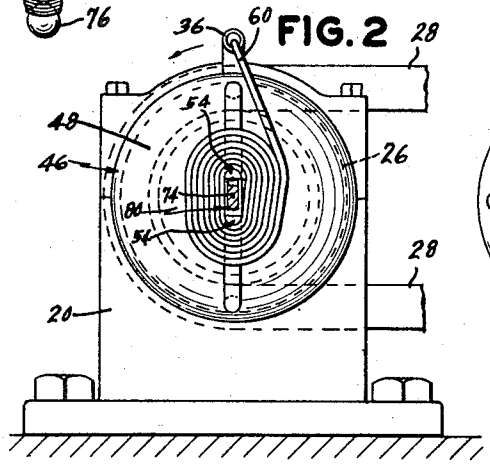


FIG. 2



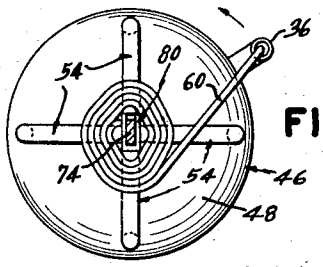


FIG. 6

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FIG. 7

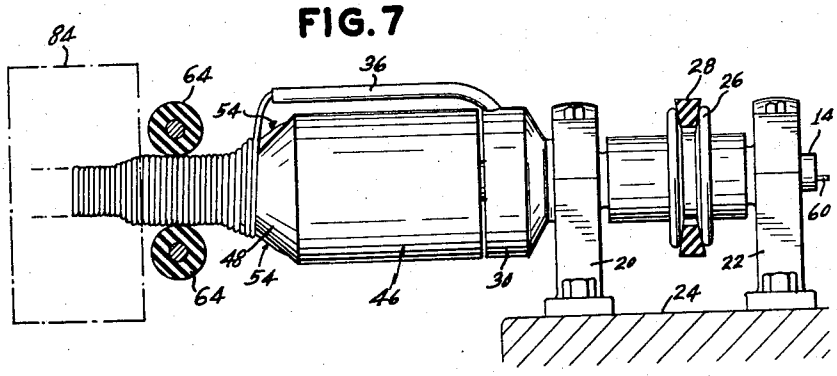


FIG. 8

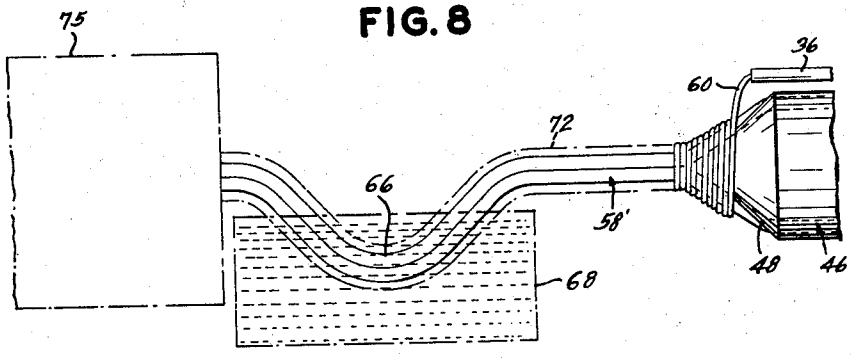


FIG. 9

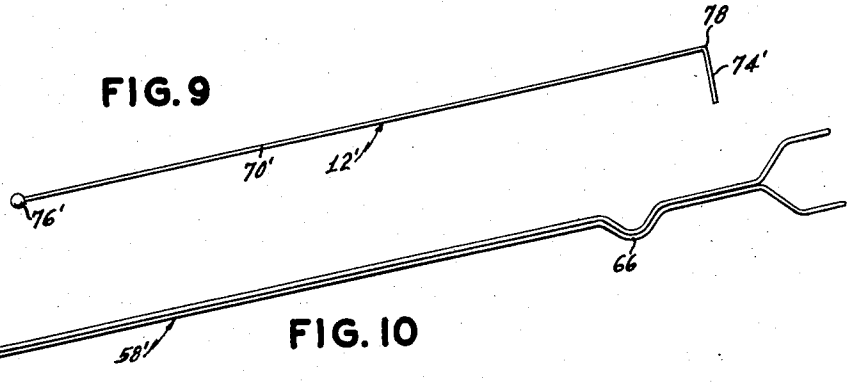


FIG. 10

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APPARATUS FOR CURLING PLASTIC YARN

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4 Claims. (Cl. 18—19)

This invention relates to a method and apparatus for continuously curling plastic yarn to be employed as hair on a doll's head.

One object of the present invention is the provision of generally new and improved apparatus for curling plastic yarn which is simple and economical both in construction and operation.

Another object of the present invention is the provision of new improved apparatus for continuously curling plastic yarn which apparatus is so arranged that as yarn curls are formed thereon, said curls exert pressure on adjacent curls to continuously move them along a mandrel whereby to provide a self-feeding of the curled yarn on said apparatus.

Another object of the present invention is the provision of a new and improved storage device for storing curled yarn which device is adapted to hold a substantially greater amount of curled yarn thereon than any device heretofore known of similar size.

The above and other objects, features and advantages of the present invention will be more fully understood from the following description taken in connection with the accompanying illustrative drawings.

In the drawings:

Fig. 1 is a sectional view of apparatus for curling plastic yarn shown connected to one form of storage device embodying the present invention, said storage device being shown in elevation;

Fig. 2 is a sectional view taken along the line 2—2 of Fig. 1;

Fig. 3 is a perspective view illustrating the details of construction of a means for connecting the curling apparatus to a storage device;

Fig. 4 is a top plan view in reduced scale illustrating the curling and storage apparatus shown in Fig. 1;

Fig. 5 is a perspective view of a rod forming part of the mandrel included in the apparatus shown in Fig. 1;

Fig. 6 is an end view similar to Fig. 2 illustrating a modification of the present invention;

Fig. 7 is a side elevational view of a modified form of apparatus for continuously curling plastic yarn;

Fig. 8 is an enlarged side elevational view illustrating a further modification of the present invention;

Fig. 9 is a perspective view of a modified form of storage device embodying the present invention; and

Fig. 10 is a perspective view of a modified form of mandrel which is adapted to be connected to the device for automatically curling yarn.

Referring now to the drawings in detail and particularly to Fig. 1, a curling device **10** is shown therein connected to a storage device **12**. The curling device **10** comprises a hollow horizontally disposed shaft **14** which is mounted for rotation on spaced ball bearings **16** and **18** which are supported by brackets **20** and **22**, respectively, mounted on a horizontal surface **24**. Fixedly mounted on shaft **14** as by a set screw **25** in a pulley **26** which is adapted to have run thereover a drive belt **28** for rotating said pulley and said shaft. Disposed

immediately to the left of bearing **16**, as viewed in Fig. 1, is a collar **30** which is fixedly mounted on shaft **14** for rotation therewith. Collar **30** is provided with a passage **32** which is in registry with an aperture **34** in shaft **14** and extending through said passage and aperture is a spinner or winding tube **36** which extends outwardly from said collar **30** and is bent into a horizontal line therewithout. With further reference to Fig. 1, a pair of bearings **38** and **40** are mounted on shaft **14** to the left of collar **30** and are spaced from each other by means of a collar **42** which is fixedly mounted on shaft **14**. Preferably, bearings **38** and **40** are of the ball bearing type whereby to substantially eliminate friction between the inner and outer races thereof. Fitted within member **46** is a collar **47** which slidably engages the side of the outer race of bearing **40**. Member **46** is fixed to collar **47** as by set screw **44** to thereby prevent longitudinal movement of member **46**. Member **46** being mounted on the outer races of bearings **38** and **40** normally remains stationary even while shaft **14** is rotating and, for reasons which shall become apparent hereinafter, when yarn is being curled upon said device the yarn further acts to prevent rotation of the member **46** with shaft **14**.

Member **46** is provided with a plurality of cavities **50**, here shown as two in number, which extend from a point within the member to the surface of the conical or tapered portion **48**. The conical or tapered portion **48** is further provided with grooves **52** extending down opposed elements thereof from the points where the cavities **50** intersect the surface of tapered portion **48**. Disposed within cavities **50** are a pair of rods **54** which have intermediate angular portions extending down said opposed elements of conical portion **48** within the grooves **52** therein. The free end portions **56** of rods **54** are preferably slightly convergent and may be tapered as shown in Fig. 1 and extend in substantially the same direction whereby to form a non-circular mandrel **58** for device **10**. By disposing rods **54** within cavities **50**, a convenient means is provided for connecting the mandrel to the member **46** in operative relation therewith. Furthermore, as may best be seen in Fig. 1, angular portions **56** of rods **54** extend above the surface of tapered portion **48** of member **46** whereby to render said tapered or conical portion non-circular. Accordingly, by the provision of rods **54**, a non-circular tapered or conical member is provided, and a non-circular mandrel, here shown as automatically rectangular in cross section, is connected therewith in fixed relation thereto.

In operation, plastic yarn or thread **60**, which is normally obtainable on relatively large spools, is drawn off the spool and led through the inside of hollow shaft **14** and to the outside of the shaft through tube **36**. In this connection it is to be noted that the end **62** of tube **36** is disposed above the non-circular tapered portion **48**. The thread **60** is wound around tapered portion **48** and thereafter shaft **14** is rotated by means of the pulley **26** and belt **28**. Since tube **36** is rotatable with the shaft **14**, the end **62** of the tube rotates around the tapered portion **48**. It has been found that by making the mandrel non-circular, the turning of the curls relative to the mandrel is resisted. This resistance to the turning of the curls is further enhanced by rendering the tapered portion **48** non-circular although it has been found that forming the mandrel as a non-circular member is sufficient by itself to achieve this end. As the curls or turns of yarn are wound onto tapered portions **48**, each curl tends to move down toward the apex of the conical or tapered portion **48** thereby tending to push the adjacent curls downward toward said apex and hence toward the mandrel **58**. Accordingly, the curls are self feeding in a direction longitudinally of mandrel **58** and no external

feeding means is necessary. However, if desired, external feeding means such as opposed rollers 64 (Fig. 7) may be employed to positively feed the curled yarn along the mandrel in a direction longitudinally thereof.

Although the rods 54 shown in Fig. 1 are relatively short, it is possible and sometimes highly desirable as will become apparent hereinafter to provide relatively long rods sometimes extending many feet from the tapered portion 48. Furthermore, it is sometimes desirable to immerse the curled thread into a liquid for reasons which will become clear hereinafter. In order to accomplish this immersion automatically, rods 54 may be provided with dips or bows 66 which are adapted to lower the curls of yarn into a liquid receptacle 68 (Fig. 8). Moreover, mandrel 58 may be formed of more than two rods 54 and may, in fact, be formed of four rods all of which may be embedded in member 46, as shown in Fig. 6.

Storage device 12 comprises a non-circular rod 70 of substantially smaller peripheral extent than that of the curls 72 formed on mandrel 58. One end 74 of the storage device 12 is adapted to be connected to mandrel 58 in a manner to be described hereinafter. The other end of the storage device is provided with a suitable fixed stop such as a ball 76 which is adapted to engage curls 72 as they move down the storage device in a manner to be described hereinafter for preventing said curls from unraveling off the storage device 12. As shown in Fig. 1, storage device 12 is formed into a helix and the rod 70 is square in cross-section. By forming the rod 70 into a helix, the device may be more conveniently handled. However, if desired, a storage device 12' made up of a straight rod 70' having a ball 76' at the free end thereof may be provided as is shown in Fig. 9. The end 74' adapted to be connected to the mandrel 58 is preferably bent at substantially a right angle to the main axis of the storage device 12, as at 78. In the helical form shown in Fig. 1, the curls 72 are moved along rod 70 by means of lateral pressure resulting from the self-feeding of the curls on the mandrel together with the force of gravity. When using a straight storage device such as shown in Fig. 9, it will be seen that portion 74' thereof is disposed in a substantially horizontal plane and the remainder of the storage device extends vertically whereby to permit the curls to move down said storage device towards the stop means or ball 76' under the influence of gravity. With either construction, by forming the storage device of a rod of substantially smaller peripheral extent than the curls, it has been discovered that the curls tend to pile on top of one another and thereby permit the storage of for example 20 curls in a space substantially equal to the width of the yarn forming the curls. Accordingly, for a given length of storage device, many times the amount of curled yarn can be stored thereon than could be stored on a storage device having a peripheral extent substantially equal to that of the curls 72. Moreover, with either storage device, the device is connected to the mandrel 58 and depends therefrom. It has been found that the weight of the storage device is sufficient to resist any turning moment applied to member 46 through bearings 38 and 40 whereby to prevent member 46 from turning.

Although mandrel 58 is preferably formed of rods 54 as hereinbefore described, it will be understood that other forms of mandrels may be employed without departing from the present invention. For instance, a peripherally continuous non-circular mandrel may be secured to tapered portion 48 and may extend longitudinally therefrom and, in fact, member 48 may be initially formed as a non-circular member whereby to obviate the necessity for the portions of mandrel rod 54 extending above the surface thereof to render said tapered portion 48 non-circular. However, when employing the presently preferred form of the invention with mandrel 58 comprising the spaced rod 54, a suitable adaptor 80 is preferably fixedly connected to one of said rods 54 as by soldering to facilitate the connection of the mandrel with the storage device. Adaptor 80 is a U-shaped member of substantially the same longitudinal extent as the mandrel 58 and is provided with a tapered channel 82 having a bottom surface which diverges from the bottom of the adaptor whereby to render the bottom of the channel 82 horizontal when the adaptor is connected to the mandrel 58. Channel 82 defines a space of substantially the same peripheral extent and configuration as the end 74 of storage device 12 whereby to provide a simple and effective means for connecting the storage device to the mandrel by merely inserting the end 74 of the storage device into channel 82 of the adaptor. Of course, if the mandrel is a relatively long mandrel, as shown in Fig. 10, then adaptor 80 need not be as long as mandrel 58' but need only extend inwardly from the free end of said mandrel for a few inches whereby to provide a suitable connection between the storage device 12 and the mandrel.

In accordance with the method for curling yarn embodying the present invention, it is presently preferred that the yarn be thermoplastic or hygroscopic or, of course, it may be both. The presently preferred yarns are cellulose acetate commonly known as acetate which is both thermoplastic and hygroscopic, and polyvinylidine chloride sold under the trade name "Saran" which is thermoplastic. Hygroscopic yarns may be plastically deformed by wetting whereas non-hygroscopic yarns which are thermoplastic may be plastically deformed by heating. Coming first to a method wherein heat is used as the plastic deforming agent, the plastic yarn, which may be constituted by a single thread or multiple strands of thread, is drawn off the spools and is passed through a suitable tension device. If the yarn displays a tendency to shrink excessively, it should preferably be preshrunk prior to treatment in accordance with the present invention. Thereafter, yarn passes through the spinning tube 36 as hereinbefore described and is wound around mandrel 58 which holds the yarn in its curled form as hereinbefore mentioned. The yarn is moved along the mandrel by self-feeding or by positive feeding such as by rollers 64 (Fig. 7). While still on the mandrel the thermoplastic yarn is subjected to heat as in a heating chamber 84 to a sufficient extent to cause plastic flow whereby to permanently deform the yarn into its curled state. Thereafter, the yarn may be cooled while in curled form and preferably while still on the mandrel to set the yarn in its curled state. When so cooling the yarn, the yarn is moving along the mandrel or it may be transferred to a storage device such as device 12 or 12' where cooling will take place with the yarn in curled form. Once the cooling has taken place, the storage device may be transferred to suitable storage rack until needed at the sewing machines which sew the yarn onto the heads of dolls to simulate hair. However, if desired, the storage devices 12 and 12' may be eliminated from the method and the permanently curled yarn may be led off the end of the mandrel and directly to the sewing machine where the curled yarn is sewed onto the doll's head as artificial hair therefor.

If, however, the plastic deforming agent is to be moisture as would be the case with a hygroscopic yarn, then after the yarn has been curled onto mandrel 58, it is wetted as by immersing it in a container 68 (Fig. 8) and thereafter is subjected to heat for rapidly drying it, as by passing it through a heat chamber 75, or it may be exposed to the atmosphere as it is carried along a relatively long mandrel to air dry the material whereupon it is transferred to a storage device 12 or 12'. Of course, the curled hygroscopic yarn may be led directly off the mandrel to a sewing machine.

When using Saran, it is preferred to heat the Saran yarn to temperatures between 170 and 240 degrees F. and preferably to heat Saran to a temperature of 200 degrees F. At these temperatures, it has been found that Saran

rapidly takes on the curled form into which it has been placed on the mandrel.

With regard to acetate yarn, if it is desired to plastically deform the acetate yarn by heat, it is preferred that the acetate yarn be heated to a temperature between 260 degrees F. and 360 degrees F. and preferably to 300 degrees F. However, if it is desired to plastically deform acetate by wetting, it has been found that if 5% of water by weight of yarn is introduced onto the acetate yarn, the acetate yarn will deform and take on curl.

It has been discovered that it is more convenient when plastically deforming acetate to rely upon the hygroscopic properties of the yarn rather than on the thermoplastic properties thereof. Accordingly, in accordance with the presently preferred mode of carrying out this invention, after the yarn is wound onto a mandrel **58**, it has been found most desirable to pass it through a steam chest **84** which has a mixture of steam and water vapor at a temperature of approximately 200 degrees. Such a steam chest contains sufficient water vapor to plastically deform acetate by wetting and will be maintained at a 200 degree temperature which is the preferred temperature for plastically deforming Saran by heating. Accordingly, one simple apparatus may be employed to plastically deform either Saran or acetate by heating and wetting, respectively.

While we have herein shown and described several forms of the present invention, it will be understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of this invention.

This is a division of our application Serial No. 554,751, filed December 22, 1955.

Having thus described our invention, what we claim and desire to secure by Letters Patent, is:

1. Apparatus for curling thermoplastic yarn or the like for the manufacture of simulated hair, comprising a tapered member, a spinning member provided with a passage therethrough for the yarn and mounted for rotation around the longitudinal axis of said tapered member for receiving the yarn from a supply and winding the yarn into curls onto said tapered member, a mandrel extending from the narrower end of said tapered member to receive the curls therefrom progressively along the length of the mandrel, said mandrel having a free outer end and a non-circular contour and tapering longitudinally from the narrower end of said tapered member to facilitate the movement of the curls longitudinally of the mandrel toward said outer end thereof, and a rotary shaft co-axial with said tapered member and connected to said spinning member for rotating the latter, said shaft having a longitudinal passage for the yarn and in communication with said passage in said spinning member for guiding the yarn from the supply to the spinning member.

2. Apparatus for curling thermoplastic yarn or the like for the manufacture of simulated hair, comprising a tapered member, a spinning member provided with a passage therethrough for the yarn and mounted for rotation around the longitudinal axis of said tapered member for receiving the yarn from a supply and winding the yarn into curls onto said tapered member, a mandrel extending from the narrower end of said tapered member to receive the curls therefrom progressively along the length of the mandrel, said mandrel tapering longitudinally from the narrower end of said tapered member to facilitate the movement of the curls longitudinally of the mandrel, and a transverse member continuous with and at the end of the mandrel remote from said tapered member, for the passage of the curls off the mandrel, and a rotary shaft co-axial with said tapered member and connected to said spinning member for rotating the latter, said shaft having a longitudinal passage for the yarn and in communication with said passage in said spinning member for guiding the yarn from the supply to the spinning member.

3. Apparatus for curling thermoplastic yarn or the like for the manufacture of simulated hair, comprising a horizontally disposed tapered member, a spinning member provided with a passage therethrough for the yarn and mounted for rotation around the longitudinal axis of said tapered member for curling the yarn around said tapered member, and a horizontal mandrel extending from the narrower end of said tapered member coaxially thereof to receive the curls from the tapered member, and a transverse member continuous with and at the end of the mandrel remote from said tapered member, for the passage of the curls off the mandrel, a rotary shaft for rotating said spinning member, and means including an anti-friction bearing supporting said tapered member on said shaft whereby said tapered member and mandrel remain stationary during rotation of said shaft.

4. Apparatus for curling thermoplastic yarn or the like for the manufacture of simulated hair, comprising a horizontally disposed tapered member, a spinning member provided with a passage therethrough for the yarn and mounted for rotation around the longitudinal axis of said tapered member for curling the yarn around said tapered member, and a horizontal mandrel extending from the narrower end of said tapered member coaxially thereof to receive the curls from the tapered member, and a transverse member continuous with and at the end of the mandrel remote from said tapered member, for the passage of the curls off the mandrel, a rotary shaft for rotating said spinning member, said shaft having a longitudinal passage for the yarn and in communication with said passage in said spinning member for guiding the yarn from the supply to the spinning member, and means including an anti-friction bearing supporting said tapered member on said shaft whereby said tapered member and mandrel remain stationary during rotation of said shaft.

References Cited in the file of this patent

UNITED STATES PATENTS

2,365,952	Hanson	Dec. 26, 1944
2,491,152	Beidle	Dec. 13, 1949
2,545,271	Gartner	Mar. 13, 1951
2,586,763	Judisch	Feb. 19, 1952
2,740,987	Moncrieff	Apr. 10, 1956
2,800,683	Teichmann	July 30, 1957