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METHOD AND APPARATUS FOR TWISTING A FLAT STRAND

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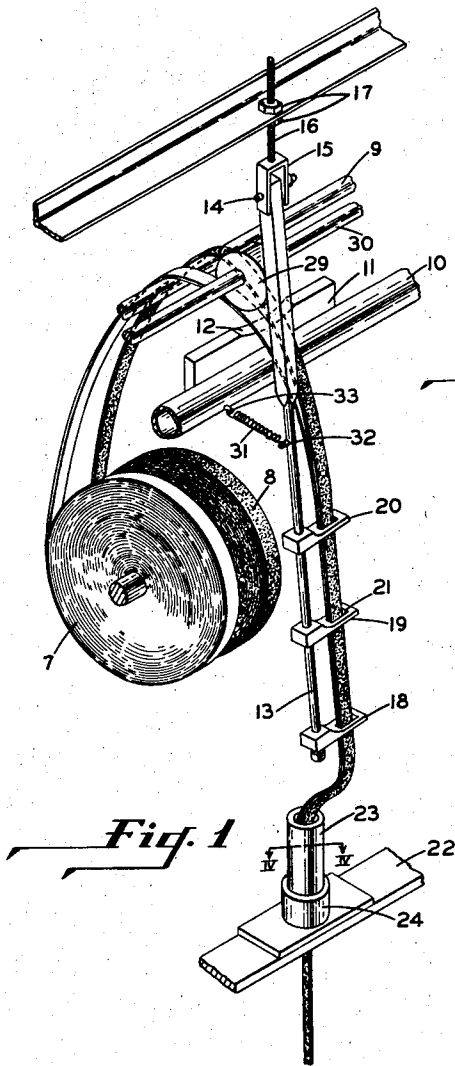


Fig. 1

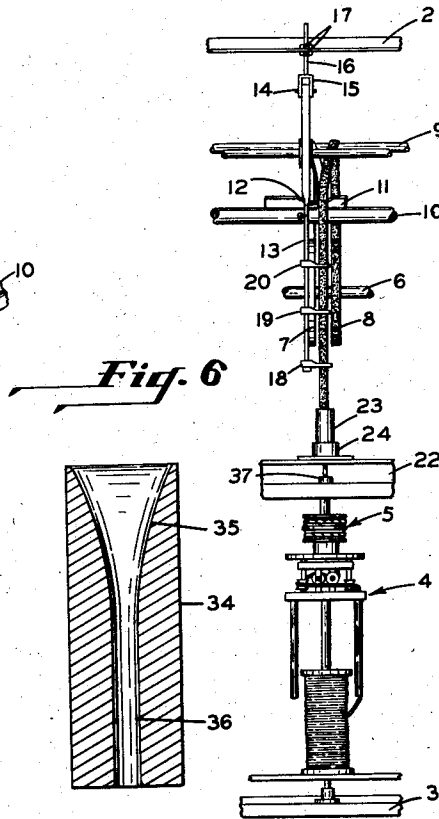


Fig. 2

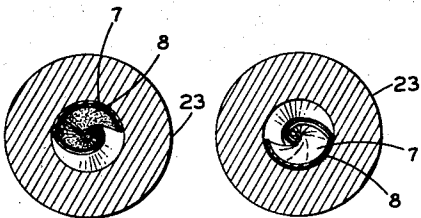


Fig. 3

Fig. 4

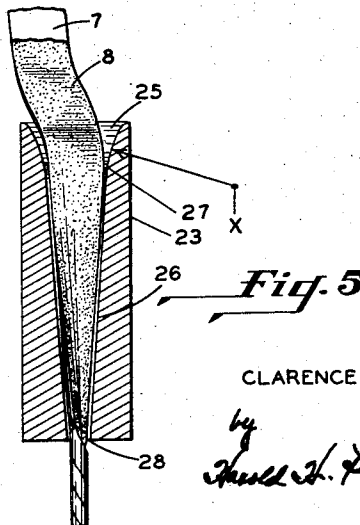


Fig. 5

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METHOD AND APPARATUS FOR TWISTING A FLAT STRAND

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This invention relates to a method and apparatus for twisting flat ribbons of paper, synthetic fibres, plastics, or the like into threads which are useful in the fabrication of woven rugs or the like.

It is common practice in the paper thread industry to form a monocolored thread by twisting a flat ribbon of paper of a single color into a thread. Sometimes the paper ribbon is reinforced or supplemented with a so-called stuffer ribbon which is twisted within the confines of an outer or covering ribbon. Also, pencil striped thread has been produced by intertwisting two or more ribbons of different colors. A third type of thread has been produced by twisting together two or more paper ribbons and varying the positions of the separate ribbons as they are fed to the twisting head so as to form a thread having sections of each of the colors, with intermediate pencil striped sections. This type of thread is disclosed in Stevenson Patent 852,356 and Lambert Patents 2,418,215 and 2,486,037.

The apparatus disclosed in these prior patents provides inadequate control of the color of the thread produced. The thread may have sections of considerable length of one color, a short pencil stripe section, followed by a short length of the second color. This may be followed by a relatively long pencil stripe section and a short section of the first color, due to inadequate control of the ribbons as they enter the twisting zone. A generally random color arrangement results. The production of thread having predetermined color characteristics along its length is not possible.

An object of the present invention is to provide a method and apparatus for producing a variegated thread which will provide for better control of the thread forming strand as it enters the twisting zone and will make possible the formation of a thread having improved color characteristics.

Another object of the invention is to provide an apparatus for forming a bicolored strand into a twisted thread, which apparatus may be adjusted to alter the length of the sections of different color characteristics provided in the twisted thread.

Other objects of the invention will be obvious from consideration of the following description of an embodiment of the invention which is shown in the attached drawing, in which:

Figure 1 is a diagrammatic perspective view of a portion of a thread twisting apparatus, showing strand control equipment of the invention;

Figure 2 is a front elevational view of a single twister unit embodying the invention;

Figure 3 is an enlarged transverse sectional view through a cupping die such as shown in Figure 2;

Figure 4 is an enlarged transverse sectional view through the cupping die of Figure 1, taken along the line IV—IV of that figure;

Figure 5 is an enlarged longitudinal sectional view through a cupping die such as shown in Figure 2; and

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Figure 6 is a view similar to Figure 5, showing a modified cupping die.

Referring first to Figure 2, the twister unit includes an upper frame member 2 and a lower frame member 3. A twisting head 4 is mounted above the lower frame 3 and is rotated by a drive 5. Any desired twisting head may be used in the combination of the present invention. A Brownell Model M twisting machine manufactured by G. L. Brownell, Inc., Worcester, Massachusetts, has been shown in the drawing. Units such as the Brownell twister, Model F, and twisters made by Haskell-Dawes Machine Company, Inc., Philadelphia, Pennsylvania; Saco-Lowell Shops, Boston, Massachusetts; Sipp Eastwood Corporation, Bloomfield, New Jersey, and Whitin Machine Works, Whitinsville, Massachusetts, and many others may be substituted. The Brownell Model M twister has been chosen as typical of the twisting units which may be used. The twisting head is effective for drawing one or more ribbons through a forming die and for continuously twisting the ribbons into a thread as drawing proceeds. The twisted thread is wound onto a spool continuously as it is formed.

Mounted above the twisting head 4, below the upper frame member 2, is a reel mounting rod 6. Ribbons 7 and 8 in the form of convolutely wound reels of paper are shown mounted on the rod 6. These ribbons may be formed of kraft paper about $1\frac{1}{8}$ " wide and about .031" thick (31# basis weight stock) and of great length. The dimensions of the ribbons are not critical but will depend upon the type and quality of product to be produced. Generally, the ribbons will be within the range of $\frac{1}{2}$ " to 2" wide and will have a basis weight of 12 to 35 pounds. The ribbon 7 may be white and the ribbon 8 may be black, as shown in the drawing for purpose of illustration. The method is not concerned with any particular type, kind, or color of ribbons. For instance, one of the ribbons may be of dull black kraft paper and the other of glossy black coated paper, and the combined ribbons may be used to produce a thread having dull and glossy black sections, with intermediate sections of a dull and glossy candy stripe. The term "color characteristics" is used to designate generally differences in true color, sheen or gloss, hue, or tint, which present to the eye a difference in visual appearance which commonly is denoted as a difference in color characteristics.

The ribbons 7 and 8 are directed over a guide bar 9 and a guide tube 10 which has a guide plate 11 mounted thereon, the plate 11 being provided with an arcuate guiding surface 12 which tends to move the ribbons passing thereover into a longitudinally superimposed position.

An oscillating guide bar 13 is pivoted at 14 to a bracket 15 which is adjustably secured to the upper frame member 2 by an adjusting screw 16. Locking nuts 17 are provided for fastening the adjusting screw 16 in adjusted position. In the embodiment illustrated, there are three ribbon guides 18, 19, and 20 which are mounted on the guide bar 13, at spaced locations along the length thereof. These guides are provided with openings 21 through which the superimposed ribbons 7 and 8 pass freely. The guides 18, 19, and 20 serve to maintain the ribbons in the desired superimposed relationship.

Mounted above the twisting head 4 on an intermediate frame member 22 of the machine is a cupping die 23 which is received within a die holder 24 mounted on the frame member 22. The cupping die 23 is shown in transverse section in Figures 3 and 4 and in longitudinal section in Figure 5. It may be formed of steel and is preferably provided with a curved mouth 25 which leads into a frusto-conical throat 26. The mouth is dimensioned so that the ribbons 7 and 8 may enter therein in a substantially flat condition but will be precupped as they move through the mouth and into the throat. For ex-

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ample, with a pair of $1\frac{1}{16}$ " wide ribbons 7 and 8, the mouth may have a maximum diameter of $\frac{7}{8}$ " and curve on a 1" radius struck from a point "X" $\frac{1}{2}$ " down from the upper edge of the die in to a diameter of $1\frac{1}{32}$ " at the top of the throat, indicated at 27 in Figure 5, and taper (at an inclination of 5°) from that diameter to a diameter of $\frac{7}{32}$ " at the bottom of the throat, indicated at 28 in Figure 5. The throat may be $2\frac{1}{4}$ " long from point 27 to point 28, measured along the axis of the cupping die. The throat length is preferably two or three times as great as the width of the ribbons 7 and 8 to provide for optimum guiding and control of the ribbons in the formation of the yarn. A throat length at least about equal to the width of the ribbons is recommended.

With this cupping die structure, the ribbons 7 and 8 as they pass through the mouth 25 and enter the throat 26 will be precupped or cupped, with the ribbon 8 disposed inwardly in the position indicated in Figure 5; and as twisting of the ribbons is effected, the ribbon 7 will be disposed as the outer cover of the thread. This is clearly shown in Figures 3 and 5. Now, if the superimposed ribbons constituting the strand to be twisted are moved to a corresponding position on the opposite side of the axis of the cupping die as shown in Figure 4, and also in Figure 1, the ribbon 7 will be cupped to the inside and the ribbon 8 will form the cover for the thread so long as the superimposed ribbons remain in such position as they enter the mouth of the die.

Movement of the superimposed ribbons to such opposite positions may be controlled effectively by movement of the guide bar 13. In the embodiment illustrated in Figures 1 and 2, this guide bar controlling and moving mechanism includes a cam or eccentric 29 mounted on a cam or eccentric shaft 30 which may be rotated from the drive for the twisting head. The cam 29 engages the guide bar 13 below the pivot 14, and the guide bar 13 is held in engagement with the cam for actuation by it. A spring 31 performs this function. It is connected at one end to a pin 32 which projects outwardly from the guide bar 13 and at the other end to a pin 33 projecting from the guide tube 10.

Another cupping die is shown in Figure 6. It includes a body 34 having a curved mouth 35 which leads into a substantially cylindrical throat 36. The maximum diameter of the mouth in this cupping die may be about .875", and the diameter of the throat may be about $\frac{7}{32}$ ". The mouth may be curved on a radius of 2.921" struck from a point $1\frac{1}{4}$ " down from the upper edge of the die. The die may have an axial length of 2.500". It will function very well in forming yarn from a strand made of two superimposed ribbons $1\frac{1}{16}$ " wide of 31 pound basis paper stock, for example.

In both of the cupping dies of Figures 5 and 6, the passageway for effecting longitudinally cupping of the strand is of buccinal or trumpet shape.

The length of the sections of different color characteristics formed in the thread is determined by the relationship between the speed of movement of the superimposed ribbons through the die, the amount of twist imparted thereto, the time intervals during which the moving, superimposed ribbons are disposed on opposite sides of the mouth of the die wherein the ribbons are cupped in each of the two opposite positions, and other variable factors. Thus, the length of the sections can be changed conveniently from bands about $\frac{1}{4}$ " long to bands of infinite length by inserting different sized cams or by controlling the speed of rotation of the cams. Minor adjustment can be effected by raising or lowering the pivot point 14 to vary the "throw" imparted to the guide bar 13 by raising or lowering the adjusting screw 16. The invention is of particular value where it is desired to have the length of the sections of different color characteristics substantial, i.e. greater than the width of the strand.

If desired, the twisted thread may be passed through

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a conventional forming die 37 mounted on intermediate frame member 22 to impart the desired final dimension and surface finish to the thread.

While preferred practice is to form the thread from a strand made up of two ribbons of equal width having different color characteristics, the invention is not limited thereto. A strand made up of three ribbons of equal width, one constituting a stuffer and the other two being disposed on opposite sides thereof and having different color characteristics, may be used. Also, the strand may be made up of a single ribbon formed of two laminated ribbons joined together as a double-faced ribbon so to speak having different color characteristics on each flat face of the strand. A similar strand may be prepared by providing each of the flat faces of a ribbon with different color characteristics as by dyeing one face black while leaving the opposite face white. Interesting effects can also be produced by providing the strand with more than one color on one or both sides, such as would be obtained by using a $\frac{1}{2}$ " ribbon of red color, for example, with a $\frac{5}{8}$ " ribbon of white. One face then would be white and the other face would be predominantly red with a white stripe or stripes, depending upon the positioning of the two ribbons. If the $\frac{1}{2}$ " wide ribbon were positioned centrally of the width of the $\frac{5}{8}$ " wide ribbon, the one face would be predominantly red with $\frac{1}{16}$ " wide white stripes on each of the longitudinal edges.

While the specific embodiments of the invention illustrated in the drawing have been described in connection with the formation of a paper yarn, it is to be understood, as mentioned previously, that the invention is not limited to the fabrication of yarn from a paper strand. It is applicable to strands of other material such as polyethylene sheet plastics, cellophane, vinyl plastic ribbons, and the like, and also various combinations of materials.

I claim:

1. In a method of twisting a flat strand into a thread, the steps comprising delivering a flat ribbonlike strand having opposite flat faces of different color characteristics to a cupping die, precupping said strand longitudinally to dispose one of said flat faces outwardly and the other of said flat faces inwardly, twisting said precupped strand into a thread with said one of said flat faces constituting the outer surface of the thread, oppositely longitudinally precupping said strand to dispose said other of said flat faces outwardly, twisting said oppositely precupped strand into a continuation of said thread with said other of said flat faces constituting the outer surface of the thread, and repeating said alternate precupping and twisting to produce a thread having alternating sections of different color characteristics.

2. In a method of twisting a plurality of ribbons into a thread, the steps comprising superimposing said ribbons one upon the other longitudinally in face-to-face engagement to provide a double-faced strand, longitudinally precupping said strand alternately in opposite directions to present opposite ribbons alternately as the outer precupped surface of said strand, and continuously twisting said precupped strand into a thread having outer covering sections formed alternately of each of the two facing ribbons of said strand.

3. The method of claim 2 in which said strand consists of two ribbons of substantially equal width disposed substantially in longitudinal alignment to form a strand of a width substantially the same as the width of the ribbons.

4. In a method of twisting a single flat paper strand into a thread, the steps comprising longitudinally precupping a flat ribbonlike strand of paper having opposite flat faces of different color characteristics to dispose one of said flat faces outwardly and the other of said flat faces inwardly, twisting said precupped strand into a thread with said one of said flat faces constituting the outer surface of the thread for a substantial length thereof, longitudinally precupping said strand in the opposite direction to dispose said other of said flat faces outward-

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ly, twisting said oppositely precupped strand into a continuation of said thread with said other of said flat faces constituting the outer surface of the thread for a substantial length thereof, and repeating said alternate precupping and twisting to produce a thread having alternating sections of different color characteristics.

5. In a method of twisting a bicolored flat strand into a thread, the steps comprising longitudinally precupping a flat strand made up of at least two ribbons of different color characteristics disposed in longitudinally superimposed position with one flat face of each of said ribbons being disposed at the surface of said strand to dispose one of said flat faces of said strand outwardly and the other of said flat faces of said strand inwardly, twisting said precupped strand into a thread with said one of said flat faces of said strand constituting the outer surface of the thread for a substantial length thereof, longitudinally precupping said strand in the opposite direction to dispose said other of said flat faces of said strand outwardly, twisting said oppositely precupped strand into a continuation of said thread with said other of said flat faces of said strand constituting the outer surface of the thread for a substantial length thereof, and repeating said alternate precupping and twisting to produce a thread having alternating sections of different color characteristics.

6. The method of claim 5 in which one of said ribbons is of less width than the other and is longitudinally superimposed on the other ribbon, said ribbons constituting the outer flat faces of the strand.

7. In a machine for twisting a flat strand into a thread, the combination of a twisting head, a cupping die having a mouth opening leading to a buccinal passageway for longitudinally cupping said strand as it is drawn through said die, said die leading to said twisting head, a strand guide disposed at a point remote from the mouth of said die for holding said strand in substantially flat condition as it approaches the mouth of said cupping die, and means for oscillating said guide in a direction substantially normal to the flat faces of said strand to present said strand alternately to one side and then another of said mouth to cause said strand to be alternately precupped longitudinally in opposite directions as said strand is drawn through said cupping die and twisted by said twisting head.

8. In a machine for twisting a flat strand made up of at least two ribbons into a thread, the combination of a twisting head, a cupping die having a tapering mouth leading into a substantially circular throat for longitudinally cupping said ribbons as they are drawn through said die, said die leading to said twisting head, a guide disposed at a point remote from the mouth of said die to maintain said ribbons in superimposed position, and means for oscillating said guide to present said superimposed ribbons alternately to one side and then another side of said mouth of said die to cause said superimposed ribbons to be alternately cupped longitudinally in opposite directions as said superimposed ribbons are drawn through said die to dispose one of said ribbons in the outer surface of said thread alternately with the disposition of the opposite ribbon into the surface of said thread.

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9. In a machine for twisting a flat strand into a thread, the combination of a twisting head, a cupping die having a curved mouth and a circular throat forming a buccinal passageway for longitudinally precupping said strand prior to twisting, a pivoted guide bar, a strand guide carried by said guide bar and disposed above said cupping die for holding said strand in substantially flat condition as it approaches the mouth of said cupping die, and means for swinging said guide bar in timed relationship with movement of said strand through said cupping die to periodically present said strand alternately to one side and then another of said mouth to cause said strand alternately to be precupped longitudinally in opposite directions as said strand is drawn through said cupping die and twisted by said twisting head.

10. In a machine for twisting a flat strand into a thread, the combination of a twisting head, a cupping die having a tapered mouth opening leading to an axially disposed throat for longitudinally cupping said strand as it is drawn through said die, said die leading to said twisting head, a strand guide through which said strand passes in flat condition to said cupping die, means for moving said strand guide to present said strand in substantially flat condition to the tapered mouth of said cupping die on opposite sides of the axis thereof to cause said strand to be alternately precupped longitudinally in opposite directions as said strand is drawn through said cupping die and twisted by said twisting head.

11. In a machine for twisting a flat strand into a thread, the combination of a twisting head, a forming die disposed above the twisting head, a cupping die disposed above the forming die for longitudinally precupping said strand as it is drawn through said cupping die, a strand guide for positioning said strand in essentially flat condition as it enters said cupping die, means for moving said strand guide with respect to said cupping die to cause said strand alternately to be precupped longitudinally in opposite directions as said strand is drawn through said cupping die, and means for drawing said strand continuously through said cupping die and said forming die.

12. In a machine for twisting a flat strand into a thread, the combination of claim 7 in which the axial length of said buccinal passageway is at least equal to the width of the strand to be twisted and the maximum diameter of said passageway at the mouth opening thereof is at least substantially equal to the width of said strand.

13. A cupping die in accordance with claim 12 in which the axial length of the passageway is equal to at least twice the width of the strand.

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