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METHOD OF AND MACHINE FOR MANUFACTURING PAPER CONES

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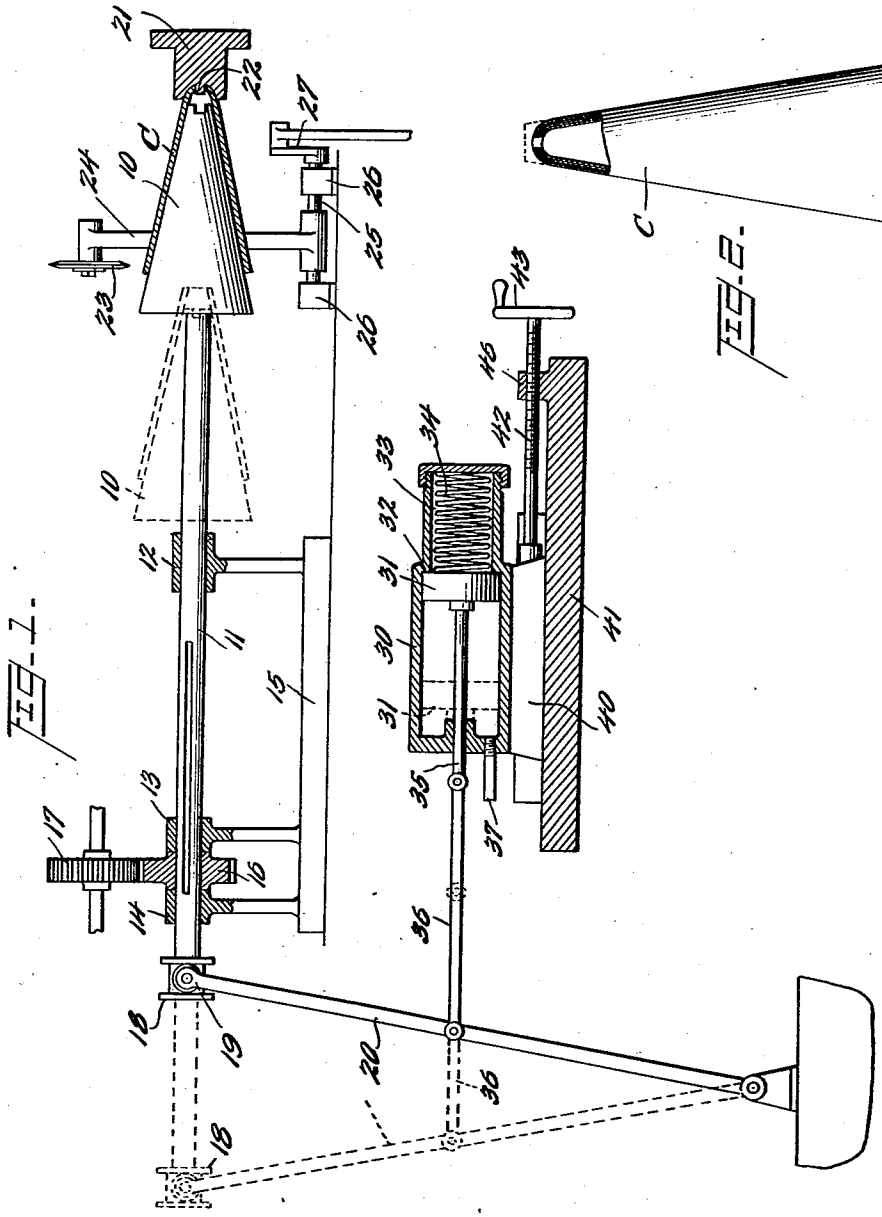


FIG. 1.

FIG. 2.

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METHOD OF AND MACHINE FOR MANUFACTURING PAPER CONES

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8 Claims. (Cl. 93—79)

The present invention relates to methods of and machines for manufacturing paper cones such, for instance, as are used in large numbers as cores for thread packages in the textile industry.

The well-known conical paper thread core is formed by a winding operation, a paper blank coated with a suitable adhesive being wound upon a mandrel so as to form a conical member, the wall of which is several plies in thickness. This method of cone manufacture and the machines employed in the practice of the method are well-known in the industry. After the winding of the cone has been completed and while the cone is still in moist condition and upon the forming mandrel, it is usually trimmed to length, a short section being removed from the point or small end of the cone and a short section from the base of the cone. After the trimming operation, the cone is removed and allowed to dry. After it is thoroughly dry, its point or small end is subjected to a polishing operation, which in the usual case effects a breaking down and inward deflection of the ends of the conical member, upsets and distorts the fibers so that the end of the cone is rounded, and imparts a high polish to this rounded surface so that the removal of thread from a thread package supported upon the cone, axially past the small end thereof, is not jeopardized by reason of roughness of the end which might result in catching and breakage of the thread.

It is highly desirable that all cones of a certain size used in any particular knitting or weaving establishment be of the same length, as otherwise the thread packages themselves would not be uniformly positioned upon their respective supporting cones. This desirable uniformity of cone length has not always been attainable in the past by the processes in use, in fact has only rarely been attained, largely because of unequal shrinkages of the cones while drying. It has been demonstrated and is well-known that paper which has been saturated with a sizing compound, such, for instance, as a starch paste, will shrink as the sizing dries. It is also known that, while to the superficial glance there seems to be little difference between one cone and another made on the same machine and trimmed in the same manner, yet there are sufficient differences between the materials of the individual cones of any definite series made on a single machine to cause them to have somewhat different lengths after each has shrunk to its final dimensions. To the textile machine operator these slight variations in length are objectionable.

In acordance with the present invention, a novel method and apparatus for trimming cones to length is provided. The invention also contemplates a method in which the point of the cone is given the desired rounded contour and polish, this last mentioned operation occurring about or after the instant of trimming so that the two operations can be performed at the same cost as either operation performed separately. In practicing the method, a fully wound and dried cone is first placed upon a correspondingly shaped mandrel with the end of the cone projecting beyond the end of the mandrel, the small end of the cone having previously been trimmed but no trimming operation having been performed upon its larger end. This projecting end of the cone is then brought into contact with a polishing die, spaced axially of the mandrel, either by a movement of the mandrel relatively to the die, a movement of the die relatively to the mandrel, or by moving both of these elements. The mechanism which is called into operation to effect this relative movement of the mandrel and die is so constructed and adjusted that the cone is thrust against the surface of the mandrel with a relatively great force so that the inner surface of the cone and the outer surface of the mandrel are caused to contact closely. This is a highly important feature of the invention, as will be appreciated by one skilled in the art, since the cones in drying very often depart from their true conical forms and become non-circular in cross-section.

As the cones are relatively strong mechanically when dried, a very considerable force is required in certain instances to cause each to conform exactly to the shape of the mandrel. While thus tightly pressed on the mandrel, the cone is trimmed at its large or base end very accurately along a predetermined line of severance, and at the same time the small end or nose is given the desired polishing operation. To effect these simultaneous operations I preferably rotate the mandrel relatively to the polishing die and relatively to a reciprocatory trimming knife which may be advanced to press against the surface of the mandrel as it rotates and to thereby trim the end. It will be apparent, however, that the mandrel might be maintained stationary and the polishing die and trimming knife rotated around the axis thereof.

Various types of machines may be employed for effecting the desired simultaneous polishing and trimming operations, of which one satisfac-

tory form is illustrated in the accompanying drawing by way of example.

In the drawing:

Figure 1 is a rather diagrammatic side view, partially in elevation and partially in section, of an apparatus of the type described; and

Figure 2 illustrates in side elevation, partially broken away, one of the completed cones, the shape of the small end of the cone prior to the polishing operation being indicated by the dotted lines.

The conical mandrel is indicated at 10 in the drawing, and this mandrel is shown to be rigidly mounted upon the end of a shaft 11 rotatably supported in bearings 12, 13, and 14 which may be conveniently mounted upon pedestals springing from a suitable base plate 15. Shaft 11 is likewise axially movable in the bearings 12, 13, and 14 so that the mandrel may be moved from the position in which it is shown in full lines in the drawing to the position indicated by dotted lines. Splined upon shaft 11 is a gear 16 interposed between bearings 13 and 14 so as to be held against movement longitudinally of the base 15 while at the same time always retaining a driving connection with the shaft. For rotating the gear 16 a second gear 17 is provided, and this second gear may be operated in turn by any type of driving mechanism desired.

To the opposite end of shaft 11 is secured a member 18 having an annular groove within which are positioned the spaced terminal portions 19 of a rocking lever 20 bifurcated at its upper end and pivoted at its lower end so as to rock about a fixed axis. By means of mechanism now to be described the shaft 11 may be reciprocated by a force applied to lever 20 so that the mandrel may be moved to its dotted line position for the purpose of removing one conical member therefrom and substituting another to be pointed and trimmed, and may thereafter be moved to its full-line or right-hand position with the forward or pointed end of the cone (which is indicated at C) within a recess formed in the stationary die or chuck 21. These dies or chucks, such as indicated at 21, are well-known in the art and need not be specifically described other than to say that the hollowed out portion or cone end receiving recess formed therein is generally semi-circular in axial section, having a small spindle-like member 22 disposed centrally therein. The die or chuck 21 may be either stationary or rotatable as desired. A circular revolving trimming blade or knife is indicated at 23, this blade being rotatably mounted upon the upper end of an arm 24, the lower end of which is fixed on a rock shaft 25 supported in bearing members 26. Also fixed on shaft 25 is the end of an operating lever 27 by means of which the shaft, and hence the arm 24, may be rocked so as to bring the edge of the cutting knife 23 down toward and into contact with the surface of the mandrel when desired.

Means for rocking the lever 20 may conveniently be of the type shown in the drawings, comprising a cylinder 30 having a piston 31 slidably supported therein and movable from the dotted line position at the extreme left-hand end of the cylinder to the position in which it is shown in full lines, in which position it snugly abuts an internal annular shoulder 32 which forms a portion of the cylinder. A hollow extension 33 of the cylinder wall houses a spring 34 which normally urges the piston 31 toward its dotted line position. The piston is provided with a piston rod 35 extending through the end wall of the cylinder to the outside, the free end of this rod being connected by means of a link 36 to the rocking lever 20 at a mid-point thereof. A fluid pressure line is indicated at 37, and through this line a fluid under pressure, such as compressed air or a liquid under pressure, may be introduced into cylinder 30 on the left-hand side of piston 31 so that piston 31 is forced to the right, against the action of spring 34, until it strikes the annular limiting shoulder or stop 32. Release of the pressure of the operating fluid enables spring 34 to become active to force the piston to the opposite end of the cylinder.

Cylinder 30 is mounted upon a base 40 which is slidably supported upon a stationary base 41. By means of a threaded adjusting member 42 provided with a handle 43, the position of slide 40 on base 41 can be changed or adjusted as desired, member 42 having threaded engagement with the cylindrical wall of an aperture formed in pedestal 46 integral with base 41 and its opposite end being connected to slide 40 by means permitting relative rotation of these elements. By adjusting the slide 40 on base 41, the maximum travel of mandrel 10 toward die 21 can be regulated, the right-hand position of the mandrel being determined by the position of the annular shoulder 32 of the cylinder 30 which comprises the only stop for limiting the movement of piston 31.

In the operation of the apparatus the mandrel is first permitted to move until it occupies the dotted line position shown. Over this mandrel is then placed a cone which is completely dry and has the same shape as the mandrel, the blunt small end or point of this cone projecting beyond the end of the mandrel as also indicated by dotted lines. Fluid pressure is then admitted to the cylinder through the conduit 37, whereupon the piston 31 moves to the right against the action of spring 34, this movement continuing until the projecting forward end of the cone has been pressed into the recess formed in die 21. The movement of the mandrel 10 and the upsetting or inward deflection of the walls of the point or small end portion of the paper cone are halted by contact of piston 31 on shoulder 32. The position of the cylinder 30 is so adjusted, however, that the movement of the mandrel 10 toward die 21 is not halted until the point of the cone is thrust against the die with a relatively great force so that complete contact of the inner surface of the cone and the outer surface of mandrel 10 is assured, notwithstanding the fact that the relatively hard and rigid cone may have been somewhat "out of round" in horizontal section prior to the application of this force. Shaft 11 and mandrel 10 are then rapidly rotated by the driving mechanism described, during which rotation the small end or point of the cone is given a high polish. During or immediately after the polishing operation, the trimming knife 23 is moved downwardly toward the mandrel by the manipulation of lever 27 and a small portion trimmed from the base of the cone. As the cone itself is quite dry, the cut made by the knife 23 is very clean and sharp, and by reason of the fact that no further shrinkage will occur, the lower edge of the cone will thereafter always remain smooth.

It will be obvious that in passing a series of cones through the operations just mentioned there is no chance that the product will vary in length inasmuch as piston 31 is always moved

until it contacts with stop 32, thus always bringing the mandrel 10 to a certain definite position with relation to the trimming knife 23 and to a certain definite position relatively to the polishing die 21. After the point of the cone has been polished and its large end trimmed, fluid pressure in the cylinder 30 is decreased and piston 31 is moved to the left by a spring 34, thus moving mandrel 10 to its dotted line position so that the removal of the completed cone and substitution therefor of an incomplete cone is facilitated.

It will be readily seen that the operation may be conveniently and rapidly carried out and that by the use of the foregoing mechanism a series of finished cones of the exact length desired may be inexpensively produced, as the cone has been completely dried prior to the trimming operation and its length is not changed thereafter by any natural shrinkage such as occurs when the drying operation actually takes place immediately after its original fabrication.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:—

1. The method of manufacturing paper cones which includes the steps of forming the cone, drying the same, placing the cone upon a conical mandrel, applying to the cone an axially directed force of sufficient magnitude to establish a tight fit of the cone on the mandrel, and trimming the base of the cone while the application of said force is maintained.

2. The method of manufacturing paper cones which includes the steps of forming the cone, drying the same, placing the cone upon a conical mandrel, applying to the cone an axially directed force of sufficient magnitude to establish a tight fit of the cone on the mandrel, revolving the mandrel and cone, and trimming the base of the cone while the mandrel is revolving and the application of said force is maintained.

3. The method of manufacturing paper cones which includes the steps of forming the cone, drying the same, placing the cone upon a conical mandrel, applying to the point of the cone an axially directed force of sufficient magnitude to establish a tight fit of the cone on the mandrel, and trimming the base of the cone while the application of said force to the point of the cone is maintained.

4. The method of manufacturing paper cones which includes the steps of forming the cone, drying the same, placing the cone upon a conical mandrel with the point thereof projecting beyond the end of the mandrel, pressing against the point of the cone a polishing die with axially directed force of sufficient magnitude to establish a tight fit of the cone on the mandrel, effecting relative rotation of the mandrel and die whereby the point of the cone is polished, and trimming the base of the cone while the application of said force is maintained.

5. The method of manufacturing paper cones which includes the steps of forming the cone, placing the same when dry upon a conical mandrel with the point thereof projecting beyond the end of the mandrel, forcing a polishing die against the projecting end of the cone with relatively great pressure, effecting relative rotation of the mandrel and die, and trimming the base of the cone while said pressure is maintained.

6. The method of manufacturing paper cones which includes the steps of forming the cone, placing the same when dry upon a conical mandrel with the point thereof projecting beyond the end of the mandrel, forcing a polishing die against the projecting end of the cone with relatively great pressure, rotating the mandrel to effect polishing of the point of the cone, and trimming the base of the cone during the rotation thereof and while said pressure is maintained.

7. Apparatus of the type described comprising, in combination, an axially reciprocable conical cone holding mandrel, a polishing die positioned on the axis of said mandrel extended, means for effecting relative rotation of said die and mandrel, means for moving the mandrel toward the die, holding the same in advanced position in fixed spaced relationship to the die during a cone polishing operation, and thereafter retracting the same, and a trimming knife for trimming the base of the cone while the mandrel is in advanced position.

8. Apparatus of the type described comprising, in combination, a cone holding mandrel, means for applying heavy pressure to the point of a cone mounted on said mandrel to force the cone tightly against the mandrel, and means for trimming the base of such cone when said first mentioned means is active.

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