

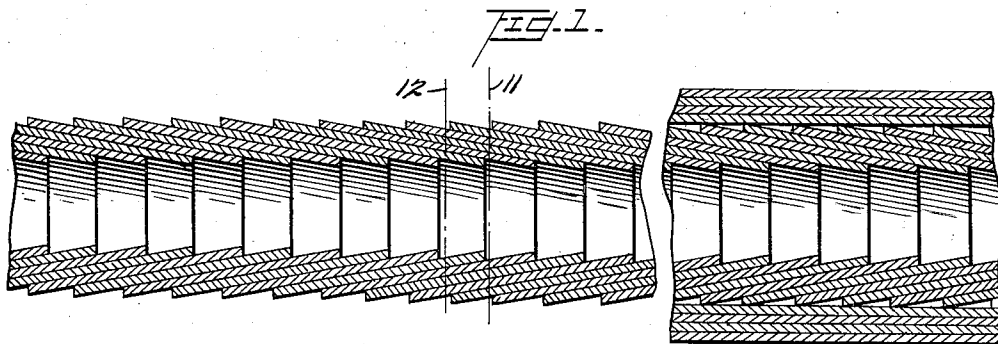
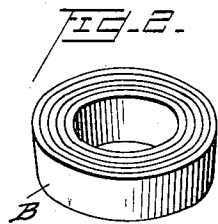
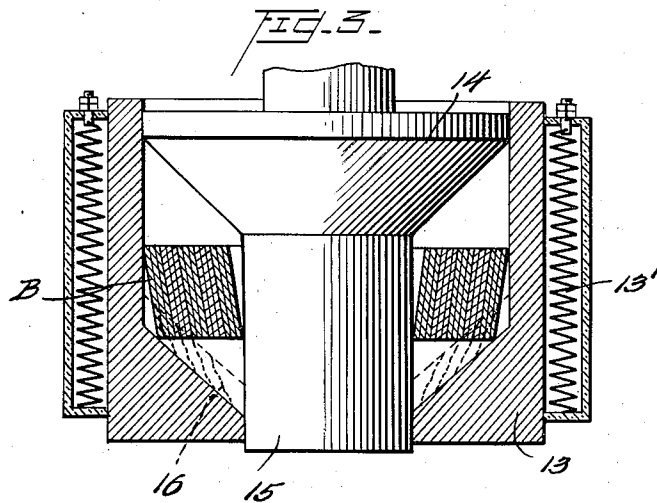
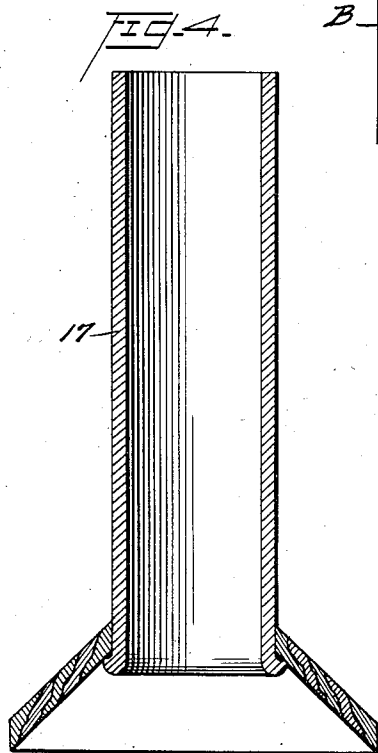
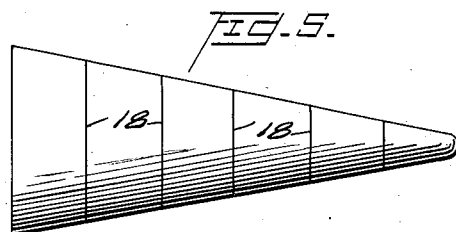
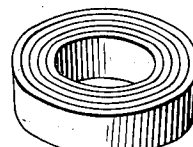
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COMPRESSED PAPER ARTICLES AND METHOD OF MAKING THE SAME

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COMPRESSED PAPER ARTICLES AND
METHOD OF MAKING THE SAMECharles K. Dunlap, Hartsville, S. C., assignor to
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5 Claims. (Cl. 18—59)

The present invention relates to compressed paper articles and to methods of and apparatus for making the same.

In accordance with the invention, articles fabricated of highly compressed paper and which are durable, inexpensive, and pleasing in appearance may be easily and rapidly produced. Such articles may have various shapes and may be put to many different uses, but I have particularly in mind the provision of compressed paper articles which may be usefully employed in the textile industry, such, for instance, as the bases of bobbins, spindles, and the like, although the invention is by no means limited in this respect. By way of example, however, the invention will be disclosed as embodied in the process of and apparatus for manufacturing a frustro-conical bobbin base, this product being typical of many which might be produced. The full and complete process involved in the manufacture of such an article includes a number of steps which may be briefly outlined as follows:

First, a grade of soft compressible paper is produced upon any well-known machine by means of which paper may be made from pulp, the pulp in question being preferably wood pulp and the fibers of the wood arranging themselves, by reason of the nature of the manufacturing operation, in planes parallel to the surfaces of the paper. The paper is next cut into blanks and the blanks formed into cones upon suitable mandrels and by well-known methods, each cone comprising several thicknesses of paper, the convolutions of which are secured together by any suitable adhesive. Next, in accordance with the preferred method, a suitable number of these cones are nested or formed into an elongated column. If desired, a suitable adhesive may be utilized to secure the cones of the column together so that they form one integral structure.

When such a column has been constructed, it is severed into disc-like members by cutting the same transversely along parallel and adjacent planes. Each blank so formed is then submitted to heavy pressure in the direction of its axis and preferably by dies having conical working faces. Each of the truncated conical paper tubes, therefore, which makes up the blank is shortened and heavily compressed, the meeting surfaces of the several tubes being forced into very intimate contact, and a unitary structure results which is of conical shape and well suited for use as the base of a bobbin. The column, or the individual blanks cut therefrom, may be impregnated prior to the compressing operation with a shellac or a

solution such as bakelite, or with paraffin, so that the resulting frustro-conical member produced has a hard body and smooth surface, the substance so employed preferably being such as to bind the several paper tubes together and to also hold the paper fibers in their distorted condition so that moisture or other influences may have no effect tending to cause them to return to their original shapes so as to result in distortion of the article so manufactured.

In the drawing:

Figure 1 is a longitudinal section through a column formed of nested cones;

Figure 2 is a perspective view of one of the blanks cut from the column;

Figure 3 is an axial section through a press for exerting great pressure axially upon blanks of the type shown in Figure 2;

Figure 4 is an axial section through a bobbin, the base of which is formed in accordance with the improved process;

Figure 5 illustrates in side elevation a cone divided into a number of sections by transverse kerfs;

Figure 6 shows the blank formed of the several sections of the cone shown in Figure 5; and

Figure 7 is a section through a column of cones about which a wrapping of paper has been placed to increase the diameter.

Each cone of the column shown in Figure 1 is of relatively soft wood pulp paper such as may be made in a continuous manner upon a Fourdrinier or equivalent machine. The manner of making this paper is well-known and will not be particularly described, it being only necessary to say here that the paper which is utilized in the manufacture of the cones is of the relatively porous uncompressed type and may be subjected to further compression whereby its volume is greatly reduced. The paper once formed is cut into suitable blanks and, by means of mandrels well-known in the art, is wound into conical form, a suitable adhesive being applied to the surfaces of the paper to insure the several convolutions of the cone rigidly adhering together after the winding operation has been completed. A plurality of cones of this type are then nested as shown in Figure 1, the column of cones thus formed being made of any desired or convenient length. In the formation of the column, an adhesive may be employed, if desired, to cause the several cones to adhere to one another. It will be seen from Figure 1 that the several cones of which the column is formed are truncated, so

that the column has an axial cylindrical aperture extending from end to end thereof.

After completion of this elongated member or column, it is severed into a plurality of discs by cutting the same along spaced transverse planes, for instance, as indicated at 11 and 12 in Figure 1. One of the resulting discs is shown in perspective in Figure 2, and it will be apparent from this figure, and also from Figure 1, that each disc so formed will comprise a plurality of short tubes nested together, the annular end surfaces of these tubular members being located in parallel planes, respectively. If the blank thus formed has not been previously impregnated with paraffin, varnish, bakelite, or the like, it may be given an impregnation with a desired liquid substance after being severed from the column and, after drying, may be placed in a press such as shown in Figure 3. This press has a die portion 13 and a plunger 14, the working surfaces of the die and plunger being frustro-conical as shown and the plunger also having an axially extending cylindrical portion 15 which passes through a correspondingly formed aperture in the base of the die.

One of the blanks, which will be designated B, is shown in Figure 3, the annular lower outer edge of this blank resting upon the conical surface of the die. The cylindrical portion 15 of the plunger extends through the central aperture in the blank, as shown. By the application of heavy pressure to the plunger 14, the blank B may be transformed in shape and size so that it is reduced to frustro-conical form and its thickness greatly decreased. Thus, it may be compressed by the action of the plunger until it occupies the shaded area 16, Figure 3. Pressures up to six thousand pounds per square inch may be placed by the mechanism just described upon the paper blank, and, in addition to the heavy pressures employed, the blank is also preferably heated to a temperature of approximately 350° F. during the time that the pressure is being applied. Any suitable means may be employed for imparting this heat to the blank, as, for instance, an annular electrical heater, such as indicated at 13.

Any impregnating substance which may be present in the pores and interstices of the paper blank prior to insertion of the die is, by virtue of the pressing operation, thoroughly and evenly distributed throughout the fibers of the paper. If a bakelite solution is used, the resulting article is then relatively dense and has smooth hard exterior and interior surfaces. If paraffin is employed, a comparatively dense and heavy article results which has a very considerable mechanical strength but which is not so hard and resistant to wear as in the case where the impregnating solution is bakelite. Various varnishes may be employed or any other solid or liquid substance which may serve to bind the various tubes of the blank together and the various fibers of the paper.

If no impregnating substance whatever is employed, it is nevertheless found that the resulting article is comparatively smooth and hard, the adhesive originally employed in the manufacture of the cone, which is generally a starchy adhesive, apparently flowing under the action of heat and pressure to all parts of the blank and also providing a smooth coating for the outside surfaces.

Upon completion of the pressing operation and after the finished article has cooled, a paper tube such as indicated at 17 may be inserted

through the central aperture thereof, the paper tube having the same external diameter as the axial extension 15 of plunger 14. A suitable adhesive may be employed to secure the tube to the base. The resulting spindle is light in weight, durable, and inexpensive.

The process may be carried out by severing individual cones, as, for instance, along the lines 18 (Figure 5) and nesting the resulting sections, as shown in Figure 6. The impregnating, heating, and compressing operations may then be carried out as before. The pressing operation does not result in disruption of the individual short tubes of the blanks, which maintain their respective identities in the completed article although changed in length and taper, as shown in Figure 4.

The process above outlined is particularly useful in the formation of articles of manufacture from paper cones which have been rejected because of manufacturing defects or have been discarded after use. Many thousands of such cones are available weekly, and a profitable method of utilizing them has been long sought. When used or discarded cones are made use of, it is necessary, as a step preliminary to forming a nested column such as shown in Figure 1, to cut the small ends or tips from the cones so that the resulting column will have the necessary central aperture, and the blanks cut therefrom will be axially apertured so as to receive the plunger extension 15.

The improved process may be utilized in the manufacture of spool heads, end plugs for paper rolls, and many other articles.

While it is preferred that the method shall be utilized in the fabrication of waste textile cones into useful articles of compressed paper, the invention is not so limited. Thus a series of cylindrical tubes may be nested, if desired, and sections for subsequent compression cut from the same. Furthermore, for the purpose of providing a blank of any desired diameter, a column of cones may be provided with a tubular envelope or a tubular wrapping (see Figures 1 and 7) in order that the diameter of the blank may be increased. When a blank of the character shown in Figure 7 is compressed, the paper cylinders and truncated cones are all mashed together to form one integral mass, possessing great mechanical strength and toughness. When such a blank is impregnated with a bakelite or other such solution prior to compression, the resulting article is not only strong but quite hard. It is not necessary to impregnate the blank before compression, however, as it has been found that, for many uses, impregnation after compression is possible. Where the articles are impregnated after compression, however, they are not so hard as when the blank is impregnated before compression, although rendered thoroughly waterproof.

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

1. The method of forming unitary conical articles of compressed paper which comprises arranging a series of generally cylindrical paper laminations of different diameters substantially concentrically about a common axis to form a blank and subjecting the blank, together with a binding substance, to heavy pressure by means of conical dies having substantially parallel pressure surfaces and which are moved toward each other along the axis of the blank, each lamination being converted by such pressure into ap-

proximately frusto-conical form and being caused to laterally interlock with adjacent laminations.

2. The method of forming unitary conical articles of compressed paper which comprises arranging a series of generally cylindrical paper laminations of different diameters substantially concentrically about a common axis to form a blank and subjecting the blank, together with a binding substance, to heavy pressure by means of conical dies having substantially parallel pressure surfaces and which are moved toward each other axially of the blank in producing such pressure, each lamination being converted by such pressure into substantially frusto-conical form with its opposed edge surfaces lying respectively in the opposed conical surfaces of the finished article.

3. The method of forming a unitary conical article of compressed paper which comprises arranging a series of generally cylindrical paper laminations of different diameters but substantially identical heights concentrically about a common axis to form a flat blank having parallel faces and subjecting the blank, together with a binding substance, to heavy pressure by means of conical dies having substantially parallel pressure surfaces and which are moved toward each other axially of the blank in producing such pressure, each lamination being converted by such pressure into approximately frusto-conical form and being caused to laterally interlock with adjacent laminations.

4. The method of forming a unitary frusto-conical article of compressed paper having a cy-

lindrical axial aperture which comprises arranging a series of generally cylindrical paper laminations of different diameters concentrically about a common axis to form an annular blank and subjecting the blank, together with a binding substance, to heavy pressure by means of frusto-conical dies having substantially parallel pressure surfaces and which are moved toward each other axially of the blank in producing such pressure, a cylinder coaxial with the dies being maintained within the central opening of the blank during the application of pressure by the dies to constrain the innermost paper lamination against inward movement, each lamination being distorted by such pressure into approximately frusto-conical form and being caused to laterally interlock with adjacent laminations.

5. The method of forming a unitary conical article of compressed paper which comprises arranging a series of generally cylindrical paper laminations of different diameters but substantially identical heights concentrically about a common axis to form a flat blank having parallel faces, and subjecting the blank, together with a binding substance, to heavy pressure by means of conical dies having substantially parallel pressure surfaces and which are moved toward each other axially of the blank in producing such pressure, the several laminations being moved axially relatively to each other by such pressure, converted into frusto-conical form, and caused to laterally interlock.

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