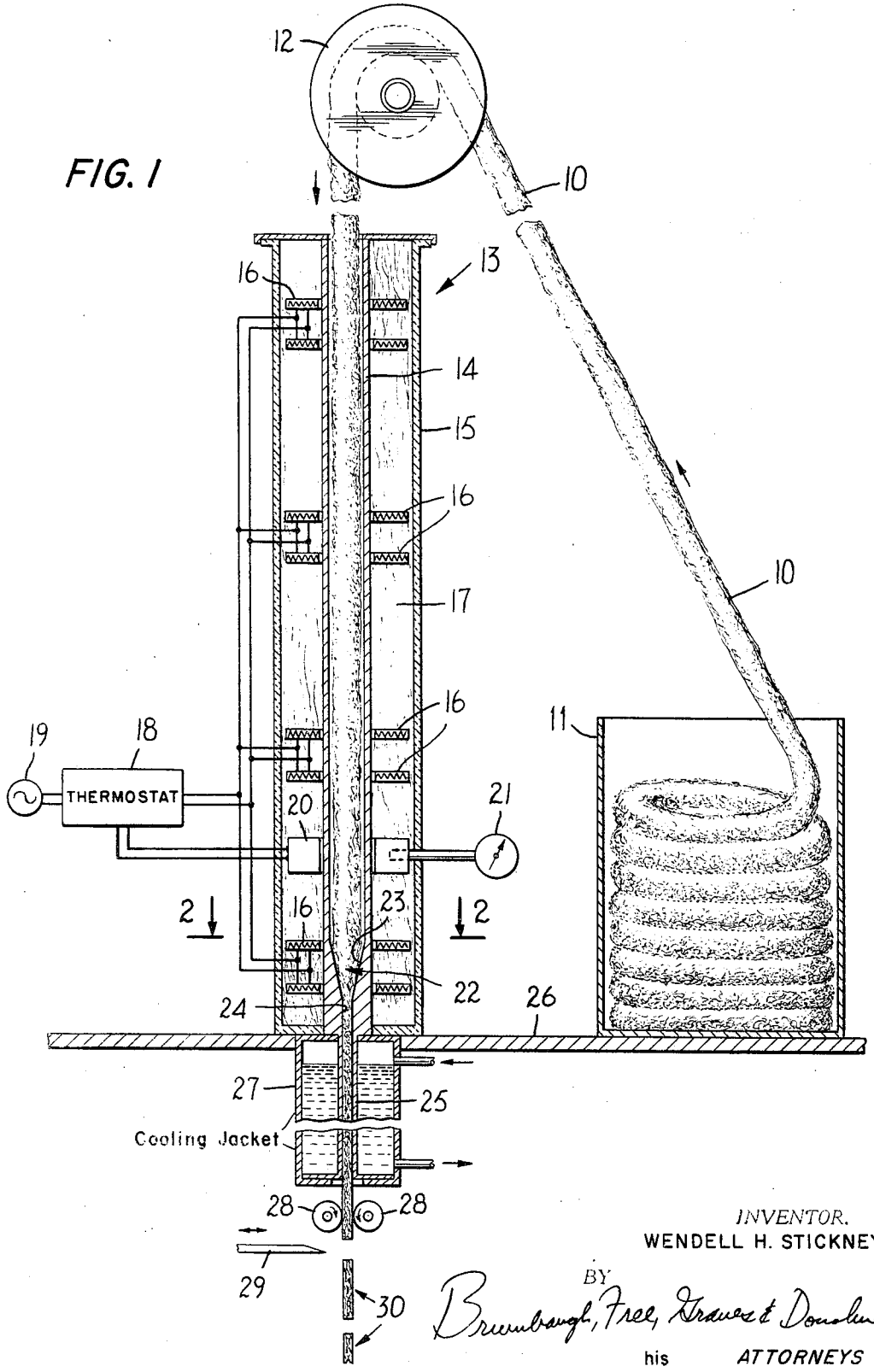
April 28, 1970 W. H. STICKNEY 3,509,014

QUASI-EXTRUDED FELT

Filed Aug. 24, 1966 2 Sheets-Sheet 1

FIG. 1



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QUASI-EXTRUDED FELT

Filed Aug. 24, 1966 2 Sheets-Sheet 2

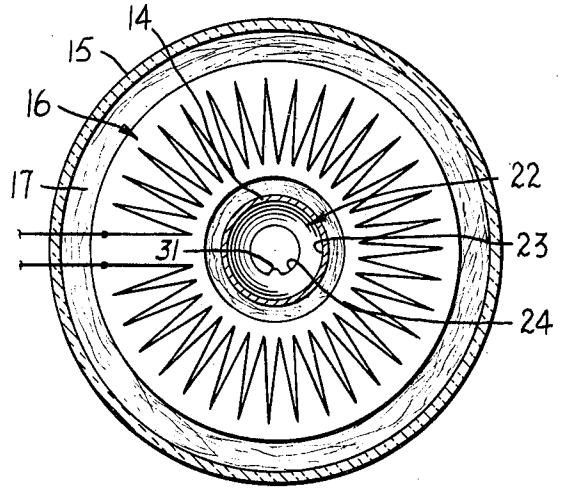


FIG. 2

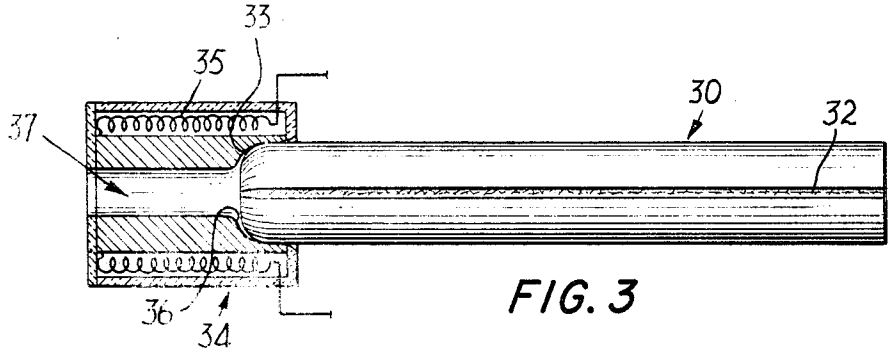


FIG. 3

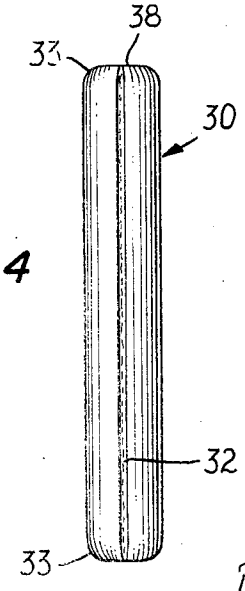


FIG. 4

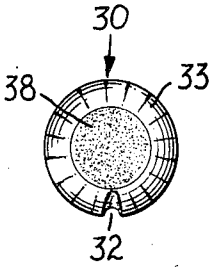


FIG. 5

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3,509,014

QUASI-EXTRUDED FELT

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Filed Aug. 24, 1966, Ser. No. 574,766
Int. Cl. D02g 3/22
U.S. Cl. 161—180 1 Claim

ABSTRACT OF THE DISCLOSURE

A felt article useful as a liquid reservoir consisting of a cylindrical fibrous member formed with a longitudinal groove along at least one side and having rounded end portions, between about one-fifth and about one-half of the fibrous material being binder fibers is disclosed. The fibrous member is heated so that the binder fibers near the outer surface of the article are bonded to the other fibers to a greater extent than are those in the interior of the article.

This invention relates to fiber-bonded felt-like materials. In order to produce elongated felt articles of this type of uniform cross-sectional shape, such as weather stripping, wicks for marking pens or the like, it has been customary to cut a length of felt from a sheet of felt material and then shape it by turning or by compression to the desired cross-sectional configuration. Moreover, short articles of identical cross-sectional shape such as felt washers have customarily been produced by stamping them out of sheet material. Such procedures are not only wasteful of material but also, because of the compression or working of the material, produce articles having non-uniform fiber distribution and, therefore, having lower liquid absorption or higher density than is desirable in many cases.

Heretofore, attempts have been made to produce felt articles of uniform cross-sectional shape by various operations on a continuous rope of material but all the previous attempts have been subject to serious disadvantages. It has been proposed, for example, to treat all of the fibers in a strip of continuous filamentary tow material with plasticizer, then form the plasticized strip into a rope and finally pass the rope into a shaping die while heating it with penetrating steam jets. Articles made in this manner, however, have a reduced absorption capacity and a nonuniform fiber distribution because the generally parallel fibers of the strip are easily packed together during passage through the die and also because groups of internal plasticized fibers adhere together to form solid lumps or slivers. In particular, the ink capacity of marking pen wicks produced in this manner is reduced to a relatively low value.

An object of the invention is to provide new and improved felt articles of uniform cross-sectional shape characterized by their low density and uniform internal fiber distribution.

An additional object of the invention is to provide a new and improved wick for marking pen reservoirs and the like having a substantially increased capacity.

These and other objects of the invention are attained by forming a roving containing some binder fibers which become adherent at an elevated temperature and other fibers which will not be rendered adherent at the temperature at which the binder fibers become adherent. As used herein, the term "roving" means any continuous length of staple fibrous material. The roving is drawn through a heated die having the desired cross-sectional configuration of the article, the die temperature being high enough to render the binder fibers adherent, and then through a cooler die portion having the same configuration. Preferably, the proportion of binder fibers in

the roving is within the range from about one-fifth to about one-half and, in a particular embodiment used to prepare marking pen wicks, the binder fiber comprised 30 to 40% of the roving. A preferred binder fiber material is plasticized cellulose acetate.

To form a marking pen wick, the die is of generally circular configuration with a longitudinal inward projection so that the continuously formed wick has a groove extending along its outer surface to provide an air vent. Furthermore, the ends of the improved wick of the present invention are rounded by heating them for a short time in another die member which does not engage the central portion of the wick.

Further objects and advantages of the invention will be apparent from a reading of the following description in conjunction with the accompanying drawings in which:

FIG. 1 is a view in elevation, partly schematic, illustrating a representative embodiment of the method for making felt materials according to the invention;

FIG. 2 is an enlarged cross-sectional view taken on line 2—2 of FIG. 1 and looking in the direction of the arrows;

FIG. 3 is a cross-sectional view illustrating a further step in the manufacturing of felt marking pen wicks according to the invention;

FIG. 4 is a side view of a marking pen wick made in accordance with the invention; and

FIG. 5 is an end view of the wick shown in FIG. 4.

In the representative method of making felt materials according to the invention which is illustrated in FIG. 1, a rope **10** of a fiber which has been prepared in roving form as, for example, on a conventional carding machine without a Peralta roll, is conveyed from a supply barrel **11** up over a feed capstan **12** and down into a vertically oriented heating tube **13**. The roving **10** consists of a mixture of synthetic binder fibers, such as cellulose acetate to which a plasticizer has been added, which becomes adherent when heated to a temperature in the range from 200° to 400° F., for example, and other fibers, either natural or synthetic, which do not become adherent at that temperature.

One preferred type of binder fiber is Estron Plasticized Acetate Staple I, manufactured by Eastman Chemical Products, Incorporated, although other binder fibers having similar properties may be used. For example, the synthetic fiber known as Vinyon No. 997 may be used. Preferably, the proportion of binder fibers is in the range from about one-fifth to one-half, but larger or smaller proportions of binder fiber may be used depending upon the nature and intended characteristics of the felt material being made. The remaining fibers of the roving may be of any synthetic or natural material otherwise suitable for the felt article being made, such as unplasticized acetate, wool, cotton, or polyester for example, and all of the fibers may be of various conventional staple lengths. Uniformity of the blend in the roving assures good quality of the finished product.

The heating tube **13** comprises an inner tube member **14** having a diameter somewhat larger than the thickness of the roving, for example, 2 inches, a co-axial outer tube member **15** of larger diameter, and four pairs of ring-shaped electrical heating elements **16**, best seen in FIG. 2, which are embedded in a fiberglass insulating layer **17** confined between the two members **13** and **14**. The heating tube is long enough to assure heating of at least the outer portion of the roving to a temperature sufficient to render the binder fibers therein adherent and may, for example, be about three feet long.

Each of the heating elements **16** is connected through a thermostat **18** to an electrical power source **19**, the thermostat being responsive to a temperature sensitive element **20** located adjacent to the inner tube member **14** near the lower end of the heating tube. In addition, a thermom-

eter 21 is mounted at the same location to provide a visual indication of the internal temperature of the tube. The thermostat 18 is arranged to maintain the temperature of the tube, as indicated by the thermometer 21, high enough to assure softening of the binder fibers at the surface of the roving 10 and, in general, the indicated temperatures at the thermometer 21 will be, for example, about 100° F. higher than the temperature of the roving.

Immediately below the thermometer 21 and within the lowest pair of heating rings 16, a die member 22 has a generally conical converging opening 23 leading downwardly to a central passageway 24 having the desired cross-sectional configuration of the felt article being formed. Usually, the felt material will expand slightly after being formed in the die 22, the extent of expansion being dependent upon the materials used and the degree of compression of the roving by the die and, for this reason, the die passageway 24 should be slightly smaller than the desired cross-section of the finished article. Typically, the amount of expansion may be about five percent.

In order to assure that the felt article being formed will maintain the desired cross-sectional shape, the die 22 includes a cooling portion 25 having the same internal configuration as the passageway 24 and extending downwardly from the bottom end of the heating tube 13, which rests on a table 26. Preferably, to assure rapid setting of the binder fibers, a cooling jacket 27 is provided about the cooling portion 25 and cold water is circulated therethrough. As the formed felt material passes through the cooled die extension 25, it is held in the desired shape until the binder fibers become firm.

After leaving the die, the formed elongated felt material passes between two drive rolls 28 which serve to draw the material through the apparatus at a controlled rate, which may be several feet per minute, depending upon the characteristics of the material and the temperature of the tube 13 and other factors. Thereafter, a cutting blade 29 severs the formed continuous felt material into separate articles 30 having the desired length.

Alternatively, where it is not necessary to maintain precise external dimensions, the cooling portion 25 of the die may be omitted, the article being held in shape during cooling by the tension applied by the drive rolls 28.

Because the heating of the roving 10 within the die 22 is generally confined to the outer surface of the roving, few, if any, of the interior binder fibers are softened sufficiently to become adherent and, consequently, the fibers are uniformly distributed throughout the interior of the finished article in substantially non-adherent relation, i.e., without any hard lumps or slivers. The depth of the hardened outer layer may be controlled by regulating the rate of motion of the roving through the die in conjunction with the die temperature and the plasticization of the binder fibers so that the appropriate rate of heat transfer to produce binder fiber softening at the desired depth is obtained. Furthermore, because many of the fibers of the roving 10 are distributed in orientations transverse to the length of the roving, instead of extending generally parallel to its length as is the case with tow fibers, for example, the spacing of the fibers in the interior of the finished article according to the invention is considerably more uniform than can be accomplished otherwise.

In accordance with another aspect of the invention, the method described above is used to prepare felt marking pen ink reservoirs of novel and advantageous configuration. For this purpose, as shown in FIG. 2, the die 22 is provided with an internal passageway 24 having an inwardly projecting ridge 31 extending longitudinally along one side of the passageway. As shown in FIGS. 3, 4 and 5, this ridge produces a longitudinally extending groove molded in the outer surfaces of the finished wick having a depth equal to about one-tenth of the diameter of the wick. This groove 32 serves as an escape passageway for air as the reservoir containing the wick is filled with ink, thereby permitting more rapid filling and assuring complete filling. In the absence of this air escape passageway, air must pass between the fibers of the wick so as to impede filling of the reservoir and some air is likely to be trapped at the inner end of the reservoir as it is filled.

Furthermore, to facilitate insertion of the wick into a reservoir having the same diameter or even a slightly smaller diameter than the wick, the ends 33 of the wick are rounded about their outer periphery by inserting them into a die 34 having an electrical heating coil 35 and an internal cavity formed with a rounded outer portion 36 and an open inner portion 37. The end of the wick is held against the rounded portion 35 just long enough to soften the plasticized fibers sufficiently to make them conform to the rounded shape. In this way, the rounded ends 33 are provided without heating the fibers in the central portion 38 of the wick sufficiently to soften them which would tend to seal the end of the wick, the open central portion 38 having a diameter equal to about half to three quarters that of the wick. Consequently, the flow of ink from the internal fibers in the end portion to the writing nib which engages that portion will not be impeded. Also, with wicks having these rounded ends, automatic loading of reservoirs with wicks is feasible.

Furthermore, by using a roving containing a mixture of binder fibers with non-softening fibers, the wick 30 of the present invention is made so that the internal fibers are more uniformly spaced and generally are not adhered together. Because of the larger proportion of passages of the proper capillary dimension, the wick has a greater ink capacity than other wicks but, at the same time, occupies substantially all of the reservoir volume.

In a particular example according to the invention, a roving consisting of about 60 to 70 percent 3.0 denier non-textile acetate and about 30 to 40 percent Estron Plasticized Acetate Staple I and having a weight of about 30 grams per yard was made by passing the fibers twice through a fiber opening and blending machine and then carding them on a conventional card without a Peralta roll. This roving was drawn through a forming apparatus of the type shown in FIGS. 1 and 2, at a rate of about three feet per minute with the thermometer 21 indicating about 375° F. The internal diameter of the heating tube 13 was two inches and the diameter of the passageway 24 was 0.562 inch. Cooling water at 35° F. was circulated through the cooling jacket 37 at a rate of one-half gallon per minute. The continuous wick produced by this method had a diameter of 0.591 inch and weighed 22 grams per yard, the roving having been elongated about 15 percent in the drawing process.

Although the invention has been described herein with reference to specific embodiments, many modifications and variations therein will readily occur to those skilled in the art. For example, rather than being generally round, the felt material prepared according to the invention may have an irregular cross-sectional configuration, such as an L-shape. Moreover, articles with central apertures such as washers may be formed by supporting an appropriate elongated hole-forming member centrally within the passageway 24 of the heated die. Accordingly, all such variations and modifications are included within the intended scope of the invention as defined by the following claim.

I claim:

1. A felt article adapted for use as a liquid reservoir within a holder comprising an alongated generally circular cylindrical fibrous member formed with a longitudinal groove along at least one side and having rounded end portions, between about one-fifth and about one-half of the fibrous material in the member being binder fibers adapted to become adherent at a selected elevated temperature and the remainder being other fibers which do not become adherent at the selected elevated temperature, a substantial proportion of the binder fibers about the periphery of the reservoir being adhered to other fibers

with which the binder fibers are in contact and substantially fewer of the binder fibers within the interior of the reservoir being adhered to other fibers with which the binder fibers are in contact.

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U.S. Cl. X.R.

161—150; 401—196