May 21, 1929. T. WENSEL 1,713,683

METHOD OF TREATING LONG GRAINED FIBROUS MATERIALS

Filed Nov. 28, 1927

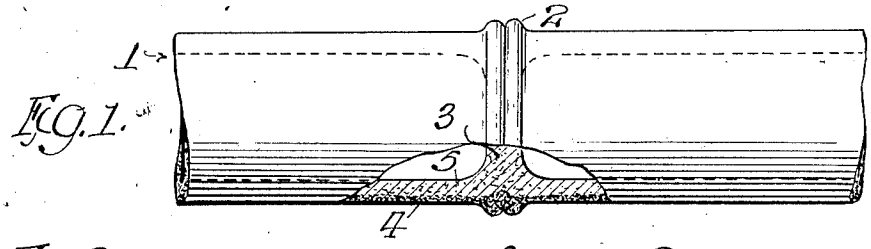


Fig. 1.

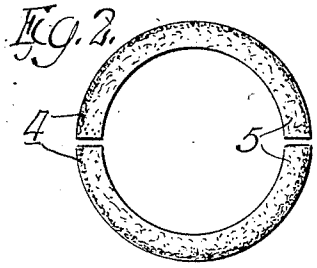


Fig. 2.



Fig. 3.

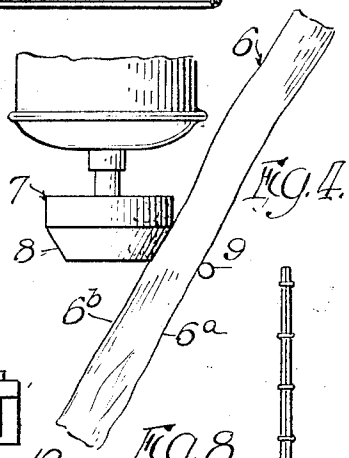
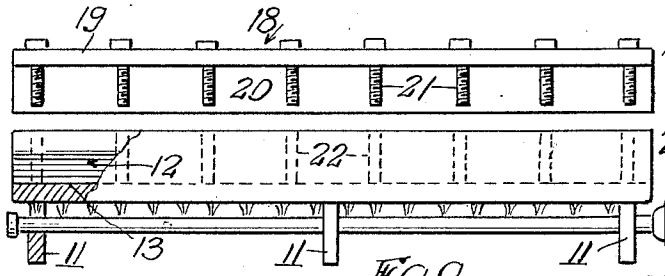


Fig. 4.

Fig. 5.



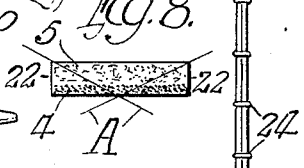


Fig. 8.

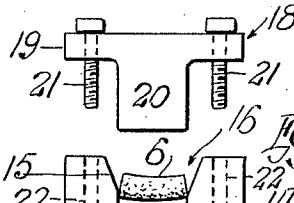


Fig. 6.



Fig. 9.

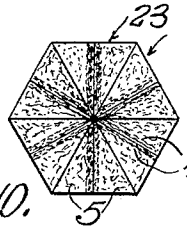


Fig. 10.

Fig. 15.

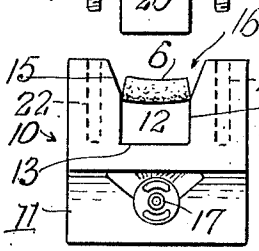


Fig. 12.



Fig. 13.

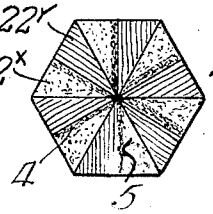


Fig. 14.

Fig. 11.

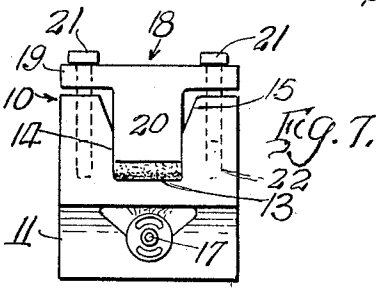


Fig. 7.

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by Arthur Pope Kellogg Atty.

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UNITED STATES PATENT OFFICE.

THEODOR WENSEL, OF CHICAGO, ILLINOIS.

METHOD OF TREATING LONG-GRAINED FIBROUS MATERIALS.

Application filed November 28, 1927. Serial No. 236,316.

This invention relates to improvements in methods of treating long grained fibrous materials and in the structures made therefrom and it consists of the matters hereinafter described and more particularly pointed out in the appended claims.

The primary object of the invention is to provide a novel method whereby certain woods, bamboo and cane and the like are reduced in bulk and made more dense so that their natural characteristics are changed to better adapt them for use in certain built up structures such as fishing rods, golf clubs and the like.

A further object of the invention is to provide a method for this purpose which includes the use of pressure or compression in the presence of heat whereby the natural resins of the materials treated are softened by the heat so that the air cells and voids therein may be collapsed under pressure and held in this condition by glomerated action of the resin to give the desired density and reduced bulk to the material treated.

A further object of the invention is to provide a built up shaft or rod structure made from material thus treated, which has the desired strength and flexibility but which will be of a minimum weight.

The above mentioned objects of the invention as well as others, together with the many advantages thereof will more fully appear as I proceed with my specification.

The improved method is especially adapted for use in treating certain long and substantially straight grained woods such as hickory and ash and for treating bamboo and cane and will be described more specifically with bamboo as the material treated, but this is to be considered as by way of illustration only and not by way of limitation because from the matters hereinafter following the treating of such woods and cane will become apparent.

In the drawings:

Fig. 1 is a view in elevation of a piece of bamboo with parts broken away to more clearly show the structure thereof.

Fig. 2 is an end view of the same on an enlarged scale as when split into halves.

Fig. 3 is an end view of a split strip after the halves shown in Fig. 2 have been further split up to produce the same.

Fig. 4 is a top plan view of means for paralleling the lateral edges of a split strip before it is placed in the certain dies for further operations.

Fig. 5 is a view in side elevation of a pair of coacting dies by which the split strips, one of which is shown in Fig. 3, are acted upon as will later appear.

Fig. 6 is an end view of the pair of dies shown in Fig. 5 when in position to receive the split strip of Fig. 3.

Fig. 7 is a view similar to Fig. 6 with the parts in a changed relation from that shown in Fig. 6.

Fig. 8 is a view in end elevation of the strip on an enlarged scale after it has been compressed and straightened in the dies and illustrates the method of producing a segmental or wedge shaped strip part, two of which are later used to provide a composite section, which sections are adapted to be grouped together to form a finished rod of a comparatively large cross section.

Fig. 9 is a detail view showing how two of the segmental strip parts, produced as shown in Fig. 8 are brought together to form a composite strip of triangular cross section for shafts or rods of comparatively large cross section.

Fig. 10 is an end view of a shaft or rod embodying my invention as made up from the duplex segmental strips of Fig. 9.

Fig. 11 is an end view of a straightened strip of smaller cross section and illustrates the method of treating the same to provide single segmental strips of triangular shape to form a rod or shaft of a smaller cross sectional area than that shown in Fig. 10.

Fig. 12 is a view in end elevation of the rod of smaller cross section made up from the segmental strips of Fig. 11.

Figs. 13 and 14 are views in end elevations of rods of composite structures and which will be more fully referred to later.

Fig. 15 is a view illustrating the method of applying an encircling pressure to a grouped complement of finished strips to bind them together under pressure for the setting of the adhesive.

Among the various materials which may be treated in accordance with the invention, I find that bamboo has those characteristics best adapting it not only to my improved method but also to the use in making built up shafts or rods. Bamboo which is classed as a member of the cane family, has a long substantially straight fibrous grain with

which is incorporated a natural resin. It comprises a tubular hollow body 1 having annular points or nodes 2 at certain intervals, the cavity or interior of the body being closed off by diaphragms 3, one at each joint or node. The outer skin 4 of the body which is often referred to as the "enamel" is dense and more compact in its fibrous arrangement than the inner portion 5 of the body which is more or less pithy. The fibers or grain of the body are substantially straight from end to end and said body has the characteristic of permitting a splitting or cleaving which follows the fibers or grain.

In carrying out the improved method so far as it relates to using bamboo as the material operated upon, I take a piece of bamboo 1 of suitable length and remove the nodes 2 therefrom in any suitable manner to provide a smooth uninterrupted exterior surface. The bamboo is then split longitudinally, preferably into halves as best shown in Fig. 2 after which the transverse walls left by the diaphragm portions 3 during this splitting, are removed in any suitable manner to leave a smooth interior surface. By splitting I do not mean ripping with a saw, but I employ a cleaving action wherein the splitting follows the grain so that the fibers are not cut transversely as would happen in sawing; the latter cutting the fiber ends which I wish to avoid. After the diaphragm portions have been removed from the two halves thus split, I further split each half into the desired number of smaller and trapezoidal sections 6; one of which is best shown in Fig. 3. Because of the following of the grain in splitting, it is apparent that the lateral edges of each section will not be exactly straight or parallel and the inner and outer surface of each section will be concavo-convex as is readily apparent.

After such a section 6 has been produced, I find it advantageous before other operations are carried out thereon first to bring the lateral edges of said sections into parallelism, irrespective of whether or not the edges are straight or undulating. To this end I provide a motor driven grinding wheel 7 having a bevelled end 8, which may be readily mounted on a suitable support. In said support I provide an upright guide pin 9 arranged with reference to the bevelled end 8 of the grinding wheel as best shown in Fig. 7. I take one of the sections 6 and arrange it substantially parallel with one side of said bevelled face 8. This will bring one edge 6^a of the section against the guide pin 9 and will bring the other edge 6^b against said wheel face 8 so that upon an endwise movement being given to the section 6, the edge 6^b will be ground down to be parallel with the edge 6^a even though the latter be undulating at one part of its length and straight at another part of its length. The section 6 is then turned end for end and the edge 6^a is ground in a similar manner. In this manner the fibers in said edge 6^a— 6^b are not cut to leave exposed ends.

After the edges 6^a—6^b are thus brought to parallelism I subject the section to the action of pressure in the presence of heat not only to reduce its bulk and increase its density but also to straighten the lateral edges thereof as well as to flatten out the concavo-convex top and bottom surfaces so that the section will be rectangular in cross section instead of trapezoidal as before mentioned. To this end I provide a press capable of being heated and including coacting die members and such a press is best shown in Figs. 5, 6 and 7. The press herein shown is typical of the most simple form of press by which the certain steps of the improved method may be carried out. It comprises an elongated heavy metal block 10 mounted on legs 11 and in the top of said block along the median line thereof is provided an upwardly opening longitudinally extending groove 12 which forms the female die of the press. The bottom surface 13 of said groove in said block is flat and the sides of said grooves are partly upright and parallel as at 14 and partly upwardly and outwardly diverging as at 15 to provide a wider mouth 16 therefor. Beneath said block and supported from the legs thereof is a burner pipe 17 by which the female die block as a whole may be heated. Associated with this female die is a male die 18 in the form of an elongated block of T shaped cross section and including a top wall 19 and a depending rib 20 corresponding to and adapted for a snug fitting engagement in the bottom portion of the female die groove 12. Along the lateral margins of the male die block I provide a plurality of bolts or screws 21 adapted to have engagement in suitable threaded openings 22 in the side walls of the female die block. With such a press comprising the male and female dies and with the burner in operation to heat the block 10 I place a section 6 in the female die as shown in Fig. 6, with the enameled side of the section downward after which the male die is placed in position and the screws 21 then tightened up. This causes a relative movement between the die members and pushes the section into the bottom of the groove 12 and tends to flatten up said section. In this position, said section will absorb heat from the female die after which the natural resins become somewhat softened. Further pressure is then imposed upon the male die by means of the screws so that the section will change its shape as is imparted to it in the press, the concave surfaces flattening out and the lateral edges straightening out in

accordance with the side walls of the groove 12. This pressure acts to drive out all air cells and voids that exist in the bamboo and the resins and fibers are glomerated into one dense mass of a cross sectional area smaller than the original section before it was operated upon. During the treatment of the section as described, the heat is maintained only at that temperature as will soften the resins and not at that temperature as will cause a charring of the surfaces of said section. The strip is left in the press until it sets after which it is removed and it will then be found true and straight on both its top and bottom as well as on its sides and will be of a flat rectangular cross section as best shown in Fig. 8.

In making up a shaft or rod of substantial cross section I take the section and rip it by means of a high speed circular saw (not shown) along the angular lines A—A indicated in Fig. 8 to provide two strips 22 each of a cross sectional shape approximating a half triangle and with the natural enamel 4 along one side, the remaining portion which comprises mostly all pithy part 5 being discarded. Thereafter I place two of such strips 22—22 side by side with the enamel parts face to face and cement them together to provide a composite strip 23 of triangular cross section with the enameled surfaces of both strip parts in the middle thereof as best shown in Fig. 9. I then take a plurality of such made up composite strips and apply an adhesive to the converging surfaces thereof after which I group them about a common axis and bind them together until the adhesive sets. When making up a bait casting rod in this manner wherein the rod tapers toward one end, I find a convenient manner is to employ rings 24—24 of different diameters and slip them on the grouped sections into a tight fit which holds the sections in snug engagement during the setting of the adhesive as best shown in Fig. 15. After the adhesive has set the rings are slipped off the smaller end of the built up rod and the excess of adhesive squeezed out from between the segments then removed and the rod is ready for the uusual varnish or like finishes. Such a rod is best shown in end elevation in Fig. 10 and it will be noted therefrom the same is of a hexagonal cross section and that the natural enamel surfaces of each duplex strip are arranged radially with respect to the axis of the rod.

In the case of rods of smaller cross sectional areas such as is found toward the tip end in sectional rods where the strips must be of a correspondingly smaller size I cut the section 22^a along the lines A^1 and A^2 to provide a strip 23^a of a substantially triangular cross section such as illustrated in Fig. 11. When said strips are assembled and adhered together as before described, the rod will be of a hexagonal cross section as before but will contain six different strips instead of twelve different strips as in the first instance but the enameled surfaces will still be arranged axially in the finished rod.

A bait casting rod made up as described is indeed strong and flexible and has the whip so desired in a rod for this purpose and will return to its straight condition after each cast.

In building up the butt end of a rod in this manner and where less weight is desired I find it convenient to make each composite strip from strip parts of different materials. For instance I find by actual test and experiment that long grained ash and hickory as well as reed cane may be treated as before described in connection with bamboo and excellent results obtained therein. In Fig. 13 I have illustrated a rod structure wherein each composite strip comprises a strip part 22^x of bamboo and a strip part 22^y of hickory or ash and the grain of the hickory or ash part being parallel with that of the bamboo strip part 22^x. This construction makes the rod lighter in weight and more flexible. In Fig. 14 I have shown a construction similar to that just described wherein each strip is made up of strip parts 22^x and 22^z of bamboo and hickory or ash respectively with the grain of the strip parts 22^z arranged annularly of the built up rod and at an approximate right angle to the grain of bamboo. Such a construction likewise decreases the weight of the rod and makes it stiffer and less flexible.

Fibrous material treated in accordance with the improved method is rendered of less bulk, is lighter in weight and made more dense and is not easily affected by changes in climatic conditions. Such treated material bends more readily so that it may be employed for many purposes for which suitable materials are not readily available and such treated materials readily take any kind of desired finish.

While in describing my invention I have referred in detail to several specific strips in the method as well as form, arrangement and construction of not only the apparatus employed but also the article made up from the treated material, the same is to be considered as by way of illustration only and not by way of limitation except as may be pointed out in the appended claims.

I claim as my invention:

1. The method herein described which consists in providing a length of substantially straight grained fibrous material splitting the same with the grain into a plurality of strips, straightening each strip by confining pressure in the presence of heat, making each straightened strip wedge shaped in cross section, applying an adhesive thereto and then grouping a full complement of

such wedge shaped strip about a common axis and applying an encircling pressure thereto until the adhesive sets to provide a built up shaft or rod.

2. The method herein described which consists in providing a length of substantially straight grained fibrous material, splitting the same with the grain into a plurality of strips of substantially rectangular cross section, straightening each strip by a confining pressure in the presence of heat, and at the same time correcting the rectangular cross section thereof, resplitting each corrected strip to provide wedge shaped strip parts of smaller cross section, applying an adhesive thereto, grouping a full complement of such wedge shaped strips about a common axis to provide a built up shaft or rod and then confining the same by an encircling pressure until said adhesive sets.

3. The method herein described which consists in providing a length of substantially straight grained fibrous material, splitting the same with the grain into a plurality of strips of substantially rectangular cross section, straightening each strip by a confining pressure in the presence of heat, and at the same time correcting the rectangular cross section thereof, resplitting each corrected strip to provide wedge shaped strip parts of smaller cross section, cementing two of such strips parts together to provide a composite strip of segmental cross section, applying an adhesive to said composite strips and grouping a full complement of such composite strips about a common axis to provide a built up shaft or rod.

4. The method herein described which consists in providing lengths of different kinds of substantially straight grained fibrous materials, splitting each length into a plurality of strips, straightening each strip and increasing the density thereof by a confining action in the presence of heat, making each strip wedge shaped in cross section, applying an adhesive to such strips of different kinds of materials, grouping them about a common axis and confining them in this relation until the adhesive has set, said strips of different materials being arranged in alternation.

In testimony whereof, I have hereunto set my hand, this 16th day of November, 1927.

THEODOR WENSEL.