

Oct. 12, 1926.

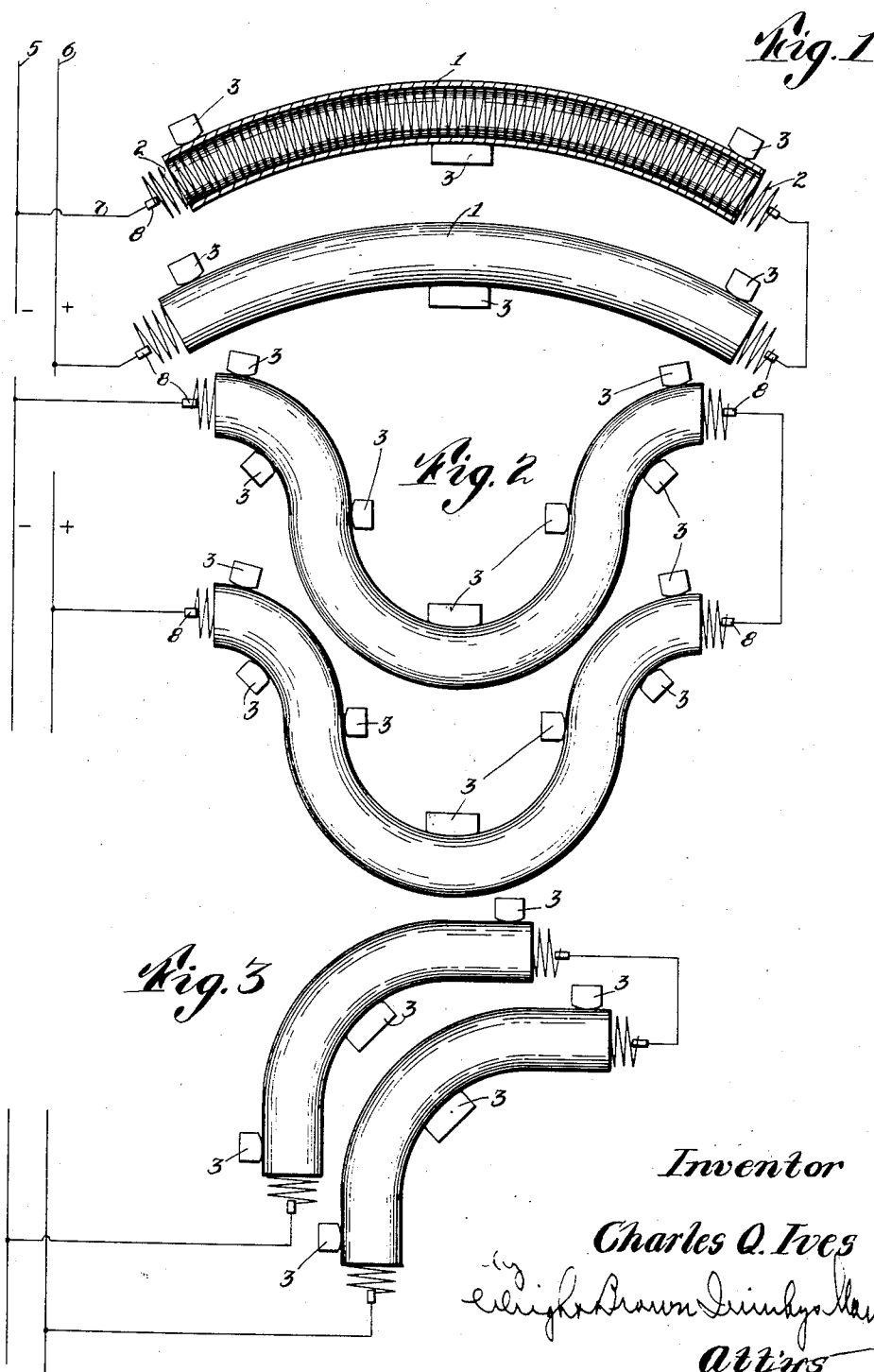
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1,602,579

METHOD OF MAKING BENDS IN FIBER TUBES

Filed Oct. 8, 1924

2 Sheets-Sheet 1



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*Fig. 4*

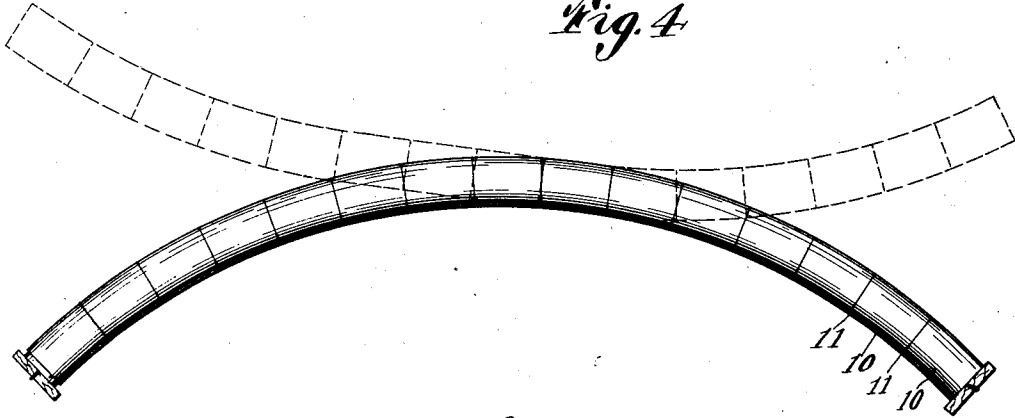


*Fig. 5*

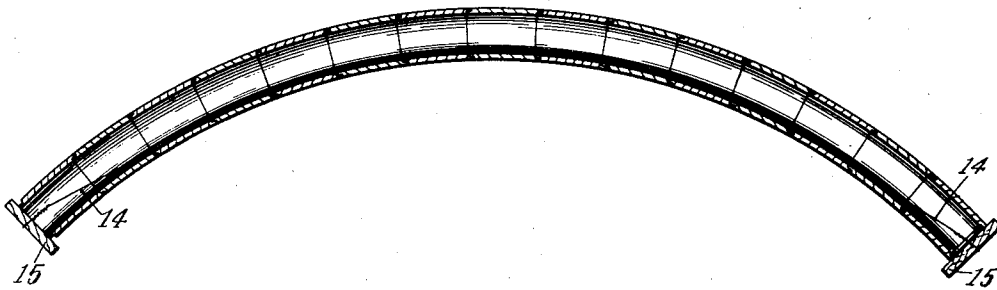
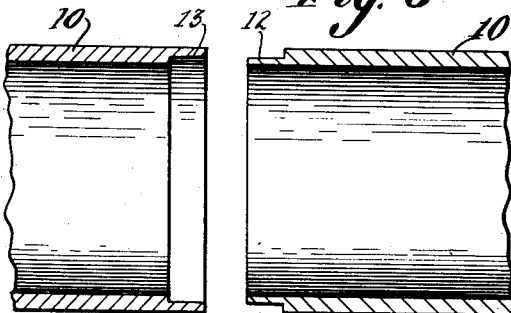


*Fig. 6*



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# UNITED STATES PATENT OFFICE.

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## METHOD OF MAKING BENDS IN FIBER TUBES.

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This invention relates to tubes or pipes such as are formed from wood or other suitable fiber as made up on a paper machine and is more particularly concerned with the manufacture of bends. In the manufacture of these tubes the wet fiber is deposited on rotating mandrels until it is of the desired caliper after which it is stripped from the mandrels and dried. The mandrels are straight so that the tubes as formed are straight, but until they have dried out they are soft and readily deformable and can be bent readily provided they are so supported as to prevent collapsing or deformation during the bending operation. In order to so support the tube while it is being bent it has been proposed to insert therein a coil of wire engaging the inner wall thereof, this coil of course yielding readily to lateral flexure but retaining quite rigidly a true circular cross section. Preferably the coil is normally of slightly larger diameter than the interior of the tube and is wound to a smaller diameter in which condition it is readily inserted into the tube whereupon it is released and uncoils sufficiently to engage the interior wall of the tube at a substantially uniform pressure. The tube with the coil therein is then bent to the desired curvature and held in such position during the drying operation after which the coil of wire may be withdrawn, the tube then being hard and remaining in its bent condition.

According to the present invention this coil of wire is made use of to facilitate the drying and hardening of the tubes in their bent conditions, this being done by passing an electric current therethrough to heat the coil to a moderate drying temperature. By this means the moisture is driven outwardly through the body of the tube and the coil does not materially obstruct the passage of air through the tube, thus causing the tube to be dried in a more uniform and expeditious manner than is otherwise possible.

After the tubes have been formed and dried it is usual to impregnate them with preservative and water-proofing material such as pitch or with other saturants, depending on the use to which the tubes are to be put.

While bends of a great variety of forms may be produced as hereinbefore described, it sometimes happens that to avoid obstructions in placing the tubes in position bends of forms other than may be at hand are nec-

essary. In order that it may not be necessary under these conditions to have such bends made specially at the factory, this invention contemplates a construction whereby such bends may be formed up at the job from standard sections.

Heretofore where installation problems of this kind have occurred it has been the practice to partly cut through the straight or curved tubes in several places to permit bending and taping the tube over the cuts. This procedure, however, permits only a small bending area and impairs the dielectric and moisture proof value of the tube.

According to the present invention a curved tube, preferably formed as heretofore described, may be cut into relatively short sections which are provided with mating socket joints at their ends. These joints permit the several sections to be turned relative to each other to any extent desired so as to permit them to be so manipulated as to assume at will a great variety of bends of different shapes and degrees of curvature.

As during the impregnation of the tubes with pitch or the like a change in diameter of the tube results, the tube should be cut into sections and the joints formed after the impregnation has been effected so that the joints may fit properly. A wire or other strand may be threaded through the several sections and fixed at their ends to hold them together until they have been shaped to the proper form in the positions which it is desired they occupy and a cement coating may be placed therearound when they have been properly positioned, which when set, retains them rigidly in proper position whereupon the wire or other strand may be removed. If desired, of course, the several sections should be united by a suitable cement or glue, for example, thermoplastic waxes or gums or the like which may be softened by heat, where conditions to which they would be subjected in use would be such that the cementing material would not be adversely affected.

For a more complete understanding of this invention, reference may be had to the accompanying drawings in which—

Figure 1 represents diagrammatically partly in section the manner in which the tube may be dried out in bent condition while held against deformation from circular cross section.

Figures 2 and 3 are somewhat similar views illustrating other forms of bends which may be treated in the same manner.

Figure 4 is a side elevation of a bend of the general form shown in Figure 1 cut to form interfitting short sections rotatable axially relative to each other to form a variety of bends in different directions.

Figure 5 is a longitudinal section of the same illustrating a manner of temporarily holding the sections assembled.

Figure 6 is a longitudinal section on an enlarged scale showing interfitting ends of two adjacent sections.

Referring to Figure 1, at 1 is indicated a tube of fibrous material to be dried which has inserted therein a coil of wire 2 which bears against the inner surface thereof with a substantially uniform pressure and permits the tube and coil to be bent as desired without permitting deformation of the tube from substantially true circular cross section. Figures 2 and 3 show other forms in which the tubes may be bent. The bent wet tubes are held in position by any suitable means as by blocks of wood 3 fixed to the floor between which tubes are held as positioned.

When the tubes are placed correctly the coils may be attached to a suitable source of electric current as shown at 5 and 6. For this purpose lead wires 7 are shown as equipped at their ends with clamps 8 which may engage the wire coils adjacent to their ends. These coils thus serve as resistance grids which are heated by the passage of current therethrough so as to facilitate the drying operation, the coils offering little obstruction to the passage of air through the tubes so that moisture is removed therefrom both inside and outside, the drying being preferably effected within a drying chamber wherein moderately heated air is caused to pass over and through the tubes. After the drying is complete the clamps 8 may be removed from the wire coils and the wires removed whereupon the tubes are found to be rigid and to retain the curvature imparted thereto. They may then be impregnated with pitch or other suitable material depending on the use to which they are put in practice in the usual manner.

If it is desired to form up adjustable bends which may be made to conform to particular conditions arising during their installation, the construction illustrated in Figures 4 to 6 may be employed. A curved and impregnated tube may be cut into sections 10 along lines 11 arranged substantially radial to the curve. These sections may then be formed with mating socket joints, for example, as illustrated in Figure 6, one end of one section being of reduced diameter as shown at 12 to fit within a counter-bored end 13 of the adjacent section. The sections are then assembled as shown in

Figure 5 and in order to hold them assembled a wire or other strand 14 may be threaded therethrough and fixed at the ends of the assembled sections as by blocks 15 bridging these ends. In this manner the sections are held assembled but are capable of axial rotation on each other to any extent desired so that a great variety of bends in various planes may be formed as desired without separating the sections from each other. When the sections have been adjusted to the desired shape they may be surrounded by cement which when it sets will hold the sections in the desired relation. When this has been accomplished the strand 14 may be removed so that there will be no obstruction within the tube.

Under certain conditions the sections might be fixed together by adhesive material, such, for example, as thermoplastic gums which would become sufficiently soft when subjected to heat for the sections to be adjusted relative to each other, and which when allowed to cool would hold them in position. Of course where adhesive of any character is employed it would necessarily be of such a character as would not be adversely affected by the conditions to which the tube would be subjected during use.

In place of cutting the sections from a bent tube, it is of course possible to utilize a straight tube and to cut it in sections along lines substantially corresponding to radii of a circle so that the cut ends of the several sections should not be parallel. If the sections are then joined and turned substantially axially relative to each other, a bend may be produced. Where the tubes are straight, however, the amount of bending which may be effected by such cutting is of course more limited than if bent tubes are used.

Having thus described certain embodiments of this invention it should be evident to those skilled in the art that various changes and modifications might be made therein without departing from its spirit or scope as defined by the appended claims.

#### I claim:

1. That step in the process of making bent fiber tubes which comprises passing an electric current through a coil of wire positioned within and supporting against deformation from circular cross section a wet fiber tube bent to the desired form.

2. The method of making a curved fiber tube which comprises forming a straight tube from wet fibrous material, while said tube is moist inserting therein a coil of wire of normal diameter sufficient to engage the inner wall of the tube and hold it against deformation from substantially circular cross section, bending the tube and coil to the desired form, passing an electric current through the coil to heat the same and dry

the tube while it is held bent, and when the tube is dry and so fixed to the desired shape removing the coil.

3. The method of forming an adjustable tubular bend which comprises bending the tube to curved form, cutting the tube substantially radially to the curve into sections, and forming joints between the ends of adjacent tube sections permitting the sections to be turned substantially axially relative to each other.

4. The method of forming an adjustable tubular bend which comprises cutting a length of tube into sections along lines substantially radial to a center, and forming joints between the ends of the adjacent tube sections permitting the sections to be turned substantially axially relative to each other.

5. The method of forming an adjustable tubular bend which comprises forming a tube of wet fibrous material, bending the tube while wet to curved form and then drying the tube, saturating the tube with a waterproof material, cutting the tube into sections along substantially radial lines, and forming joints between the ends of adjacent sections permitting them to be turned substantially axially relatively to each other.

6. The method of forming an adjustable tubular bend which comprises forming a tube of wet fibrous material, drying the tube, saturating the tube with waterproof material, cutting the tube into sections along lines substantially radial to a center and forming joints between the ends of adjacent sections permitting them to be turned substantially axially relative to each other.

7. The method of forming a tubular bend which comprises forming a tube of fibrous material, saturating the tube with a preservative, cutting the tube into sections along

lines substantially radial to a center, forming joints between adjacent sections permitting them to be turned substantially axially relative to each other, turning them to relative positions to form the desired bend, and fixing them in such relation.

8. The method of forming a tubular bend which comprises forming a tube of fibrous material, saturating the tube with a preservative, cutting the tube into sections along lines substantially radial to a center, forming joints between adjacent sections permitting them to be turned substantially axially relative to each other, turning them to relative positions to form the desired bend, and encasing them in cementitious material.

9. The method of making bent fiber tubes, which comprises bending a straight fibrous tube to the desired form while maintaining it against deformation from substantially circular cross-section by a coil of wire positioned therein and engaging the inner wall thereof, passing an electric current through the coil to heat and dry the tube while it is held bent, and then removing the coil.

10. The method of making bent fiber tubes, which comprises bending a straight fibrous tube to the desired form while maintaining it against deformation from substantially circular cross-section by a coil of wire positioned therein and engaging the inner wall thereof, passing an electric current through the coil to heat and dry the tube while it is held bent, removing the coil and then saturating the tube with a waterproofing material.

In testimony whereof I have affixed my signature.

CHARLES Q. IVES.