V. P. VON PINDTERSHOFEN.

PROCESS FOR MAKING INSULATING TUBES.

APPLICATION FILED OCT. 27, 1910.

1,025,763. Patented May 7, 1912.

Fig.1.

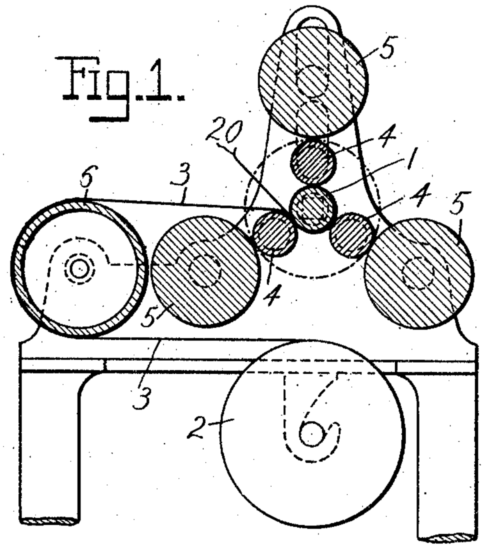


Fig.2.

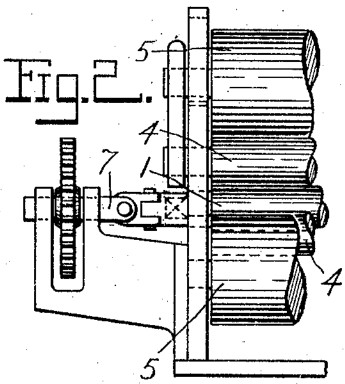


Fig.3.

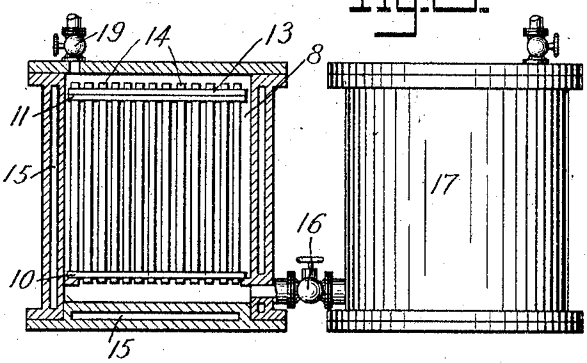


Fig.5.

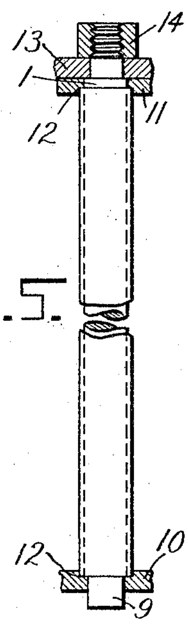
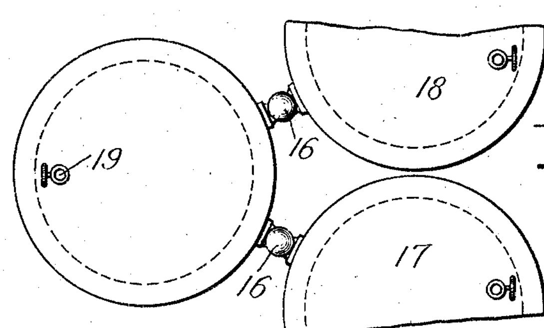


Fig.4.



Witnesses

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VICTOR PINDTER v. PINDTERSHOFEN, OF WIENER-NEUSTADT, AUSTRIA-HUNGARY.

PROCESS FOR MAKING INSULATING-TUBES.

1,025,763. Specification of Letters Patent. Patented May 7, 1912.

Application filed October 27, 1910. Serial No. 589,387.

To all whom it may concern:

Be it known that I, VICTOR PINDTER VON PINDTERSHOFEN, civil engineer, a subject of the Emperor of Austria-Hungary, residing at Wiener-Neustadt, Austria-Hungary, have invented certain new and useful Improvements in Processes for Making Insulating-Tubes; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

Insulating tubes have already been made of fibrous material or paper by coiling these materials on a mandrel. In the greater number of those processes the paper, etc., is impregnated with an insulating composition shortly before, or during the coiling operation, so that the insulating tube is ready for use. It has also been proposed to coil fibrous material in the form of a continuous strip spirally on a mandrel, and to pass the tube shell so produced together with the mandrel through an impregnating liquid, which on setting fills up the interstices formed in the shell by the spiral convolusions of the strip. All those processes however do not produce an insulating tube having a perfectly uniform texture or capable of resisting very high electric pressures. Now the process forming the subject of the present invention is essentially different from known existing processes, and it consists substantially in making the tube of a web of paper having a width equal to the length of the tube to be made, and coiling the said web upon a mandrel under very great pressure and tension until the desired thickness of wall is obtained. Unsized paper of uniform texture is employed for this purpose. The tube shell thus formed is placed into insulating composition and boiled therein so as to allow the insulating composition to penetrate gradually the several thicknesses of paper constituting the coiled tube shell from the outside, and thus completely impregnate the tube shell. In this manner a tube completely uniform throughout its thickness is produced because the paper web is coiled in uniform layers without any creases and the subsequent impregnating operation in the heat causes the insulating composition to penetrate the layers of paper in a perfectly uniform manner from the outside to the inside. After the tubes have been thoroughly boiled in the insulating composition the mandrels are removed from the tubes which are allowed to remain in the liquid insulating composition. The tubes then drip gradually from top to bottom whereby both the inside and outside of the tubes acquire an extremely smooth and uniform surface.

One way of carrying out the improved process will now be described by way of example with reference to the accompanying drawings in which:—

Figure 1 is a vertical section of the machine for coiling the paper web; Fig. 2 is an end elevation of the machine; Fig. 3 is a vertical section of the vessel in which the tubes are impregnated, and an elevation of a vessel for continuing the insulating composition; Fig. 4 is a plan thereof, and Fig. 5 is a detail view of a device for fixing the mandrel and the tubes for the purpose of impregnating the latter.

The mandrel 1 on to which the paper web 3 is coiled that is unwound from a roll 2, is mounted between two or more pressing rolls 4. In the present example, three pressing rolls are provided.

In view of the small diameter and very great length of the cylindrical mandrel 1, and also with the object of greater accessibility, and of exerting a greater pressure, the pressing rolls 4 are each preferably made of small diameter, and therefore counterpressing rolls 5 are provided for the purpose of preventing bending of the pressing rolls.

The upper rolls 4 and 5 are mounted at both ends in such a manner that they can be shifted upwardly for the purpose of insertion and removal of the mandrel 1, and also of enabling the rolls to yield in the upward direction as the thickness of the paper shell increases on the mandrel 1.

For the purpose of coiling the paper tube shell, the end of the paper web 3 is suitably fastened to the periphery of the mandrel 1, for instance by means of a thin streak of adhesive.

For coiling, only the mandrel 1 is driven counter-clockwise, while the pressing rolls 4 and counterpressing rolls 5 rotate freely. By this means the paper web is subjected to very great tension and pressure while it is being coiled, so that the several layers are laid very tightly and closely upon one another.

With the object of increasing the tight-

ness of the coiling, and also of expelling as far as possible all the moisture from the paper web, the latter is passed over a cylinder 6 that is heated inwardly by steam or gas. By this heating, the paper web is also rendered more supple, and any creases or folds therein are removed by the compression. For this purpose the paper web is further braked before it passes on to the cylinder 6, for instance by braking the paper roll 2.

When the tube wall has reached its desired thickness by the coiling, a narrow strip of adhesive is applied to the paper for the conclusion of the coiling, and the paper is cut across behind the said strip. The end of the paper in being coiled up then sticks to the coiled paper tube. The tube is thereby formed of non-adhering thicknesses or layers and which by reason of the moisture expelling process leave the pores opened, thoroughly dried, and quite independent of each other, *i. e.* the tube layers have substantially free spaces between them, which spaces receive the insulating solution. This condition would not obtain where the surface of the sheet is covered with an adhesive to unite the layers when the sheet is rolled into tube form. The coiled paper tube while on the mandrel is then placed in the impregnating vessel for impregnating with the insulating composition.

For the purpose of impregnating, a large number of the paper tubes on their mandrels are placed in the impregnating vessel 8 shown in Fig. 3. For this purpose the mandrels are set upright side by side with their lower journals 9 in a perforated plate 10. A similarly perforated plate 11 is placed upon the upper ends of the mandrels. The perforations in the upper plate 11 are sufficiently large to allow of the mandrels being removed upwardly through them (Fig. 5).

For the purpose of keeping the tubes upright between the plates 10 and 11, during and after the removal of the mandrels, circular grooves 12 into which enter the ends of the tubes, are provided in the plates around the perforations for the mandrels (Fig. 5). Preferably a similarly perforated plate 13 is also placed on the plate 11, and to this plate 13 the screw threaded upper ends of the mandrels 1 are fixed by means of nuts 14. In order to remove the mandrels from the impregnated tubes, it is therefore merely necessary to lift the plate 13 to which all the mandrels are attached by the nuts 14.

Since it would be impossible to remove the mandrels from the impregnated or unimpregnated tubes that have been coiled upon them under great pressure and great tension, the following expedient is employed:—

Before the coiling of the paper web, all the mandrels are coated with a thin layer of the insulating composition with which the tubes are to be impregnated. This layer is hard when cold, but fluid when hot. Therefore the mandrels can be readily removed from the tubes either during the impregnating operation or after it while the tubes are still hot.

For the purpose of impregnating, the tubes with the mandrels are placed upright in the vessel 8 and the cover of the latter is fastened down air-tight. Then, while preferably heating the vessel 8 by means of its heating jacket 15, a vacuum is produced in it, whereby all the moisture and air is sucked out of the paper. After the vacuum has been maintained for a certain time, by opening a valve 16, the heated and therefore liquefied impregnating composition is admitted from a vessel 17 into the vessel 8 preferably from below until the tubes are completely covered by it.

In order to effect a thorough penetration of the paper layers of the tubes by the liquid impregnating composition, the composition is not only kept freely liquid permanently by heating the heating jacket 15, but also a high pressure is produced inside the vessel 8 whereby the liquid composition is forced into the wall of the tubes.

The impregnating composition which must also have a high degree of insulation, may be composed of a mixture of beeswax, paraffin, earth wax, Japan wax, carnauba wax, and the like, and resins such as colophony, asphalt, pitch, and the like.

The mandrels 1 are removed from the tubes that are held between the two plates 10 and 11, while the tubes are still completely immersed in the impregnating composition. The impregnating composition is drawn off gradually from the bottom of the vessel only after the tubes have been taken out.

As shown in Fig. 4, the vessel 8 is placed by means of the stop valves 16 into communication with the two vessels 17 and 18 that contain the impregnating composition. After the impregnating operation, the heated liquid composition contained in the vessel 8 is forced out of the vessel 8 back into one or the other of the vessels 17, 18 by means of compressed air supplied through the valve 19. The tubes are upright in the vessel 8, and therefore as the composition is being forced out, the excess composition on the tubes gradually runs down the tubes to the bottom, so that when the tubes have become quite cold, their inner and outer surfaces will be very smooth and appear as if polished.

The insulating tubes made according to this invention are rendered by their uniform internal structure highly insulating as well as highly resistant to damp. Their walls

are comparatively resistant to mechanical influences and they are air-tight. This invention thus produces an insulating tube of extremely good quality. Any other unsized fibrous material may be employed instead of paper.

If it is desired that the insulating tube be capable of resisting piercing by sharp instruments, such as nails or the like, then one or more layers of wire gauze or sheet metal 20 are rolled into the tube as it is being formed (see Fig. 1). Since the metal insertion is placed between the layers of paper said insertion is prevented from rusting by reason of the insulating composition with which the tube is treated.

What I claim is:—

1. A process for making insulating tubes consisting in drying a sheet of fabric to expel the moisture therefrom and open the pores of the same, rolling said sheet, under tension, for its whole width on a mandrel to form a tubular body of non-adhering thicknesses; placing said mandrel and tubular body in an impregnating solution to completely immerge the tube; and then withdrawing said mandrel from the tube, substantially as described.

2. A process for making insulating tubes consisting in rolling a sheet of fabric on a mandrel to form a tube; placing said tube in a closed chamber; creating a vacuum in the chamber to remove moisture from the tube; and then admitting an insulating solution into said chamber to saturate the tube; substantially as described.

3. A process for making insulating tubes consisting in rolling a sheet of fabric on a mandrel to form a tube; placing the tube in a closed chamber; creating a vacuum in the chamber to remove moisture from the tube; admitting an insulating solution into said chamber; and then admitting a fluid under pressure into the chamber to impregnate the tube with said solution, substantially as described.

4. A process for making insulating tubes consisting in rolling a sheet of fabric on a mandrel to form a tube; placing the tube in a closed chamber; creating a vacuum in the chamber to remove moisture from the tube; admitting an insulating solution into said chamber; subjecting said fluid to pressure to impregnate the tube with said solution; and then expelling the solution from the chamber under pressure and allowing the solution to drain from the tubes, substantially as described.

5. A process for making insulating tubes consisting in drying a sheet of fabric to expel the moisture and open the pores thereof, rolling said sheet, under tension, for its whole width on a mandrel, which is coated with an insulating medium, to form a tubular body of non-adhering thicknesses; placing said mandrel and tubular body in a closed chamber; creating a vacuum in the chamber to further remove moisture from the tube; then admitting an impregnating solution in the chamber to completely immerge the tube; and then admitting a fluid under pressure into said chamber to impregnate the tube with said solution, substantially as described.

In testimony whereof, I have affixed my signature, in presence of two witnesses.

VICTOR PINDTER v. PINDTERSHOFEN.

Witnesses:
ADA MARIE BUGER,
ADELAIDE FUNK.