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METHOD OF MAKING PAPER TUBES

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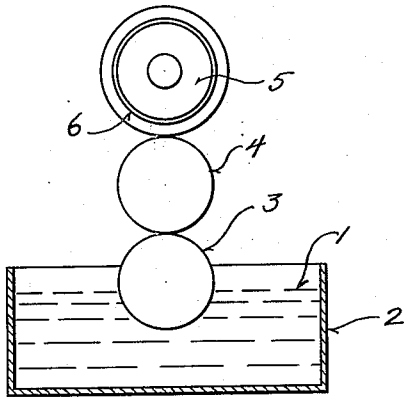


FIG. 1

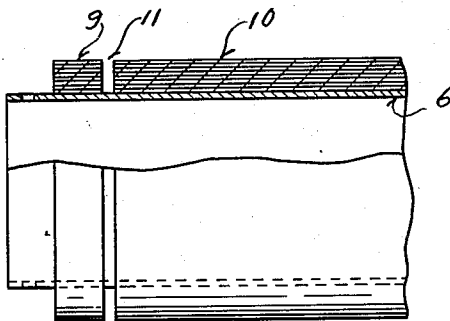


FIG. 3

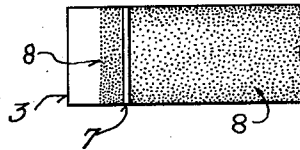


FIG. 2

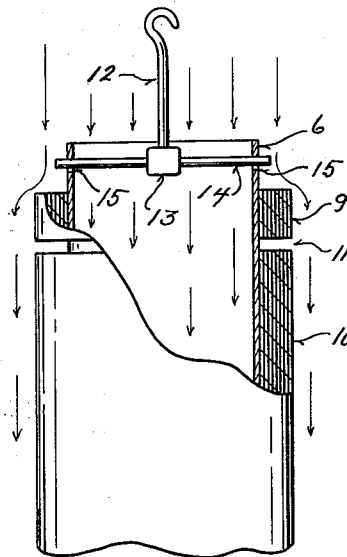


FIG. 4

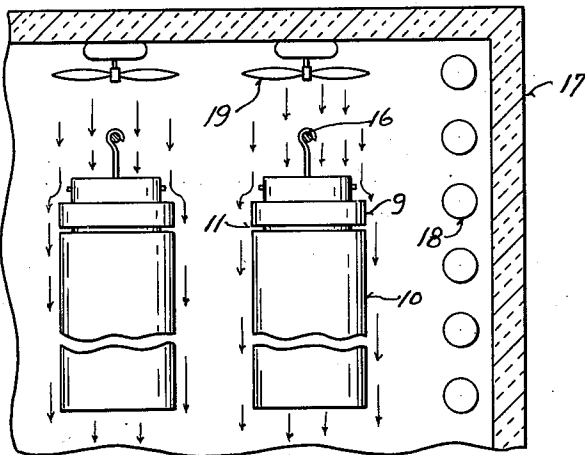


FIG. 5

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METHOD OF MAKING PAPER TUBES

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1 Claim. (Cl. 92-66)

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This invention relates to a method of making paper conduits or tubes which are formed of wound paper pulp or other fibrous material.

In the manufacture of paper pulp tubes, such as conduits, it is the usual practice to wind the paper pulp on a mandrel until the desired thickness has been obtained, and then remove the tube from the mandrel. The removal of the wet and easily damaged tube from the mandrel requires a high degree of skill and the usual method was to blow air under pressure between the tube and mandrel at each end of the tube to cause it to expand sufficiently so that it could be removed from the mandrel. It was a virtual impossibility to maintain a close tolerance for the internal diameter of the tube and it frequently happened that portions of the tube stuck to the mandrel and damaged the inner surface of the tube.

After the tubes were removed from the mandrels, they were dried. During this drying process the tubes frequently shrunk and often had internal voids as moisture vapor became trapped between the inner and outer surfaces of the tube due to the fact that the inner and outer surfaces dried first and produced a hard surface which greatly hampered, and sometimes prevented, the passage of moisture vapor from the interior of the wall of the tube. In addition to this, the tubes frequently warped during drying and had to be straightened. It was found that where a blast of air was employed to hasten drying, that the end of the tube against which the air was directed became frayed and had to be trimmed off.

Tubes produced in the manner hereinabove set forth had to be individually inspected for internal diameter, for straightness, and for damage to the inner surface. Such tubes as passed inspection were subsequently impregnated with a waterproofing and insulating material in the usual manner.

This invention is designed to overcome the above noted defects and to provide a process of making tubes which eliminates warping during drying or change in internal diameter, which guards against damage to the inner surface of the tube, which avoids the production of voids during drying, and which insures a straight tube with correct internal diameter and free from voids and free from fraying at the end, thus eliminating the necessity of individual inspection for internal diameter, for straightness, and for integrity of inner surface, and the necessity for trimming one end.

In general, this method of making paper tubes

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greatly increases production, does not require a high degree of skill of the operator, and results in a much more uniform product.

An embodiment of the invention is shown in the accompanying drawings, in which:

Figure 1 is a diagrammatic view of a portion of the machine for winding the paper tubes from paper pulp.

Figure 2 is a fragmentary detail of the first roller in the series on the machine.

Figure 3 is a fragmentary view showing a paper tube completely wound from pulp on a metal sleeve, such view being partly broken away and partly in section.

Figure 4 is a view corresponding to Figure 3 showing the sleeve with the paper tube thereon suspended and showing by means of arrows the direction of air flow.

Fig. 5 is a fragmentary view partly broken away and partly in section showing a portion of a drying room with tubes suspended therein.

In practicing the process forming the subject matter of this invention, the paper tubes are wound from the paper pulp which is indicated by the reference character 1 and which is maintained at a predetermined level within a suitable tank 2 in the usual manner. A screen roller 3 is partially submerged in the paper pulp and has a partial vacuum formed therein. It picks up the paper pulp and carries it to an upper roller 4 which is also provided with a screen and which has a felt covering. This upper roller 4 has a vacuum formed internally thereof, which may be slightly higher than that in the roller 3 in accordance with the usual practice. The winding mandrel is indicated by the reference character 5. Ordinarily, the paper pulp in the old process would be wound on the mandrel, but in the process forming the subject matter of this invention, the mandrel removably carries a thin metal shell or sleeve 6 on which the paper pulp is wound. The details of the rollers or drums 3, 4, and 5 are not shown as they are of the usual and well known type.

It is to be noted from Figure 2 that the screen roller 3 is provided with a tape 7 which extends completely around the roller adjacent one end and near one end of the screen 3. The narrow tape 7 prevents the picking up of the paper pulp at the part covered by the tape and consequently the paper tube is wound in two sections, namely a shorter section 9 and a main or longer section 10 separated by a small space 11, approximately the width of the tape 7.

After the paper pulp has been wound to a suit-

able thickness, the metal sleeve 6 with the paper tube wound thereon is removed from the mandrel 5 and is hung up on any suitable hanger. For instance, a hook-like member 12 may be provided with a head 13 through which a transverse rod 14 slidably passes. The rod 14 is adapted to enter apertures 15 formed at diametrically opposed points in the now upper end of the sleeve 6. The wound paper tubes carried by the metal sleeve 6 are hung on rods on any suitable supports 16 in a drying room 17 which is provided with steam pipes 18 to heat the air and with fans or any other suitable means 19 for producing a downward blast of such heated air. Any other suitable drying room could be employed.

The air rushing downwardly passes through the metal sleeve 6 and around the paper tube. It is to be noted that the small section 9 of the paper tube acts as a shield to prevent the air from fraying or splitting apart the larger or main section 10 of the paper tube and thus acts as a guard member. The result of this is that when the tube is finally dried, there is no necessity for trimming the upper end of the tube. Heretofore the upper ends of the tubes were found to be frayed or split due to the downward draft of air and had to be trimmed off. During the drying process the temperature is maintained at a suitable point. For example, as merely as a matter of illustration, at 160° F. The drying continues until the paper tubes are thoroughly dry.

It is to be noted that the metal sleeves 6 absorb heat from the air much more quickly than the paper tubes and consequently the drying of the paper tubes progresses from the inside outwardly and the outer surface of the paper tubes is maintained moist during drying due to the passage therethrough of the vaporized water or other liquid from the interior of the tube. Heretofore, where the tubes were simultaneously dried at substantially equal rates from the inside and outside, as for example when they were not provided with the metal sleeve, it was found that a hard surface was formed on the outside and on the inside of the tube prior to complete drying of the tube and that the trapped water vapor formed voids within the tube as it could not freely escape either from the inside or the outside. However, by following the method hereinabove outlined, the drying progresses from the inside to the outside and the water vapor freely escapes through the outside of the tube until the drying has been completed.

It is to be noted also that the paper pulp tubes when placed within the dryer are extremely fragile and have no set or inherent rigidity. The metal sleeves expand due to the heat, and shape the interior of the tubes. As drying progresses, the paper tubes acquire a set.

After drying has been completed, the metal sleeves with the dried paper tubes thereon are removed from the dryer and are allowed to cool. During this cooling the metal sleeves shrink away from the paper tubes and free themselves from the paper tubes. They are then freely withdrawn from the paper tubes.

The small sections 9 are discarded and are used again in making pulp. The upper end of each of the dried tubes requires no trimming whatsoever. Also there is no warping of these dried paper tubes as the metal sleeves hold them perfectly straight throughout the drying operation. In addition to this, there is no damage to the interior of the paper tubes as the surface of the

interior of the paper tubes is never disturbed and is kept smooth and uniform throughout its extent by the metal sleeve during the drying process.

Further than this, the internal diameter of the tube is accurately maintained by the metal sleeve and, therefore, tubes manufactured in accordance with this process have a very much closer tolerance for internal diameter than tubes manufactured in the customary manner.

In actual practice, the metal sleeves are made quite thin and may be made of aluminum alloy or other suitable material. One aluminum alloy that has been found very satisfactory has the following composition: .25% copper, .6% silicon, 1.1% magnesium, .25% chromium, 97.9% aluminum.

It is to be understood that the data is given merely as an illustration and is not to be construed as limiting the invention in any sense. Any suitable metal sleeve may be employed if desired.

Wherever the expressions "paper pulp" or "paper tube" are employed, it is to be understood that these expressions are not limited strictly to paper pulp or paper tube but are intended to cover any fibrous pulp or fibrous tube.

In actual tests conducted, it has been found that a very marked increase in production results from the process. Further it has been found that there is no blistering or damage to any portion of the tube and that inspection for straightness and internal diameter can be wholly dispensed with.

Although the tape 7 has been shown adjacent one end only of the screen roller, it is nevertheless within the province of this invention to have a tape adjacent each end of the screen roller. The lower smaller section of the paper tube would not act as a guard, as does the upper smaller section, but would eliminate the necessity of trimming the lower end, the elimination of the necessity of trimming the upper end being secured by the use of the upper smaller section as hereinabove set forth.

Further than this, no particular skill is required of the operator as in the heretofore known processes.

It will be seen that a novel method of making paper tubes has been provided by this invention which may be very expeditiously followed and which results in a uniform product free from warping, blistering or variations in internal diameter.

Although this invention has been described in considerable detail, it is to be understood that such description is intended as illustrative rather than limiting, as the invention may be variously embodied and is to be interpreted as claimed.

I claim:

The method of making paper tubes comprising winding paper pulp on a metal sleeve in two sections with one of the sections relatively short axially of the metal sleeve and located adjacent one end of the metal sleeve, directing a blast of heated air towards that end of the metal sleeve having the relatively short section of paper tube thereon, whereby the relatively short section of paper tube acts as a shield and guards the adjacent end of the longer section of paper tube from fraying due to the blast of heated air, continuing the drying process until the paper tube is thoroughly dried and set and maintaining a fixed relation between the short and longer sections of said paper tube throughout the entire drying

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process, cooling the paper tube and metal sleeve, and withdrawing the metal sleeve from the paper tube.

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