

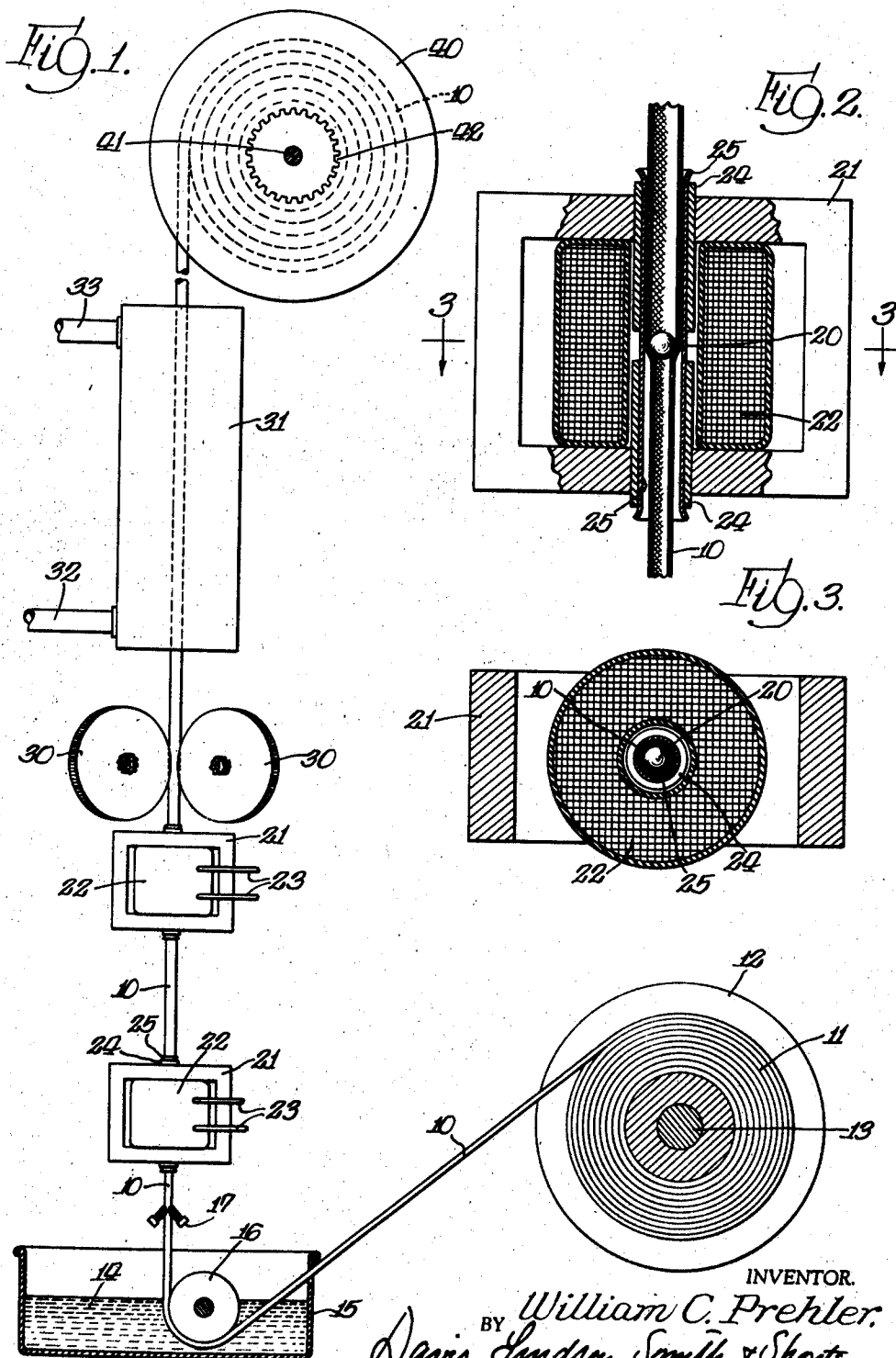
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APPARATUS FOR IMPREGNATING AND FORMING FABRIC TUBING

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APPARATUS FOR IMPREGNATING AND FORMING FABRIC TUBING

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3 Claims. (Cl. 91—53)

This invention relates to an apparatus for impregnating and forming fabric tubing.

Impregnated fabric tubing is used to insulate electrical conductors in various types of apparatus, for example, radios, the tubing being slipped over the conductors so as to provide an efficient and neat insulating covering for them. This tubing is made of woven fabric, generally cotton, which is impregnated with an insulating varnish which, when dried, makes the tubing fairly stiff, holds it in a cylindrical shape, improves its insulating qualities, and provides a smooth, attractive finish for its exterior, it being possible to vary the color to suit the requirements of the user. As the woven fabric comes from the weaving machine, it is in tubular form but very loose and flexible so that, when wound on a reel, it assumes a substantially flat shape, being very much like a cotton cord. Heretofore, in coating this tubing, the woven fabric has been pulled over mandrels which are then dipped in a vat of insulating varnish and dried. This operation is repeated the necessary number of times to give the tubing the number of coatings required. The length of the mandrels is limited to two or three feet because, after the tubing has dried, it must be removed from the mandrels and this is practically impossible if the mandrels are made of any substantial length. Obviously, such a process is cumbersome, slow and expensive. It has the further disadvantage that the inside of the tubing is not coated because the contact of the fabric with the mandrel prevents the insulating varnish from coating the inside of the tubing.

The general object of the invention is to provide an improved apparatus for making impregnated fabric tubing.

Other objects and advantages of the invention will appear from the following specification and drawing.

An embodiment of the invention is illustrated in the accompanying drawing, in which:

Figure 1 is an illustration of the steps of the process as well as the apparatus for practicing it;

Fig. 2 is a sectional elevation through the electromagnetic means for shaping the tubing into cylindrical form after it has been impregnated; and

Fig. 3 is a horizontal section, on the line 3—3 of Fig. 2.

The woven fabric tubing 10 is taken from a source of supply, illustrated in Fig. 1 as a roll 11 carried by a reel 12 rotatably mounted on a shaft 13. If desired, the tubing may be taken directly from the weaving machine, although

present-day weaving machines ordinarily do not weave the tube fast enough for use in the present process.

The tubing is passed from the source of supply through a bath of impregnating material 14, such as insulating varnish, contained in a receptacle 15, the tubing passing over a suitable guide which, in the present instance, has been illustrated as a roller 16. The tubing remains in the bath sufficiently long to be thoroughly saturated and impregnated with the insulating varnish and well coated both inside and out.

From the impregnating bath the tubing passes to where it is shaped into cylindrical form. If desired, it may first pass wipers 17 for removing excess varnish which drains back toward the receptacle.

As soon as the tubing leaves the bath, the varnish tends to dry and stiffen. While a small amount of preliminary drying might be employed immediately after the tubing comes from the bath to increase the stiffness of the tube before shaping, ordinarily this is not necessary because the varnish is of such a nature that the impregnated tubing has a certain amount of stiffness, such, for example, as the stiffness given any piece of fabric when coated with a quick-drying varnish or lacquer. As the tubing comes from the bath, it is substantially flat and in no shape to be used. If dried immediately to a final condition, the interior sides of the tube would adhere and the opening would be too small to receive conductors.

In order to give the tubing an accurate cylindrical shape of the required size, it must be opened up, or expanded, and then "set" so that it will remain in its expanded condition. The forming requires that something be placed on the inside of the tubing to expand and shape it, but, heretofore, this has presented an insurmountable obstacle because no practical means has been available for holding anything on the inside of the tube which at the same time would permit the tube to move along in a continuous manner. I have discovered an efficient way of accomplishing the result that enables the tubing to be continuously, rapidly and effectively formed.

Referring to Figs. 2 and 3, a highly polished steel ball 20 is placed on the inside of the tubing. The tubing, with the ball in it, is passed through an electromagnet comprising a frame 21 and a winding 22, the latter being connected to a suitable source of electrical energy by the conductors 23 (Fig. 1). The electromagnet is made of such strength that it will hold the steel ball at its center as the tubing is moved along during

the process. This strength is a matter of calculation, being varied for different sizes of tubing and different sizes of steel balls, or for any other factors affecting the force necessary to hold the steel ball against movement.

The electromagnet is provided with two core tubes 24 (Fig. 3) made of magnetic material, such as steel, and inside of these tubes is a tube 25 made of nonmagnetic material such as brass. The brass tube 25 extends through the electromagnet and its interior diameter is slightly greater than that of the finally desired size of the fabric tubing so as to permit the latter to pass freely while at the same time guiding it. This brass tube also prevents the steel ball 20 from being displaced laterally, that is, at right angles to the longitudinal axis of the electromagnet.

As the tubing is pulled over the steel ball, it is expanded and shaped to the desired form, the impregnating material giving it sufficient stiffness to enable it to remain in this form after it passes from the electromagnet. The smooth surface of the ball, coupled with the fact that there is a small area of contact between the ball and the tubing, enables the tubing to be formed without requiring an excessive pull on it.

While the ball has been referred to as being a steel ball, it need not necessarily be made of steel but can be made of any magnetic material that enables the electromagnet to hold the ball in place by electromagnetic force. Although the ball is preferably round, it need not be exactly spherical. For example, it can be oval, or egg-shaped, or it may be flattened along one diameter so as to form an oval tubing. Also, it may be slightly longer along an axis in the direction in which the tubing is moving than along an axis at right angles to the tubing. It is to be understood that the term "ball" as used herein is intended to have a broader meaning than that ordinarily given it, namely, it is to include various shapes such as mentioned above.

The number of shaping steps may be varied to suit the requirements. As illustrated in Fig. 1, after the tubing has been passed through the first forming means, it is passed through a second and similar forming means to insure greater accuracy in the final shaping of the tubing. By the time the tubing reaches the second forming operation, the insulating varnish has dried a little more and the tubing will remain in shape a little better. Additional forming steps can be employed if desired, and, obviously, if more than one coating of impregnating varnish is desired, an impregnating bath can be interposed between the forming steps. In other words, the number of impregnating baths and the number of forming steps can be varied to suit the requirements of the tubing being made.

After the tubing has been shaped it is "set," or "fixed," and this is accomplished by a drying step. Preferably, the drying occurs immediately after the tubing is shaped. As shown in Fig. 1, the tubing passes through suitable guiding and tube-moving rollers 30, having knurled, concave peripheries, two of a set of three being shown in Fig. 1. These rollers, which may be driven from any suitable power source, move the tubing from the supply reel 12, through the bath 14, and through the expanding and shaping devices from

where it passes through a dryer 31 which may be of any suitable form such as an oven, that shown in Fig. 1 being a hot air dryer provided with a supply pipe 32 and an exhaust 33. As the tubing comes from the dryer, it is sufficiently stiff to definitely hold its cylindrical shape while at the same time being sufficiently flexible to enable it to be wound on a reel. As shown in Fig. 1, the finished tubing is wound about a reel 40 rotatably mounted on a shaft 41 driven by a gear 42 which is rotated from any suitable power source, the reel serving to move the tubing through and out of the dryer. The reel is preferably quite large so as not to bend the tubing too sharply. The process and apparatus employed are such that the resistance of the tubing to movement in the continuous process is relatively slight, enabling the finished tubing to be pulled along without requiring a great deal of power.

While the various parts of the form of apparatus shown in Fig. 1 have been illustrated somewhat diagrammatically for the purpose of clarity in explaining the apparatus, these parts, for example, the reel 12, the receptacle 15, the forming devices 20-25, the guides 30, the dryer 31, and the reel 40, all can be carried by a common support and thus form a combination apparatus by means of which the process may be practiced.

It is to be understood that the apparatus illustrated and described are by way of illustration only and that variations may be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. A device for shaping and sizing a fabric tubing impregnated and coated with a liquid insulating material comprising an electromagnet, a non-magnetic cylinder extending through said magnet of a size to permit said tubing, in its finished shape, to be passed therethrough, a ball-like member of magnetic material within said cylinder and said tubing, said electromagnet being of a strength sufficient to hold said ball-like member against displacement when said tubing is moved and said ball-like member being of size and shape to give said tubing, when pulled over said ball, the required size and shape, and means for moving said tubing over said member.

2. A device for shaping and sizing fabric tubing impregnated and coated with a liquid insulating material comprising an electromagnet having aligning tubular magnetic cores spaced apart at their inner ends within the electromagnet, means for moving the coated tubing endwise through said cores, and a ball-like member of magnetizable material positioned in said tubing in the space between said cores.

3. A device for shaping and sizing fabric tubing impregnated and coated with a liquid insulating material comprising an electromagnet having aligning tubular magnetic cores spaced apart at their inner ends within the electromagnet, means for moving the coated tubing endwise through said cores, a ball-like member of magnetizable material positioned in said tubing in the space between said cores, and a tube of non-magnetic material positioned in said cores and enclosing said ball-like member and said tubing to prevent displacement of said ball-like member laterally of said tubing.

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