Nov. 19, 1929. H. J. DAVIS 1,736,699

METHOD OF FORMING VULCANIZED FIBER TUBES

Filed Dec. 31, 1927

Fig. 1.

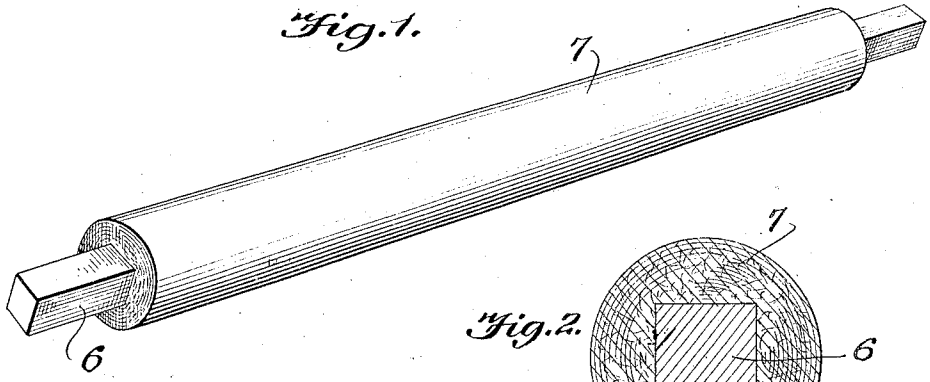


Fig. 2.

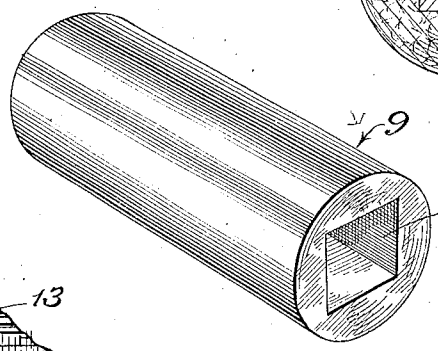
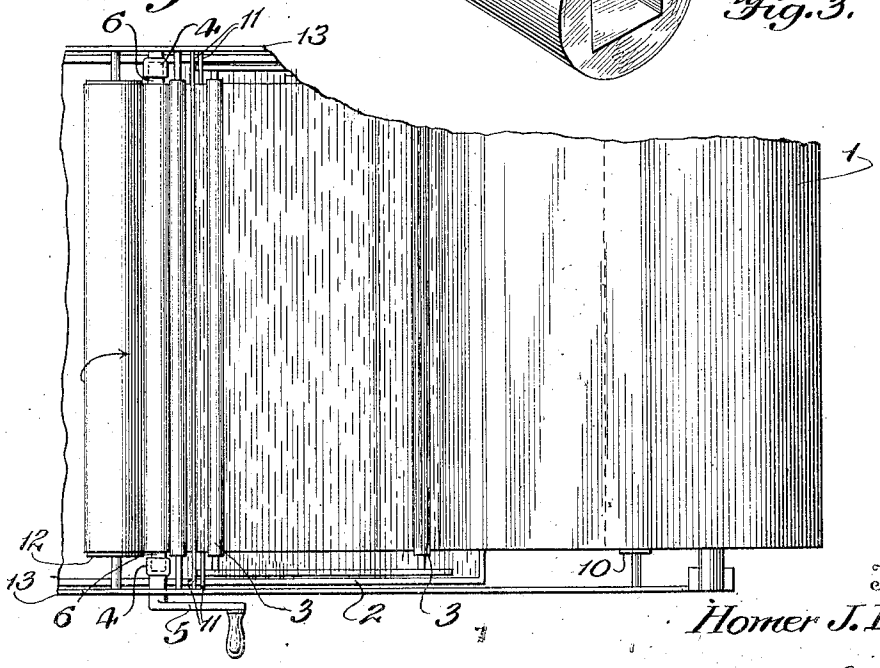


Fig. 3.

Fig. 4.



Inventor

Homer J. Davis.

By William C. Linton

Attorney

Patented Nov. 19, 1929

1,736,699

UNITED STATES PATENT OFFICE

HOMER J. DAVIS, OF WILMINGTON, DELAWARE

METHOD OF FORMING VULCANIZED FIBER TUBES

Application filed December 31, 1927. Serial No. 243,982.

This invention relates to improvements in the manufacture of composition or plastic tubing, the invention having for an object to provide a highly commercially advantageous process for the manufacture of tubing from the so-called vulcanized fiber method, i. e., tubing of paper, fabrics, phenol condensation products or near phenol condensation products, bakelite, plastics or casein, resins, gums, pastes and adhesives, the tubing being formed during the primary steps of manufacture thereof with a cross sectionally square or other multi-sided inner surface and a round or other design or shape of exterior surface, such formations being required in the trade for many uses, as for example, for cores upon which to wind carbon paper for billing machines, for receiving other paper or fabric, for electric motor brush insulators, or for ferrules, sleeves or spacers adapted for arrangement upon cores, rods and shafts of multi-sided cross sectional shape.

That the merit of the present invention may be distinguished from hitherto developments in this art, it may be stated that the production of tubing of the kind indicated heretofore, having an inner or inside shape or surface such as will permit of its engagement over a cross sectionally square or multi-sided core, rod, shaft, etc., is highly desirable. In the attainment of this type of tubing, many different methods have been practiced, all of which, however, have more or less proven inefficient and commercially impractical. In illustration, a vulcanized fiber tubing having a multi-sided inner surface and a cross sectionally round outer surface has been heretofore produced in this art by first completely forming, drying and vulcanizing a tube with round inside and outside surfaces, then as a separate and distinct step of manufacture, engaging a square or multi-sided mandrel in the same and subjecting the mandrel carrying tube to a squeezing or calendering action, whereby to break down the round inner surface of the tube and cause it to conform more or less to the cross sectional shape of the mandrel therein, after which the mandrel is removed. This method of tube formation having a muti-sided inner and a round or other design of outer surface, obviously, entails, a materially increased labor production cost, hence, rendering its usage commercially prohibitive and additionally, the reshaping of the finished or partially finished tubing, at best, presents a poorly workmanshipped product, oftentimes unacceptable and waste because of the cracking or fissuring thereof during its subjection to the extensive calendering or squeezing pressure.

Towards overcoming the disadvantages incident to the tubing described in the preceding paragraph, a comparatively make-shift method has been heretofore practiced to some extent, wherein a mandrel, polygonal in cross section, is driven into a finished or partially finished tube, following which the tube is rolled under calender pressure rolls, just enough to impress the corners of the inserted mandrel upon the tube inner surface, thus forming a plurality of longitudinally disposed relatively spaced grooves in the same to seat the edges or corners of a core, rod, shaft or other cross sectionally multi-sided device inserted therein. This method of construction, however, is objectionable in that should the rolling or squeezing be effected to but a slight degree of excess, the corners of the shaping mandrel will be forced through the tube walls or will crack the same, thereby entailing waste of material and labor. Also, the grooves in the inner surface of a tube so formed are oftentimes insufficient to permit of a snug seating or keying fit of the tube upon the device receiving it.

By my improved process of tube manufacture, I am enabled to produce tubing having a cross sectionally square or other multi-sided inner surface and a round or other design of outer surface, completely eliminating those disadvantages heretofore experienced in the art, in that the tubing is made in a wet state upon a square or polygonal mandrel, pured, dried and shrunk upon said mandrel and then calendered or finished upon the mandrel or rolled off the mandrel to permit of a maximum circulation of drying or curing medium therethrough, whereupon the tube is

finished upon a subsequently inserted mandrel, either of these latter operations producing a vulcanized fiber tubing of finished workmanship-like nicety of appearance without any step of re-handling. By this process a minimum amount of material is used in the making and also, the calendering or finishing of a dried or vulcanized tube may be effected with considerably less liability of spoilage of the product as by fracturing, cracking or fissuring the tube due to excessive calendering or finishing pressure.

Other objects of the invention will be in part obvious and in part pointed out hereinafter.

In order that the invention and its mode of operation may be readily understood by those skilled in the art to which it appertains, I have in the accompanying illustrative drawings and in the detailed following description based thereupon, set out one possible embodiment of my invention.

In these drawings:

Figure 1 is a perspective view of a fiber tube constructed in accordance with my invention showing the mandrel engaged therethrough, such mandrel being herein shown to be of a substantially cross sectionally square shape.

Figure 2 is an enlarged transverse section through a fiber tube in its wet state, wound upon a cross sectionally square mandrel showing that the reaction of the chemical bath to which the same is subjected during a winding operation will render the fiber material a homogeneous mass,

Figure 3 is a perspective view of a completed vulcanized fiber tube formed in accordance with the invention having a round outside surface and a cross sectionally squared inside surface and

Figure 4 is a fragmentary top plan view showing the manner in which the process is practiced.

Having more particular reference to the drawings, in connection with which like characters of reference will designate corresponding parts, it will be noted, at the outset, that I have shown in the accompanying drawings, for purposes of illustration, the improved method having been practiced for the production of a cross sectionally square inner surface and a round outer surface vulcanized fiber tube, although it will be appreciated, as the description proceeds, that the method may be as equally advantageously practiced or worked for the production of differently shaped tubes, that is, tubes of a cross sectionally multi-sided inner surface and a curved or other form of outer surface, such as conditions or preference may dictate.

In forming the improved fiber tube, paper or other sheet fibrous material is rolled from a suitable supply 1, rotatably supported in bearing brackets adjacent one end of a vat or receptacle 2, in frame 13, the free end of the fibrous sheet being threaded or passed over stationary guide drum 10, over which it slides and down under stationary guide bars 3 supported within the vat 2 in a manner to effect a thorough immersing of the fibrous sheet in the chemical solution within said vat; two stationary bars or scrapers are fixed in position generally indicated by the numerals 11, which scrape the excess chemical from the fibrous sheet which passes up over the steam heated cylinder 12 as indicated by arrow; rotatable brackets 4, being supported in transversely aligned positions in appropriate portions of the opposite sides of said frame 13 above the vat and in which frame the vat is supported as illustrated in the Fig. 4, one of which is supplied with a crank handle 5 so that with the removable positioning of a cross sectionally square mandrel 6 therein, said mandrel may have the threaded free end of the fibrous sheet engaged therewith and then rotated in a manner to wind a predetermined number of layers of the fibrous sheet about the same, whereby to produce a fibrous body such as indicated in Fig. 2 by the numeral 7, the chemical bath given the fibrous material, in conjunction with the application of heat thereto from the steam heated cylinder 12 adjacent to it causes said material, with arrangement upon the mandrel, to become a homogeneous body by reason of the resulting chemical reaction.

In winding the fibrous sheet about a mandrel 6 supported between the brackets 4, through the medium of the crank handle 5, it will be noted that the inner layers or convolutions thereof will snugly engage or embrace the flattened sides of the mandrel 6, in the manner shown in the Figures 1 and 2, whereas with continued winding of the fibrous sheet thereabout, a tube having a curved outer surface will be built up thereupon.

When the desired number of layers have been wound about the mandrel 6, the fibrous sheet is severed adjacent the rolled tube and the free end of the sheet upon the mandrel is smoothed onto the peripheral surface thereof, following which, said mandrel 6 with the homogeneous fibrous mass is removed from the brackets 4 of the frame 13 and a new or empty mandrel 6 is engaged with the bracket 4 whereupon the adjacent end of the fibrous sheet from the supply 1 is affixed thereto and the winding of a second tube upon the last inserted mandrel is effected through rotation of the crank handle 5.

The mandrel 6 having the fibrous matter 7 thereabout is placed in a weak solution of same chemical by which it is made and after a certain period known in the art by experience, the mandrel 6 is withdrawn from the fibrous matter 7 and said fibrous matter is placed in fresher water or water changed on

it until all trace of chemical is leeched out until it is what is termed pure.

The mandrel 6 is inserted in the fibrous matter 7 and is now placed in a suitable type of drier and is permitted to remain therein for a certain or prescribed period of time, during which time, the fibrous matter will be dried or go through that process generally known in the art as vulcanization, resulting in the shrinking of the fibrous mass or body upon the mandrel 6 and the forming of a comparatively hard homogeneous fibrous tube.

With drying or vulcanizing of the fibrous mass 7 upon the mandrel 6, the product is then removed from the drier and is submitted to a rolling under calender pressure rolls whereby to finish the same. However, it is to be understood that with drying or vulcanization and shrinking of the previously wet fibrous mass 7 upon the mandrel 6, the tube thus formed may be loosened with respect to the mandrel by subjecting the same to repeated passing through crusher rolls and then removed from said mandrel, this step being commonly known in trade parlance as rolling tubes from the mandrel and may be permitted to remain so for a period of time which will effect a thorough curing of the fibrous material by reason of the circulation of air or other drying medium through and over or about the same.

After this drying of the tube, the same is then carried through a calendering machine whereupon a mandrel similar to the mandrel 6 is passed therethrough and the tube subjected to a finishing or calendering operation, after which the mandrel is removed and the tube is ready for shipping or for cutting to the required lengths.

The vulcanized fiber tube produced in accordance with the method constituting this invention will be formed with a cross sectionally squared inner surface and a round outer surface as is indicated by the numerals 8 and 9 in the Figure 3, hence rendering the tube especially desirable for usage in various ways well known in this particular trade and in which it is highly desirable to provide a vulcanized fiber tube having a cross sectionally square or multi-sided inner surface and a round or other design or shape of outer surface. Furthermore, a tube so constructed will possess a maximum of workmanship nicety and due to the manner in which the fibrous material is arranged over the sharp corners of the particular mandrel employed, it will be understood that whereas the desired multi-sided interior shape will be had, the tube will not be cracked, crazed or fissured adjacent those corners, as is oftentime the result in vulcanized fibrous tubes produced in accordance with those methods or processes now prevalent in the art.

In the manufacture of tubes in accordance with my invention, I have found it desirable, in some instances, to roll or wrap the fibrous material upon a mandrel of cross sectional size or area slightly greater than that of the core, rod, shaft or other device upon which the finished product is to be arranged. For example, where the specifications for the forming of tubing states that such tubing is to be used and is to be readily engaged over a three-eighths inch core, mandrel, rod, shaft or similar device, the fibrous material in a wet state is rolled or arranged about a square or multi-sided mandrel of a thirteen-thirty seconds inch or a twenty-five sixty-fourths inch size. With shrinking in vulcanization of the wet fibrous material about this mandrel, it is rolled from the same by subjecting it to a light rolling action from calender press rolls whereupon a thirteen-thirty seconds inch or a twenty-five sixty-fourths inch square mandrel is inserted in the same and the tubing is finished upon a calendering machine, thus producing a finished article, which will permit of a sliding or loose fit on a three-eighth inch core, mandrel, rod, shaft or other receiving device.

From the foregoing, it will be understood by workers skilled in the art that I am enabled to produce vulcanized fiber tubing or tubing of similar composition having a multi-sided cross sectionally shaped inner surface and a round or other design of outer surface at a price approximating or equal to the cost of production of the ordinary round inside by round outside vulcanized fiber tubing well known in the art at this time, thereby avoiding the additional cost of production incident to the making of square of a multi-sided inside surface and outside surface tubing and also, avoiding the liability of damage or wastage of the tubing by those methods heretofore practiced in the art for converting round inside by round outside tubing into tubing having an inside surface such as will permit of its snug or keying like engagement with a cross sectionally square or multi-sided core, mandrel, rod or shaft or other receiving device.

As hereinbefore described, it is clearly within the province of the method constituting this invention to produce vulcanized fiber tubes having inner surfaces of different cross sectional multi-sided designs or shapes and different outer or exterior surfaces or shapes, this being dependent upon the requirements of the particular trade to receive the same, the spirit of the invention residing in the formation of fibrous tube or tubes composed of similar matter, in a wet state about a cross sectionally multi sided mandrel, puring, then shrinking, drying or vulcanizing the fibrous matter upon said core and finishing the vulcanized product under calender pressure rolls either with or without the original mandrel therein.

I claim:

1. A method of forming chemically reconstituted tubes consisting in winding fibrous matter in an acid wet state about a multi-sided mandrel, puring, then drying said matter upon the mandrel and then finishing the same by calendering.

2. A method of forming tubes consisting in snugly arranging fibrous matter about a multi-sided mandrel and forming the outer surface thereof round, puring, then drying said matter upon the mandrel and then calendering the same.

3. A method of forming tubes consisting in arranging fibrous matter in an acid wet state about a multi-sided mandrel, puring, then drying and shrinking said matter upon the mandrel, and then subjecting the same to a calendering.

4. A method of forming tubes consisting in winding fibrous matter in an acid wet state about a multi-sided mandrel, then vulcanizing and shrinking the matter upon said mandrel, and then subjecting the same to pressure from calender rolls.

5. A method of forming tubes consisting in snugly winding fibrous matter in an acid wet state about a multi-sided mandrel, puring, then drying said matter upon the mandrel, removing the dried matter from the mandrel, then inserting a similar mandrel and subjecting the matter to pressure from calender rolls.

6. A method of forming tubes, consisting in snugly winding fibrous matter in an acid wet state about a cross sectionally square mandrel, puring, then vulcanizing and shrinking said matter upon the mandrel, then removing the mandrel from said matter and finally, inserting a similar mandrel and subjecting the matter to pressure from calendering rolls.

7. A method of forming square inside by round outside tubes, consisting in snugly winding fiber matter in an acid wet state about a multi-sided mandrel, neutralizing the acid upon said matter, then drying the same upon the mandrel after which the tube is removed from said mandrel for further drying or circulation of air therethrough, then inserting a similar mandrel in the dry tube and subjecting said tube to pressure from calender rolls.

In witness whereof I have hereunto set my hand.

HOMER J. DAVIS.