

C. H. THORDARSON,  
MACHINE FOR MAKING INSULATING ELEMENTS.  
APPLICATION FILED MAR. 20, 1915.

1,220,378.

Patented Mar. 27, 1917.

3 SHEETS—SHEET 1.

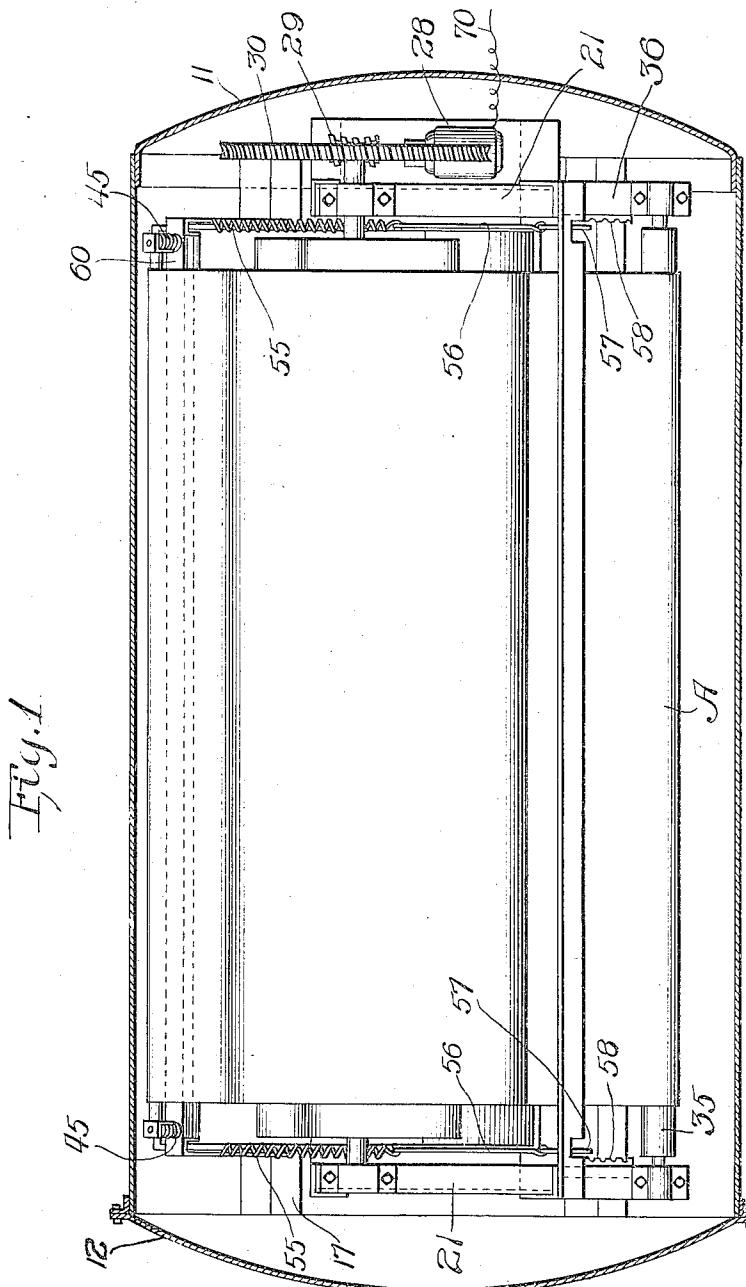


Fig. 1.

Witnesses:

Harry S. Gaither  
Bertrude E. Dowle.

Inventor:

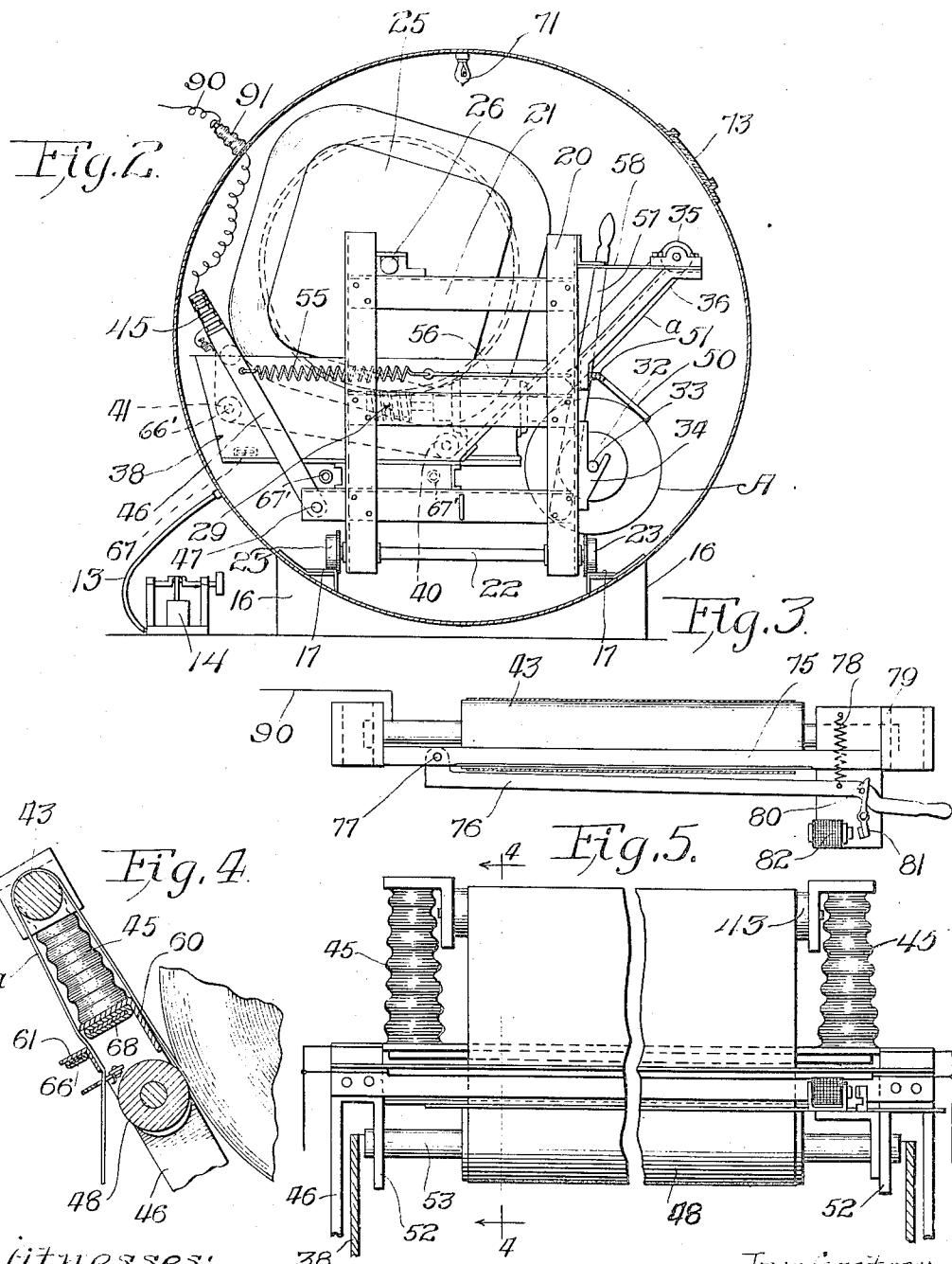
Chester H. Thordarson  
by William H. Hall  
Atty.

C. H. THORDARSON,  
MACHINE FOR MAKING INSULATING ELEMENTS,  
APPLICATION FILED MAR. 20, 1915.

1,220,378.

Patented Mar. 27, 1917.

3 SHEETS—SHEET 2.



*witnesses:*

Harry S. Gathier  
Burtrude E. Dowle.

4 Inventor:  
Chester H. Thordarson  
by William H. Stelle  
affid.

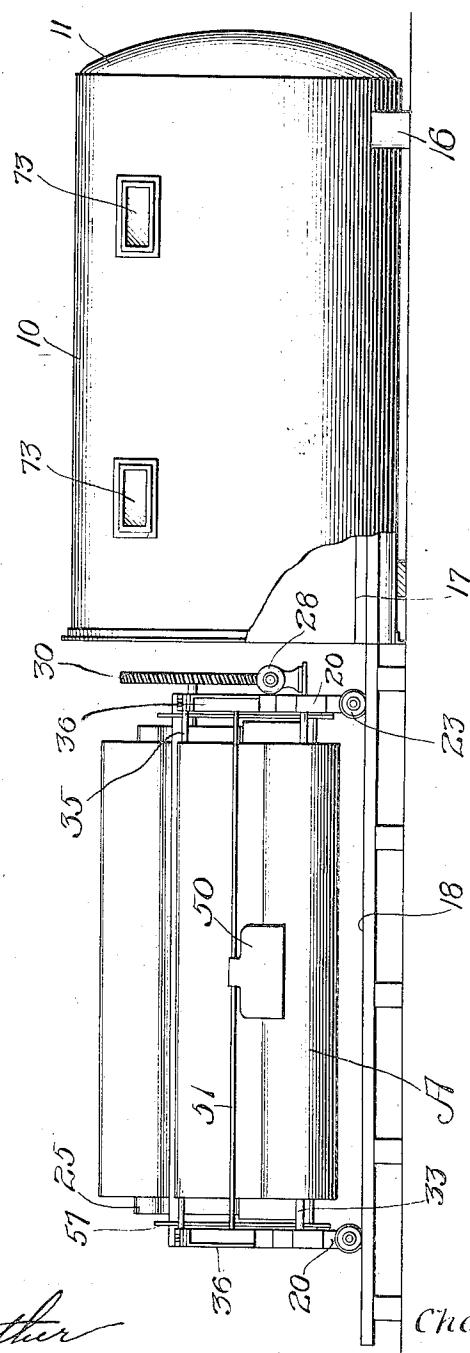
C. H. THORDARSON.  
MACHINE FOR MAKING INSULATING ELEMENTS.  
APPLICATION FILED MAR. 20, 1915.

1,220,378.

Patented Mar. 27, 1917.

3 SHEETS—SHEET 3.

Fig. 6.



Witnesses:

Harry S. Gauthier  
Bertrude E. Dowle.

by

Inventor:  
Chester H. Thordarson  
William F. Hall.  
Atty.

# UNITED STATES PATENT OFFICE.

CHESTER H. THORDARSON, OF CHICAGO, ILLINOIS.

## MACHINE FOR MAKING INSULATING ELEMENTS.

1,220,378.

Specification of Letters Patent.

REISSUED

Patented Mar. 27, 1917.

Application filed March 20, 1915. Serial No. 15,930.

To all whom it may concern:

Be it known that I, CHESTER H. THORDARSON, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Machines for Making Insulating Elements; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

This invention relates to a machine for making insulating elements composed of a plurality of superposed turns or sheets of insulating material which are impregnated with a flowable insulating compound during the winding or laying on operation and are insulatedly separated by a thin film of said compound.

Such an insulating element and the machine for making same are shown in my prior application for U. S. Letters Patent, Serial No. 833,182, filed on the 20th day of April, 1914, and the invention herein disclosed constitutes an improvement on the invention shown in my prior application.

Among the objects of the invention is to provide a machine for assembling such insulating elements, whether the same have the form of a tube or are flat, in the presence of a high vacuum so that air and other gases are to a maximum degree withdrawn from the body of the material from which the insulating element is formed and from between the layers of said material.

A further object of the invention is to provide a machine of this character in which the winding or laying on mechanism, with its power plant, constitutes a unitary mechanism which may, as a whole, be readily removed from and inserted into the air tight compartment or tank which incloses said mechanism.

A further object of the invention is to provide means whereby the sheet which is being assembled into the insulating element may be cut when the desired number of layers are assembled and whereby the vacuum or low pressure may be in any suitable manner released, and whereby the assembling mechanism may be continued in operation after such vacuum release to prevent the entrance of air under normal pressure be-

tween the layers of the insulating material which compose the insulating element, at the ends of the latter, the insulating element for this purpose being rotated in the flowable insulating compound until sufficiently cooled to prevent the entrance of air between said layers.

A further object of the invention is to provide means for subjecting the sheet to the effects of a high tension electro-static discharge just prior to the laying of the sheet on the insulating element so as to thereby further drive out air, gases, water and other deleterious foreign matter from the sheet.

A further object of the invention is to provide in a machine of this character means for scraping the excess insulating compound from the face of the sheet prior to the assembling of the sheet in the insulating element, and for maintaining the scraping device sufficiently heated to render the scraping operation efficient.

Other objects of the invention are to simplify and improve machines of this general character, and the invention consists in the matters hereinafter set forth and more particularly pointed out in the appended claims.

In the drawings:—

Figure 1 is a horizontal section of a machine embodying my invention.

Fig. 2 is an end view thereof, showing the inclosing tank in section.

Fig. 3 is a top plan view of a portion of the winding mechanism and the shearing mechanism.

Fig. 4 is a vertical section on the line 4—4 of Fig. 5.

Fig. 5 is a front elevation of a portion of the winding mechanism and the scraping and shearing mechanisms.

Fig. 6 is a side view of the machine, partially broken away, showing the winding mechanism partly withdrawn from the inclosing tank.

As shown in the drawings, 10 designates an air tight tank, preferably circular in cross section, provided with a fixed end wall 11 and a removable end wall 12, the latter being attached to the tank wall by means providing an air tight joint. The said tank is adapted to be connected by a suitable hose or pipe 13 with a vacuum pump 14 or other source of low pressure whereby a high vacuum is maintained in the tank. The said tank is supported in its horizontal position

by means of suitable horizontal supporting members 16 attached thereto at the sides of its center. It is provided with internal tracks 17, 17 which extend from end to 5 end of the tank and on which the winding mechanism, hereinafter to be described, is normally supported. The said winding mechanism is adapted to be withdrawn outwardly onto supplemental tracks 18 arranged 10 in endwise extension of the tank tracks and which may be temporarily connected to the tank tracks when the end wall 12 is removed.

The winding mechanism is a power driven, 15 self contained machine. It comprises, in general terms, a frame composed of rigidly connected upright and horizontal members 20, 21, respectively. Extending across the said frame at the lower side thereof are axles 20 22 which carry supporting wheels 23, that rest and roll on the tracks 17 and 18. When the winding mechanism is run out onto the supplemental tracks 18 free access may be had thereto to remove a wound tube therefrom or to apply a new reel of sheet material thereto and to thread it through the guiding and winding elements.

The tube may be wound upon any suitable mandrel 25, as for instance, the collapsible 30 mandrel shown in my aforesaid prior application. The shaft 26 of said mandrel is rotatively mounted in suitable divided bearings supported on the frame in the manner shown in Fig. 2, whereby the mandrel and 35 the wound tube may be readily removed from the machine and another mandrel applied thereto. The mandrel is herein shown as driven by a motor 28 supported on the frame and is connected through the medium 40 of a worm 29 to a worm wheel 30 that is fixed to one end of the mandrel shaft. Any other suitable drive may of course be employed.

32 designates a rotative reel, the shaft 33 45 of which is mounted in bearings 34 carried by the upright members of the frame at one side thereof. Said reel receives a roll A of sheet material which is unwound to produce the insulating element. The sheet a is carried 50 from the reel over a guide roller 35 mounted in an extension 36 of the frame, thence downwardly into a receptacle 38 which contains a flowable insulating compound or bath by which the sheet is to be 55 impregnated. The sheet is guided through said insulating bath about guide rollers 40, 41, the shafts of which are rotatively mounted in the end walls of the tank. It is continued from the roller 41 upwardly over a 60 roller 43 which, in the present instance, is a metal roller and constitutes one of the electrodes of a high tension current circuit, and from said roller 43 the sheet is wound upon the mandrel 25. The bearings for the roller 65 43 are carried by insulators 45 which are

supported by the upper ends of swinging arms 46 that are pivoted at their lower ends at 47 to the machine frame and swing at their upper ends toward and away from the tube winding mandrel. At the line at which 70 the sheet is laid on the mandrel or the forming tube thereon there is provided an ironing or pressing roller 48 which presses the sheet closely upon the forming tube in a manner similar to that shown in my aforesaid prior application. If desired, a suitable tension device may be applied to the roll or the reel 32 so as to prevent too free unwinding of the sheet from the roll. The 75 said tension device may be like that shown in my aforesaid prior application, or it may consist of a weighted bar 50 which lies upon the roll and is connected to the machine frame by resilient arms 51.

The ironing roller 48 is mounted in the 80 upper ends of the said swinging arms 46. As herein shown the said swinging arms extend above the level of the top of the insulating bath tank 38 and are provided with inwardly and downwardly extending members 52 which extend over the top edges of the end walls of the tank and support the shaft 53 of the roller 48. Said roller 48 may be pressed toward the forming tube on the 85 mandrel by spring pressure device which 90 consists, in the present instance, of springs 55 attached at their rear ends to the swinging arms 46 and are connected at their forward ends by means of links 56 to hand levers 57 that are pivotally connected at 95 their lower ends to the frame. Said hand levers may be locked in any suitable manner to ratchets 58 carried by the frame and engaging the upper ends of said levers. The 100 hand levers and ratchets provide means whereby spring pressure of the roller 48 against the forming tube may be varied.

Between the rollers 43 and 48 the sheet is subjected to a scraping operation to remove surplus insulating compound therefrom. The 105 said scraping operation is herein shown as effected by means of the sharpened edges of upper and lower scraper bars 60, 61, respectively, which extend between and are attached in any suitable manner to the upper 110 ends of the swinging arms 46. The said scraping bars are shown as of angular cross section, one edge of each bar being sharpened to constitute a scraping edge. In the present 115 instance, the scraping edge of the lower bar is formed at the lower edge of the vertical member thereof and contacts with the outer surface of the sheet. The sheet passes across said scraping edge and along the vertical member of the bar and engages at 120 its inner side the scraping edge formed on the horizontal member of the upper bar 60.

Preferably the upper and lower scraper bars are equipped with suitable heating elements 68, 66, respectively, which may con- 125

sist of thin strips of metal of low electrical resistance insulated in any suitable manner from the bars, as by being inclosed in envelopes of insulating material. The heating of the bars prevents hardening of congealing of the insulating compound on the sheet to such extent as would render its removal therefrom by the scraper bars inefficient. Desirably also the roller 41 in the 10 tank at the rising side of the sheet is also provided with a low resistance element, indicated at 66, so as to assist in maintaining the insulating compound at the desired degree of fluidity.

15 The main or principal source of heat to heat the insulating compound in the tank 38 may be of any suitable or preferred character such as the burner pipes 67' arranged below the tank and supported in any suitable manner and connected with an external source of fuel supply by means of a suitably located supply pipe or hose. As additional means of maintaining the compound suitably warm I may provide the tank with one 25 or more internal heating elements 67, one being herein shown. The said heating elements of the scraper bars, the guide roller 41 and the heating element 67 may be connected with a suitable source of electrical 30 energy in multiple in the manner indicated in Fig. 5 and more fully disclosed in my companion application for U. S. Letters Patent, filed on the 20th day of March, 1915, Serial No. 15,929, suitable switches being included in the circuits to permit them to be 35 separately controlled as found necessary or desirable.

The electric motor 28 is fed from a suitable source of supply through a conductor 40 70 which leads through an outlet plug in the tank wall, not herein shown. Preferably the tank is provided with a plurality of internal lamps 71 to illuminate the winding mechanism. The said lamps may be supported on the tank wall or on the frame, as desired, and the lamp circuit may be connected with the motor circuit in the manner indicated in my aforesaid companion application. When so equipped with illuminating lamps the tank will be provided with 45 one or more windows 73 through which the operation of the winding mechanism may be observed.

In order that the sheet may be readily severed at the time sufficient number of turns or layers have been wound into the tube to provide the required thickness of the tube wall, I have provided a shearing mechanism, with means for automatically operating it, 50 to sever the sheet. Said shearing mechanism may be located either at the rising or descending side of the sheet. As herein shown it is located at the rising side of the sheet between the insulating bath and the 55 winding mandrel or form. It comprises a

fixed shearing blade 75 and a swingable shearing blade 76 pivoted at 77 to the fixed blade or other suitable support. The said blades are normally separated by a space through which the sheet passes. The movable blade is swung into its shearing position by an operating spring 78 which is connected to the free end of said blade and to a fixed part of the machine. Said movable blade is held in its normally retracted position by means of a pivoted latch 79 that is provided with a tooth which engages a stud 80 carried by the swinging or free end of the blade. The heel end of the latch is formed to constitute an armature 81 which 80 co-operates with the core of an electro-magnet 82, the arrangement being such that when the said magnet is energized the armature is drawn toward said core to release the latch from the pin or stud 80 and to 85 thereby permit the spring 78 to swing the movable blade into its cutting position. The winding of said electro-magnet 82 may be connected in the motor circuit in the general manner illustrated in my aforesaid companion application.

After the sheet has been severed by the shearing mechanism described, the end wall 12 of the tank is removed and the winding and insulating mechanisms are withdrawn 95 from the tank 10 out onto the supplemental tracks 18. The connections of the various circuit wires of the internal terminals, and the connection of the supply pipe to the gas burners is such as to permit the mechanism 100 to be thus withdrawn without disconnecting the terminals and gas supply pipe. The opening of the tank releases the vacuum from the wound tube and raises the pressure thereon to atmospheric pressure. In 105 order to prevent air leaking into the spaces between the turns or convolutions of the wound tube at the ends thereof after the release of the vacuum, the rotation of the finished tube may be continued for a period 110 while it is subjected to the drying influence of a fan or other suitable drying means. The application of heat to the insulating compound may be also continued so as to maintain said compound in a suitable liquid 115 or flowable state. Thus the liquid insulating compound within the receptacle seals the interspaces between the layers or convolutions of the tube at the ends of the latter and prevents leakage of air therebetween. The 120 same general results with respect to the release of the vacuum may be effected within the tank 10 before the winding mechanism is withdrawn therefrom after the sheet is severed by the shearing mechanism by continuing the rotation of the tube until it is sufficiently dry or hardened to prevent the leakage of air between the layers or convolutions of the said tube. However, the withdrawal of the tube with the winding mech- 125 130

anism from the tank is preferred inasmuch as the drying operation may be thereby greatly hastened.

After the tube has been sufficiently cooled 5 and hardened the winding mandrel and the tube are removed from the frame and the mandrel removed from the tube. The tube may be subjected to an external pressure during the further setting or hardening of the 10 tube in the manner described in my aforesaid application, Serial No. 833,182. It will be understood that the tube may be wound on a cylindric mandrel instead of the rectangular mandrel herein indicated.

15 The roller or electrode 43 is connected to a source of high tension pulsating direct current through the means of a conductor 90 which may be connected to the rotating trunnion of the said roller in any suitable manner, said conductor being insulated from the tank by an insulator 91. The conductor 90 is attached to one end of the roller or electrode 43 and the circuit is open at the other end thereof. One or both of the scraper 20 bars, or other metal parts of the frame, is grounded so that there is set up between said electrode 43 and said grounded metallic portion of the machine an electro-static discharge that has the effect of driving out 25 moisture, air, gases and other deleterious foreign substances from the sheet. In this manner the sheet, while being thoroughly impregnated with the insulating compound, is free from deleterious foreign substances 30 such as would decrease its insulating efficiency. Thus the tube produced possesses uniform insulating qualities throughout the area thereof.

After the tube and the mandrel have been 40 removed from the frame, another mandrel or the same mandrel, is applied thereto and another sheet or roll of paper is applied to the frame and the leading edge thereof is threaded through the guiding rollers and attached to the mandrel. Thereafter the mechanism thus equipped is pushed into the tank and the end wall 12 is fastened thereto, whereupon the operation of winding a new tube is begun.

50 It will be observed that the sheet or web  $\alpha$  is directed from the roll A over the roll 35 to the insulating compound bath. This length of exposure, when operating under a partial vacuum, serves to free the sheet 55 or web from free air and gases, so that the sheet enters the bath with the pores open to receive the insulating compound. Thereby the sheet becomes impregnated with a larger percentage of the compound than if 60 the process were carried on under atmospheric pressure. It will be furthermore observed that the sheet is directed from the insulating bath to the forming mandrel over directing rollers which exert no compressive 65 or squeezing action on the sheet, so that all

of the insulating compound which is taken up by the body of the sheet remains therein and the sheet therefore carries a maximum amount of the insulating material and a minimum amount of free air and gases. The 70 withdrawal of the free air and gases and the substitution of the insulating compound increases the dielectric quality of the sheet and of the tube resulting from the assemblage of the sheet layers. The scrapers across 75 which the sheet passes between the insulating compound bath and the mandrel are designed only to remove surplus insulating material from the surface of the sheet and to remove air globules or free water which may 80 adhere to said surface.

It will be understood that the structural details of the machine are capable of variations within the spirit and scope of the invention, and that the invention is not limited to the structural details shown except as herein made the subject of specific claims and as imposed by the prior art.

I claim as my invention:—

1. A machine for the purpose set forth 90 comprising an air tight tank with means to produce and maintain a vacuum therein during the impregnation and assembling operation, mechanism within the tank for assembling thin sheets to constitute a multi-ply 95 insulating element, means to apply pressure to the sheet as the layers are assembled in the element, means for impregnating the sheets with an insulating compound prior to the assembling operation and means whereby the sheet is subjected uniformly in all its parts to the action of the vacuum before it is impregnated.

2. A machine for the purpose set forth 105 comprising an air tight tank with means to produce and maintain a vacuum therein during the impregnating operation, and a tube winding mechanism embracing a rotating mandrel, means to support a roll of sheet material within the tank, means to wind it 110 on said mandrel, means to apply pressure to the sheet as it is wound upon the mandrel, and a receptacle for a liquid insulating compound through which the sheet is passed on its way to said mandrel, the roll supporting 115 means being exterior to said receptacle.

3. A machine for the purpose set forth 120 comprising a receptacle to contain an insulating compound, a mandrel rotatable in the insulating compound in said receptacle, a 125 reel to receive an insulating sheet roll, means to guide the sheet from said roll through the insulating compound in said receptacle to said mandrel, scraping means between the said receptacle and said mandrel to scrape excessive insulating compound from said sheet, and means to heat said scraping means.

4. A machine for the purpose set forth 130 comprising a receptacle to contain an insu-

lating compound, a mandrel rotatable in the insulating compound in said receptacle, a reel to receive an insulating sheet roll, means to guide the sheet from said roll through the 5 insulating compound in said receptacle to said mandrel, scraping means between the said receptacle and said mandrel to scrape excessive insulating compound from said sheet, means to heat said scraping means and 10 means between said scraping means and said mandrel to subject said sheet to the influence of a high tension electro-static discharge, for the purpose set forth.

5. A machine for the purpose set forth 15 comprising an air tight tank with means to produce and maintain a vacuum therein, and a tube winding mechanism embracing a rotating mandrel, means to support a roll of sheet material within said tank, means 20 to wind it on said mandrel, a receptacle for a liquid insulating compound through which the sheet is passed on its way to said mandrel, scraper devices to engage said sheet to scrape excess insulating compound 25 therefrom and means for heating said scraper devices.

6. A machine for the purpose set forth 30 comprising an air tight tank, with means to produce and maintain a vacuum therein, a tube winding mechanism within the tank embracing a rotative mandrel with means to direct an impregnated sheet thereto, cutting means adjacent to and parallel with the mandrel to sever the sheet and actuating means for the cutting means operatable from a point exterior to the tank.

7. A machine for the purpose set forth 35 comprising an air tight tank with means to produce and maintain a vacuum therein, and a tube winding mechanism in the tank embracing a rotative mandrel, said tank having a self-contained motor driving means, means to support a roll of sheet material in the tank, means to wind it on said mandrel, 40 a receptacle to contain an insulating compound through which the sheet is passed on its way to the mandrel, means to release the vacuum within the tank, and shearing means to sever the sheet while in the tank.

50 8. A machine for the purpose set forth comprising an air tight tank provided with a removable closure, means to produce and maintain a vacuum therein, tracks in said tank, a wheeled tube winding mechanism 55 within said tank supported on said tracks, and supplemental tracks exterior to the tank outwardly upon which the said wheeled tube winding mechanism is adapted to be drawn when the closure is removed.

60 9. A machine for the purpose set forth comprising an air tight tank with means to produce and maintain a vacuum therein, and provided with a removable wall and with an interior track, a tube winding mechanism in said tank, comprising a wheeled 65

frame supported on said track, a rotative mandrel on said frame, an insulating compound receptacle supported on said frame, means to guide a sheet of insulating material through the insulating compound, 70 means to wind it on said mandrel, and supplemental tracks exterior to the tank outwardly upon which the frame is adapted to be drawn.

10. A machine for the purpose set forth 75 comprising an air tight tank with means to produce and maintain a vacuum therein, and provided with a removable wall and with an interior track, a tube winding mechanism in said tank, comprising a wheeled frame supported on said track, a rotative 80 mandrel on said frame, an insulating compound receptacle supported on said frame in such position that a forming tube is partially submerged in the compound, means to guide a sheet of insulating material through the insulating compound, means to wind it on said mandrel, supplemental tracks exterior to the tank outwardly upon which the frame is adapted to be drawn, said tube 85 winding mechanism being provided with a self-contained operating motor supported on said frame, whereby the tube may be rotated in the insulating compound after the frame has been withdrawn upon said supplemental track. 90

11. In a machine for the purpose set forth, assembling means for superposing impregnated sheets to constitute a multi-ply insulating element and means for subjecting 100 the sheet to the influence of a high potential electro-static discharge prior to the assembling operation.

12. In a machine for the purpose set forth, means for impregnating a sheet with an insulating compound, means for winding the impregnated sheet into a tube, and means for subjecting the impregnated sheet to the influence of a high potential electro-static discharge prior to the winding operation. 105

13. In a machine for the purpose set forth, means for impregnating a sheet with an insulating compound, means for winding the impregnated sheet into a tube, means for scraping excess of insulating compound 110 from the sheet and means for subjecting the scraped sheet to the influence of an electro-static discharge.

14. In a machine for the purpose set forth, assembling means for superposing impregnated sheets to constitute a multi-ply insulating element and means for subjecting the sheet to the influence of a high potential electro-static discharge prior to the assembling operation, combined with means for 115 subjecting the sheet to a high vacuum during the winding operation.

15. A machine for the purpose set forth comprising a receptacle to contain a liquid insulating compound, a mandrel mounted to 120

130

rotate partially in the receptacle, with means to rotate it, and to feed a sheet of insulating material through the compound and to reel it on said mandrel, arms pivoted to the frame and swingable toward and from the mandrel, a smoothing roller carried by the arms, with means to yieldingly press it against the sheet at the line of laying the sheet on the forming tube on the mandrel, 10 a metal roller over which said sheet passes on its way to said smoothing roller, said metal roller being included in a high potential electric open circuit, and the sheet adjacent to said metal roller being subjected to an electro-static discharge between said roller and a grounded metallic part of the winding mechanism.

16. A machine for the purpose set forth comprising a receptacle to contain a liquid insulating compound, a mandrel mounted to rotate partially in the receptacle, with means to rotate it, and to feed a sheet of insulating material through the compound and reel it on said mandrel, arms pivoted to the frame and swingable toward and from the mandrel, a smoothing roller carried by the arms, with means to yieldingly press it against the sheet at the line of laying the sheet on the forming tube on the mandrel, a metal 20 roller over which said sheet passes on its way to said smoothing roller, said metal roller being included in a high potential electric open circuit, the sheet adjacent to said metal roller being subjected to an electro-static discharge between said roller and a grounded metallic part of the winding mechanism, and scraper bars carried also by said swinging arms between the smoothing roller and said metallic roller for scraping excess 30 insulating compound from said sheet.

17. A machine for the purpose set forth comprising means for impregnating the sheet, means for superposing the impregnated sheet in layers to constitute a multi-ply insulating element, means to subject the sheet before it is impregnated to a partial vacuum and means whereby the formed element is subjected to a pressure considerably higher than the pressure under which the 40 element is formed.

18. A machine for the purpose set forth comprising means to support a sheet roll, means to assemble the sheet in superposed layers to constitute a multi-ply insulating element, means between the support for the roll and the assembling means to impregnate the sheet with an insulating compound and means whereby the sheet before it passes to the impregnating means, and the 50 insulating element after it has been formed, may be subjected to varying air pressures.

19. A machine for the purpose set forth comprising an air tight tank with means to produce and maintain a vacuum therein during the impregnation and assembling opera-

tion, mechanism within the tank for assembling thin sheets to constitute a multi-ply insulating element, means to apply pressure to the sheet as the layers are assembled in the element, means for impregnating the sheets 70 with an insulating compound prior to the assembling operation and means to release the vacuum prior to the setting of the insulating compound whereby the multi-ply element sets or hardens under atmospheric 75 pressure.

20. A machine for the purpose set forth comprising an air tight tank and an insulating compound receptacle therein, a mandrel on which to form a tube from a continuous sheet while the forming tube is partially submerged in the compound in said receptacle, means to maintain a partial vacuum within the tank during the tube forming operation, means to release the vacuum 80 and means to turn the mandrel and formed tube in the compound while said tube sets or hardens.

21. A machine for the purpose set forth comprising an air tight tank provided with 90 a removable closure, a mechanism within the tank for assembling thin sheet layers to constitute a multi-ply insulating element, means for impregnating the sheet layers with an insulating compound prior to the 95 assembling operation and a supporting frame for the assembling and impregnating means movable into and out of the tank.

22. A machine for the purpose set forth comprising a tank provided with a removable closure, a rotating mandrel, means to support a roll of sheet material within the tank and to wind it on said mandrel, a receptacle for liquid insulating compound through which the sheet is passed on its way 100 to said mandrel, and a supporting frame for said mandrel, roll and receptacle movable into and out of the tank.

23. A machine for the purpose set forth, comprising an air tight tank, means to produce and maintain a partial vacuum therein, a receptacle for liquid insulating compound in said tank, a tube forming mandrel also within said tank, means within the tank to support a roll of sheet material and to direct it through said receptacle and to the mandrel, and a supporting frame for said sheet supporting means, said receptacle and said mandrel movable into and out of the tank.

24. A machine for making insulating elements comprising an air tight tank, with means for producing a vacuum therein, means to support a roll of sheet material, a mandrel on which the impregnated sheet is 110 wound, means for directing a sheet through a bath of insulating material and for directing the impregnated sheet to the mandrel without exerting a squeezing pressure thereon of a nature to expel the insulating 120

130

material from the body of the sheet and means at the mandrel to free the surface of the sheet from free fluid, the sheet supporting, the winding and the fluid freeing means, being all contained within the tank.

25. A machine for making insulating elements comprising means for assembling a plurality of layers or laminae of a sheet into an element, means to impregnate the sheet with an insulating compound prior to the assembling operation, and means to

subject all parts of the sheet prior to the impregnating operation to a vacuum.

In testimony, that I claim the foregoing as my invention I affix my signature in the 15 presence of two witnesses, this 26th day of February, A. D. 1915.

CHESTER H. THORDARSON.

Witnesses:

W. L. HALL,  
G. E. DOWLE.