J. P. A. McCOY.

APPARATUS FOR APPLYING COVERING OF SHEET MATERIAL.

APPLICATION FILED JULY 9, 1917.

1,385,967.

Patented July 26, 1921.

2 SHEETS—SHEET 1.

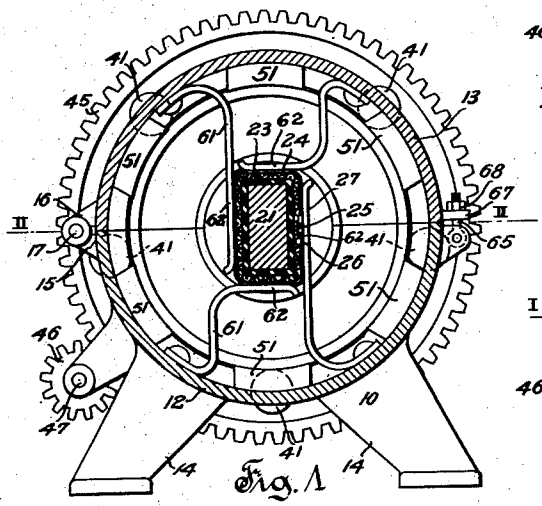


Fig. 1

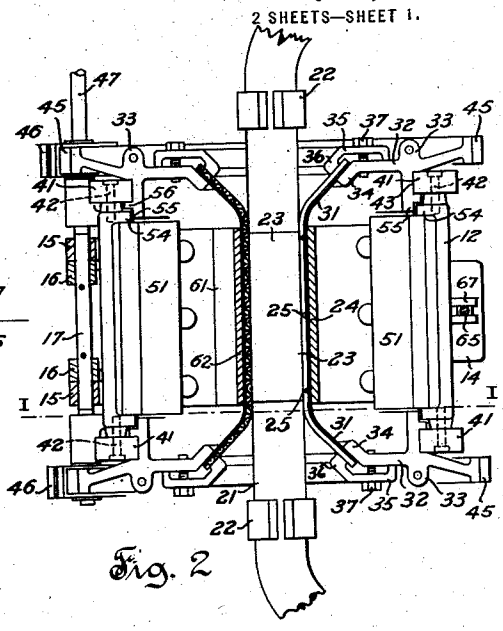


Fig. 2

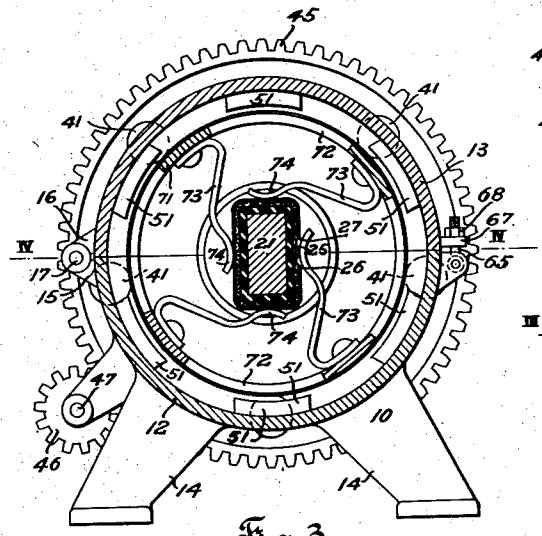


Fig. 3

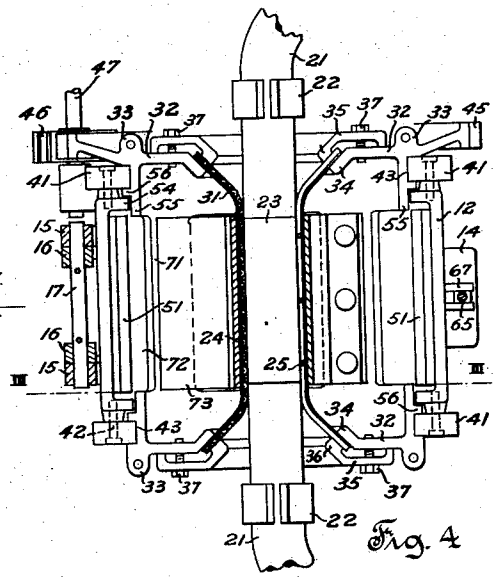


Fig. 4

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2 SHEETS—SHEET 2.

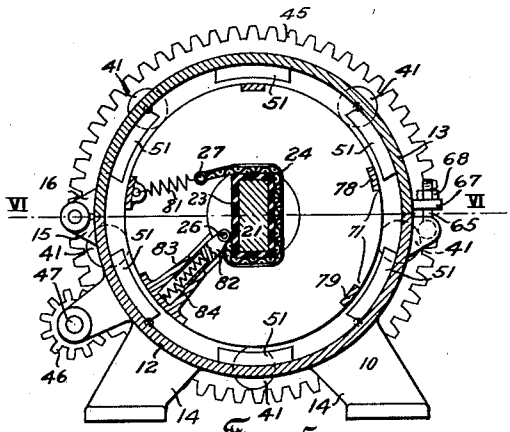


Fig. 5

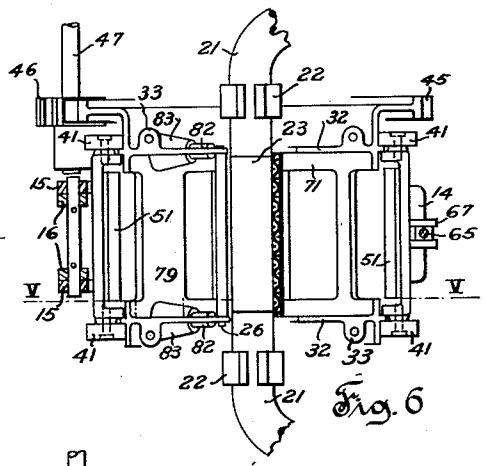


Fig. 6

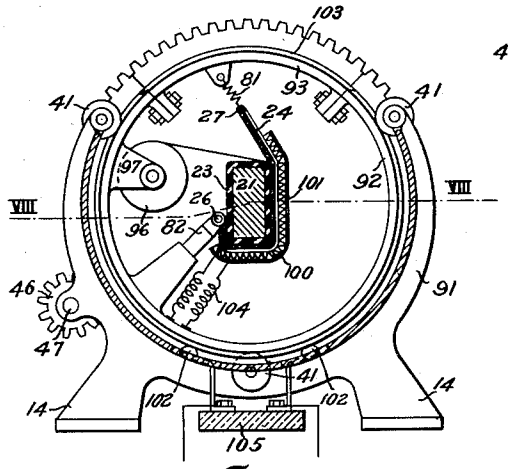


Fig. 7

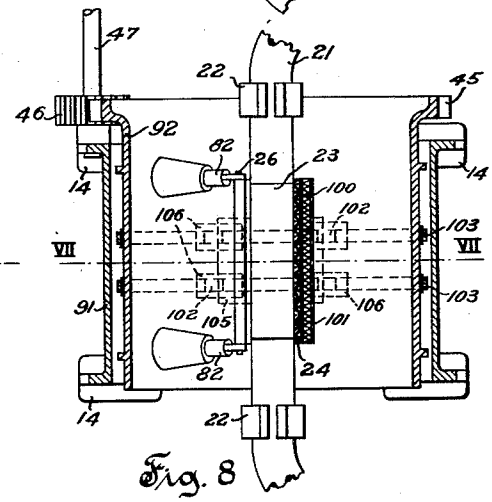


Fig. 8

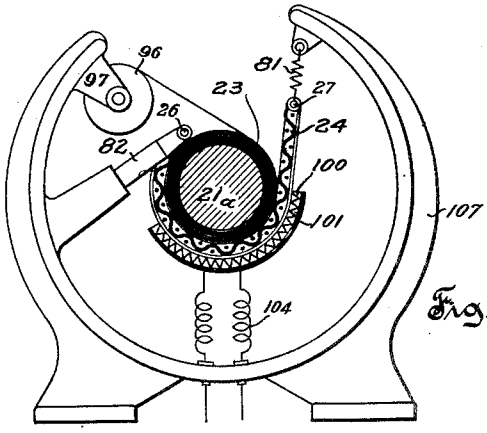


Fig. 9

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# UNITED STATES PATENT OFFICE.

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## APPARATUS FOR APPLYING COVERING OF SHEET MATERIAL.

1,385,967. Specification of Letters Patent. Patented July 26, 1921.

Application filed July 9, 1917. Serial No. 180,015.

*To all whom it may concern:*

Be it known that I, JAMES P. A. McCOY, a subject of the King of Great Britain and Ireland, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented a certain new and useful Improvement in Apparatus for Applying Covering of Sheet Material, of which the following is a specification.

This invention relates in general to apparatus for applying wrappings or coverings to objects, and has particular relation to apparatus of this general character especially adapted for applying or compacting insulating sheet material on core-like bodies, such as the side portions of coils for dynamo-electric machines, to form tube-like insulating elements thereon.

A very desirable form of insulation which may be used as a covering or wrapping for conductors, or as a hollow insulating tube or conduit, is made up of one or more sheets of insulating material wrapped about a core and pressed and compacted so as to exclude air from between the several turns of the wrapping. Usually, the sheet material of which this wrapping or insulation is formed, is of paper or fiber of good insulating qualities provided with a varnish or other gum coating on one side, this coating preferably being hard at ordinary temperatures to facilitate handling and applying the sheet material. In applying this insulating sheet material to a body to be insulated, or in forming an insulating tube upon a temporary core, the material is wound upon the core, whether it be of a temporary or permanent character, and, either during the winding or subsequently thereto, heat is applied to the material to soften the gum coating which is preferably on the inner side of the material, and pressure is applied while the coating is soft to compact the several layers of the wound sheet material to thereby exclude air therefrom and generally to form a firm and solid covering about the core with adjacent layers or turns of the covering adhering to each other.

The present invention is directly concerned with the production of an improved apparatus of this general character suitable for forming an insulating covering, made up of several layers of sheet material, about portions of coils for dynamo-electric machines or other core-like bodies, and wherein the element for applying pressure, or heat and pressure, to the material wound upon the core is flexible and of novel character.

It is an object of this invention to provide an apparatus of improved design and construction for applying pressure to a covering or wrapping of sheet material wound upon a core, for the purpose of compacting this covering.

It is a further object of this invention to provide an improved apparatus for applying heat and pressure to a covering or wrapping of sheet material wound upon a core, for the purpose of softening a gum or other coating on the material and compacting the layers of the covering into a substantially solid mass.

It is a further object of this invention to provide an improved apparatus of this general character which reduces manual operations to a minimum and is substantially automatic in its operation of heating and compacting the covering of sheet material.

It is a further object of this invention to provide an improved apparatus of this general character wherein the element for transferring heat to, or heating, or for pressing, or for both heating and pressing, the wrapping of sheet material comprises a flexible pad of metal fabric, and wherein means are provided for producing relative rotation between the flexible pressing pad and the sheet material to be operated upon.

These and other objects are attained by this invention, the various novel features of which will be apparent from the description and drawings, disclosing one embodiment of such invention, and will be particularly pointed out in the claims.

In the accompanying drawings:

Figure 1 is a sectional elevation of an apparatus embodying features of this invention, the section being taken along the line I—I of Fig. 2.

Fig. 2 is a sectional plan view of the apparatus of Fig. 1, along the line II—II of Fig. 1, with a coil side in full plan view.

Fig. 3 is a sectional elevation of a modification of the apparatus disclosed in Fig. 1, the section being taken along the line III—III of Fig. 4.

Fig. 4 is a sectional plan view of the apparatus of Fig. 3, along the line IV—IV of Fig. 3, with a coil side in full plan view.

Fig. 5 is a sectional elevation of a further modification, the section being taken along the line V—V of Fig. 6.

Fig. 6 is a sectional plan view of the apparatus of Fig. 5, along the line VI—VI of Fig. 5, with a coil side in full plan view.

Fig. 7 is a sectional elevation of a further modification, the section being taken along the line VII—VII of Fig. 8.

Fig. 8 is a sectional plan view of the apparatus of Fig. 7, along the line VIII—VIII of Fig. 7, with a coil side in plan view.

Fig. 9 is an elevation, partly in section, of a modified apparatus embodying features of applicant's invention.

In accordance with the disclosure of Figs. 1 and 2, a frame 10, of generally cylindrical shape, is made up of lower and upper sections 12 and 13, respectively. The lower section 12 is provided with supporting feet 14, and one or more apertured projections 15 at one side. The upper section 13 is provided with one or more apertured projections 16, the apertures of which are axially alined with the apertures in the projections 15, these apertures receiving a hinge pin 17 whereby the upper section may be swung back out of the position indicated in Fig. 1 to permit the insertion and removal of a coil side or other core, indicated at 21, to be operated upon.

In the form shown, the element 21 held in operative position relative to the frame 10 may be considered as the side of a coil for a dynamo-electric machine. This core element 21 may he held in operative position by clamps 22, with its longitudinal axis in approximate coincidence with the axis of the frame 10. The core element 21 is shown as being provided with a previously applied covering or wrapping 23, formed by winding several layers of insulating sheet material upon each other. This wrapping or covering 23 of sheet material has a varnish or gum coating applied to one side thereof, preferably the side that lies radially inward when the covering is applied to the core. This coating is comparatively hard at ordinary temperatures to thereby facilitate handling of the sheet material.

An element for applying heat and pressure to the wrapping 23 is indicated at 24. This element is in the form of a flexible pad or sheet of fabric woven from metal wire or links, a very desirable form being one similar to the ordinary chain mail or chain mesh. However, the desirable features of this pressing pad are flexibility, ability to retain heat, indestructibility and more or less mass to facilitate the application of pressure to the wrapping or covering to be operated upon. As indicated, the longitudinal edges of this flexible pressing pad are brought together, or comparatively close to each other, and secured by means of one or more spring clips 25 which connect rods 26 and 27 secured to the opposing edges of the pad. This form of spring connection is such as to provide a substantially closed tube of great flexibility and more or less elasticity and one which tends to lie in close contact with the covering or wrapping 23 and to exert more or less pressure thereon.

This pressing fabric or pad which, in assembled condition of the apparatus, is in a generally tubular form, at least, at that portion which surrounds and is in contact with the covering of sheet material 23 to be operated upon, has flaring end portions 31 which serve for attachment to rotatable carriers to secure rotation of the generally tubular portion of the pressing pad in engagement with the covering 23. These flared end portions are secured to and supported by end plates 32 having inwardly inclined conical flanges 34 against which the ends of the flared portions 31 of the pressing pad are secured by clamps 35 having correspondingly shaped conical flanges 36, these clamps being secured in position by bolts 37. These end plates 32 and clamping plates 35 are formed in two sections, preferably divided along a diameter, as indicated, and may be provided with axially extending, apertured lugs 33, which may be bolted together to thereby secure the two sections of the parts in operative position.

The assembled end plates 32 are held in operative position and centered by means of rollers 41 mounted upon pins 42, carried by the sections of the frame 10, and bearing upon peripheral portions 43 of the end plates. It will be apparent that any suitable means for driving the end plates in synchronism may be utilized. In the apparatus illustrated, the end plates are provided with gear teeth 45 meshing with the teeth of pinions 46 mounted upon a driving shaft 47. However, it will be apparent that these end plates may be driven by belts or driving rollers, or the centering rollers 41 may be utilized as driving rollers, with suitable provision made for applying power to these rollers.

The radially inner side of the frame 10 is provided with one or more heaters 51 for supplying the heat necessary to cause softening of the gum coating on one side of the sheet material of which the wrapping 23 is formed. The heat producing elements of these heaters may be electrical resistance coils or burners for consuming liquid or gaseous fuel. In fact, any suitable means for applying heat at a point within the frame may be used. As generally indicated in the drawings, the frame 10 in con-

nection with the end plates 32 form a housing and serve to confine the heat supplied by the heaters 51. As indicated, the sections of the frame 10 are provided with radially inwardly extending flanges 54 forming a comparatively close fit with the axial extensions 55 on the end plates and the radial flanges 56 extending therefrom. Such an arrangement serves to form an inclosure which is open only at points adjacent the center, that is, adjacent the flaring portions 31 of the flexible pressing element.

While the spring connection 25 between the longitudinal edges of the flexible pressing element 24 serves to draw this pressing element tightly about the insulating or other wrapping 23 with sufficient pressure to thoroughly press and iron the latter, nevertheless, it may be desirable to provide additional pressing means. This additional means may be in the form of a plurality of leaf springs 61 each attached at one end to a section of the frame 10 and having a comparatively flat bearing portion 62 in engagement with a portion of the flexible pressing pad that is over one of the sides of the core 21. Of course, depending upon the cross-sectional shape of the core to be operated upon, the shape and other characteristics of these assisting springs might be varied.

The section 12 of the frame 10 may be provided with a swinging bolt 65 which engages in a slotted lug 67 on the frame section 13. By means of this swinging bolt and a nut 68 threaded thereon and against the extension 67, the two frame sections may be firmly clamped together and held in operative position relative to the other parts.

The particular form of apparatus illustrated in Figs. 1 and 2 is such as is adapted for heating and pressing a previously applied covering of sheet material having a gum coating upon one side thereof. With the sections of the frame 10 and the end plates 32 separated and the upper portion of the flexible pressing element 24 turned back, the coil side 21, or other core, may be inserted to operative position, and may be secured therein by means of the clamps 22. The movable sections of the end plates 32 and the frame 10 are then returned to operative position and the flared ends 31 of the pressing element are attached to the removable portions of the end plates by the corresponding portions of the clamping plates 35, and the opposing longitudinal edges of the pressing element are connected together by means of the spring clips 25.

The end plates 32 may then be rotated through the pinions 46 and shaft 47, and the flexible pressing pad 24 rotated about the core 21 and its wrapping or covering 23. Heat transferred to the flexible pressing pad from the heaters 51 is effective to soften the gum coating on the inner side of the sheet material of the wrapping and the pressure due to the spring connection between the longitudinal edges of the pressing pad and also to the springs 61, causes the pressing pad to force out air pocketed between turns of the wrapping and to compact these layers or turns, and generally to force the turns into intimate contact. When the desired amount of heat and pressure has been applied to the covering 23, the sections of the frame 10 and the end plates may be separated and the coil side or other core removed. In the final condition of the wrapping the gum coating cements the adjacent layers of the covering into intimate contact or union, the finished product comprising a covering or coating that is practically solid.

The apparatus shown in Figs. 3 and 4 is quite similar, as to both structure and operation, to the apparatus of Figs. 1 and 2. The main structural difference is that the end plates 32 of the apparatus of Figs. 3 and 4 are connected together by a generally cylindrical frame portion 71, divided along a horizontal diameter and attached to or integral with the end plates. The frame 71 is provided with comparatively large openings 72 to permit the comparatively unobstructed transfer of heat from the heaters 51 to the pressing element 24. These openings 72 are axially within the ends of the frame 10 to avoid any loss of heat therethrough. The springs 73 which bear upon the outer side of the flexible pressing element are attached to the rotatable frame 71 associated with the end plates 32, rather than being attached to the frame 10, as in the apparatus of Figs. 1 and 2. In view of the fact that these springs rotate about the coil side or other core, which may be of rectangular cross section, as indicated, they are necessarily of comparatively great flexibility and have their free ends formed with bearing portions of comparatively limited area, as generally indicated at 74. It will be apparent that while the bearing portions of the springs 73 remain in engagement with substantially the same portions of the flexible pressing element 24 throughout the operation of the apparatus, nevertheless, the desired pressure is applied to the covering 23, since all peripheral portions of this covering successively assume positions wherein they are under the influence of these bearing portions of the springs.

Due to the fact that the end plates are connected together through the frame 71, it will be apparent that one of the pinions 46 and the coöperative geared portion of an end plate may be unnecessary and can be dispensed with, as indicated. The operation of the apparatus of Figs. 3 and 4 will be readily apparent from the above description and explanation.

The apparatus disclosed in Figs 5 and 6

is more or less similar to that disclosed in Figs. 3 and 4, inclusive, as to the general structural features of the supporting frame for the flexible pressing element 24. This latter supporting frame 71 is divided along a diameter and has upper and lower sections 78 and 79, respectively. The end of the pressing element with which the rod 27 is associated is connected to the frame section 78, preferably through the intermediary of one or more tension springs 81, and the end of the pressing element with which the rod 26 is associated is connected to plungers 82 supported by and slidable in sockets 83, preferably integral with the end plates 32, and within which compression springs 84 are disposed, these springs acting to urge the plungers and the end of the pressing element connected thereto in a general radially inward direction. When the parts are assembled in operative position, indicated in the drawings, the spring connections associated with the ends of the flexible pressing element 24 serve to wrap the same tightly about the core 21 and the covering 23 of sheet material thereon.

The previously wrapped core 21 is inserted to operative position when the removable sections of the inner and outer frames 71 and 10, respectively, are removed and the upper end of the pressing pad 24 is turned back. With the sections of the frame in the position shown in the drawings, and the ends of the pressing element 24 connected as shown, it will be apparent that, on rotation of the frame 71, the pressing element 24 is rotated about the core 21 and its wrapping 23 and serves to press or compact the layers of the wrapping upon the core. As described above, heat may be supplied to the flexible pressing element by heaters 51 to soften the varnish or gum coating upon the inner side of the wrapping 23. The rotation of the flexible pressing element about the wrapping serves to roll or wrap the individual layers of the wrapping upon one another to thereby squeeze out any occluded air and to firmly compact the wrapping into a practically solid mass. The driving means for the rotatable frame 71 is quite similar to that described in connection with Figs. 3 and 4. A pinion 46 on a driving shaft 47 meshes with a toothed portion of one of the end plates 32. However, it will be obvious that any suitable means for driving the frame 71 may be utilized.

In the apparatus disclosed in Figs. 7 and 8, instead of having a supporting frame 10 in a plurality of sections, a single piece stationary frame 91 is used. The inner rotatable frame 92 which carries the rotatable pressing element 24 differs from the rotatable frame 71 of Figs. 3 to 6, inclusive, in that, instead of being divided along a diameter, this frame 92 has a comparatively small removable portion 93. Attaching means, in the form of removable bolts coöperative with alined apertured ears on the parts, are provided for removably securing the removable portion 93 to the main portion of the frame. As in the case of the previously described forms of the apparatus, the inner rotatable frame is centered by rollers 41 associated with the outer frame 91 and is driven by a pinion 46 in mesh with a toothed portion of the rotatable frame. The end of the flexible pressing element 24 associated with the rod 27 is attached to lugs or projections on the removable frame portion 93, either directly or through a spring connection 81; and, as described in connection with the form of apparatus of Figs. 5 and 6, the other end of the pressing element is connected to a spring-pressed plunger 82.

While the coil side or other core 21 may be disposed in operative position in the apparatus subsequent to the provision of the core with a wrapping or covering of sheet material 23, nevertheless, the particular form of apparatus disclosed in Figs. 7 and 8 embodies means for applying this wrapping to the core simultaneously with the operation of the flexible pressing element 24 to heat and compact the layers of the wrapping upon the core. This wrapping is supplied from a roll 96 rotatably mounted upon lugs 97 on the body portion of the rotatable frame 92. Further, in the particular form of apparatus disclosed herein, heat is applied to the flexible pressing element by means of an electrical heating pad 100 attached to the outer side of the flexible pressing element, a heat insulating covering 101 being applied to the outer side of the heating element. Electrical energy may be supplied to this heating pad through brushes 102 engageable with slip rings 103 on the rotatable frame 92 and flexible leads 104. The brushes may be mounted on an insulating support 105, and may pass through openings 106 in the frame 91, as indicated. However, instead of having a separate heating pad, such as that indicated at 100, resistance elements may be woven in the pressing pad itself and insulated from the metallic material thereof.

Although the apparatus disclosed in Figs. 7 and 8 is capable of applying the sheet material to the core 21 and simultaneously heating and pressing the layers of the wrapping or covering as the same is applied, nevertheless, the sheet material forming the wrapping may be applied to the core prior to its insertion to operative position within the apparatus, in which case there is no necessity for applying material from the roll 96.

In any of the forms of apparatus dis-

closed above, the source of heat may be mounted upon either the stationary supporting frame or the rotatable frame mounted within the stationary frame, in the latter case, suitable means being provided for conducting to the rotatable element the energy to be utilized for heating purposes.

In the apparatus disclosed in Fig. 9, general features of this invention are utilized in connection with a core element $21_a$ mounted for rotation relatively to a flexible pressing pad, heating apparatus therefor and a roll for supplying wrapping or covering sheet material. One end of the flexible pressing element 24 is attached to a stationary frame 107 either directly or through the spring connection 81, and the other end of the pressing element is attached to the spring-pressed plunger 82, similar to that previously described, the general mounting and supporting means being such as is effective to cause the flexible pressing element to be wrapped about and held in close association with the covering 23, either previously applied to the core $21_a$ or, as indicated, wrapped upon the core during the operation of the apparatus, as generally described in connection with the apparatus of Figs. 7 and 8. The heating pad 100 is shown as being associated with only that portion of the flexible pressing element with which the material wrapped about the core first comes in contact. This arrangement permits the application of heat and pressure to the wrapping as it is first laid upon the core, and the subsequent application of pressure alone, that is, from the unheated portion of the pressing pad 24. It will be apparent that in the operation of this apparatus, the sheet material is heated to soften the gum coating thereon as the material is laid upon the core $21_a$, and pressure is applied both during the heating of the gum coating and immediately thereafter to compact the individual layers as the same are disposed upon the core.

It will be obvious that certain features of the several particular embodiments of the invention disclosed may be interchanged in the different forms, especially those features concerned with the various methods of applying heat to the pressing element and of supporting the pressing element to provide for relative rotation between the same and the core to which the wrapping of sheet material is applied.

It should be understood that it is not desired that the invention claimed be limited to the exact details of construction shown and described for obvious modifications will occur to a person skilled in the art.

It is claimed and desired to secure by Letters Patent:

1. Apparatus for applying a covering to a body, comprising an open, flexible pressing element of belt-like form, and means for producing relative rotation between said body and said pressing element while maintaining said pressing element in forcible engagement with the covering on said body.

2. Apparatus for applying a covering to a core, comprising an open, flexible pressing and heating element, and means for producing relative rotation between said core and said pressing element while maintaining said pressing element in yielding forcible engagement with the covering on said core.

3. Apparatus for applying a covering to a core comprising an open-ended combined heating and pressing element of flexible metal fabric, and means for producing relative rotation between said core and said pressing element while maintaining said pressing element in forcible engagement with the covering on said core.

4. In apparatus for applying a covering to a core, a pressing element of flexible metal fabric, and means for causing relative rotation between said pressing element and the covering on said core while maintaining said pressing element in forcible engagement with said covering.

5. Apparatus for applying a covering to a body, comprising a flexible pressing element of belt-like form, and means for producing relative rotation between said body and said pressing element while maintaining said pressing element in engagement with the covering on said body.

6. Apparatus for applying a covering to a body, comprising a frame, a heating and pressing element of flexible metal fabric carried by said frame, means for supporting said body in operative position relative to said frame, and means for causing relative rotation between said pressing element and said body with said pressing element held in yielding engagement with said body.

7. Apparatus for applying a covering to a core, comprising a frame, a pressing element of flexible metal fabric, means for supporting said core in operative position relative to said frame, means for yieldingly supporting said pressing element in operative position relative to the covering on said body and urging said element into yielding engagement with said covering, and means for causing relative rotation between said pressing element and the covering on said core to thereby press and compact said covering.

8. In combination, a supporting frame, a core having a covering of sheet material applied thereto, means for supporting said core, an open-ended pressing element carried by said frame and held in yielding forcible engagement with the covering on said core, means for applying heat to a portion of said pressing element, and means for producing relative rotation between said pressing element and the covering applied to said

core to thereby press said covering into compact form.

9. In combination, a supporting frame, a core, means for supplying a covering of sheet material to said core, an open-ended pressing element yieldingly supported by said frame and yieldingly engageable with the covering of sheet material on said core, and means for producing relative rotation between said pressing element and said core to cause said sheet material to be wrapped about said core and pressed into compact form.

10. Apparatus for applying a covering to a core, comprising a frame, means for supporting said core in operative position relative to said frame, means for applying a covering of sheet material to said core, a pressing element of flexible metal fabric, means for yieldingly supporting said pressing element in operative engagement with the covering on said core, and means for causing relative rotation between said pressing element and the covering of sheet material on said core to thereby press and compact said covering.

11. In combination, a supporting frame, a core, an open-ended pressing element of flexible metal fabric yieldingly supported by said frame, means for applying heat to a portion of said pressing element, said means comprising a flexible electrical heater associated with a portion of said pressing element, means for supplying sheet material to said core, and means for producing relative rotation between said pressing element and said core to cause said sheet material to be supplied to and wrapped about said core and said pressing element to heat and press said covering of sheet material into compact form.

12. Apparatus for applying a covering to a body, comprising a flexible pressing element conformable substantially to the configuration of said body through a number of degrees of periphery, and means for producing relative motion between said body and said pressing element while maintaining said pressing element in engagement with the covering on said body.

In testimony whereof, the signature of the inventor is affixed hereto.

JAMES P. A. McCOY.