Sept. 27, 1938. C. F. OBERMAIER 2,131,598

METHOD AND APPARATUS FOR APPLYING A FIBROUS COATING TO A FILAMENT

Filed Sept. 28, 1934

Fig. 1.

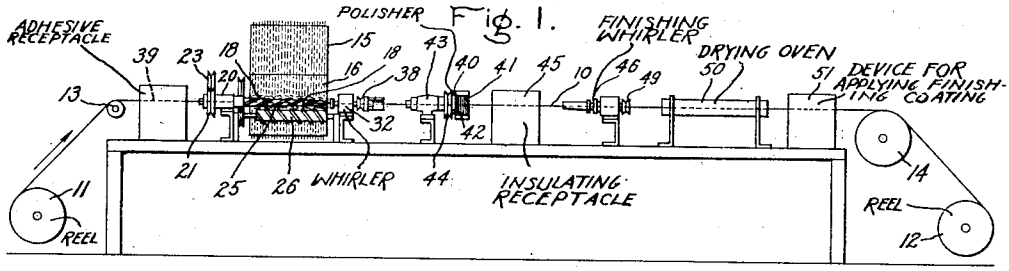


Fig. 2.

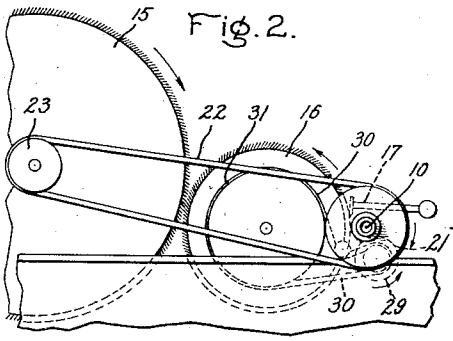


Fig. 3.

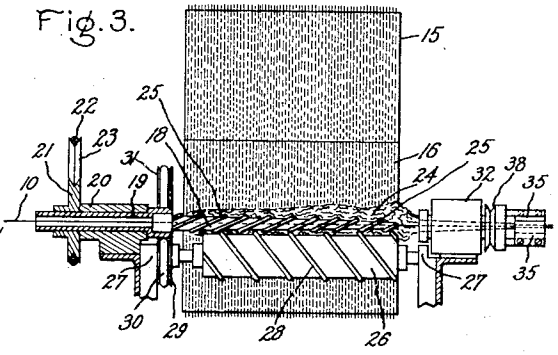


Fig. 4.

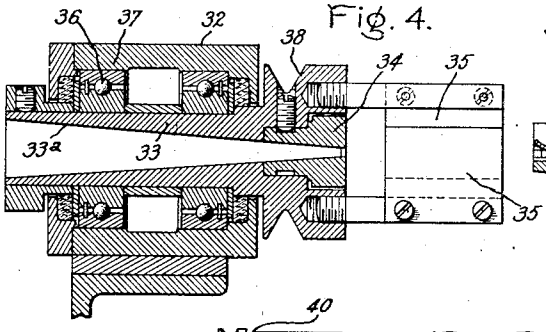


Fig. 5.

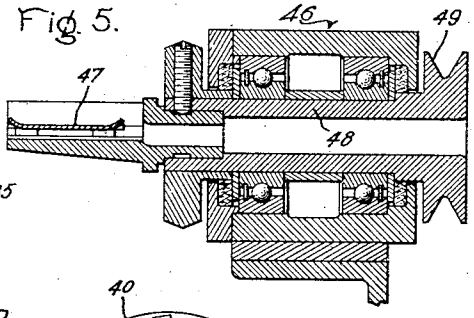


Fig. 6.

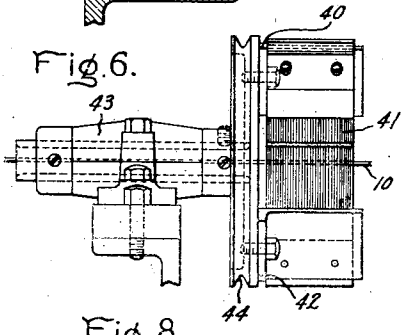


Fig. 7.

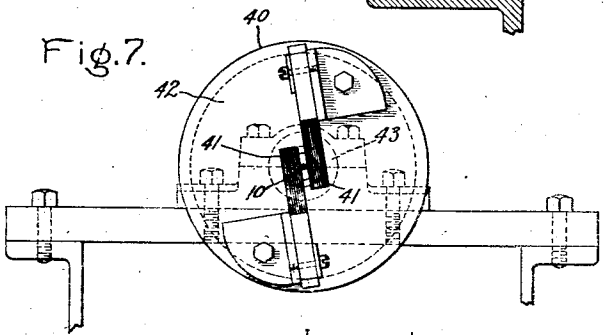


Fig. 8.

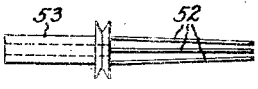
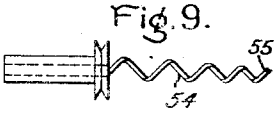


Fig. 9.



Inventor:
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by Harry E. Dunham
His Attorney.

Patented Sept. 27, 1938 2,131,598

UNITED STATES PATENT OFFICE

2,131,598

METHOD AND APPARATUS FOR APPLYING A FIBROUS COATING TO A FILAMENT

Carl F. Obermaier, York, Pa., assignor to General Electric Company, a corporation of New York

Application September 28, 1934, Serial No. 745,871

16 Claims. (Cl. 173—244)

My invention relates to method and apparatus for applying fibrous material to a filament, more particularly for applying fibrous insulation material, such as asbestos fibres, to an electrical conductor and the like, and it has for its object the provision of improved method and apparatus for applying fibrous material to a conductor in a simple, reliable, economic and efficient manner.

In carrying out my invention in one form thereof, I effect the longitudinal movement of a conductor while holding it against rotation. A mass of loosely associated, inter-entangled and inter-engaged fibres, in which preferably all parallelism of the fibres has been completely destroyed, is applied to the conductor as it advances. This is accomplished by causing a cylindrical mass of fibres to rotate about the conductor. The rotating mass of fibres is held out of contact with the conductor except at one end of the mass where the fibres contact the conductor. A fresh supply of fibres is continuously delivered to the rotating mass of fibres and advanced longitudinally of the mass toward the end thereof where they contact the conductor and become attached to it. If desired, an adhesive may be applied to the surface of the conductor before it reaches the zone of application of the fibres so that the fibres are caused firmly to adhere to the conductor by said adhesive coating.

The cylindrical mass of fibres may be conveniently formed by delivering the fibres directly to a rotary cylindrical conveyor which surrounds the conductor and rotates on it as an axis. The fibres are fed to the cylindrical conveyor in a formless mass, preferably throughout the length of the conveyor. This may be accomplished conveniently by feeding the fibres directly to the conveyor from any suitable well-known carding machine, the fibres being acted upon by a suitable comb or equivalent device to destroy their parallelism before they are applied to the conveyor.

The rotary conveyor is arranged to feed the mass of fibres forwardly to one of its ends where the fibres are applied to the conductor and become attached to it by the adhesive on it, and at the same time imparts to the mass of fibres a rotary motion about the conductor. The mass of fibres, therefore, is given two motions, one forwardly with the conductor in its direction of travel, and another in a rotary direction about the conductor. These two motions arrange the fibres on the surface of the conductor in non-parallel, and inter-entangled twisted relation.

Auxiliary means are provided to assist the conveyor to move the fibres to the zone of application on the conductor and to impart to the fibrous mass its rotary motion.

The fibres in the application zone on the conductor are further twisted about and condensed upon the conductor by means of a suitable whirler.

This application is a continuation in part of my copending application, Serial No. 702,155, filed December 13, 1933 and assigned to the same assignee as this invention.

For a more complete understanding of this invention, reference should be had to the accompanying drawing in which Fig. 1 is a diagrammatic elevation of apparatus for applying fibrous material to a filamentary body arranged in accordance with this invention; Fig. 2 is an end elevation of a portion of the apparatus shown in Fig. 1, taken on an enlarged scale; Fig. 3 is a front elevation of the apparatus shown in Fig. 2; Fig. 4 is an enlarged elevation mainly in section of a portion of the apparatus shown in Figs. 1, 2 and 3; Fig. 5 is an enlarged elevation in section of a portion of the apparatus shown in Fig. 1; Fig. 6 is an enlarged elevation of a portion of the apparatus shown in Fig. 1; and Fig. 7 is a front view of the apparatus shown in Fig. 6; and Figs. 8 and 9 are views in elevation illustrating various other forms of conveyors for receiving and delivering the fibrous material to the filamentary body, both arranged in accordance with this invention.

Referring more particularly to Figs. 1–3 inclusive, I have shown my invention in connection with means for applying asbestos fibres to an electrical conductor. As shown, the filament or conductor 10 is advanced in a longitudinal direction from a suitable supply spool 11 to a suitable collecting spool 12. It will be understood that any suitable means may be provided for advancing the conductor between the two spools. Thus, for example, a suitable motor or other suitable driving means may be attached to the spool 12 for revolving it so as to draw the conductor through the apparatus from the spool 11 to the spool 12. Both of the spools 11 and 12 are stationarily mounted, that is, are mounted to revolve upon fixed axes, so that the conductor 10 is held against rotation. The conductor is directed over idler guiding rolls 13 and 14 whereby the conductor is caused to advance in a predetermined direction between the spools 11 and 12. The member 14 may also be used to draw the conductor 10 through the apparatus whether the

member 12 or the member 14 is used for this purpose, it should have a variable speed control.

Asbestos fibres which are to be applied to the conductor 10 are treated by means of any suitable well-known carding machine so as to produce a fine fleece of flocculent material, the fibres being combed, separated, and arranged in substantially parallel relation with respect to each other. This carding apparatus is provided with a carding drum 15 and with various worker and fancy rolls (not shown) associated therewith and which cooperate with the drum to act upon the fibres so as to separate them and to arrange them in substantially parallel relation. It will be understood that raw asbestos fibres fed into the carding apparatus will be worked by the worker and fancy rolls so as to be cleaned, combed, and separated and arranged in substantially parallel relationship with each other. The fibres thus treated are stripped from the carding drum 15 by means of a doffer cylinder or ring 16, and from the doffer ring by means of a vibratory comb 17. The drum 15 and the ring 16 rotate in the directions indicated by the arrows associated with these members in the drawing. It is believed to be unnecessary to describe in greater detail the carding apparatus including the carding drum 15, the doffer drum 16, and the vibratory comb 17, because all of these elements are old and well-known to those skilled in the art.

Arranged directly opposite the doffer drum 16 is a rotatably mounted cylindrical conveyor 18. This conveyor, as shown, has a tubular form and is arranged so that the conductor 10, as it advances between the guides 13 and 14, passes through the conveyor 18. Preferably, the conveyor 18 will be arranged so that its axis of rotation is substantially coincident with the conductor. As shown, the conveyor is provided with a suitable journal 19 at one end which is received in a bearing 20 that is arranged to support the conveyor for rotation about the conductor 10 as an axis. The conveyor 18 is provided with a pulley 21 over which any suitable driving belt 22 is passed to effect rotary motion of the conveyor. As shown, this belt 22 is directed over a pulley 23 which is arranged to rotate with the carding drum 15. It will be understood however that any other suitable source of power may be used to drive the conveyor 18. It is contemplated that the conveyor will be driven in a clockwise direction, as viewed in Fig. 2, and in the particular form of the invention shown it is driven at approximately 45 R. P. M.

The conveyor 18 as shown is mounted with relation to the doffer drum 16 so that the fibres which are stripped from the doffer by the vibratory comb 17 fall by gravity directly onto the rotary conveyor. The conveyor 18, as shown, has a length substantially equal to the width of the doffer drum 15. This is not necessary, however, and the conveyor may be considerably shorter than the width of the drum.

As shown in Fig. 1, the conveyor 18 has a substantially conical formation, the outer surface of the conveyor tapering downwardly to its smaller diameter or apex in the direction of travel of the filament 10.

The asbestos fibres are stripped from the doffer ring 16 by the comb 17 and drop down in a mass upon the surface of the conveyor 18 in such manner that all parallelism of the fibres is completely destroyed. This mass of indiscriminately arrang ' fibres falling upon the conveyor is carried around with the conveyor by the friction between the inner fibres and the outer surfaces of the conveyor and the inter-engagement of the fibres with each other so as to form a mass 24 (Fig. 3) of fibres completely covering the conveyor, the fibres forming the mass being completely interentangled and intermingled with each other.

In other words, the conveyor functions to form a hollow mass of indiscriminately arranged fibres which completely surrounds the conductor 10, but out of contact with it, and which rotates about the conductor. This rotating mass of fibers is continually advanced forwardly toward the apex of the cone 18 where the fibres contact the conductor 10 and where they become attached to the conductor. The mass of fibres is advanced to the apex end, that is to the application zone, both by the conical formation given the conveyor and by the adherence of the fibres to the conductor.

It will be understood that while the fibres are being continually advanced to the application zone additional fibres are being continually supplied to the revolving mass from the carding apparatus, the mass building up in thickness from the end of the cone 18 where the conductor enters it to the exit end of the cone where the fibres are applied to the conductor, as shown in Fig. 3 of the drawing.

The conical conveyor 18, as shown, is provided on its surface with an upraised wall 25 defining a thread from one end to the other of the conveyor and arranged so that when the conveyor is rotating it will engage the innermost fibres of the mass of fibres 24 to assist in moving the mass forwardly to the application zone, and moreover, to effect a more positive drive between the conveyor and the mass of fibres to revolve the mass about the conductor.

I have provided an auxiliary device to assist the conveyor 18 to rotate the fibrous mass and to advance it to the application zone. This consists in a cylinder 26 mounted below the conveyor for rotary motion in bearings 27. The cylinder 26 is mounted to rotate on an axis parallel with the axis of rotation of the conveyor, and is arranged with its surface relatively close to the surface of the conveyor, and substantially coextensive with it. Arranged on the surface of the cylinder 26 is a thread 28 arranged to engage the outermost fibres of the revolving mass 24 so as to advance the fibres to the application zone. The cylinder 28 further functions to assist the conveyor to revolve the mass of fibres about the conductor, and also to support the lower portions of this mass, as shown in Fig. 3. The cylinder 26 is provided with a driving pulley 29 over which a driving belt 30 is passed. This belt, as shown is driven by a pulley 31 mounted to rotate with the doffer drum 16. The cylinder 26 is driven in a counterclockwise direction, as shown in Fig. 2, and in the particular form of the invention shown is driven at about 52 R. P. M.

Cooperating with the conveyor 18 is a rotary whirler 32 which engages the fibres applied to the application zone of the conductor so as to revolve or twist them about the conductor and to condense them upon the conductor. This whirler is located at the exit end of the application zone and comprises a rotary member 33 (Fig. 4) having a conical shaped passageway 33a therethrough which decreases in diameter from the entering to the leaving end. The diameter of the leaving end determines the diameter or size of the covered conductor leaving the whirler.

The whirler may be and as shown in Fig. 4 is provided with a removable part **34** in which the portion of the passageway **33a** of smallest diameter is formed, and which may be removed and replaced with another of the same or different diameter to compensate for wear, and also to vary the exterior diameter of the covered conductor. The whirler may also be provided at its smaller end with polishing plates **35** formed of spring material and secured at their edges to the whirler so as to have a slight yielding movement. The rotary member **33** is mounted in a ball bearing **36** which in turn is mounted in a frame or standard **37**. A pulley wheel **38** is attached to the member **33** over which a suitable driving belt (not shown) driven by any suitable means is passed to rotate the whirler.

The whirler is rotated at a high speed, the particular speed depending somewhat upon the form of the wire. Thus, if the conductor has a rectangular cross-section, the whirler will be driven in the form of the invention illustrated at about 1533 R. P. M., whereas if the conductor be round in cross-section the whirler will be rotated at about 3577 R. P. M. The whirler is rotated in the same direction of rotation as the conveyor **18**. The exterior fibres of those applied to the conductor **10**, are carried around the conductor by the whirler which imparts to the mass of fibres in the application zone a rotary motion about the conductor. That is, the fibres in the application zone, as well as those on the conveyor are revolved as a mass about the conductor, the speed of the mass increasing from the entering end of the conveyor **18** to the exit end of the whirler **33**.

As the conductor **10** is held from rotation while the fibrous mass revolves, the fibres in the application zone will be wound or twisted around the conductor as it advances. The inner fibres which have become attached to the conductor, of course, do not rotate, but will be held against rotation as they are drawn along with the filament. These fibres in turn tend to retard the rotary motion of the fibres interengaged with them, with the result that the speed of rotation of the whirling mass of fibres is reduced from the outermost fibres to those adjacent the conductor. This action causes a continuous rearrangement of the fibres in a circular direction about the conductor.

In addition to this, the fibres which have become attached to the conductor **10** are drawn along in the direction of travel of the conductor at a greater speed than the fibres in the outer layers of the whirling mass. This causes a continuous rearrangement of the fibres longitudinally of the conductor between the innermost fibres attached to the conductor and moving with it, and the outermost fibres.

Thus, there is a continuous rearrangement of the fibres both in a longitudinal and in a circular direction about the conductor. These two rearrangements result in bringing the fibres into substantially a completely intermingled and non-parallel, compacted and twisted relationship.

It is preferable in certain cases to cover the conductor **10** with a suitable adhesive before it enters the conveyor **18**. For the purpose of applying the adhesive to the conductor, I have provided a suitable adhesive pot or receptacle **39** between the pulley **13** and the conveyor and through which the conductor is passed and which is coated with an adhesive as it passes through. Any suitable adhesive solution, such as shellac, synthetic resin varnishes, resin, gum solutions, etc., may be used. After the conductor passes through the adhesive pot **39** it passes directly to and through the conveyor **18**. Suitable spray devices may be used instead of the device **39** to apply the adhesive to the conductor, because they obviate the necessity to use wipers. Moreover, spray devices are preferable in cases of rectangular and odd shaped conductors.

My apparatus therefore applies a fibrous coating to a conductor, the fibres in the coating from its inner to its outer surface being completely inter-entangled and interengaged so that fibres cannot become separated either laterally or longitudinally either by bending the conductor or subjecting it to rough treatment.

It will be understood that after the conductor **10** passes the application zone at the end of the conveyor **18**, it may be subjected to certain other finishing operations. Thus, it may be passed through a suitable polishing device **40**. The polishing device **40** comprises a pair of opposed polishing shoes **41** (Figs. 6 and 7) mounted upon a plate **42** which is rotatably mounted in a bearing **43**. The brushes are formed of a flexible material and are arranged when the conductor **10** is passed between them, as shown in Figs. 6 and 7, to apply a pressure to its coating and thereby polish the coating as the shoes revolve. The plate **42** has a pulley **44** attached thereto over which a suitable driving belt (not shown) is passed.

After the covering has been applied to the conductor **10**, it is often desirable to impregnate the fibres with a suitable electrically insulating varnish, such as lacquer. For this purpose, the conductor is advanced through a suitable bath **45** of the insulating varnish where the fibres are impregnated.

From the receptacle **45**, the covered conductor **10** is directed through a finishing whirler **46** which comprises a flexible shoe **47** (Fig. 5) arranged to bear upon the covering of the conductor as it passes through the whirler so as to polish the covering. The shoe is mounted upon a rotary member **48** to which a driving pulley **49** is attached.

The conductor may then be passed through a drying oven **50**, which serves to dry the insulating varnish, and from the oven the conductor may be passed through a suitable device **51** for applying a coating of wax or talc—if such coatings are desired.

It is to be understood that the conveyor **18** need not be of conical formation, but may have other forms. Thus, it may be cylindrical. The conveyor may also consist essentially in a plurality of pin-like members **52** (Fig. 8) projecting laterally from a supporting journal **53** and arranged so that when the journal is fitted into the machine, as is the conveyor **18** in Fig. 1, the pins will be directed in the direction of travel of the filament. The pins preferably will be tapered toward each other in this direction, as shown. The fibres which are fed to these pins from the carding apparatus are caused by the pins to assume a cylindrical formation about the conductor, and are advanced longitudinally of the pins to the application zone. Also, as shown in Fig. 9, the conveyor may consist of a screw **54** that is arranged to rotate on an axis substantially coincident with the conductor as it passes through the machine. This screw receives a mass of fibres from the carding machine, forms them into a whirling mass about the filament and positively moves the fibres longitudinally to the feeding end **55** where they are deposited on the filament. The

pitch of this screw may be even or it may vary, as desired.

It will be understood that my process and apparatus may be used to apply various fibres, such as cotton, jute, wool, etc., to filaments of various characters. The filaments covered may be solid or hollow, may be of round, square, or rectangular cross-section, or may consist of strands of relatively small or relatively large diameters twisted together. In each of these cases, the conveyor functions to form a hollow mass of rotating fibres, advance the fibres to an application zone where the fibres are twisted about the conductor by the combined action of the conveyor and the associated whirler and are condensed on the conductor by the whirler.

It is to be understood that the fibrous material may be applied directly to the filament, or may be applied in combination with various other materials. For example, the fibres may be applied to a coating of rubber which has previously been applied to the filament.

Furthermore, my process and apparatus may be used to apply heat-insulating material to pipes, etc.

While I have shown particular embodiments of my invention, it will be understood of course that I do not wish to be limited thereto since many modifications may be made, and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of this invention.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. Apparatus for applying fibrous material to a filament and like member comprising means for continuously advancing said filament in a longitudinal direction, a cylindrical member surrounding said filament arranged to rotate about said filament, means for rotating said cylindrical member, and means for continuously dropping fibres a sufficient distance to insure a haphazard arrangement between them and onto the outer surface of said cylindrical member to build up on said surface a mass of intertangled fibres increasing in volume progressively substantially from the end of said cylinder where said filament enters it to the other end where said filament leaves it, said cylindrical member arranged by its rotary motion to rotate said mass of fibres around said filament and means acting on said fibres to advance them forwardly on said cylindrical member to its end where said filament leaves it to apply said fibres to said filament.

2. Apparatus for applying fibrous material to a filament and like member comprising means for continuously advancing said filament in a longitudinal direction, means for applying an adhesive to said filament, a cylindrical member surrounding said filament and arranged to rotate about said filament as an axis, means for rotating said cylindrical member, means for continuously delivering loosely associated non-parallel fibres to the surface of said cylindrical member, and a thread on said surface of said cylindrical member arranged to engage said fibres so as to advance them longitudinally of said cylindrical member in the direction of travel of said filament to the end of said cylindrical member where they are applied to said filament.

3. Apparatus for applying fibrous material to a filament and like member comprising means for continuously advancing said filament in a longitudinal direction, a conical member surrounding said filament and arranged to rotate on its axis, the apex of said conical member being directed in the direction of motion of said filament, means for effecting relative rotary motion between said conical member and said filament, means for continuously delivering loosely associated fibres to the surface of said conical member, the conical member advancing said fibres to its apex where said fibres are applied to said conductor, and an auxiliary rotary device adjacent said conical member acting on said fibres after they have been delivered to said conical member to assist said conical member to advance said fibres toward said apex.

4. Apparatus for applying fibrous material to a filament and like member comprising means for continuously advancing said filament in a longitudinal direction, means for applying an adhesive to said filament, a cylindrical member surrounding said filament and arranged to rotate about said filament as an axis, means for rotating said cylindrical member, means for continuously delivering loosely associated non-parallel fibres to the surface of said cylindrical member, a second cylindrical member substantially coextensive with said first cylindrical member arranged to rotate on an axis substantially parallel with the axis of rotation of said first cylindrical member, and having its surface relatively close to the surface of said first member, means on the surface of said second cylindrical member engaging said fibres so as to impart a rotary motion thereto in the same direction as the motion imparted to said fibres by said first cylindrical member and to advance said fibres on said cylindrical member in the direction of travel of said filament so as carry said fibres to the end of said first cylindrical member where they are applied to said filament, and means for rotating said second cylindrical member.

5. Apparatus for applying fibrous material to a filament and like member comprising means for continuously advancing said filament in a longitudinal direction, means for applying an adhesive to said filament, a cylindrical member surrounding said filament and arranged to rotate about said filament as an axis, means for rotating said cylindrical member, means for continuously delivering loosely associated non-parallel fibres to the surface of said cylindrical member where they collect in a loosely associated mass on the surface of said member and are drawn from it at its forward end in the direction of movement of said filament by the adhesive on said filament, a second cylindrical member below said first cylindrical member substantially coextensive with it and arranged to rotate on an axis substantially parallel with the axis of rotation of said first cylindrical member, and having its surface relatively close to the surface of said first member so as to engage and support said mass of fibres that hang below said first cylindrical member, and means for rotating said second cylindrical member in a direction to impart to said fibres on said first cylindrical member a rotary motion in the same direction as that imparted to them by said first cylindrical member.

6. Apparatus for applying asbestos fibres and the like to an electrical conductor comprising means for advancing said conductor continuously in a longitudinal direction, a cylindrical member surrounding said conductor arranged to rotate about said conductor as an axis, means for continuously delivering a loosely associated mass of non-parallel asbestos fibres to the surface of said cylindrical member, feeding means on said sur-

face positively engaging said mass to impart a rotary motion to it about said conductor and to advance said mass as it rotates to the end of said cylindrical member where said conductor leaves it and where said fibres are applied to said conductor and advanced with it, a rotary whirler adjacent said end of said cylindrical member defining between said whirler and said end an application zone, said whirler arranged to rotate on said conductor as an axis and to engage said fibres in said application zone as they advance with said conductor to rotate said fibres about said conductor in the direction of rotation imparted to said mass by said cylindrical member, whereby said fibres in said zone are twisted and condensed to a compact interengaged and interentangled mass on said conductor, and means for rotating said whirler.

7. Apparatus for applying asbestos fibres to an electrical conductor comprising means for advancing said conductor continuously in a longitudinal direction, a conical member surrounding said conductor and arranged to rotate about said conductor on the conductor as an axis, the apex of said conical member being directed in the direction of motion of said conductor, means for continuously delivering a loosely associated mass of non-parallel asbestos fibres to the surface of said conical member, means on said surface positively engaging said mass to impart a rotary motion to it about said conductor, and to advance said mass as it rotates to the apex of said conical member where it is applied to said conductor and advanced with it, a cylindrical member substantially coextensive with said conical member arranged to rotate on an axis substantially parallel with the axis of rotation of said conical member and having its surface relatively close to the surface of said conical member, a thread on the surface of said cylindrical member arranged to positively engage said fibres on said conical member so as to assist said conical member to rotate said mass of fibres and to advance them to the apex of said conical member, and means for rotating said cylindrical member.

8. Apparatus for applying fibrous material to a filament and like member comprising means for continuously advancing said filament in a longitudinal direction, means for applying an adhesive to said filament, a member arranged to rotate about said filament comprising a plurality of pin-like members projecting longitudinally of said member in the direction of travel of said filament and arranged to rotate about said filament, and means for continuously delivering loosely associated fibres to said pin-like members.

9. Apparatus for applying fibrous material to a filament and like member comprising means for continuously advancing said filament in a longitudinal direction, means for applying an adhesive to said filament, a member of screw formation surrounding said filament and arranged to rotate about said filament, means for rotating said screw member and means for continuously delivering loosely associated fibres to the surface of said screw member in a zone extending substantially from one end to the other of said member, said screw member being arranged to rotate said fibres about said filament and to advance said fibres longitudinally of said member in the direction of travel of said filament in order to apply said fibres to said filament.

10. The method of applying fibres to an electrical conductor and the like which comprises continuously advancing said conductor in a longitudinal direction, surrounding a zone of said conductor of predetermined length with a mass of loosely associated fibres in non-parallel felted relation, advancing said mass of fibres but holding it out of contact with said conductor except at one end of said mass where said fibres contact said conductor, continuously causing fibres to drop freely onto said mass, and effecting continuous relative rotary motion between said mass of fibres and said conductor as said conductor is advanced.

11. The method of applying asbestos fibres and the like to a conductor which consists in continuously advancing said conductor in a longitudinal direction, forming a hollow cylinder of non-parallel asbestos fibres about said conductor with the axis of said cylinder substantially coincident with said conductor and the inner walls of said cylinder out of contact with said conductor, continuously supplying fibres in flocculent form to said cylinder substantially from one end thereof to the other, advancing said fibres continuously to one end of said cylinder where they contact said conductor, continuously applying forces to both the inner and outer walls of said cylindrical mass of fibres to continuously rotate the mass about said conductor as it advances and thereby by the longitudinal movement of said conductor to arrange said fibres on said conductor in non-parallel interentangled and interengaged relation.

12. The method of applying asbestos fibres to an electrical conductor and the like which comprises continuously advancing said conductor in a longitudinal direction, applying an adhesive to said conductor as it advances, surrounding a zone of said conductor of predetermined length with a mass of loosely associated asbestos fibres in non-parallel felted relation, continuously dropping fibres in non-parallel relation onto said mass, advancing said mass of fibres but holding it out of contact with said conductor except at one end of said mass where said fibres contact said conductor through a zone of predetermined length, effecting continuous relative rotary motion between said mass of fibres and said conductor as said conductor is advanced, and revolving the mass of fibres in said application zone so as to twist and condense said fibres on said conductor.

13. The method of applying a fibrous insulating coating to a conductor filament which consists in continuously moving a conductor filament longitudinally, continuously applying an adhesive to said conductor as it moves, continuously forming a hollow cylinder of non-parallel fibres through a zone of predetermined length about said conductor with the axis of said cylinder substantially coincident with said conductor and the inner walls of said cylinder out of contact with said conductor, said mass of fibres increasing in thickness from the entering to the leaving end of said zone, acting on the inner and outer walls of said cylinder to advance said fibres continuously to the leaving end of said zone where they contact said conductor and become attached thereto by said adhesive and to simultaneously establish a rotary motion between said filament and said mass of fibres, and continuously imparting to said fibres applied to said conductor after they leave said zone a rotary motion with reference to said filament whereby said fibres are twisted about and condensed upon said filament.

14. Apparatus for applying fibrous material to a filament and like member comprising means for continuously advancing said filament in a

longitudinal direction, means for continuously dropping fibres toward said filament a sufficient distance to insure a loose haphazard arrangement between them, an elongated member rotatable about said filament constructed and arranged to intercept said fibres as they fall toward said filament to build up an elongated rotating mass of fibres about said filament and the fibres being applied to said filament at the end of said elongated member where said filament travels out of it, means acting on the fibres to advance them toward said end to be applied to said filament, a whirler adjacent said end of said elongated member to establish between said elongated member and the whirler an application zone on said filament in which said fibres are applied to the filament from the elongated member, means for rotating said elongated member, and means for rotating said whirler in the same direction of rotation as said elongated member so as to condense and compact the fibres in said application zone onto said filament.

15. Apparatus for applying fibrous material to a filament and like member comprising means for continuously advancing said filament in a longitudinal direction, a conical member arranged to rotate around said filament, means for rotating said conical member, means for continuously dropping fibres a sufficient distance to insure a haphazard arrangement between them and to destroy parallelism between the fibres, and onto the outer surface of said conical member, said conical member arranged by its rotary motion to rotate said fibres and to advance them forwardly to the apex of the conical member where they leave the member and are applied to the filament, a whirler adjacent the apex of said conical member mounted to rotate about said filament and arranged to engage the fibres applied to the filament to condense, and compact the fibres on the filament when the whirler is rotated in the same direction of rotation as said conical member, and means for rotating said whirler in the same direction of rotation as said conical member.

16. Apparatus for applying fibrous material to a filament and like member comprising means for continuously advancing said filament in a longitudinal direction, a conical member surrounding said filament arranged to rotate about it, means for rotating said conical member, means for continuously dropping fibres a sufficient distance to insure a haphazard arrangement between them and to destroy parallelism beween the fibres, and onto the outer surface of said conical member, said conical member arranged by its rotary motion to rotate said fibres and to advance them forwardly to the apex of the conical member where they leave the member, a whirler adjacent the apex of said conical member to establish between said apex and said whirler an application zone on said filament in which said fibres are applied to the filament from the conical member, and means for rotating said whirler in the same direction of rotation as said conical member and at a relatively higher speed so as to twist, condense and compact the fibres in said application zone onto said filament.

CARL F. OBERMAIER.

CERTIFICATE OF CORRECTION.

Patent No. 2,131,598. September 27, 1938.

CARL F. OBERMAIER.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 55, after the word "apparatus" insert a period and for "whether" read Whether; page 4, second column, line 35, claim 4, after "as" insert to; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of December, A. D. 1938.

Henry Van Arsdale

(Seal)

Acting Commissioner of Patents.