

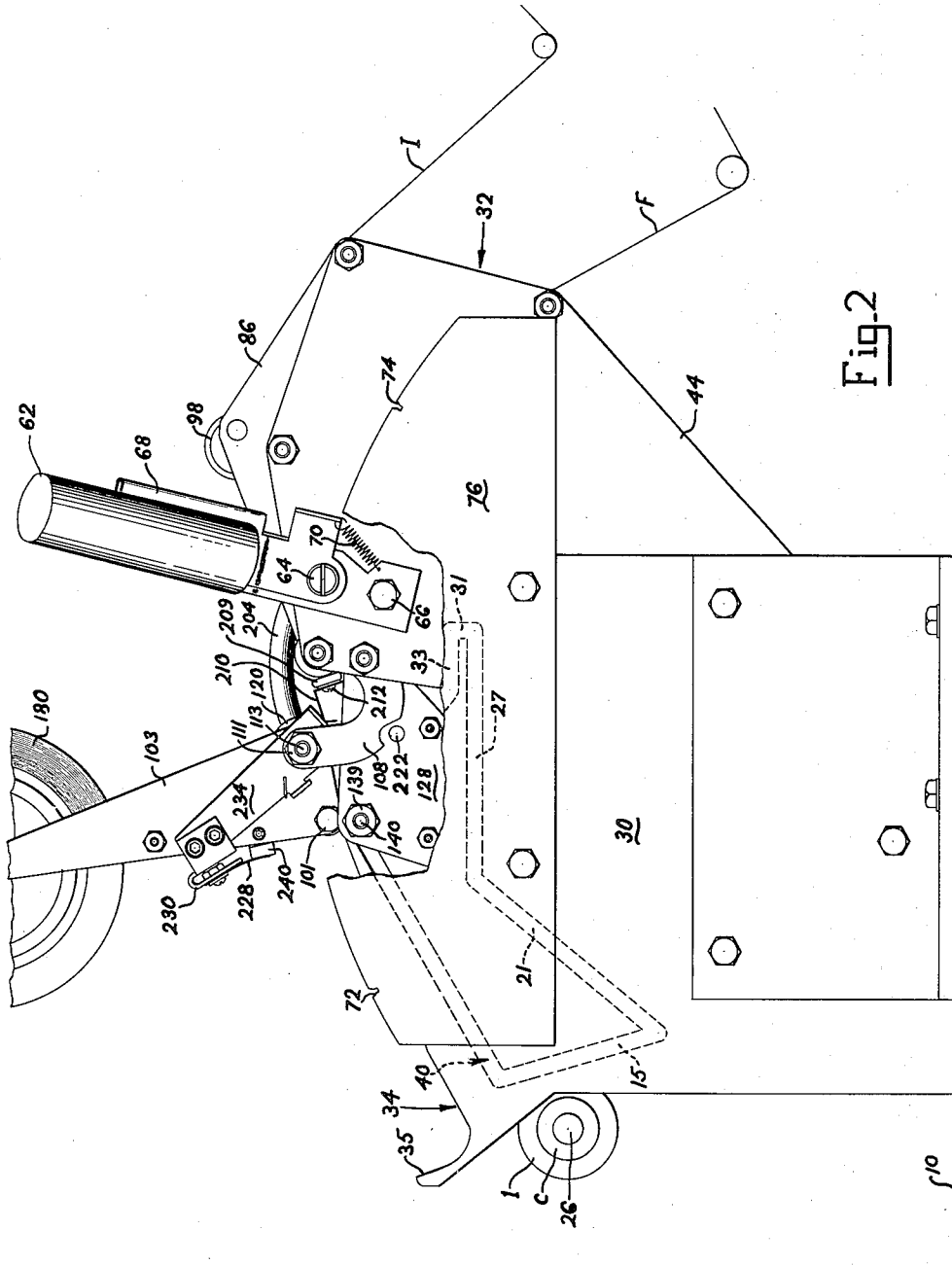
Jan. 31, 1961

T. A. WHITING
WINDING MACHINE

2,969,888

Filed Oct. 31, 1957

10 Sheets-Sheet 2



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T. A. WHITING
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10 Sheets-Sheet 3

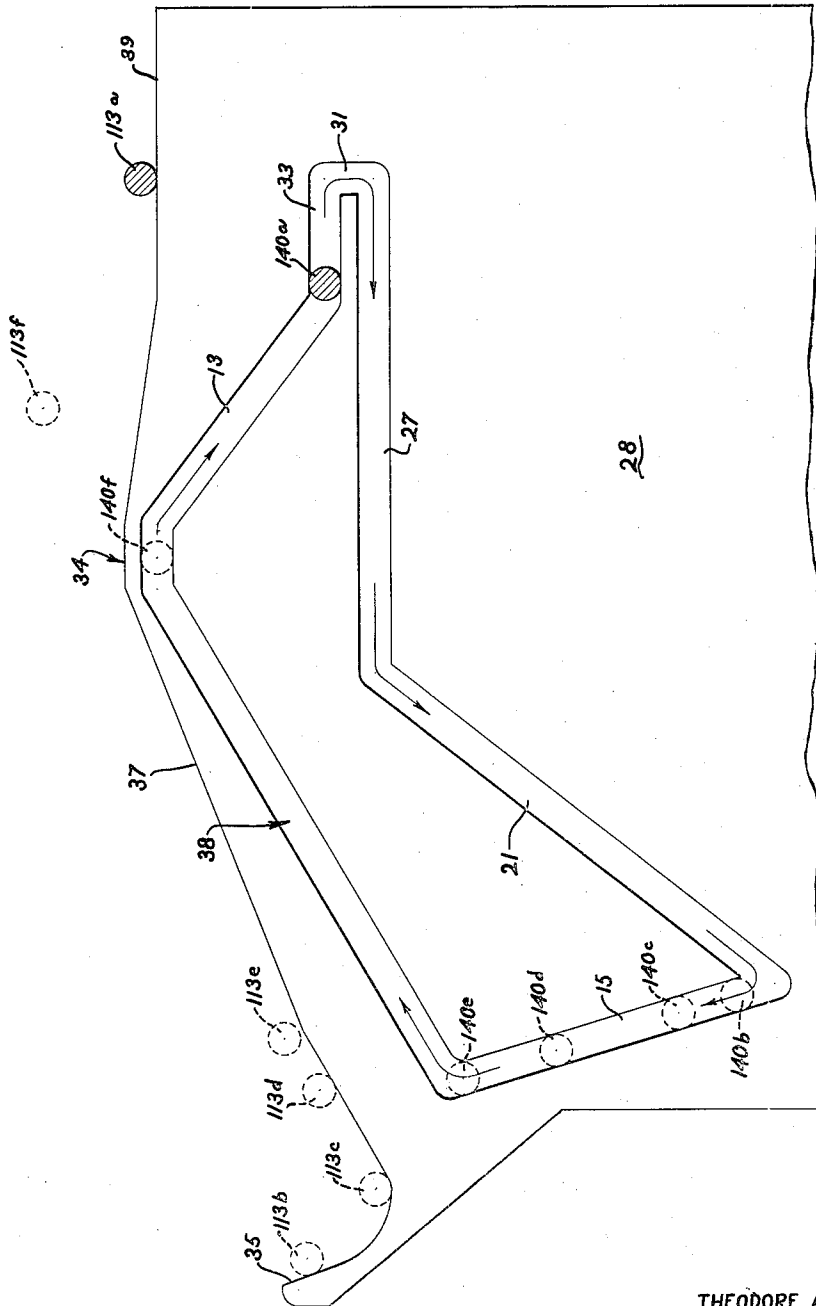


Fig. 3

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WINDING MACHINE

10 Sheets-Sheet 4

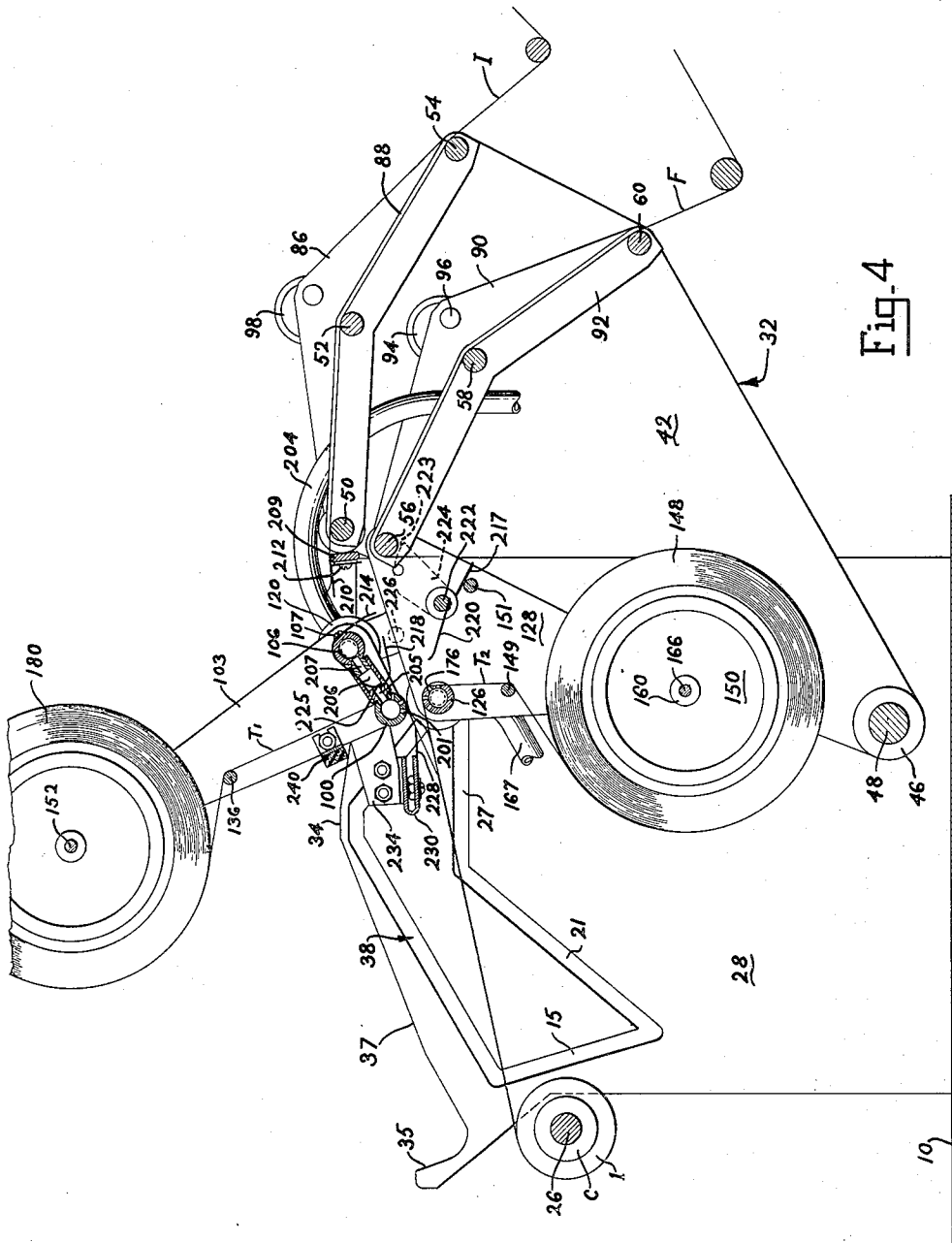


Fig. 4

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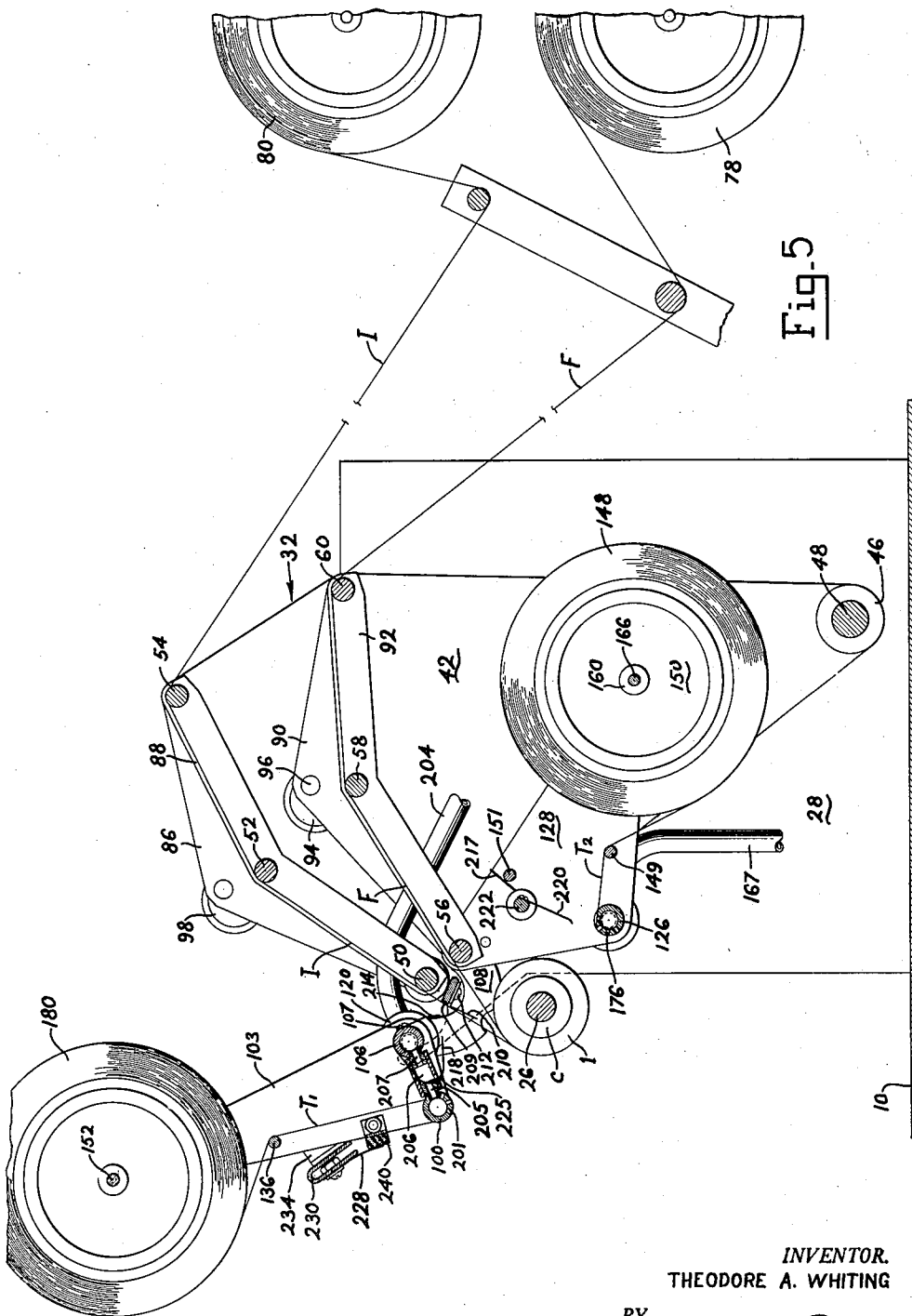
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T. A. WHITING
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10 Sheets-Sheet 5



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T. A. WHITING
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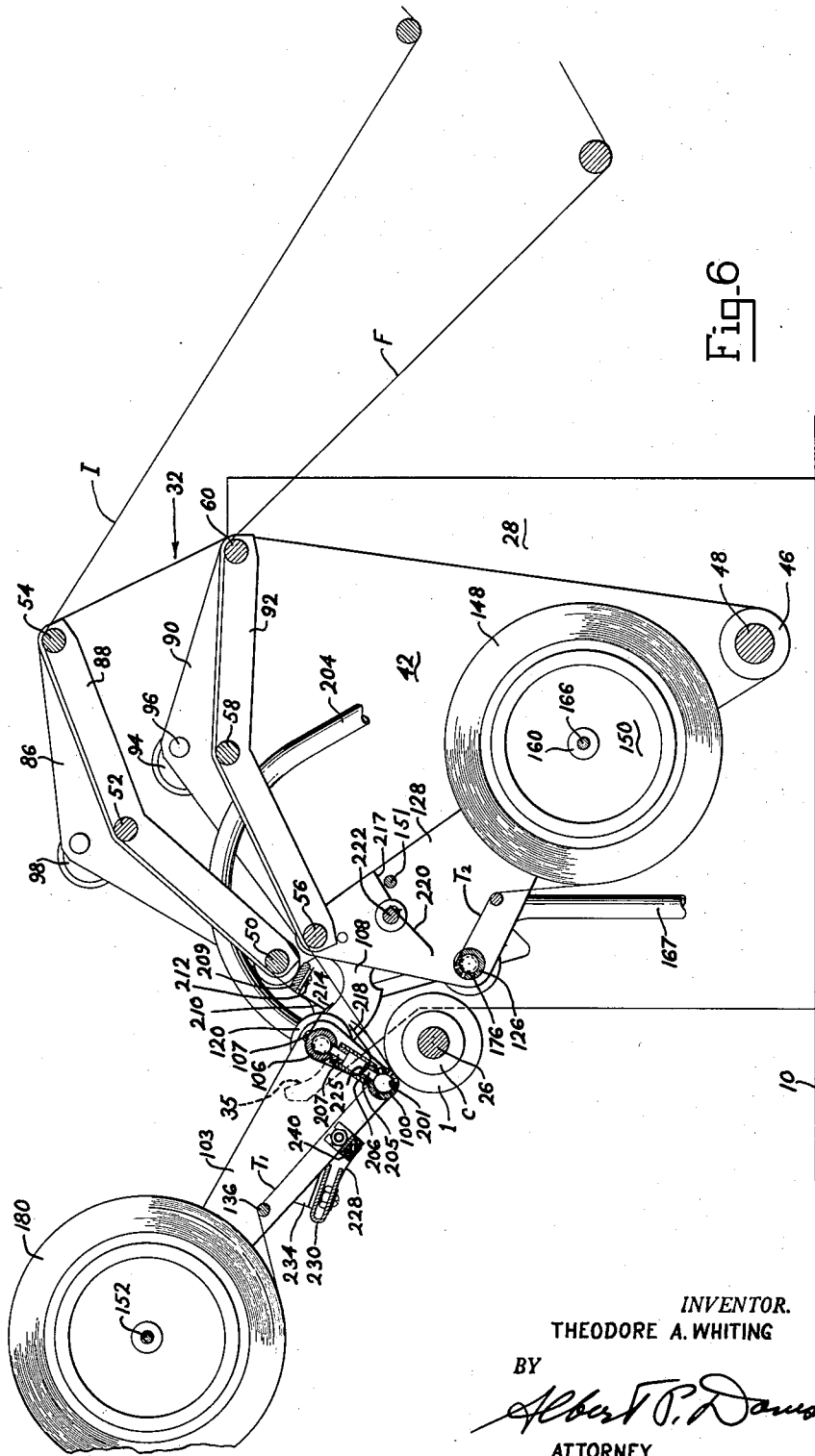


Fig-6

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WINDING MACHINE

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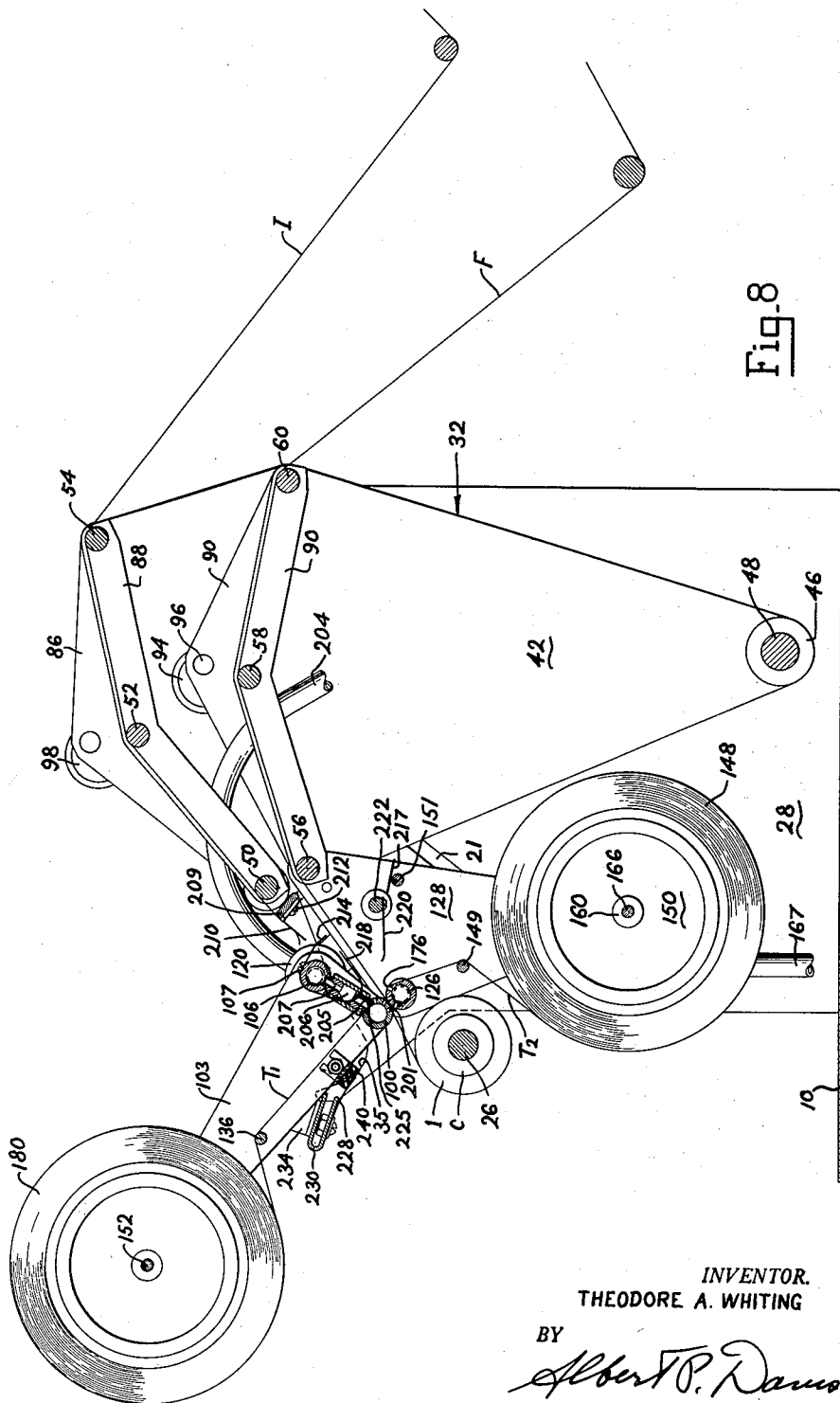
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T. A. WHITING
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10 Sheets-Sheet 8



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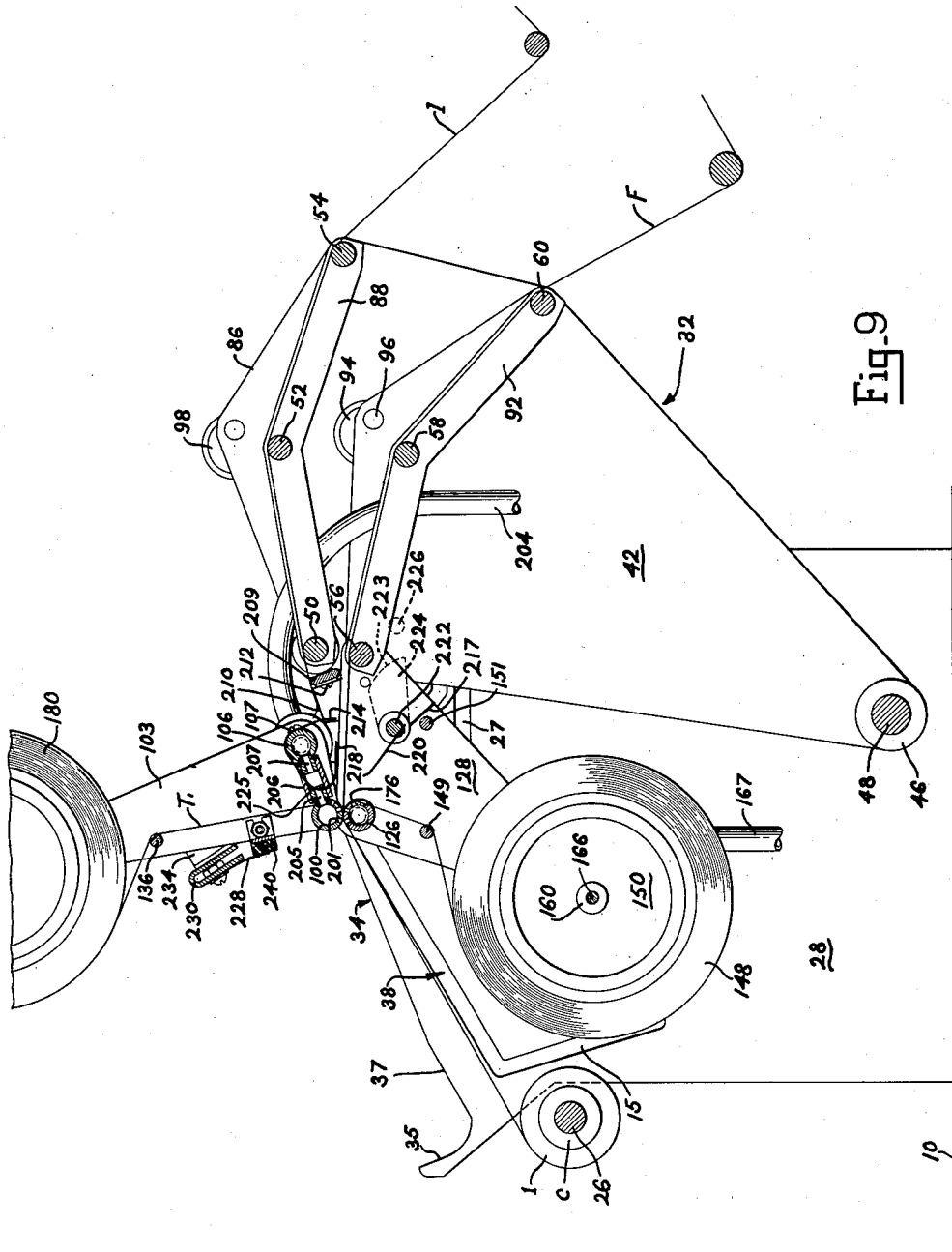
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10 Sheets-Sheet 9



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T. A. WHITING
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10 Sheets-Sheet 10

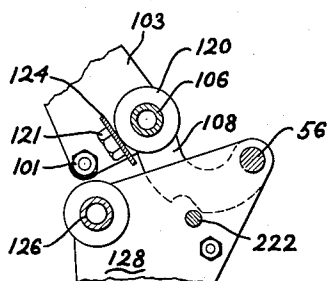


Fig. 11

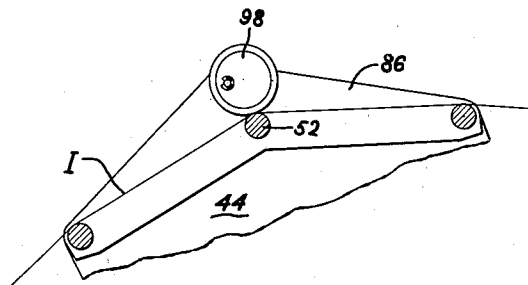


Fig. 10

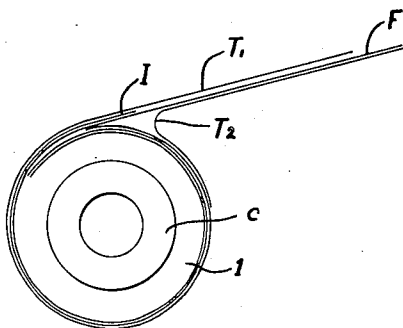


Fig. 12

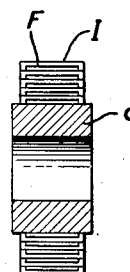


Fig. 13

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2,969,888

WINDING MACHINE

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Filed Oct. 31, 1957, Ser. No. 693,747

8 Claims. (Cl. 216—33)

The present invention relates to a machine for winding electrical coils and more particularly relates to a machine for winding such coils from a ribbon of thin sheet-like conductive material.

It has been suggested that electrical coils for certain uses as, for example magnet coils, be wound from ribbons of thin sheet-like conductive material as, for example, aluminum foil, having a thickness in the order of from .0002 to .004 inch. Such coils are more desirable than coils wound from wire in many applications because they are easy to connect electrically, are more compact and are less expensive than wire coils.

Winding such coils from ribbons of thin sheet-like conductive material, hereinafter sometimes called foil coils, has heretofore presented certain problems and has required a large amount of skilled hand labor due to the fact that it is necessary to secure the end of the conductive ribbon to an electrically conductive core member at the start of the winding cycle, insulate the layers of ribbon from each other, tape the finished coil to prevent it from unwinding and insulate the free end of the ribbon.

One object of the present invention is to provide a machine for winding a coil from a ribbon of thin conductive material and insulating the layers of such coil from each other.

Another object of the present invention is to provide a machine for winding foil coils having means for taping a finished coil to prevent it from unwinding.

Another object of the present invention is to provide a machine for winding foil coils having means for insulating the free end of foil.

Another object of the present invention is to provide a machine for winding foil coils having means for taping a finished coil and insulating the free end of foil.

Another object of the present invention is to provide a machine for winding foil coils, insulating the layers of foil in such coil from each other and having means for cutting said foil and the insulating material at the completion of the winding cycle.

Another object of the present invention is to provide a machine for winding foil coils and having means for applying two lengths of adhesive tape to a wound coil to prevent it from unwinding and to insulate the free end of foil.

Another object of the present invention is to provide a machine for winding foil coils, applying two lengths of adhesive tape to a wound coil to prevent it from unwinding and to insulate the free end thereof and having means for cutting one length of said adhesive tape.

Another object of the present invention is to provide a machine for winding foil coils quickly and inexpensively and with a minimum of skilled hand labor.

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

The invention accordingly comprises the apparatus possessing the construction combination of elements and arrangement of parts which are exemplified in the

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following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings wherein:

Figure 1 is a front elevation of a winding machine embodying the present invention and showing the movable carriage thereof located at its uppermost position;

Fig. 2 is a side elevation of the winding machine of Fig. 1;

Fig. 3 is a detail view showing the two cams formed in the end plates and the positions of the cam followers during different stages of the winding and taping cycle;

Fig. 4 is a sectional view taken on the line IV—IV of Fig. 1 and looking in the direction of the arrows but showing the movable carriage located in the position it assumes at the start of a winding cycle;

Figs. 5, 6, 7, 8 and 9 are sectional views similar to Fig. 4 but showing the movable carriage in different positions it assumes during the winding and taping cycle;

Fig. 10 is an enlarged fragmentary view showing the no-back brake employed to prevent reverse movement of the foil and insulating material;

Fig. 11 is an enlarged fragmentary view showing the upper and lower suction tube support plates;

Fig. 12 is an enlarged side elevation of a foil coil manufactured on the machine of the present invention; and

Fig. 13 is an enlarged cross sectional view of the coil of Fig. 12.

The foil coil wound by the machine comprising the present invention does not comprise part of the present invention but is illustrated in Figs. 12 and 13 so that the operation of the winding machine can be better understood. The coil 1 includes a tubular core member C formed from conducting material as, for example, aluminum. A ribbon of thin sheet-like conducting material F, preferably aluminum foil which may have a thickness from .0002 to .004 of an inch is secured at one of its ends to the periphery of core C. A ribbon of sheet-like insulating material I, preferably having a thickness in the range of .00025 to .004 inch, is positioned on top of foil F and its end also secured to the core C. Insulating ribbon I preferably is a polyethylene terephthalate but also may be formed from craft paper or any other convenient thin insulating material. The superimposed ribbons of foil and insulation are wound on core C until the desired number of turns have been placed thereon whereupon the ribbon of insulation is cut. An insulating tape T1, having a pressure sensitive adhesive on one surface thereof is stuck to the periphery of the wound coil and is wrapped at least approximately 270° therearound and then extends over the free end of the foil F to insulate one surface thereof. A second piece of insulating tape T2 is stuck to the periphery of the coil and the outer surface of tape T1 and is wrapped around substantially 90° of the periphery of the coil in the opposite direction from that taken by tape T1 to complete the insulation of the outer surface of the coil. Tape T2, when it meets the end of foil F is stuck to the surface thereof opposite tape T1 to thereby complete the insulation of said foil end which projects from the body of the coil and acts as a lead for connecting said coil in a circuit.

The coil winding machine of the present invention comprises means for rotating a tubular core member to wind a foil ribbon and a superimposed ribbon of insulating material thereon. A movable carriage is provided to bring the foil and insulating ribbons together from sources of supply and to place them in superimposed relation and to guide them onto the rotating tubular core member. The movable carriage member carries

two supplies of insulating tape having a pressure sensitive adhesive on one surface thereof and the carriage is provided with means for bringing the pressure sensitive coatings on the insulating tapes into contact with a wound coil to facilitate taping the periphery thereof and insulating the free end which extends therefrom as a lead. Cam means are provided which cooperate with the movable carriage for moving the adhesive surface of the insulating tapes into contact with the periphery of the wound coil and for cutting the foil, the superimposed insulation and one adhesive insulating tape at various predetermined positions in the movement of the carriage.

Referring now to the drawing, the coil winding machine embodying the present invention is supported on a bed or table 10 supported by pedestals 12 and 14. A winding head 16 contains a spindle 17 suitably journaled and driven by a variable speed motor, not shown, mounted in head end pedestal 12. This motor is controlled by foot treadle 18 to obtain any desired starting and winding speed. A tailstock 20 is adjustable mounted on bed 10 and has a suitably journaled spindle 22 for mounting winding arbor 26 between said spindles for rotation thereby. Spindle 17 is provided with hand wheel 23 for rotating said spindle manually if it is so desired.

Means are provided between, and to the rear of, spindles 17 and 22 for guiding a strip of foil and a strip of sheet insulation to winding arbor 26 to wind a coil on core C carried thereby and for applying strips of pressure sensitive adhesive tape to wound coils, in a manner to be explained in detail hereinafter, to complete said coils. Said means comprises a pair of upstanding end plates 28 and 30, which pivotally support a tape carriage 32. The upper edges of end plates 28 and 30 are shaped to form cams 34 which control certain functions of carriage 32 as said carriage is pivoted, and cam grooves 38 and 40 (Figs. 2 and 3) are formed in the inner surface of plates 28 and 30 respectively and control other functions of said carriage, also as said carriage is pivoted.

Carriage 32 is a rigid frame comprising the generally triangular shaped side plates 42 and 44 which are fixed at their apex 46 to shaft 48 adjacent the inner surfaces of end plates 28 and 30 respectively. Shaft 48 is rotatably journaled in end plates 28 and 30 adjacent bed 10 and approximately midway between their front and rear edges. Side plates 42 and 44 are fixedly connected to spaced traverse rods or bars 50, 52 and 54 adjacent their upper edges and to spaced traverse rods 56, 58 and 60 located beneath rods 50, 52 and 54 respectively to provide a rigid frame capable of pivoting about shaft 48. Carriage operating lever 62 is secured to the upper portion of side plate 44 by means of studs 64 and 66 and projects above said side plate and end plate 30. A latch 68 is pivotally mounted on stud 64 for selective latching engagement under the influence of spring 70, in notches 72, 74 formed in quadrant 76 which is secured to the outer surface of end plate 30 and which projects thereabove. Notches 72 and 74 are so located on quadrant 76 that carriage 32 can be held in the correct position for winding coils and for doffing wound coils and threading the machine preparatory to starting a new winding cycle.

The machine of the present invention is adapted to simultaneously wind a plurality of coils along arbor 26. However, inasmuch as the mechanisms involved in carriage 32 for each winding position are identical, only one such mechanism will be described in detail herein.

Rods 56, 58 and 60 in addition to forming part of carriage 32 also support and guide a ribbon of metallic foil F, or the like, and rods 50, 52 and 54 support and guide a ribbon of sheet insulating material I. Rolls of foil 78 and insulating material 80 are supported at the rear of the winding machine in any convenient manner. Spaced plates 86 and 88 are adjustably mounted on rods 50, 52 and 54 to prevent lateral movement of the ribbon

I of insulating material, and guide plates 90 and 92 are adjustably mounted on rods 56, 58 and 60 beneath 86 and 88 to prevent lateral movement of foil ribbon F. A brake 94 is eccentrically mounted for rotation about stud 96 fixed to guide plate 90 and is so positioned that it will bear on rod 58. A similar brake 98 is eccentrically mounted on guide plate 86 to bear on rod 52. Brakes 94 and 98 are preferably formed from a material having a high coefficient of friction as, for example, rubber and function as no-back brakes to permit foil ribbon F and insulation ribbon I to be drawn from rolls 78 and 80 towards the coil winding on arbor 26 but to prevent any reverse movement thereof.

The apparatus described thus far can be utilized to wind coils of foil ribbon but is not capable of finishing those coils when wound by taping and functions in the following manner. Carriage 32 is pivoted forwardly until latch 68 engages in notch 72, the position illustrated in Fig. 5. The foil ribbon F is drawn from the roll 78, over rods 60, 58 and 56 and under no-back brake 94 and is secured to electrically conductive core C carried on arbor 26. The insulation ribbon I is drawn from roll 80, over rods 54, 52 and 50 and under no-back brake 98 and is also secured to core C. Inasmuch as insulation ribbon I is over foil ribbon F said ribbon F will be in contact with core C through most of the first wrap made therearound to thereby provide a good electrical contact therewith. With carriage 32 still in the position, illustrated in Fig. 5 treadle 18 is operated to cause spindle 17 to rotate arbor 26 and core C to wind a coil thereon while guide plates 90, 92, 86 and 88 and forward rods 56 and 50 direct foil F and insulation I thereto. Once the coil is completed it must be taped to prevent it from unwinding and the end of foil ribbon F extending therefrom must be insulated. This, of course, can be done manually, but such operations are slow and costly. The mechanism hereinafter described performs those operations rapidly and economically as a function of the apparatus.

Means for applying tape to the periphery of foil coil 1 and its lead are carried by carriage 32 and are actuated by the pivotal movement of said carriage. The taping means includes support members for holding two supplies of tape having a pressure sensitive adhesive on one face thereof on opposite sides of the ribbon of foil F as it extends from its supply to the coil 1. The means also includes holding members associated with the supplies of adhesive tape for holding the free ends thereof while the coil 1 is being wound and for moving those ends into contact with the periphery of the coil after it has been wound to commence the taping operation and to guide the adhesive tape onto the periphery of the coil and along the lead extending therefrom.

Both the tapes T1 and T2 preferably comprise polyethylene terephthalate, but can be of any convenient insulating material, having a coating of any convenient pressure sensitive adhesive as, for example, such as is disclosed in U.S. Patents Numbers 2,607,711, 2,567,671, 2,328,066 or 2,177,627. A roll 180 of adhesive tape T1 is journaled between a pair of triangular shaped plates 103 by means of the shaft 152 which extends across the space between said plates and is attached to the uppermost apex thereof. The rearmost lower corners of plates 103 are provided with openings which fit over tube 106 to thereby mount said plates on said tube. The ends of tube 106 are fixedly secured to one end of links 108 which are pivotally journaled at their opposite end on rod 56. A tubular member 100 is secured between plates 103 at the forward corner thereof. A plurality of perforations 201 pass through the wall of tube 100 adjacent the mid-point and on the lower side thereof. The interior of tube 106 is connected to the interior of tubular member 100 by means of two flexible tubes 206 the ends of which fit over nipples 205 and 207 which pass through the walls of tubular member 100 and tube 106 respectively.

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tively. It will be understood that the ends of tubular member 100 are closed by any suitable means as for example by means of the bolts 101 employed to secure said tubular member to the plates 103. The ends of tube 106 are closed by means of bolts 111 threaded into the ends of said tube and which have studs 113 extending axially therefrom over the uppermost surface of end plates 28 and 30 and cam surfaces 34 formed thereon. Inasmuch as tubes 206 are flexible plates 103 and tubular member 100 can pivot on tube 106 to a limited extent permitted by the bending of said tubes 206. To limit the counterclockwise pivoting movement of said plates 103 and tubular member 100, as viewed in Figs. 2-9, a plate 124 having a laterally extending ear 123 formed thereon is fixed to the front of tube 106 adjacent one side plate 103 by means of the collars 120 and screws 121 with said ear extending under plate 103 in supporting relation thereto. Inasmuch as studs 113 contact cam surface 34 it will be seen that as carriage 32 is pivoted forwardly and rearwardly tube 106 will be raised and lowered in accordance with the configuration of said cam 34 causing plates 103, roll of adhesive tape 180 and tubular member 100 to pivot around rod 56 on link 108. As carriage 32 is pivoted forwardly as viewed in Fig. 1 or counterclockwise, as viewed in Figs. 2 through 9, studs 113 will ride down the forwardly inclined portion 37 of cam surface 34 until they reach the lowermost point thereon, 113c in Fig. 3, after which continued forward movement of carriage 32 will cause them to be lifted by the upwardly inclined portion 35 of said cam 34 until they assume the position 113b in Fig. 3. When studs 113 are in position 113b, tubular member 100 is above and in front of the coil winding on arbor 26, see Fig. 5. After a coil has been wound on arbor 26 carriage 32 is pivoted rearwardly causing studs 113 to move down cam surface 35 to position 113c causing tubular member 100 to be lowered into contact with the periphery of a coil wound on arbor 26, see Fig. 6. Continued rearward movement of carriage 32 causes tubular member 100 to move along the length of foil extending from the wound coil whereby it and the holding means for tape T2 are supported thereby, in a manner to be explained more in detail hereinafter, until such time as studs 113 once again engage the surface of cam 34.

Tube 106 is connected to a vacuum pump, not shown, by means of flexible tube 204 so that a partial vacuum can be maintained inside said tube 106 and tubular member 100. The end of tape from roll 180 is threaded under guide bar 136 and beneath tubular member 100 so that the back or non-adhesive surface of said tape is in contact with the perforations 201 in said tubular member to permit the vacuum maintained in said member 100 to hold the end of tape T1 against the periphery of said member 100.

A second supply of adhesive tape T2, similar to tape T1, in the form of roll 148 is rotatably mounted between a pair of generally triangular shaped side plates 128 having their upper most apexes pivotally journaled on rod 56 to permit swinging movement of said plates and said supply 148 of tape. Plates 128 are spaced a predetermined distance apart by combined spacer and guide bar 149 and shaft 166 which is removably secured to and extends between the lowermost apexes of said plates 128. The roll of tape 148 is held in alignment with coil core C, insulation I and foil F by means of collar 160 which is adjustably secured on shaft 166 and against which one side of the core 150 of roll 148 is pressed by helical spring 158 which is compressed between said core and a second adjustable collar 162. In addition to accurately locating roll 148 on shaft 166 collar 160 and spring 158 comprise means for applying a predetermined tension to the tape T2 as it is drawn from said roll. Obviously, the resistance of roll 148 to unwinding can be increased or decreased by moving collar 162 toward or away from collar 160. A similar arrangement (not shown) is em-

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ployed on shaft 152 to accurately locate roll 180 of tape T1 and to impart a predetermined tension thereto. Tube 126, carrying spacing collars 125, is fixed across the third or intermediate apex of plates 128 and is provided with a plurality of perforations 176, similar to the perforations 201 in tubular member 100, in the uppermost portion of its wall and intermediate said plates 128. The ends of tube 126 are plugged by bolts 139 threaded into the ends of said tube and which have studs 140 which extend outwardly therefrom and received in the cam grooves 38 and 40 formed in the inner surfaces of end plates 28 and 30 respectively. Cam grooves 38 and 40 are identical except for being opposite in hand and are eight-sided closed grooves or tracks in which the studs 140 travel in a generally clockwise direction, as viewed in Fig. 3, as carriage 32 is pivoted forwardly and rearwardly.

The end of tape T2 is drawn from roll 148, passed under guide bar 149 and around tube 126 and passed over the perforations 176. The interior of tube 126 is connected to a vacuum pump, not shown, by means of flexible tube 167 to thereby maintain a partial vacuum inside of tube 126. The vacuum maintained inside tube 126 creates a suction in perforations 176 that holds the end of tape T2 on the periphery of said tube.

At the start of a winding cycle carriage 32 is moved to the rear until such time as latch 68 engages rear-most notch 74 and when in this position the cam following studs 113 and 140 will occupy the positions with respect to their respective cams as is disclosed at 113a and 140a in Fig. 3 and the apparatus as a whole will assume the position illustrated in Fig. 4. When said cam following studs are in this position arbor 26 carrying a coil core C is positioned between the spindles 17 and 22 preparatory to starting a winding cycle. Latch 68 is released and carriage 32 is pivoted rearwardly to move follower 140 rearwardly along the lengths 33 of cams 38 and 40, until said followers 140 drop down the length 31. The rearward wall of vertical length 31 serves as a stop preventing further rearward movement of carriage 32. At this point carriage 32 is pivoted forwardly causing follower 140 to move forwardly along the substantially horizontal length 27 and downwardly in length 21 and follower 113 to move forwardly along the surface of cam 34. Carriage 32 reaches the end of its forward movement when followers 140 arrive at the junction of lengths 21 and 15. When this point is reached carriage 32 is pivoted rearwardly until latch 68 engages in forward notch 72 in quadrant 76. This slight rearward movement of carriage 32 causes followers 140 to move forwardly and upwardly a slight distance in the cam length 15 to the position designated 140b in Fig. 3 and illustrated as a whole in Fig. 5. When cam follower 140 occupies the position 140b cam follower 113, which controls the tubular member 100, has moved to the position 113b. When the two cam followers are in these last mentioned positions tube 126 and tubular member 100 are spaced apart approximately their maximum distance and inasmuch as said tube 126 and tubular member 100 carry the ends of tapes T1 and T2 said tapes are spaced approximately their maximum distance apart. When carriage 32 is in this position the end of foil F is secured to coil core C and the end of insulation I is also secured to said coil core. Treadle 18 is actuated to cause arbor 26 to rotate to wind a coil upon core C. When the coil has been wound carriage 32 is moved rearwardly to cause follower 140 to move upwardly in cam track 15 and cam follower 113 to move rearwardly and downwardly upon the cam surface 35. During this latter rearward movement of carriage 32 insulation I is cut either manually by the operator or by means to be explained more fully hereinafter which are actuated by such movement of said carriage. When cam follower 113 reaches the position 113c (see also Fig. 6) the adhesive surface of tape T1 is brought into contact with the periphery of the newly wound coil carried by arbor 26 and carriage 32 is held

in that position while said arbor and coil are rotated at least approximately 270° by means of hand wheel 23 to wind a length of tape on the periphery of said coil. Carriage 32 is then pivoted further rearwardly to move cam follower 140 upwardly to position 140d (see also Fig. 7) when tube 126 presses the adhesive surface of tape T2 into contact with the periphery of the wound coil and over the end of tape T1 which is adhered thereto. Continued rearward movement of carriage 32 causes tape T1 to be drawn along the uppermost surface of foil F as it extends between the wound coil and guide bar 56 and causes cam followers 140 to move upwardly in cam groove length 38 to position 140e (see also Fig. 8) to thereby lift tube 126 from the periphery of the coil to the underside of foil F to thereby draw tape T2 from the periphery of the coil to the underside of foil F to press said tape against said foil and to support tubular member 100. Continued rearward movement of carriage 32 causes cam followers 140 to move rearwardly along the cam grooves 38 until said followers reach the location 140a. During this latter movement tube 126 presses tape T2 against the under side of foil F and supports tubular member 100 whereby the lead extending from the coil is insulated. At the end of this latter movement cam followers 113 contact cam surfaces 39 to lift tubular member 100 away from foil F and followers 140 enter cam groove 13 to lower tube 126 away from said foil. At this point tapes T1 and T2 and foil F are cut, either manually or in a manner to be explained hereinafter, carriage 32 is moved rearwardly until followers 113 and 140 assume the positions 113a and 140a respectively, the position they were in at the start of the cycle, arbor 26 and the coil thereon are removed from the apparatus and the above described cycle started again. It will be understood that once tape T2 has contacted the undersurface of foil F the coil is rotated substantially 90° to cause the length of tape extending from the periphery of the coil to the undersurface of the foil to be folded between said coil and the lead formed by the extending length of foil.

The means for cutting insulation I comprises a pair of resiliently flexible blades 210 and 214 which are moved relative to each other and which cooperate with each other to shear said insulation at a predetermined time in the operating cycle. Blade 214 is formed by one end of the generally C-shaped member 225 which is fixedly secured to the tube 106 by screw 107 so that the end of blade 214 depends from the rear of said tube. Member 214 is preferably formed from a thin sheet of spring steel so that the ends thereof can flex slightly during the cutting operation. Blade 210 is fixedly secured to the underside of rod 59, and depends therefrom, by means of knife bar 209 and screws 212. As hereinbefore explained, the vertical movement of tube 106 relative to carriage 32, and rod 59, is controlled by cam 34. Blades 210 and 214 are of such length that the edge of one will engage the face of the other adjacent its edge and slide off said face to shear the ribbon of insulation I as carriage 32 is moved rearwardly from the position 113b to the position 113c. It will be recalled that the insulation I passes over bar 59 as it runs to the coil on arbor 26 and thus located between the two blades 210 and 214.

The other end of C-shaped member 225 forms blade 218 which cooperates with blade 220 to shear the foil ribbon F as carriage 32 is pivoted rearwardly from position 113f to position 113a. Blade 220, preferably made from a thin sheet of spring steel is fixedly secured to shaft 222. Shaft 222 is rotatably journaled between the side plates 128 with the left hand end thereof, as viewed in Fig. 1, extending beyond side plate 42 and adjacent to end plate 28. Finger 224 having the cam surface 223 formed on its upper edge is fixed to the left hand end of shaft 222. Cam surface 223 is adapted to engage pin 226 projecting from the inner surface of end plate 28 as carriage 32 pivots rearwardly to rotate shaft

222 in a clockwise direction, as viewed in Fig. 9. Clockwise rotation of shaft 222 swings blade 220 upwardly against the side of blade 218 causing blade 218 to slide across the edge of blade 220 to shear foil ribbon F. It will be recalled that foil ribbon F extends from bar 56 to the winding coil and therefore is positioned between blades 218 and 220. Helical spring 217, located upon shaft 222, adjacent side plate 128 has one of its ends secured to said side plate and its other end secured to collar 215 which is fixed to said shaft to rotate said shaft in a counterclockwise direction after finger 224 passes pin 226 to thus reset blade 220. Pin 221 fixed to the right hand end of shaft 222 (see Fig. 1) engages transverse bar 151 to limit the counterclockwise rotation of said shaft 222. A pointed knife blade 228 is provided to cut adhesive tape T1 upon manual operation thereof. Knife 228 is fixedly secured to cross bar 230 and inclines downwardly and to the rear thereof. Bar 230 is secured at its ends to the upper ends of arms 232 and 234 which are pivotally journaled at their lower ends on tube 106. Helical springs 236 and 238 are carried by tube 106 adjacent arms 232 and 234 respectively and urge said arms in a clockwise direction as viewed in Fig. 2 to press knife 228 against the surface of guard 240. Guard 240, which functions to shield knife 228 to prevent the operator from accidental cuts and also protects said knife from damage, is mounted on, and is located between plates 103.

When carriage 32 is in position 113a bar 230 is manually depressed to press the point of knife 228 against the surface of tape T1 to pierce that tape. Once the point of knife 228 has penetrated tape T1 a slight rotation of the wound coil by means of hand wheel 23 draws said tape past said knife and causes the tape to be severed.

After insulation I, foil F and tape T1 have been cut the operator cuts tape T2 by any convenient means as, for example, a knife or scissors. It will, however, be obvious to those skilled in the art that means can be provided to cut tape T2. For example, a knife or blades similar to those disclosed hereinabove can be located on carriage 32 to cut tape T2.

The machine of the present invention operates in the following manner. With carriage 32 in position 113a arbor 26 and core C are inserted between spindles 17 and 22. Carriage 32 is then pivoted forward to position 113b and foil F and insulation I are attached to core C and treadle 18 is depressed to rotate arbor 26 to wind a coil on core C. After the coil is wound carriage 32 is pivoted rearwardly until tubular member 100 presses tape T1 into contact with the periphery of said coil (position 113c and 140c, Fig. 3 and Fig. 6). During this latter movement blades 210 and 214 sever insulation I. Carriage 32 is held stationary in the position illustrated in Fig. 6 and arbor 26 is rotated at least about 270° to wind a partial turn of tape T1 around said coil. After this has been accomplished carriage 32 is pivoted rearwardly to position 113a. During this latter movement the carriage passes through positions 113 and 114d, e and f which correspond to Figs. 7, 8 and 9 respectively. At position 113d, 140d, Fig. 7, tubular member 126 presses tape T2 against the periphery of the coil. As carriage 32 moves from this latter position to position 113f, 140f, tapes T1 and T2 are drawn along the foil lead extending from the coil, position 113e, 140e, Fig. 8, and as carriage 32 approaches position 113f, 140f, Fig. 9, blades 218 and 220 cut foil F. With carriage 32 at position 113f knife 228 is swung downwardly to pierce tape T1 and arbor 26 is rotated about 90° to draw tape T1 past knife 228 to sever said tape a short distance ahead of the end of coil F and to also fold the length of tape T2 extending from the periphery of the coil to the lead between said coil and lead. The operator then cuts tape T2 and swings carriage 32 rearwardly to the starting position 113a and removes arbor 26 and the completed coil.

Since certain changes may be made in the above apparatus without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A machine for winding electrical coils from ribbons of conductive material comprising a rotatable spindle for rotating a core member about its longitudinal axis to wind a coil thereon, a pair of spaced side plates adjacent said axis, a carriage pivotally mounted between said side plates for pivotal movement toward and away from said axis, means for holding a supply of conductive ribbon, guide means on said carriage for directing a ribbon of conductive material drawn from the supply thereof onto said core, means carried by said carriage for holding a supply of tape having an adhesive on one face thereof, suction means carried by said carriage and movable relative thereto for holding the end of said tape, said end holding means being adapted to hold the end of said tape with its surface parallel to the axis of said core and in radial alignment with a coil wound thereon, and means carried by one of said side plates and engaged by part of said carriage as it is pivoted for moving said suction means from a position to one side of said ribbon as it extends between said guide and said coil wound on said core to a position wherein it presses the adhesive side of said tape against the periphery of said coil for application to said periphery circumferentially thereof.

2. A machine for winding electrical coils from ribbons of conductive material comprising a rotatable spindle for rotating a core member about its longitudinal axis to wind a coil thereon, a pair of spaced side plates adjacent said axis, a carriage pivotally mounted between said side plates for pivotal movement toward and away from said axis, means for holding a supply of conductive ribbon, guide means on said carriage for directing a ribbon of conductive material drawn from the supply thereof onto said core, means carried by said carriage for holding a supply of tape having an adhesive on one face thereof, suction means carried by said carriage and movable relative thereto for holding the end of said tape, said end holding means being adapted to hold the end of said tape with its surface parallel to the axis of said core and in radial alignment with a coil wound thereon, and means carried by one of said side plates and engaged by part of said carriage as it is pivoted for moving said suction means from a position to one side of said ribbon as it extends between said guide and said coil wound on said core first to a position wherein it presses the adhesive side of said tape against the periphery of said coil for application to said periphery circumferentially thereof and subsequently moves it adjacent and along said ribbon.

3. A machine for winding electrical coils from ribbons of conductive material comprising a rotatable spindle for rotating a core member about its longitudinal axis to wind a coil thereon, a pair of spaced side plates adjacent said axis, a carriage pivotally mounted between said side plates for pivotal movement toward and away from said axis, means for holding a supply of conductive ribbon, guide means on said carriage for directing a ribbon of conductive material drawn from the supply thereof onto said core, means carried by said carriage for holding a supply of tape having an adhesive on one face thereof, suction means carried by said carriage and movable relative thereto for holding the end of said

tape, means carried by said carriage for holding a second supply of tape having an adhesive on one face thereof, suction means carried by said carriage and movable relative thereto for holding the end of said second tape, said end holding means being adapted to hold the ends of said tape with their surfaces parallel to the axis of said core and in radial alignment with a coil wound thereon and means carried by one of said side plates and engaged by part of said carriage as it is pivoted for moving said suction means from positions spaced from the opposite sides of said ribbon as it extends between said guide and said coil wound on said core to positions wherein they press the adhesive sides of said tapes against the periphery of said coil for application to said periphery circumferentially thereof.

4. A machine for winding electrical coils from ribbons of conductive material comprising a rotatable spindle for rotating a core member about its longitudinal axis to wind a coil thereon, a pair of spaced side plates adjacent said axis, a carriage pivotally mounted between said side plates for pivotal movement toward and away from said axis, means for holding a supply of conductive ribbon, guide means on said carriage for directing a ribbon of conductive material drawn from the supply thereof onto said core, means carried by said carriage for holding a supply of tape having an adhesive on one face thereof, suction means carried by said carriage and movable relative thereto for holding the end of said tape, means carried by said carriage for holding a second supply of tape having an adhesive on one face thereof, suction means carried by said carriage and movable relative thereto for holding the end of said second tape, said end holding means being adapted to hold the ends of said tape with their surfaces parallel to the axis of said core and in radial alignment with a coil wound thereon, and means carried by one of said side plates and engaged by part of said carriage as it is pivoted for moving said suction means from positions spaced from the opposite sides of said ribbon as it extends between said guide and said coil wound on said core first to positions wherein they press the adhesive sides of said tapes against the periphery of said coil for application to said periphery circumferentially thereof and subsequently moves them adjacent and along opposite sides of said ribbon.

5. A machine for winding electrical coils as set forth in claim 1 wherein said means carried by said side plate is a cam.

6. A machine for winding electrical coils as set forth in claim 2 wherein said means carried by said side plate is a cam.

7. A machine for winding electrical coils as set forth in claim 3 wherein said means carried by said side plate is a cam.

8. A machine for winding electrical coils as set forth in claim 4 wherein said means carried by said side plate is a cam.

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