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Z. C. POSSIS ET AL
AUTOMATIC TAPING APPARATUS FOR APPLYING ADHESIVE
TAPE STRIPS ABOUT A WIRE COIL
Filed March 27, 1959 8 Sheets-Sheet 1

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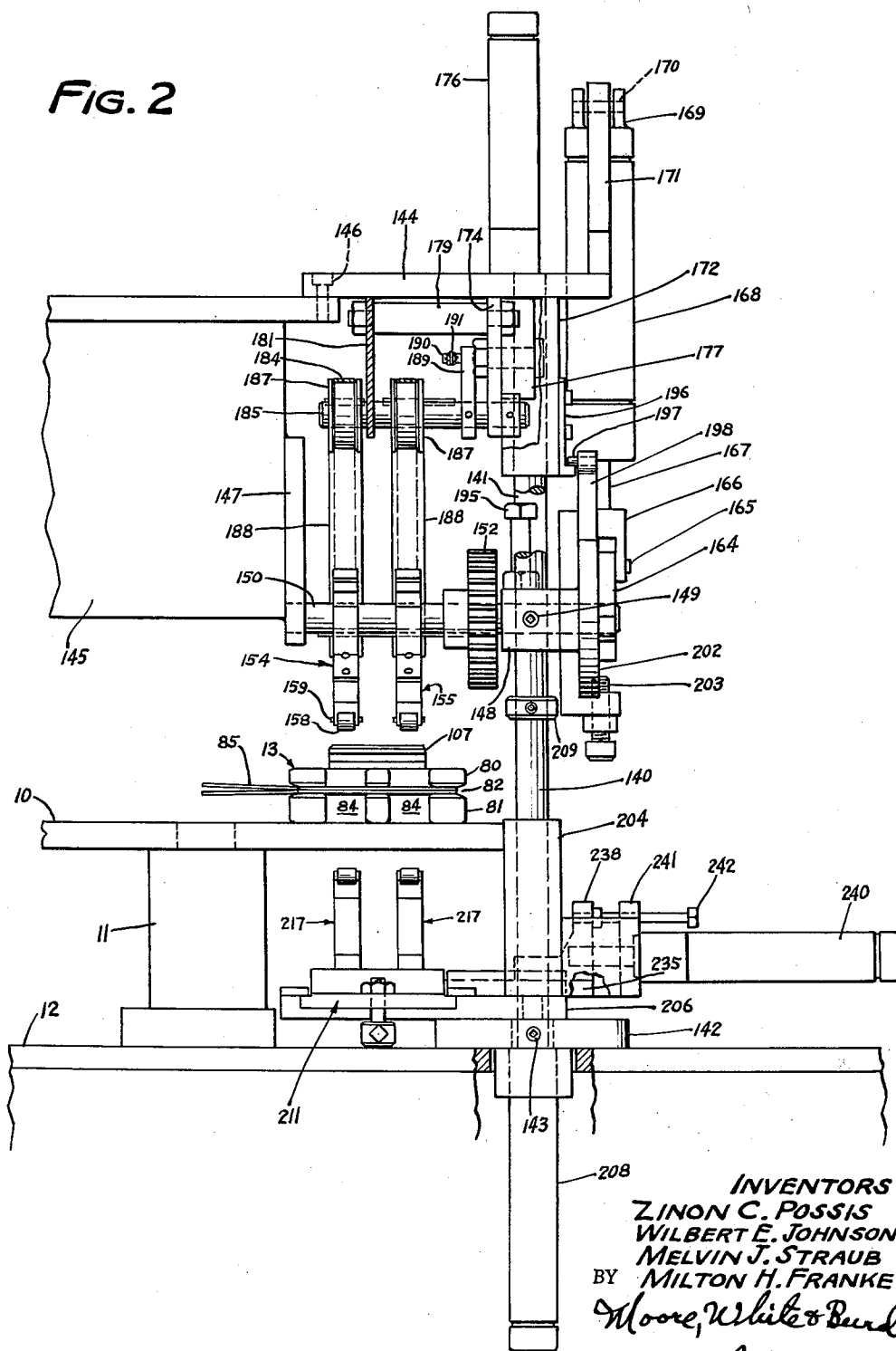
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FIG. 2



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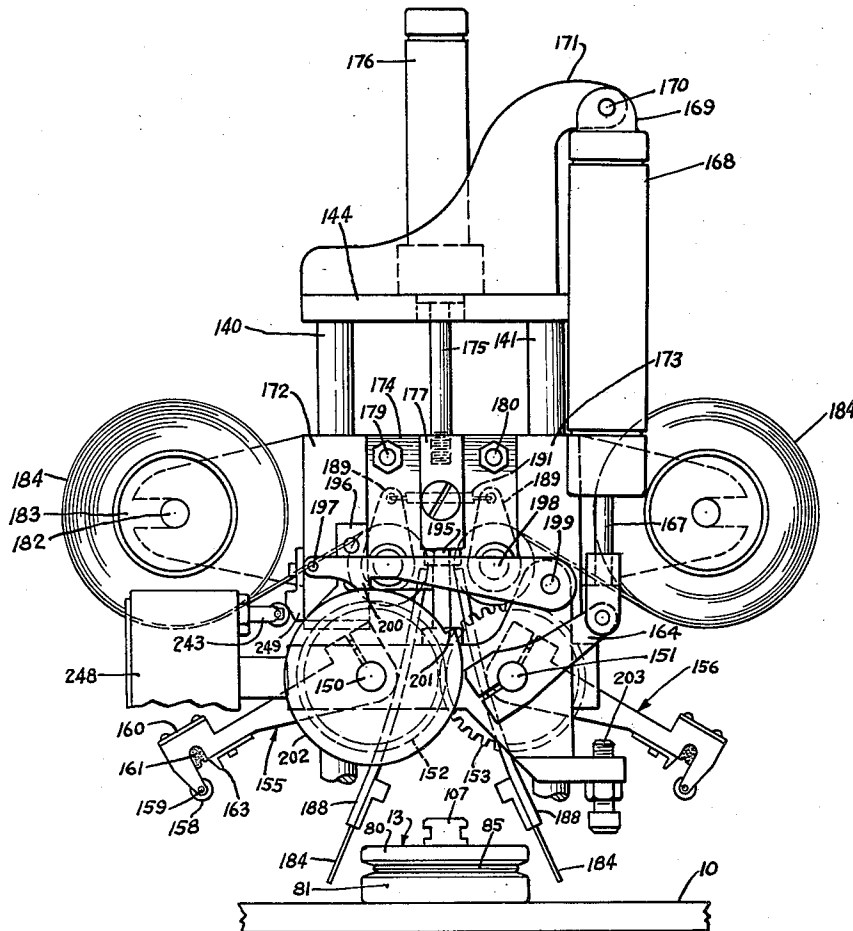


FIG. 3

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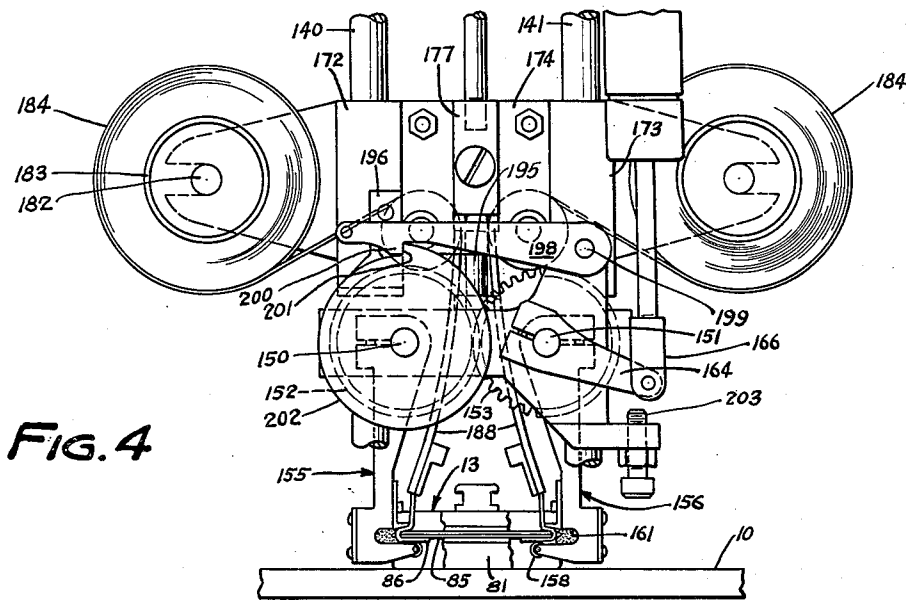


FIG. 4

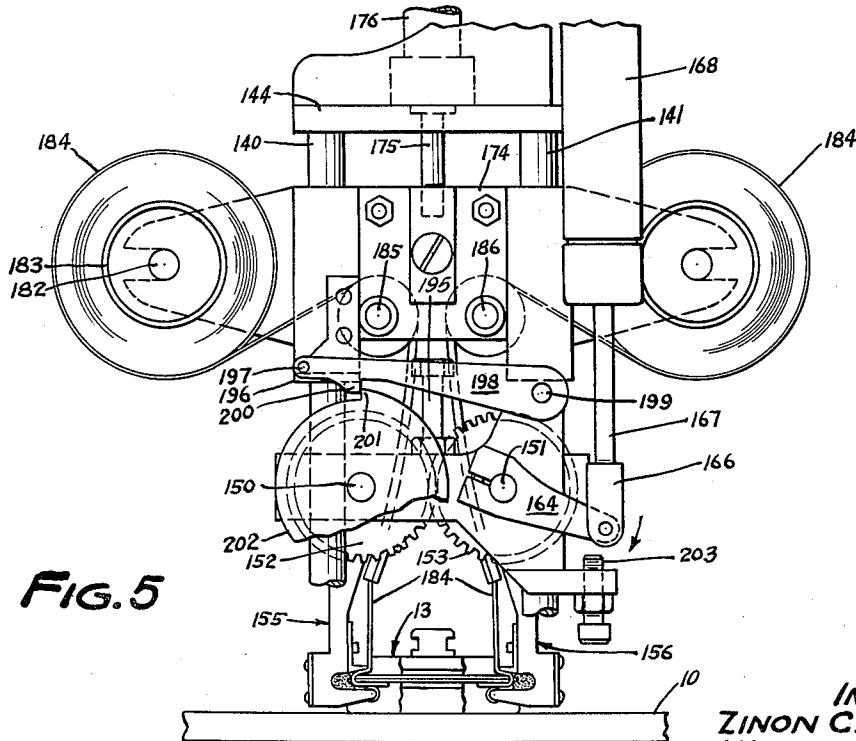


FIG. 5

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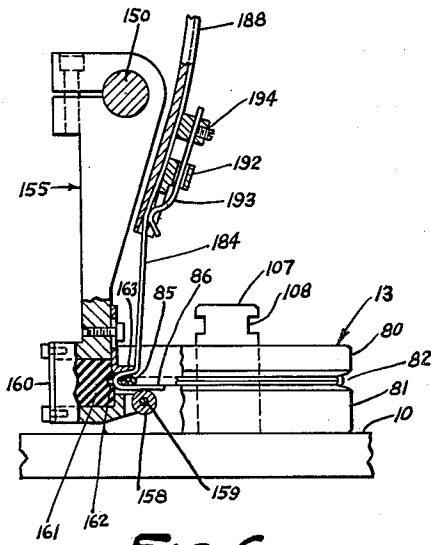


FIG. 6

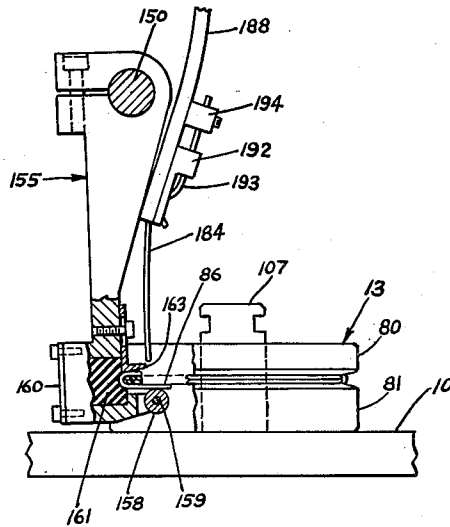


FIG. 7

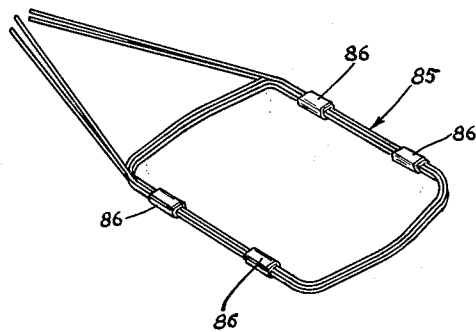


FIG. 13

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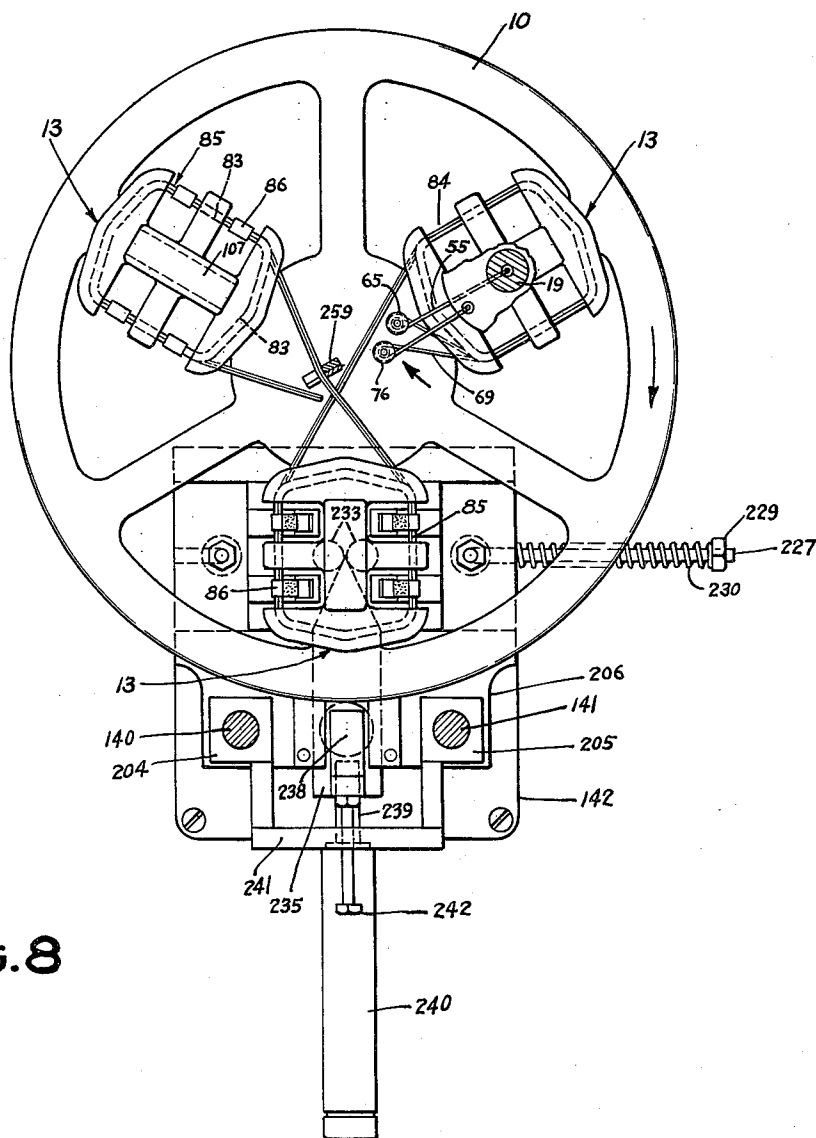


FIG. 8

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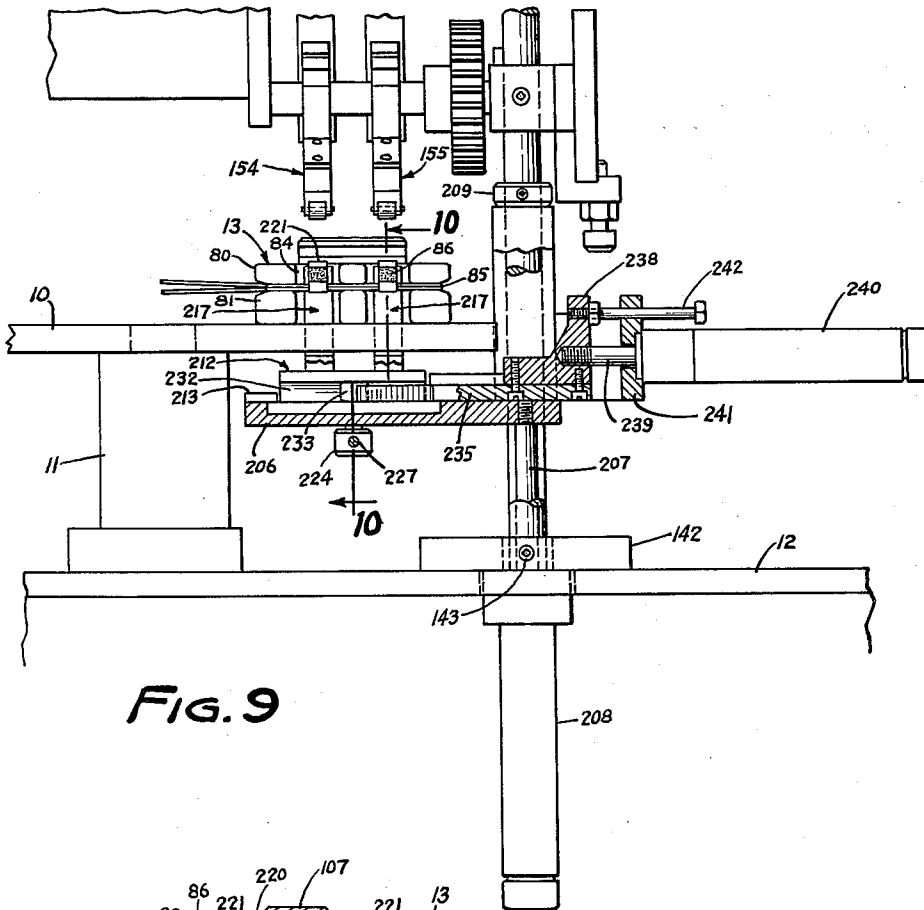


FIG. 9

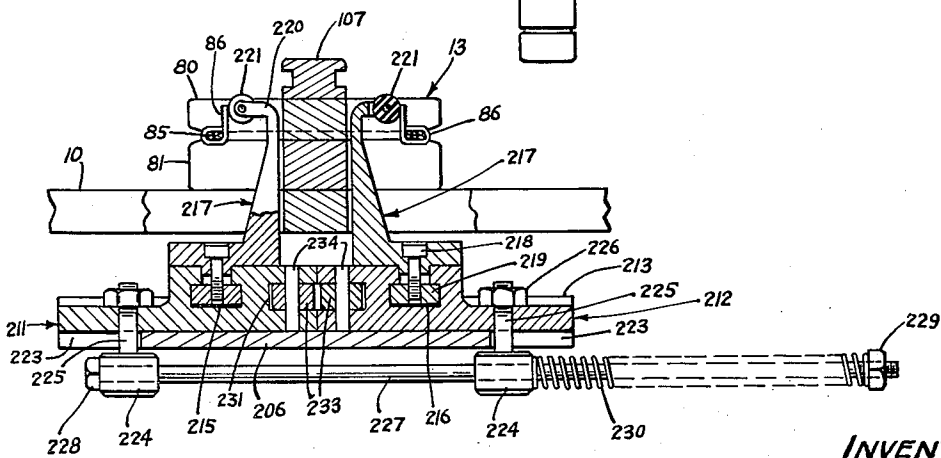


FIG. 10

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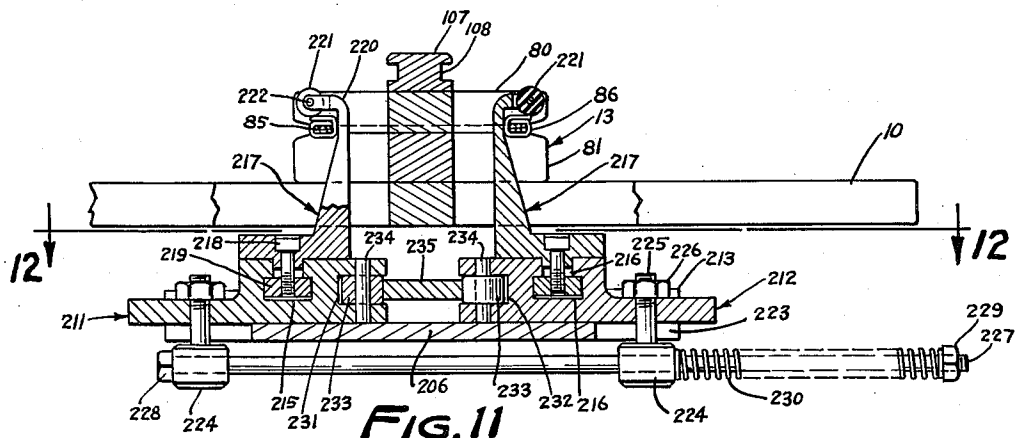


FIG. 11

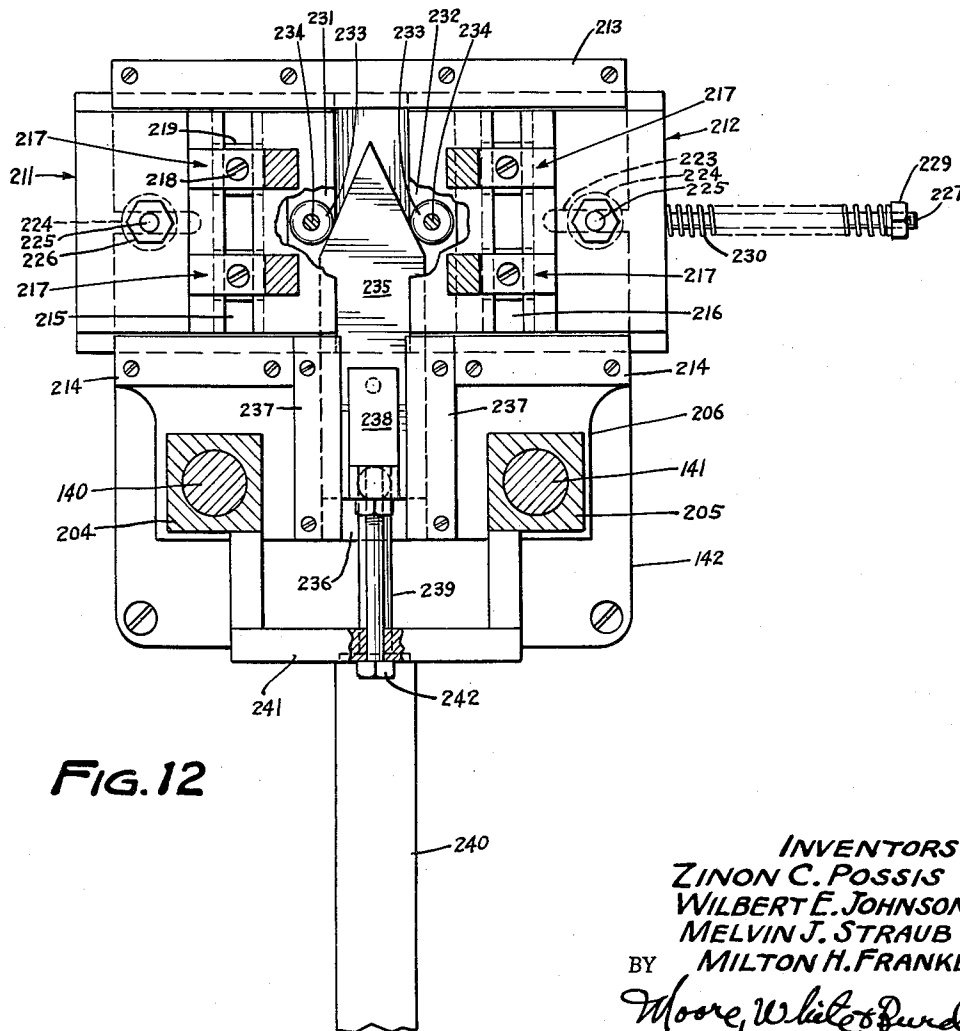


FIG. 12

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AUTOMATIC TAPING APPARATUS FOR APPLYING ADHESIVE TAPE STRIPS ABOUT A WIRE COIL

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Filed Mar. 27, 1959, Ser. No. 802,463
23 Claims. (Cl. 156-468)

This invention relates generally to machines for winding coils for use in armatures. More particularly, this invention relates to a taping structure and associated mechanism for the application of one or more lengths of tape to bind together the several wires comprising a coil.

The principal object of this invention is to provide means for binding together the wires comprising an armature coil.

A further object of this invention is to provide automatic means for simultaneously applying a plurality of adhesive tape strips at spaced intervals about a wire coil and enfolding the tape around the several wires comprising the coil.

A still further object of this invention is to provide taping structure for use in conjunction with means for winding coils and means for removing and ejecting a finished coil from a coil winding machine.

Other objects of the invention will become apparent as the description proceeds.

To the accomplishment of the foregoing and related ends, this invention then comprises the features hereinafter fully described and particularly pointed out in the claims, the following description setting forth in detail certain illustrative embodiments of the invention, these being indicative, however, of but a few of the various ways in which the principles of the invention may be employed.

The invention is illustrated by the drawings in which the same numerals refer to corresponding parts and in which:

FIGURE 1 is an elevation of the taping structure according to this invention showing the elements of the structure at rest between operating cycles;

FIGURE 2 is an end elevation, partly in section and partly broken away, showing the taping structure elements in the same position as in FIGURE 1;

FIGURE 3 is an elevation similar to FIGURE 1 but showing the tape supply mechanism lowered into operating position;

FIGURE 4 is a fragmentary elevation similar to FIGURE 3 but showing the tape applying mechanism in tape applying position;

FIGURE 5 is a similar fragmentary elevation showing a later stage in the operation after the tape supply means have been raised;

FIGURE 6 is a fragmentary elevation, partly in section, and enlarged to show the detail of one upper and outer tape applying arm;

FIGURE 7 is a similar view showing one of the outer tape applying arms in a later operational stage pressing tape against a coil and severing a strip of tape from the supply roll;

FIGURE 8 is a plan view of the turntable of a coil winding machine showing the successive stages in the manufacture of a coil and showing in particular the arrangement of lower and inner tape applying arms which complete the enfolding of tape strips about the wires of a coil;

FIGURE 9 is a fragmentary end elevation similar to FIGURE 2, partly in section, and showing the inner and lower tape applying arms raised into operating position;

FIGURE 10 is an enlarged fragmentary section taken

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on the line 10-10 of FIGURE 9 and in the direction of the arrows;

FIGURE 11 is a similar sectional view showing the inner tape applying arm at a later operational stage;

FIGURE 12 is a horizontal section taken on the line 12-12 of FIGURE 11 and in the direction of the arrows; and

FIGURE 13 is a perspective view of a finished coil whose wires are bound together by tape by means of the present invention.

Referring to the drawings, the winding machine incorporating the taping structure according to this invention includes generally a rotary horizontal turntable 10 mounted for rotation on a vertical standard 11 supported on a suitable base 12. A coil winding form or block, indicated generally at 13, is secured to the top of the turntable 10. The winding form or block 13 is separable and is formed of mated top and bottom portions 80 and 81. A peripheral groove 82 is formed at the interface between the top and bottom segments of the winding block to receive and position the wire as it is spun onto the winding block by spinners as described in copending application Serial No. 758,226, filed September 2, 1958, now Patent No. 3,065,771. As best shown in FIGURE 8, the turntable 10 preferably carries three winding blocks 13 for successive positioning upon rotation of the turntable at a winding station, a taping station and a removal and ejection station. The winding operation is described in the aforesaid copending application Serial No. 758,226. The removal and ejection operation is described in copending application Serial No. 758,227, filed September 2, 1958, now Patent No. 3,063,475.

To facilitate removal of the coil from the winding block, all of the groove 82 is formed in the top segment 80 of the separable winding block 13 to provide a coil supporting shoulder 83 of size and shape corresponding generally to the size and shape of the coils to be wound. In order to facilitate binding the finished coil 85 with spaced strips of tape 86 by means of the taping structure according to this invention, a plurality of relatively wide vertical channels 84 extending substantially deeper than the shoulders 83 are provided on opposite sides of the winding form 13. The coil 85 is composed of individual wires and the finished coil is held in its desired shape by means of the strips of tape 86 surrounding the wires as shown in FIGURE 13.

The taping structure, according to this invention, includes a pair of vertical parallel guide rods or shafts 140 and 141 each supported in a base plate 142 mounted on the base structure 12. The guide rods are secured by means of set screws 143 or equivalent fastening means. A top plate 144 is supported at the tops of the vertical guide rods. The back edge of top plate 144 is supported on the top surface of a beam 145 of the winding machine frame and is suitably secured thereto by means of bolts 146 or equivalent fastening means. A vertical shaft bracket 147 is mounted at the end of beam 145. A bearing bar 148 is immovably secured to the vertical guide rods 140 and 141 by means of set screws 149 or equivalent fastening means. A pair of parallel horizontal shafts 150 and 151 are journaled in the shaft bracket 147 and bearing bar 148. Shafts 150 and 151 extend between the shaft bracket 147 and bearing bar 148 and extend forwardly from the bearing bar. Keyed to the shafts immediately rearwardly of the bearing bar 148 are a pair of sprocket gears 152 and 153, mounted on shafts 150 and 151, respectively. The teeth of sprockets 152 and 153 intermesh.

Keyed to shaft 150 between sprocket 152 and shaft bracket 147 is a pair of upper tape arms 154 and 155. Keyed to shaft 151 is a similar pair of upper tape arms 156 and 157 (arm 157 of which is not visible on the

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drawing). Each of the upper tape arms is identical in structure and, as best shown in FIGURES 6 and 7, they are each provided at their outer extremities with an inwardly projecting bifurcated tip in which is fitted a roller 158 journaled for rotation on a roller shaft 159. Immediately rearward of roller 158 at the extremity of the tape arm is an open cavity or chamber covered by a cover plate 160 and filled with an insert 161 of resilient material, such as rubber. The exposed face of the resilient insert 161 is provided with a horizontal notch 162 adapted to press against a piece of tape and urge it into intimate contact with a wire coil. A toothed tearing edge or cutting knife 163 is mounted on the inside face of the upper tape arm spaced from the roller 158 by a distance just slightly exceeding the thickness of a wound coil. The cutting knife 163 is preferably slotted to permit adjustable mounting on the upper tape arms.

An arm 164 for controlling the movements of gears 152 and 153 and the shafts 150 and 151 carrying the upper tape arms is keyed to the extremity of shaft 151 which extends forwardly from bearing bar 148. The free end of control arm 164 is pivotally attached by means of a pin 165 between the arms of a clevis 166 which is mounted at the end of the piston rod 167 of a hydraulic cylinder 168. The opposite end of cylinder 168 is provided with a clevis 169 pivotally attached by means of pin 170 to a hanger or supporting bracket 171 mounted along the front edge of the top plate 144. Thus, when hydraulic pressure is applied behind the piston of cylinder 168, the piston rod 167 is extended and rotates the control arm 164 to rotate shaft 151 and gear 153. Because the teeth of the gears 152 and 153 intermesh, gear 152 and shaft 150 are simultaneously rotated but in the opposite or counter-clockwise direction, when viewed from the front. As the shafts 150 and 151 are rotated, the upper tape arms 154-157 are moved in unison into position against the side of a coil 85 held on a winding block 13.

A tape supply and feeding means is movably supported on the vertical guide rods by means of an upper slide 172 on guide rod 140 and an upper slide 173 on guide rod 141. Slides 172 and 173 are joined together at their rear edges by a plate 174 to permit the slides to be moved in unison. The piston rod 175 of a hydraulic cylinder type of hydraulic motor 176 which is mounted on top of top plate 144 is secured to a stop block 177 which is mounted on and secured to plate 174 by means of a stud or equivalent fastening means. Thus, when hydraulic pressure is applied behind the piston of cylinder 176, the piston rod 175 is extended and the slides and their connecting plate and associated mechanism supported thereon are moved down the vertical guide rods 140 and 141.

A pair of identical shafts or rods 179 and 180 are secured to and extend rearwardly from plate 174. Shafts 179 and 180 are stationary and at their opposite ends support a depending roll bracket 181. The roll bracket is notched at each end to receive a short shaft carrying two spools or reels 183 of pressure sensitive tape material 184. Identical shafts and reels are mounted at each end of the roll bracket. A pair of parallel horizontal shafts 185 and 186 are journaled in plate 174 and roll bracket 181. The shafts are secured to plate 174 by means of suitable collars or equivalent fastening means. Each of the shafts 185 and 186 carries a pair of tape guide rolls 187, each aligned with one of the tape supply reels 183. The two guide rolls on each shaft are disposed on opposite sides of the roll bracket 181 and are keyed to their shafts for rotation therewith.

Each of the tape guide rolls 187 is provided with an elongated slightly arcuate tape guide channel 188 which is tangential to the periphery of the guide roll and extends generally downwardly therefrom. Each of the shafts 185 and 186 is provided with a rocker arm or link

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189 keyed to its shaft. Each of the rocker arms 189 is provided with a pin 190 at its outer extremity and the pins 190 are joined by a tension spring 191. Spring 191 thus normally tends to urge the two rocker arms 189 together. Rotation of the shafts 185 and 186 is normally resisted, however, because of the tape guide channels 188 bearing against the hubs of the upper tape arms 154-157. However, by virtue of their slight curvature, the guide channels are closer together at their tops than at their bottoms and hence will be further spread apart upon lowering of the tape supply mechanism, since the guide channels will pivot apart under the influence of spring 191 as far as their engagement against the hubs of the upper tape arms will allow. This is shown by comparison of FIGURES 1 and 3. The lower extremity of each of the tape guide channels 188 is provided with a bridging spring guide 192 through which a wire spring 193 is passed and secured at 194 to provide the desired spring tension against the tape 184 in the guide channel to hold the free end of the tape in place.

The two upper slides 172 and 173, the plate joining them 174 and all of the structure supported thereby are referred to herein generally as the upper slide assembly or mechanism. The structure secured to the slides and their joining plate all move whenever the slides and plate move and hence are thought of as an assembly. This structure includes the shafts 179-180, the roller bracket 181, the reels 183, the shafts 185 and 186, guide rolls 187, the channels 188 secured to the guide rolls 187, the rocker arms 189 secured to the guide rolls 187, the rocker arm pins 190, the spring 191 interconnecting the pins 190, the bridging spring guide 192 in each of the channels, the spring 193 in each of the bridging spring guides and the means 194 for securing the springs 193 in the bridging spring guides 192. Because this structure supplies tape, it is also referred to as the tape supply mechanism.

The limit of downward movement of the tape supply mechanism 172-194 under influence of hydraulic motor 176 is determined by an adjustable stop means 195 on the top surface of bearing bar 148 positioned to be engaged by the bottom surface of stop block 177 secured to the plate 174 connecting the slide members 172 and 173. The forward face of upper guide 172 carries a stop plate 196 having a horizontal projecting lip which during most of the course of vertical travel of the guide engages a pin 197 at the outer extremity of a stop arm 198. The opposite end of stop arm 198 is pivotally and eccentrically mounted on the stationary bearing bar 148. Stop arm 198 is in the nature of a pawl and is provided with a pawl tooth or stop 200 which is positioned to engage a similar tooth or stop 201 of a stop cam 202 keyed to rotate with shaft 150.

As shown in FIGURE 3, when the tape supply mechanism is lowered under influence of hydraulic motor 176, stop arm 198 pivots downwardly carried by pin 197 engaging the projecting lip of stop plate 196 on upper guide 172 until the pawl tooth 200 comes to rest on the periphery of stop cam 202. The tape supply mechanism carried by the upper slides continues downwardly until it comes into engagement with stop 195 disengaging pin 197 from the lip of stop plate 196. Then when shafts 150 and 151 carrying the upper tape arms 154-157 are rotated under influence of hydraulic motor 168 acting upon control arm 164 to rotate gears 152 and 153, the rotary movement of the shafts, gears and tape arms is limited by the engagement of cam stop 201 with the pawl tooth 200 of the stop arm 198. The movement of the piston rod 167 of the hydraulic motor 168 is limited by an adjustable stop means 203 carried in a bracket supported from the stationary bearing bar 148. As will be pointed out in greater detail hereinafter, the movement of the piston rod and the resulting movement and rotation of the associated shafts, gears and tape arms is halted by engagement of the tooth of the stop cam with the tooth of the stop arm

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before that movement can be stopped by the secondary stop means 203.

The structure heretofore described supplies tape for application to the coils and performs the initial steps of applying and securing the tape about the coils. Wrapping of the tape strips around the wires of the coil to completely encircle the wires with tape is completed by a co-operating lower taping unit. The lower taping unit is carried by a pair of lower slides 204 and 205 on vertical guide rods 140 and 141, respectively. The lower slides 204 and 205 are secured to and movable with a slide plate 206. Slides 204 and 205 and slide plate 206 are movable vertically along the vertical guide rods 140 and 141 by virtue of hydraulic cylinder 208 whose piston rod 207 is attached to the slide plate 206. The upward movement of the lower slides 204 and 205 is limited by a collar stop 209 on one or both of the vertical guide rods.

The upper surface of slide plate 206 is provided with a longitudinal recess or channel in which are fitted a pair of lower taping slides 211 and 212. The lower taping slides are retained in the slide plate channel against vertical movement with respect to the plate by means of one long slide strap 213 and a pair of shorter slide straps 214. A recessed transverse slot 215 and 216 is provided in the upper surface of the lower taping slides 211 and 212, respectively. A pair of upstanding lower tape arms 217 is secured in each of the slots 215 and 216 by means of bolts 218 and nuts 219. Each of the lower tape arms 217 is provided with an upstanding vertical portion terminating in an outwardly extending horizontal projection 220 which is bifurcated to receive a resilient roller 221 supported on a pin 222.

As shown in FIGURES 10 and 11 the rollers 221 of the lower tape arms bear against the strips of tape 86 and against the inside edges of the coil 85 in the upward course of travel of the lower taping mechanism and then the rollers 221 bear against the strips of tape 86 and the top surfaces of the coil 85 to complete the encirclement of the wires of the coil with tape.

The means by which the opposed lower tape arms are spread apart to accomplish the complete encirclement of the wires of the coil by the tape strips 86 is as follows: The opposite ends of slide plate 206 are provided with aligned longitudinal slots 223. Each of a pair of rod holder sleeves 224 is secured by means of a bolt 225 and a nut 226 to the respective lower taping slides 211 and 212. The bolts 225 extend through slots 223 and are movable therein. A spring rod 227 provided with a head 228 at one end and threaded at the opposite end to receive a nut 229 is passed through the two rod holder sleeves 224. A coil spring 230 is provided around the spring rod 227 between one of the rod holder sleeves 224 and nut 229 so as to normally urge the rod holder sleeves 224 and the lower taping slides 211 and 212 to which they are connected together.

The respective edge faces of lower taping slides 211 and 212 are each provided with a transverse horizontal slot 231 and 232 in each of which is recessed a roller 233 journaled on a pin 234. At the top of the upstroke of the lower taping mechanism, the lower taping slides 211 and 212 carrying lower taping arms 217 are spread apart against the pressure exerted by spring 230 by virtue of wedge 235 entering between and bearing against rollers 233. Wedge 235 moves transversely with respect to the lower taping slides in a transverse channel 236 provided in the top surface of slide plate 206. The wedge is held in the channel against vertical movement with respect to the slide plate by a pair of slide straps 237 disposed above opposite edges of the channel.

A cylinder mount 238 is secured to the upper surface of wedge 235. The cylinder mount 238 is in turn secured to the piston rod 239 of a hydraulic cylinder 240 supported on a yoke 241 mounted on lower slides 204 and 205 for movement therewith. Adjustable stop means are provided by dowel or bolt 242 which extends with a slide fit through yoke or bracket 241 and is secured to

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cylinder mount 238 to limit movement of the wedge 235 under influence of the hydraulic motor 240. It will be seen that after a strip of tape 86 has been applied around the upper and lower and outside edges of the bundle of wires comprising coil 85 by means of the upper taping arms 154-157 those arms are retracted and lower taping arms 217 complete the taping operation. After the upper taping arms are retracted, the lower taping mechanism is raised and in its upward path of travel rollers 221 bear against the strips of tape and inside edges of the coil and the lower taping arms are then spread apart with rollers 221 urged outwardly against the tape and upper surface of the wire coil to press the free ends of the tape strips down in overlapping relation to complete the encirclement of the coil with tape. As the lower taping arms are retracted because of the withdrawal of wedge 235 and are lowered out of operating position, the resilient rollers 221 again bear against the tape and coil to force the tape firmly into place.

All of the structure that is mounted on and moved with the slides 204 and 205 together with the plate 206 which interconnects them is referred to herein as the lower slide assembly or lower tape applying mechanism. This structure includes, in addition to the slides 204-205 and plate 206, all of the other structure identified by numbers from 207 up to and including 242. The lower slide assembly will therefore be designated by number as 204-242.

A portion of the control system is shown in FIGURES 1 and 3. A plurality of switches 243-247 are supported on a switch mount 248. A switch cam 249 is mounted on upper slide 172 adapted to engage switch 243 when the upper slide assembly bearing the tape supply is lowered. One end of the switch bar 250 is pivotally mounted by means of pin 251 on stop cam 202. The opposite end of switch bar 250 is guided between rollers 252 and 253 of a guide bracket 254 supported on the switch mount. Switch bar 250 carries a plurality of switch rollers 255-257 adapted to actuate switches 244-246 respectively. The lower guide 204 carries a switch cam 258 adapted to engage switch 247.

As shown in FIGURE 8, the turntable 10 is preferably provided with three winding blocks 13 so that as one coil is being wound by spinning the wires about the winding block, as described in the aforesaid copending application Serial No. 758,226, another coil is being simultaneously taped according to the present invention and a third coil is severed by cutter 259, removed from the winding block, and ejected from the machine as described in the aforesaid copending application Serial No. 758,227. It will also be noted from FIGURE 8 that the turntable is constructed in the form of a spoked wheel with the winding blocks 13 mounted in the spoke areas so as to provide open spaces on either side to permit the lower taping arms to reach through and above the top surface of the turntable to complete wrapping of the tape strips about the coils.

In the operation of the winding machine of which the present taping structure forms a part, the turntable 10 is indexed so as to come to a full stop to position a winding block at each of the operating stations. Thus, when viewed in FIGURE 8, the turntable after completion of one cycle of working operations is automatically rotated clockwise through 120° and stopped. This results in the presentment of one completed, severed and taped coil at the removal and ejection station, the presentment of an empty winding block at the spinning station and the presentment of a wound, but unbound, coil at the taping station. When the turntable comes to a halt, switch means are actuated to control the circuit to introduce hydraulic fluid behind the piston of hydraulic cylinder 176. The piston rod 175 is extended and moves the upper slide assembly comprising slides 172 and 173 and connecting plate 174 and associated tape supply and guide mechanism until the stop block 177 comes into contact with stop 195 and halts.

In the course of the downward travel of the upper slide mechanism 172-194, the plurality of tape guide channels 188 which are secured to the plurality of tape guide rolls 187 are constantly urged apart into sliding contact with the hubs of upper tape arms 154-157. (See column 4, lines 3 to 15. Thus, as the upper slide assembly 172-194 is lowered, the tape guide channels 188 are simultaneously lowered and spread apart and come to rest immediately above the vertical channels 84 in the coil support or winding block 13.

At this time, in a manner described more fully hereinafter, the free end of each of the tape guide channels has a length of tape suspended from it which is more than sufficient to wrap completely around a given cross-section of the coil and be overlapped to insure a tight bind. The free end of the tape 184 is held in the tape guide channel 188 under pressure of spring 193. As the slide assembly is lowered, pin 197 projecting from the end of stop arm 198 rides with the projecting lip of stop plate 196 secured to upper slide 172. The pawl tooth 200 of stop arm 198 comes to rest on the periphery of stop cam 202 before the downward movement of upper slide assembly is stopped by stop 195. Thereafter, pin 197 is disengaged from stop plate 196 and the stop arm 198 rides freely on the periphery of the stop cam.

As the upper slide assembly 172-194 reaches its lowermost position, switch cam 249 on upper slide 172 engages and actuates switch 243 to control the flow of hydraulic fluid behind the piston of cylinder 168. Piston rod 167 is then extended to exert pressure upon and rotate control arm 164. That control arm is keyed to shaft 151 as are gear 153 and upper tape arm 156 and tape arm 157 (not visible in the drawings). Thus, as arm 164 is rotated in a clockwise direction, the shaft 151, gear 153 and arms 156 and 157 (arm 157 not appearing in the drawings) are likewise rotated in a clockwise direction, as viewed in FIGURE 1. Because the teeth of gear 153 mesh with the teeth of gear 152 which is keyed to shaft 150 along with upper tape arms 154 and 155, that gear and shaft and those tape arms are rotated in the opposite direction, or counter-clockwise as viewed in FIGURE 1.

All of the tape arms 154-157 move in unison and as shown in the transition between FIGURES 3 and 4, are moved into engagement with the opposite sides of the wound coil and the free ends of the tape suspended over the coils at those positions. Each tape arm is aligned with a tape guide and, as best shown in FIGURE 6, roller 158 engages the free end of the tape and presses it against the bottommost surface of the coil. The tape used is preferably flexible and provided with a pressure-sensitive coating so as to adhere to the wires of the coil on contact. As seen in FIGURES 4 and 5 when shaft 150 is rotated counterclockwise, it carries with it stop cam 202 which is keyed to the shaft. A stop 203 is provided to limit the movement of the piston rod 167 and associated mechanism, but it will be seen from FIGURE 4 that the pawl tooth 200 of stop arm 198 engages the cam tooth 201 of stop cam 202 before stop 203 can be effective.

The rotation of stop cam 202 causes switch arm or bar 250 to be moved downwardly to bring switch roller 256 into engagement with switch 245. This initiates flow of hydraulic fluid in front of the piston of cylinder 176 to retract the piston rod 175 and lift the upper slide assembly 172-194 from its lowermost position. In the course of the upward movement of the slide assembly 172-194, the projecting lip of stop plate 196 engages pin 197 of stop arm 198 as seen in FIGURE 5. As the upper slide assembly 172-194 continues in its upward path of travel, the pawl tooth 200 is disengaged from the cam tooth 201. When this happens, the restraint upon further movement of shafts 150 and 151 and their associated gears 152 and 153 and tape arms 154-157 is removed and cylinder 168 is permitted to extend piston rod 167 the short distance further until stop 203 is engaged. The effect of this is to give the taping arms 154-157 a sudden

inward movement or jolt, the result of which is seen in the transition between FIGURES 6 and 7.

As the upper slide assembly 172-194 is raised, the tape which previously had been held taut, continues to be so held in the grip of the taping arms against the side edges of the coil. Thus, as the upper slide assembly raises, a further length of tape 184 is pulled free from the tape supply rolls held on reels 183. The amount of additional tape which is thus pulled free from the supply rolls is sufficient to encircle and be overlapped on the next succeeding coil. The sudden quick jolt given to the upper taping arms when the restraint on their movement imposed by stop cam 202 is removed forces the sides of the notch 162 in the resilient block 161 of each of the taping arms into intimate contact with the tape strips and coil edges to firmly press the tape into place. At the same time, the toothed cutting knife 163 is forced sharply against the taut tape to sever it.

At the same time that restraint upon movement of stop cam 202 is removed, the switch bar 250 is pushed downwardly farther to bring switch roller 257 into engagement with switch 246. Meanwhile, the upper slide mechanism 172-194 has returned to its original uppermost position. Flow of hydraulic fluid ahead of the piston of cylinder 168 is initiated to retract the piston rod 167 and withdraw the upper tape arms 154-157 from the partially bound coil. As the upper tape arms are withdrawn, a short length of tape projects inwardly from the bottom edge of the coil. At the same time hydraulic fluid is introduced behind the piston of cylinder 208 to extend piston rod 207 and raise the lower slide assembly 204-242 including slide plate 206, lower slides 204 and 205 and associated mechanism including a plurality of lower tape arms 217.

As the lower slide assembly is raised, the lower tape arms pass upwardly on opposite sides of the turntable spoke supporting the winding block 13 and through the channels 84 in the winding block. In so moving the resilient rollers 221 of the lower tape arms engage the portion of tape projecting inwardly from the bottom edges of the coil, folding the tape upwardly around the coil and pressing it against the inside coil surfaces. The upward movement of the lower slide assembly is limited by collar stop 209.

When piston rod 167 is fully retracted, the control arm 164, upper tape arms 154-157, stop cam 202, etc. are all returned to the position shown in FIGURE 1. When this occurs, switch roller 255 is brought into engagement with switch 244. Thus, when the lower slide assembly 204-242 reaches the upper limit of its movement, hydraulic fluid is introduced behind the piston of cylinder 240 to extend piston rod 239 and push the point of wedge 235 between the rollers of the lower taping slides 211 and 212. This action of the wedge against the rollers 233 is to separate and push apart the lower slides in their slide channels against the pressure of spring 230. The effect of this is to push the lower taping arms 217 outwardly with their resilient rollers 221 pressing the free upfolded end of the tape strip outwardly into overlapping relation with the other end of the tape on the upper edge of the coil.

The lower tape arms 217 are then retracted by introducing fluid pressure ahead of the piston in cylinder 240 to retract the piston rod 239 and wedge 235. As the wedge is withdrawn, the pressure of spring 230 forces the lower taping slides together to retract the tape arms. As the tape arms are retracted, the resilient rollers 221 again press against the overlapped tape on the upper surface of the coil. The lower slide assembly is then returned to its original position below the turntable by introducing hydraulic fluid ahead of the piston of cylinder 208 to retract the piston rod 207.

As the lower slide assembly is returned, the lower tape arms again press against the inside of the coil to press the tape firmly into place. Upon return of the lower

slide assembly, switch cam 258 mounted on lower slide 204 is brought into engagement with switch 247. The turntable is then rotated through a $\frac{1}{3}$ turn to bring a newly spun coil into position for taping. Thereafter, the taping cycle is repeated.

It is apparent that many modifications and variations of this invention as hereinbefore set forth may be made without departing from the spirit and scope thereof. The specific embodiments described are given by way of example only and the invention is limited only by the terms of the appended claims.

We claim:

1. In a coil winding machine adapted to form a coil composed of a plurality of wires, a taping structure for securing the wires of the coil together, coil support means with a plurality of vertical channels formed in its periphery, said taping structure including tape supply means to contain a supply roll of adhesive tape and adapted to be moved into tape applying position relative to said coil support means, first tape applying means movable with respect to said coil support means adapted to press tape from said supply means into contact with the wires at the outer periphery of a coil on said support means to partially encircle the wires of the coil with tape, means for withdrawing said tape supply means while said tape is held in adhering contact with a coil by said first tape applying means to pull free tape from said tape supply roll, and second cooperating tape applying means movable with respect to said coil support means adapted to extend through the vertical channels in the periphery of said coil support means to press the tape into contact with the wires at the inner periphery of the coil to complete the encirclement of the wires of the coil with tape.

2. A coil winding machine according to claim 1 further characterized in that said taping structure is entirely vertically disposed relative to the plane of movement of said coil support means, said tape supply means is disposed above said coil support means and is vertically movable with respect thereto.

3. A coil winding machine according to claim 2 further characterized in that said tape supply means comprises a plurality of tape supply reels and a plurality of tape guide means adapted upon downward movement to supply tape to opposite sides of a wire coil wound upon said coil support means adjacent the vertical channels in the coil support.

4. A coil winding machine according to claim 2 further characterized in that said tape supply means is movable on vertical guides by a hydraulic motor, stop means being provided to limit the downward movement of said tape supply means.

5. A coil winding machine according to claim 1 further characterized in that said first tape applying means comprises a plurality of tape applying arms normally disposed above and on opposite sides of said coil support means, the arms on opposite sides of said coil support being pivotally movable in opposite directions into contact with the wires of a coil on said coil support adjacent the vertical channels therein.

6. A coil winding machine according to claim 5 further characterized in that said tape applying arms are each provided with an inwardly projecting tip fitted with a roller adapted to press tape against the outer and lower periphery of a coil on said coil support and an inner resilient portion to press tape into intimate contact with the outer periphery of a coil.

7. A coil winding machine according to claim 5 further characterized in that said tape applying arms are each provided with tape severing means, and means secured to said tape supply means for limiting the movement of said tape applying arms to an amount less than their full movement, said tape applying arms being moved to their full movement when said tape supply means is withdrawn; whereby said tape severing means are actuated.

8. A coil winding machine according to claim 5 further

characterized in that said tape applying arms are mounted on a pair of parallel horizontal shafts each fitted with meshing gears for rotational movement together, a control arm on one of said shafts and a hydraulic motor connected thereto to move said tape applying arms.

9. A coil winding machine according to claim 5 further characterized in that said first tape applying means is provided with first and second sequential stop means; said first tape applying means when stopped by said first sequential stop means engages lightly a coil on said coil support means and upon release of the said first sequential stop means intimately engages a coil on said coil support means and said second sequential stop means.

10. A coil winding machine according to claim 1 further characterized in that said second cooperating tape applying means comprises a plurality of upwardly and outwardly extending tape applying arms normally disposed below the vertical channels in the halted position of said coil support means, said arms being movable together vertically in said vertical channels into contact with tape on the inner periphery of a coil on said coil support.

11. A coil winding machine according to claim 10 further characterized in that said tape applying arms are provided with rollers at their outer extremities, said arms being horizontally movable in opposite directions to press said rollers against tape on the inner and upper periphery of a coil on said coil support.

12. A coil winding machine according to claim 11 further characterized in that said horizontally movable tape applying arms are supported on a pair of horizontally movable slides and wedge means movable between said slides at right angles to the direction of movement of the slides.

13. A coil winding machine according to claim 12 further characterized in that said horizontally movable tape applying arms are movable vertically together by a hydraulic motor and said wedge means is movable horizontally by a hydraulic motor, stop means being provided to limit the upward and outward movement of said arms.

14. In a coil winding machine adapted to form a coil composed of a plurality of wires, a taping structure for securing the wires of the coil together, coil support means with a plurality of vertical channels formed in its periphery on opposite sides thereof, said support means being rotatably movable in a horizontal plane and adapted to be halted intermittently in operating relation with said taping structure, said taping structure being vertically disposed relative to the plane of movement of said coil support means, said taping structure including tape supply means disposed above said coil support means and vertically movable with respect thereto, said tape supply means including a plurality of tape supply reels and a plurality of tape guide means adapted upon downward movement to supply tape to opposite sides of a wire coil wound up on said coil support means adjacent the vertical channels in the coil support, first tape applying means including a plurality of tape applying arms normally disposed above and on opposite sides of said coil support means, the arms on opposite sides of said coil support being rotatably movable in opposite directions into contact with the wires of a coil on said coil support adjacent the vertical channels therein, means for raising said tape supply means after said first tape applying means has moved into contact with the wires of a coil on said coil support, said arms each provided with an inwardly projecting tip fitted with a roller adapted to press tape against the outer and lower periphery of a coil on said coil support and an inner resilient portion to press tape into intimate contact with the outer periphery of a coil, second cooperating tape applying means including a plurality of upwardly and outwardly extending tape applying arms normally disposed below the vertical channels in said coil support means, said last named arms being movable together vertically in said vertical channels into contact with the inner periphery of a coil on said coil support,

said last named arms being provided with rollers at their outer extremities and being also horizontally movable in opposite directions to press said rollers against tape on the inner and upper periphery of a coil on said coil support, said last named arms being supported on a pair of horizontally movable slides and wedge means horizontally movable between said slides in the same plane and at right angles to the direction of movement of the slides.

15. A coil winding machine according to claim 14 further characterized in that said tape supply means is movable on vertical guides by a hydraulic motor and stop means are provided to limit the downward movement of said tape supply means.

16. A coil winding machine according to claim 14 further characterized in that said first upper tape applying arms are mounted on a pair of parallel horizontal shafts each fitted with meshing gears for rotational movement together in opposite directions, a control arm on one of said shafts and a hydraulic motor connected thereto to move said tape applying arms.

17. A coil winding machine according to claim 14 further characterized in that said first tape applying means is provided with first and second sequential stop means; said first tape applying means when stopped by said first sequential stop means engages lightly a coil on said coil support means and upon release of said first sequential stop means intimately engages a coil on said coil support means and said second sequential stop means.

18. A coil winding machine according to claim 14 further characterized in that the horizontally movable tape applying arms of said second cooperating tape applying means are movable vertically together by a hydraulic motor and said wedge means is movable horizontally by a hydraulic motor, stop means being provided to limit the upward and outward movement of said arms.

19. A coil winding machine according to claim 1 further characterized in that said first tape applying means is provided with tape severing means, and means secured to said tape supply means for limiting the movement of said first tape applying means to an amount less than its full tape applying movement, said first tape applying means being moved to its full tape applying movement when said tape supply means is withdrawn; said tape severing means secured to said first tape applying means in a retracted position relative to tape when tape is held by said first tape applying means as limited by said movement limiting means for limiting movement of said first tape applying means and in an extended tape engaging and cutting position when said first tape applying means is moved to its full tape applying movement.

20. A coil winding machine according to claim 1 further characterized in that said first tape applying means is provided with first and second sequential stop means; said first tape applying means when stopped by said first sequential stop means engages lightly a coil on said coil support means and upon release of said first sequential stop means intimately engages a coil on said coil support means and said second sequential stop means, said tape supply moving means withdrawing said tape supply means during said initial application of tape to said coil, and severing means mounted on said first tape applying means that is actuated when said tape is pressed into intimate contact with the coil.

21. A tape applying structure comprising a frame, a tape supply reel secured to and freely movable on said frame, a support for an object to be taped secured to said frame, a motor secured to said frame and said tape supply reel to move said reel bodily toward and from said support, whereby an extending portion of tape is presented adjacent to said support, a tape presser movably secured to said frame near said support, means secured to said frame for advancing said tape presser toward said support, whereby said extending portion of tape is pressed into contact with an object on said support, said motor withdrawing said tape supply reel while said tape presser is holding said extending tape portion in such contact, whereby additional tape is pulled from said tape reel.

22. The structure of claim 21 in which said tape presser has a first tape applying position for pressing tape into contact with an object on said support, a second tape applying position for pressing tape into greater contact with an object to be taped, and a tape cutting blade secured to said tape presser, said motor withdrawing said tape supply reel while said tape applying means is in its first position, and said power means thereafter moving said tape applying means to its second position, whereby said cutting blade cuts said tape near an object on said support.

23. The structure of claim 21 in which said tape presser comprises, arms that pivot toward and into the plane of said support and away from and out of the plane of said support.

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