

April 8, 1952

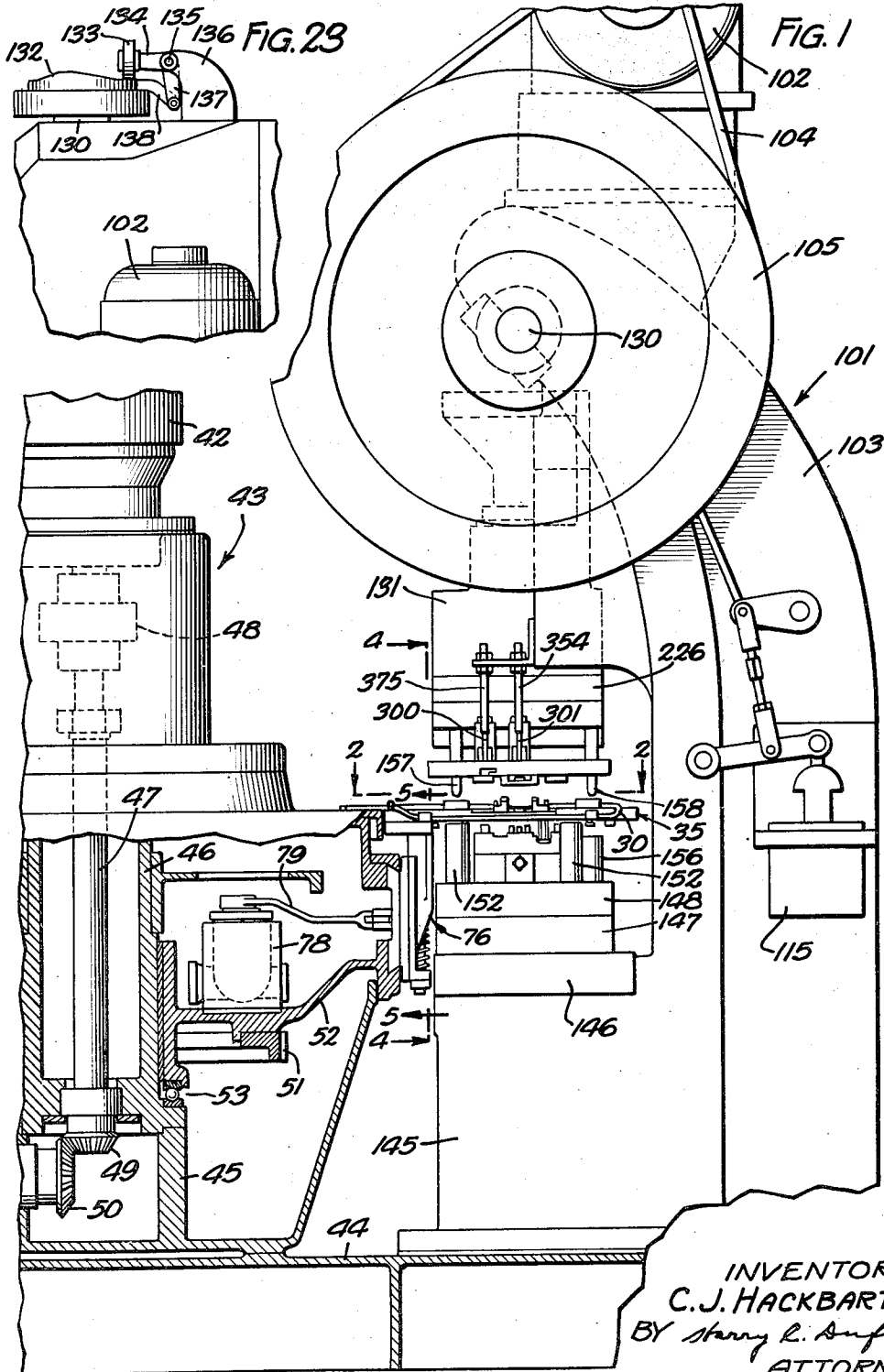
C. J. HACKBARTH

2,592,276

ARTICLE ASSEMBLING APPARATUS

Filed Jan. 11, 1945

8 Sheets-Sheet 1



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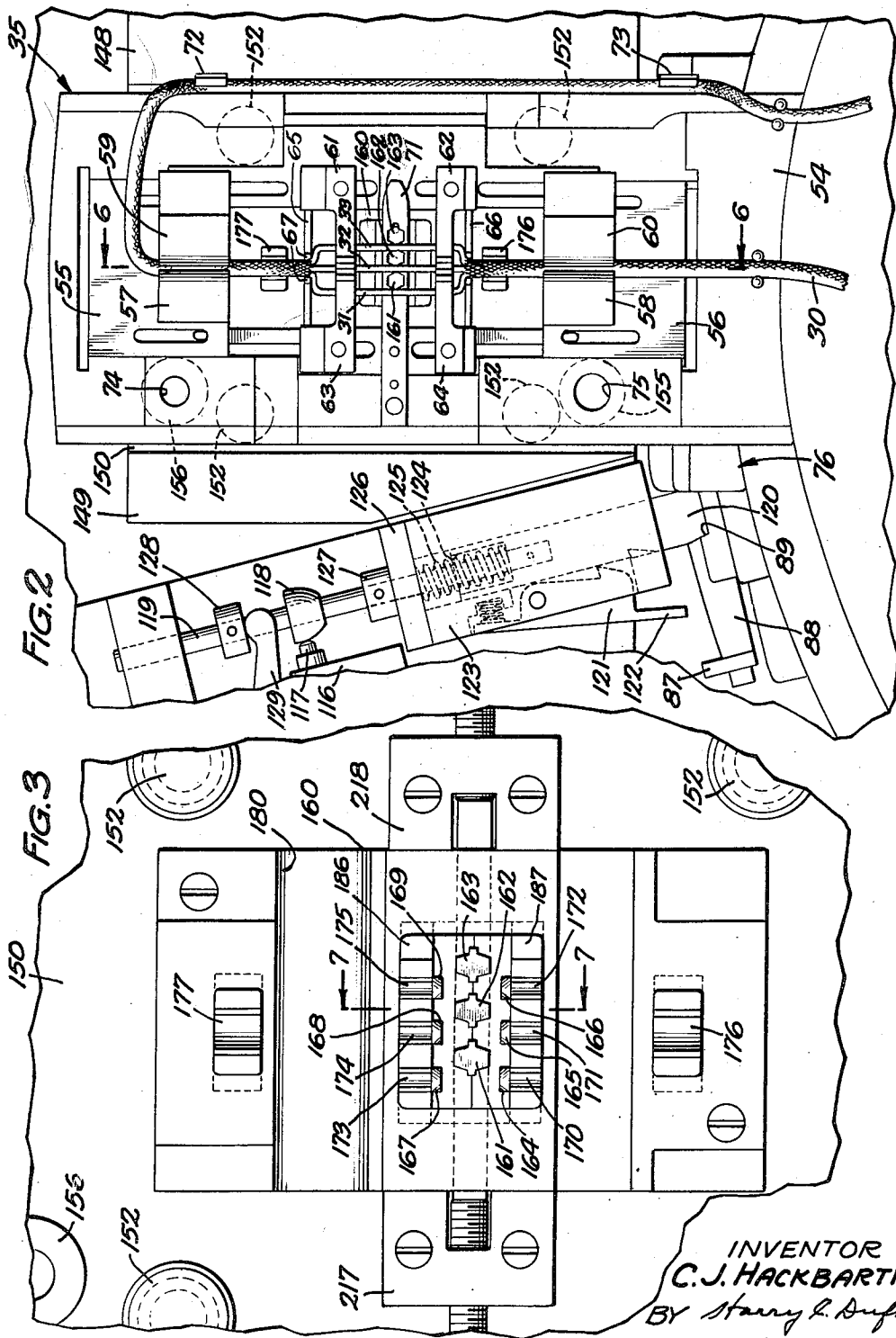
C. J. HACKBARTH

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ARTICLE ASSEMBLING APPARATUS

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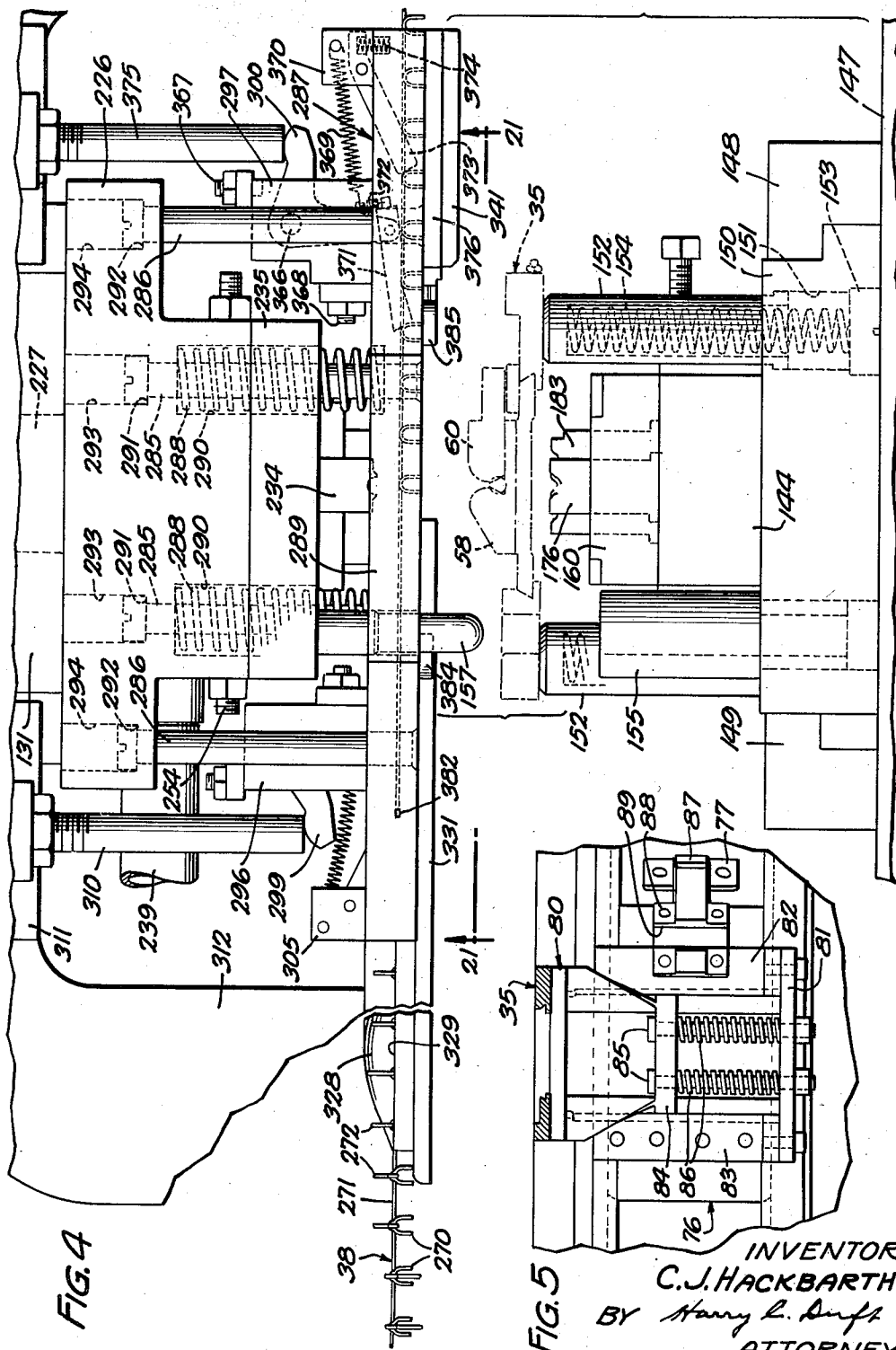
C. J. HACKBARTH

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ARTICLE ASSEMBLING APPARATUS

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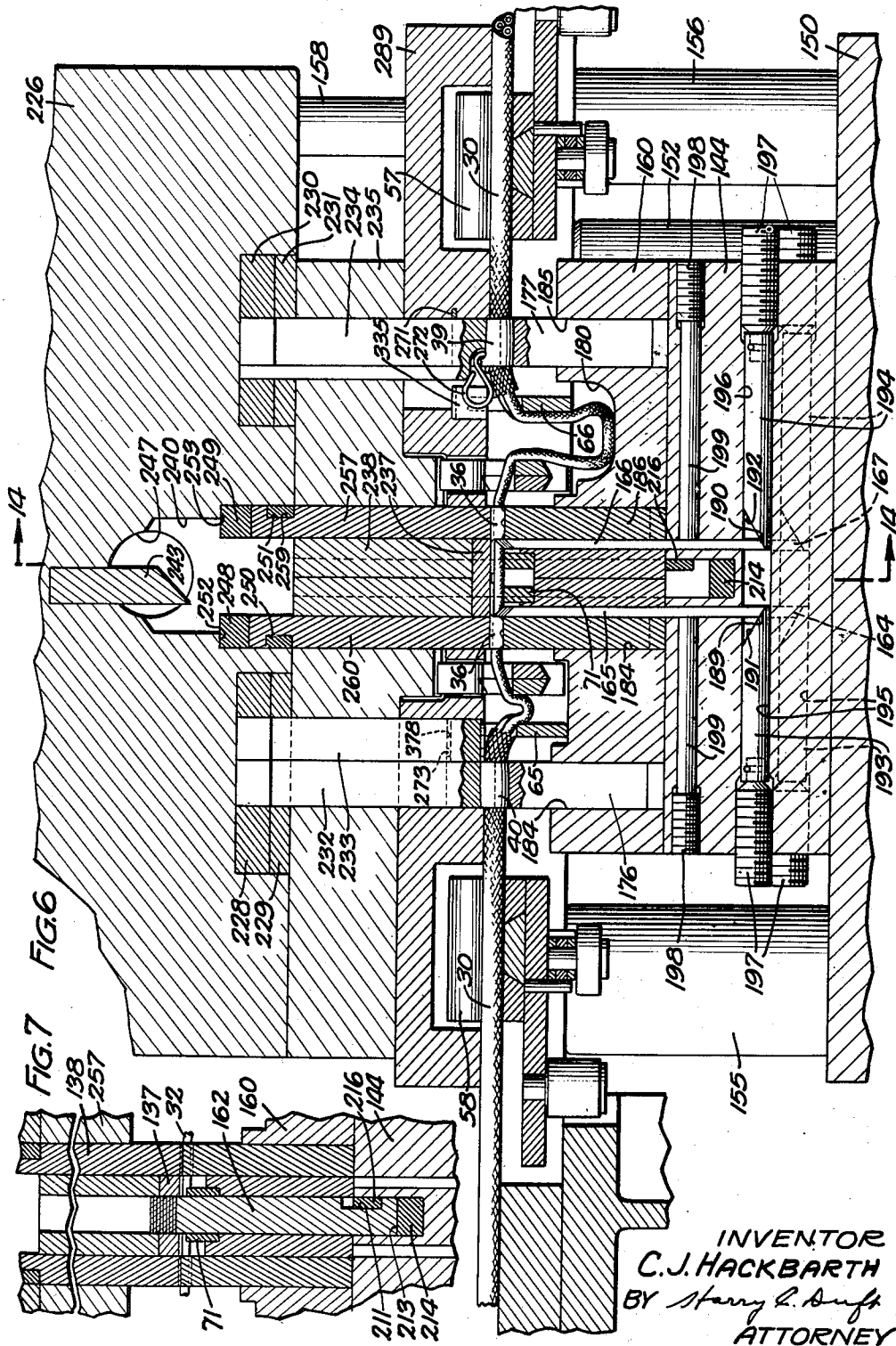
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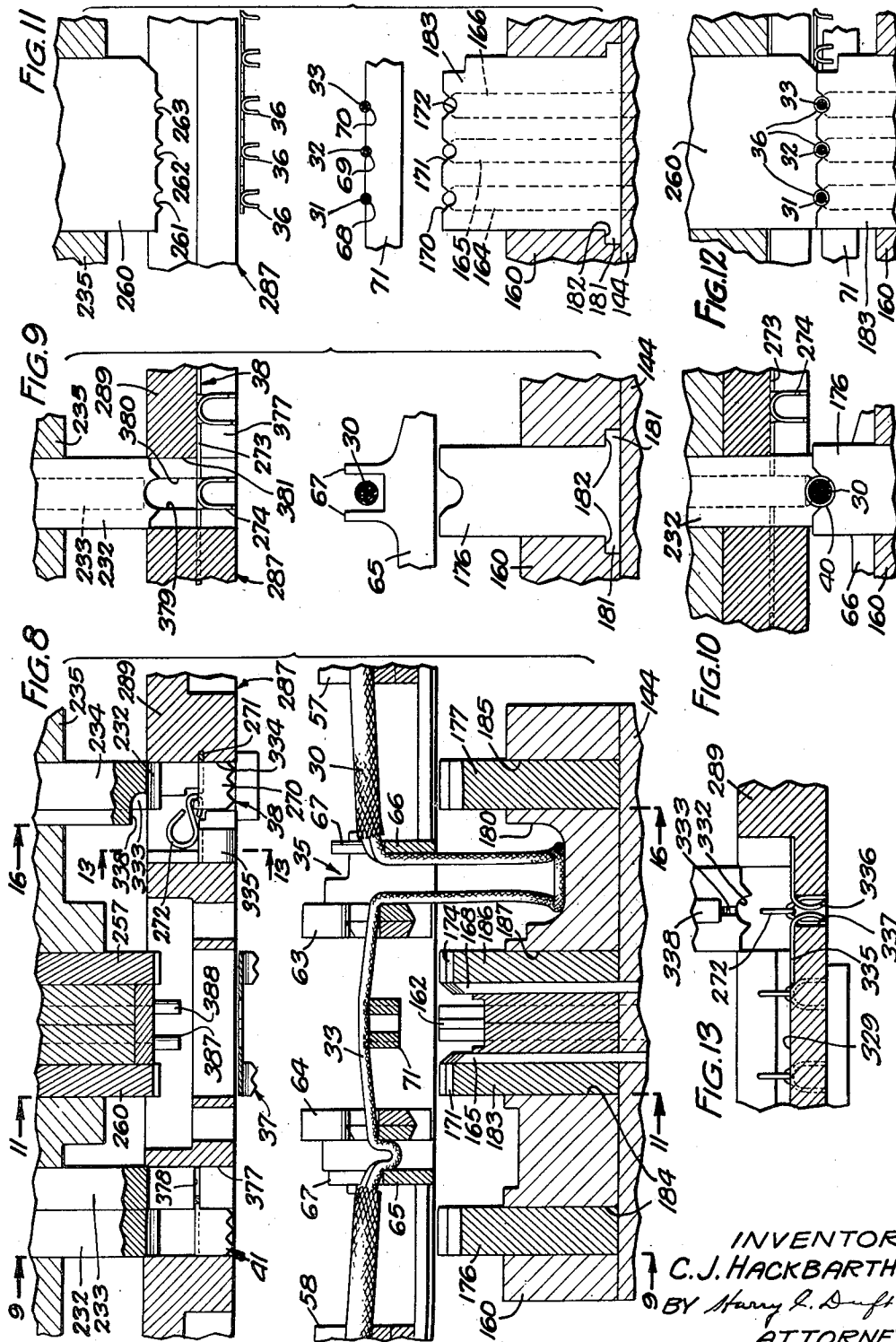
C. J. HACKBARTH

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ARTICLE ASSEMBLING APPARATUS

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8 Sheets-Sheet 5



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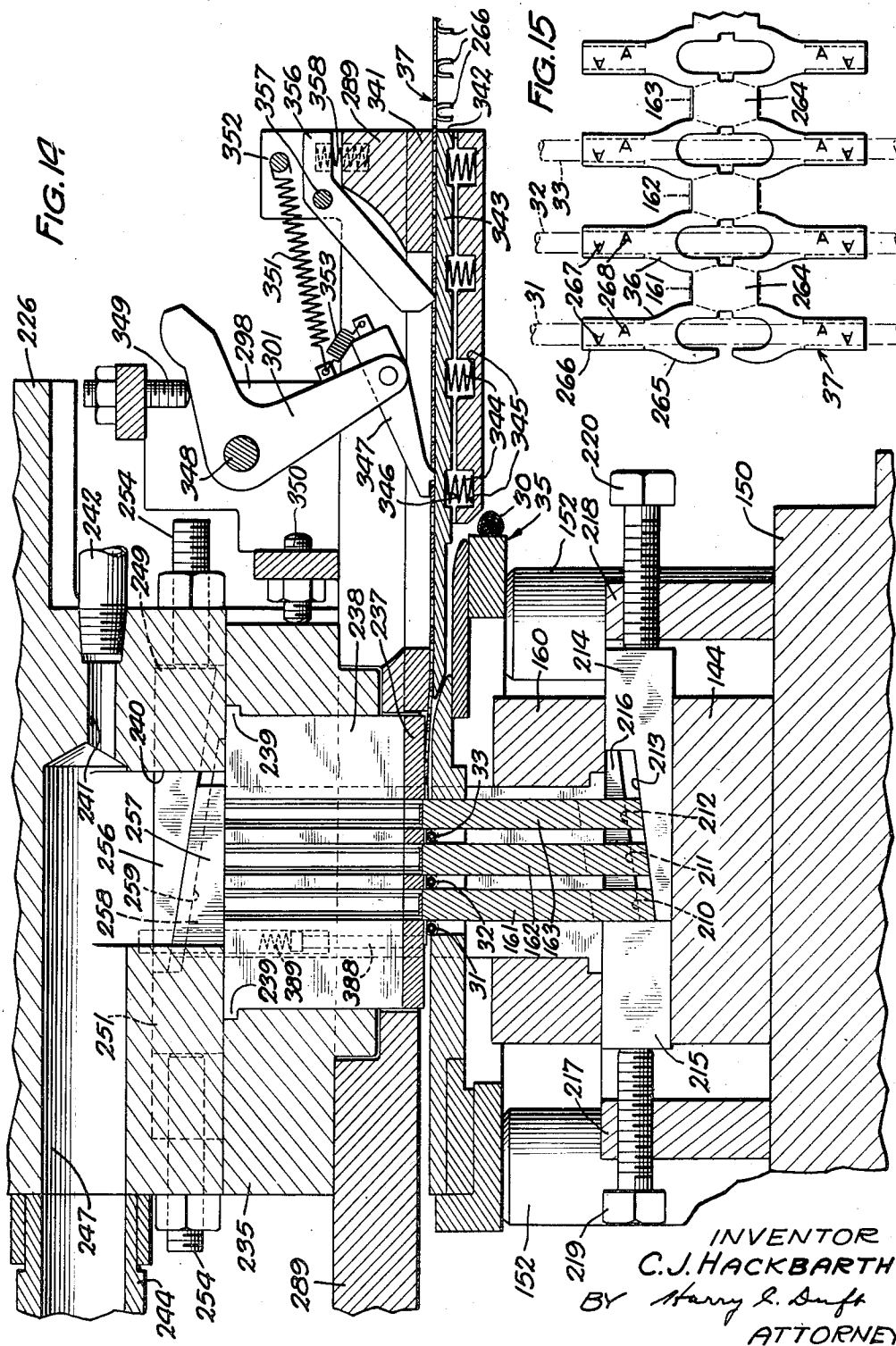
C. J. HACKBARTH

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ARTICLE ASSEMBLING APPARATUS

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8 Sheets-Sheet 6



INVENTOR
C. J. HACKBARTH
BY *Harry L. Swift*
ATTORNEY

April 8, 1952

C. J. HACKBARTH

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ARTICLE ASSEMBLING APPARATUS

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8 Sheets-Sheet 7



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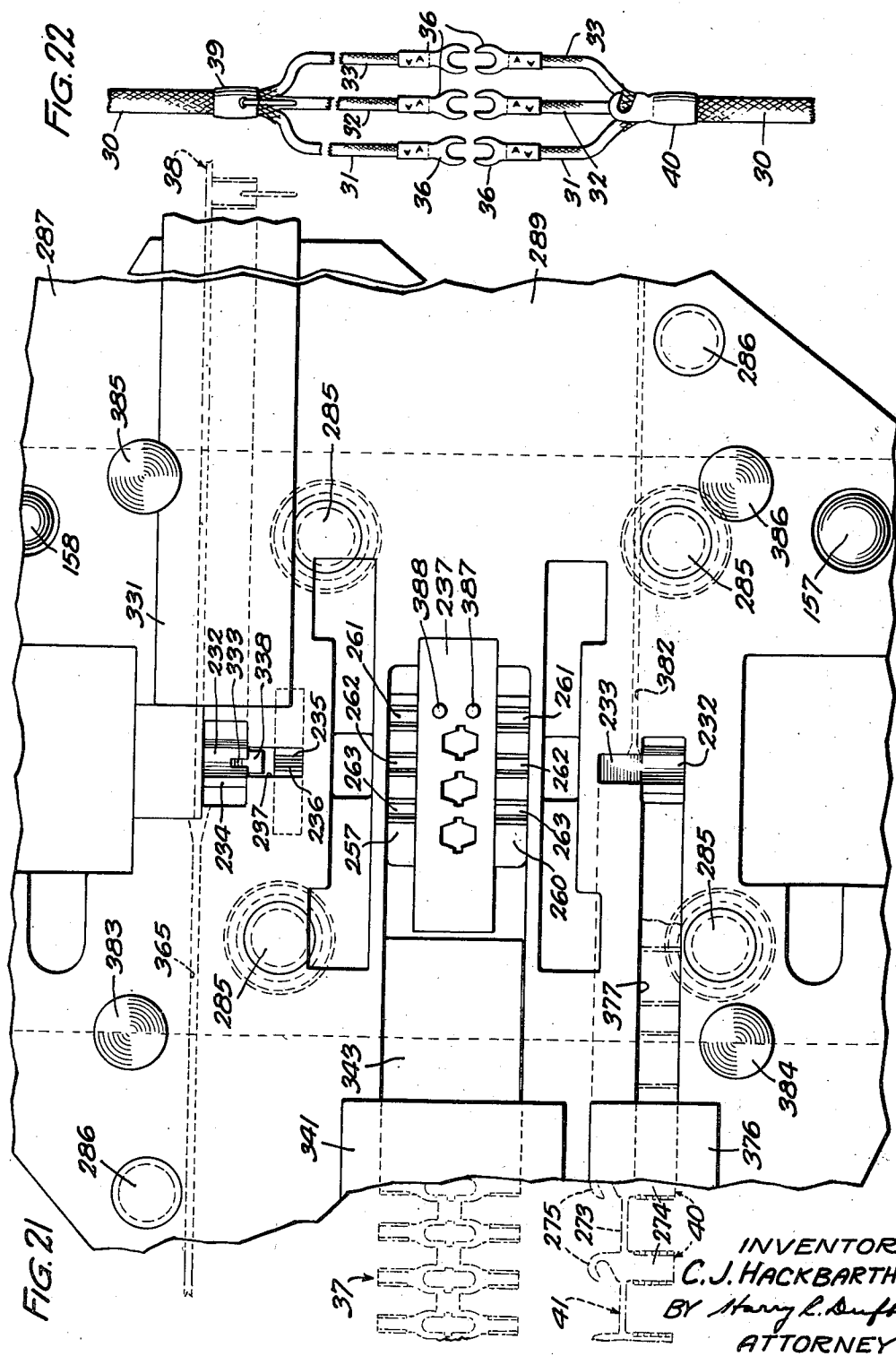
C. J. HACKBARTH

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8 Sheets-Sheet 8



INVENTOR
C. J. HACKBARTH
BY *Harry R. Suft*
ATTORNEY

UNITED STATES PATENT OFFICE

2,592,276

ARTICLE ASSEMBLING APPARATUS

Carl J. Hackbarth, Baltimore, Md., assignor to
Western Electric Company, Incorporated, New
York, N. Y., a corporation of New York

Application January 11, 1945, Serial No. 572,419

6 Claims. (Cl. 153—1)

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This invention relates to article assembling apparatus and more particularly to press operated apparatus for assembling the parts of double ended telephone cords.

It is an object of the present invention to provide an efficient apparatus for rapidly assembling articles.

In accordance with one embodiment of the invention an apparatus is provided wherein cooperating tools or dies on the movable head and stationary platen of a punch press serve, in cooperation with a cordage supporting plate, which positions the individually insulated conductors comprising the multi-conductor core of the cordage and extending between adjacent ends of a braided covering for the cordage, to feed interconnected strips of partially formed binding and terminal elements to the cordage and to attach the binding and terminal elements to the cordage and to the conductors, respectively. Tools are also provided for cutting the conductors against the terminal elements and for cutting the binding elements and terminal elements from the interconnected strips thereof in the same stroke of the press which attaches the elements to the conductors and cordage.

A complete understanding of the invention may be had by reference to the following detailed description when considered in conjunction with the accompanying drawings, wherein

Fig. 1 is a view partly in section and partly in side elevation showing a punch press mechanism which operates in timed relation to the operation of the movement of cord positioning plates for attaching terminals to the individually insulated conductors of a cord and for applying bands to prevent unravelling of the braided covering on the braid covered cord, the bands for preventing the braid from unravelling comprising "S-hooks" and "stay bands;"

Fig. 2 is a fragmentary plan view on an enlarged scale taken looking in the direction of the arrows along the line 2—2 of Fig. 1 and showing a cord positioning plate in position to cooperate with the punch press;

Fig. 3 is a fragmentary plan view looking in the same direction as Fig. 2 with the cord positioning plate removed and showing the die directly beneath the cord positioning plate in the punch press;

Fig. 4 is an enlarged fragmentary vertical sectional view taken substantially along the line 4—4 of Fig. 1 in the direction of the arrows showing the upper and lower dies of the punch press in elevation, showing the cord positioning plate

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in dot and dash lines between the dies, and showing parts of a means for positioning portions of the S-hooks to be applied to the braided cover. In this figure, the dies are shown in their open position preparatory to performing their operations of attaching stay bands, S-hooks and terminals to the braided cover of the cord and to the individual conductors forming the core of the cord;

Fig. 5 is a fragmentary vertical sectional view taken substantially along the line 5—5 of Fig. 1 in the direction of the arrows showing part of the mechanism for supporting a plate in the punch press;

Fig. 6 is a fragmentary vertical sectional view taken substantially along the line 6—6 of Fig. 2 in the direction of the arrows showing the punch press dies in their closed position with the cord positioning plate between them;

Fig. 7 is a fragmentary vertical sectional view taken substantially along the line 7—7 of Fig. 3 in the direction of the arrows showing some details of the forming dies which attach the terminals to the individually insulated conductors of the core to which the terminals are fed in strip form;

Fig. 8 is an enlarged fragmentary vertical sectional view taken substantially along the line 8—8 of Fig. 2 in the direction of the arrows and is similar to Fig. 5 except that it shows the dies of the punch press in their open position;

Figs. 9 and 10 are fragmentary vertical sectional views taken substantially along the line 9—9 of Fig. 8 in the direction of the arrows and showing the dies in their open and closed positions, respectively;

Figs. 11 and 12 are fragmentary vertical sectional views taken substantially along the line 11—11 of Fig. 8 in the direction of the arrows and showing the terminal attaching dies in their open and closed positions, respectively;

Fig. 13 is a fragmentary detail sectional view taken substantially along the line 13—13 of Fig. 8 in the direction of the arrows and showing a means for retaining a portion of the S-hook in proper alignment during the attachment thereof to the braid covering of a cord after the S-hook has been sheared from its strip;

Fig. 14 is a fragmentary sectional view taken substantially along the line 14—14 of Fig. 6 in the direction of the arrows showing some details of construction of the upper die mechanism of the punch press and also showing some details of the feed mechanism for feeding the terminals in strip form to the punch and die mechanism;

Fig. 15 is a detail view of the interconnected strip of terminals fed to the conductors to which they are to be attached showing the conductors in dot and dash lines prior to the attachment of the terminals to them and the cutting of the conductors;

Fig. 16 is a fragmentary vertical sectional view taken substantially along the line 16—16 of Fig. 8 showing some details of the mechanism for feeding the S-hooks to the punch press in strip form;

Fig. 17 is a fragmentary plan view taken substantially along the line 17—17 of Fig. 16 in the direction of the arrows;

Fig. 18 is a fragmentary view of a portion of the mechanism shown in Fig. 16 and taken at the same place that Fig. 16 was taken but showing the dies in their closed position;

Figs. 19 and 20 are fragmentary detail sectional views taken along the lines 19—19 and 20—20 of Fig. 16 and showing the means for guiding portions of the S-hooks into position to be attached to the cords;

Fig. 21 is a view of the underside of the upper die of the punch press taken substantially along the line 21—21 of Fig. 4 in the direction of the arrows;

Fig. 22 is a detail view of the adjoining ends of two cords to which stay bands, S-hooks and terminals have been attached in the apparatus, and

Fig. 23 is a fragmentary plan view of the upper portion of the press showing some details of a control mechanism.

The specific embodiment of the invention illustrated herein is adapted to cooperate with a processing or article forming apparatus of the type shown in detail and claimed in the copending application of R. T. Adams and J. A. Wagner, Serial No. 730,512, filed February 24, 1947, as a continuation-in-part of R. T. Adams and J. A. Wagner application Serial No. 572,414, filed January 11, 1945, now abandoned, wherein cordage 30, comprising a group of three individually insulated conductors 31, 32 and 33 enclosed in a braid cover 34, is positioned upon a cord positioning plate 35 and the braided covering on the cordage is cut at the point where the individually insulated conductors are thrown out through the cordage. In the apparatus of the present invention, terminal members 36—36, as shown most clearly in Fig. 22, are adapted to be sheared from a strip of partially formed terminal members 37 (Fig. 21) and attached to the individually insulated conductors 31, 32 and 33. A strip 38 of partially formed S-hooks is also fed into the apparatus and S-hooks 39 are sheared from the strip and are attached to the cordage adjacent one of the points where the individually insulated conductors 31, 32 and 33 extend out of the end of the braid cover 34, and stay bands 40 are sheared from an interconnected strip of partially formed stay bands 41 and are attached to the cordage at the point where the individually insulated conductors extend from the braid cover opposite the point where the S-hook 39 is attached to the cordage.

The individually insulated conductors 31, 32 and 33 may be properly positioned to be operated upon in the apparatus in the present invention in any suitable manner, for example, in the manner disclosed in the Adams-Wagner applications, hereinbefore identified, wherein there is provided a mechanism for processing the cordage, which includes a motor 42 mounted upon the upper end of a housing assembly 43, which

is, in turn, supported by a main supporting base 44. The main supporting base 44 has a main base casting 45 mounted on it for supporting a tubular bearing member 46, in which a main drive shaft 47 is journaled for rotation. The main drive shaft 47 is interconnected with the motor 42 by a coupling 48 and drives gearing, including beveled pinions 49 and 50, which, through suitable gearing, drive a ring gear 51 attached to a dial supporting casting 52 journaled on the outer surface of the tubular bearing member 46, a thrust bearing 53 being provided for supporting the casting 52.

The dial supporting casting 52 serves to support a plurality of cord positioning plates 35, which comprise, as shown most clearly in Fig. 2, a main plate framework 54, on which there are slidably positioned clamp supporting plates 55 and 56 and on which there are fixed two main fixed clamping members 57 and 58 and two main movable clamping members 59 and 60, together with two auxiliary movable clamping members 61 and 62 and two auxiliary fixed clamping members 63 and 64. These fixed and movable clamping members serve to position cordage in the manner shown in Fig. 2, where individually insulated conductors 31, 32 and 33 extend between two cord locating combs 65 and 66, which have guide fingers 67 extending upwardly from them to assist in positioning the cordage so that the conductors 31, 32 and 33 may be positioned in notches 68, 69 and 70 on a die bar 71. The extending end of the cordage 30, which is looped back toward the center of the processing apparatus, may be held in suitable clamps 72 and 73, which are fixed to the side of the main plate framework 54.

While the details of construction of the cord positioning plate 35 as thus generally described will serve to position the cordage to be operated upon by the apparatus of the present invention, it will be understood that other positioning means (not shown) may be provided which would hold the cordage 30 and the individually insulated conductors 31, 32 and 33 in a similar position and that the mechanism described is simply illustrative of one type which will cooperate with the apparatus of the present invention.

In the preferred embodiment of the invention, the framework 54 has a pair of locating-pin receiving apertures 74 and 75 formed in it to receive locating pins, as will be described hereinafter, which serve to properly locate the plate in position with respect to the tools of the present apparatus. In its travel around the bearing 46, the cord positioning plate 35 is supported upon a carriage 76 (Figs. 1 and 5), which is normally held against a stop member 77 by a door check mechanism 78, which, through its operating arm 79, tends to hold the carriage 76 against the stop member 77. The plate 35 is fixed to a supporting bracket 80, which is slidably mounted with respect to the carriage 76. The carriage 76 comprises a cross plate 81 formed integrally with a pair of forwardly extending portions 82 and 83 (Fig. 5). The supporting bracket 80 is slidably mounted between the two forwardly extending portions 82 and 83 of the carriage 76 and has a cross rib 84 formed integrally with it which extends out over the cross plate 81. A pair of bolts 85 extend through the rib 84 and cross plate 81 and are surrounded by compression springs 86, which are interposed between the rib 84 and cross plate 81 normally to hold the bracket 80 in its upper position, as shown in Fig. 5, the

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springs 86 being compressible in the operation of the punch press to permit the cord positioning plate 35 to move downwardly. Mounted on the forwardly extending portion 82 of the carriage 76 is a bracket 88, carrying a camming finger 87, the purpose of which will become apparent as the description progresses. In addition to the camming finger 87, the bracket 88 has a socket 89 formed in it, by means of which the carriage 76 may be latched in position in the punch press, as will be described hereinafter.

The apparatus of the present invention comprises a punch press, designated generally by the numeral 101 (Fig. 1). As illustrated generally in this figure, the punch cycle is provided with a driving motor 102, which is mounted at the top of a standard 103 and, through a driving element 104, which may be either a chain drive or belt drive, imparts rotation to the punch press fly wheel 105, as is usual in such apparatus. The punch press motor 102 may be supplied with power from a suitable power source (not shown) and the motor 102 will continuously drive the fly wheel 105.

The punch press 101 is provided with a trip solenoid 115 (Fig. 1), which, upon operation, will trip the punch press mechanism to cause it to go through one complete cycle and then come to rest. This tripping mechanism may be of any suitable construction and, since the details of it are not pertinent to the present invention, they are not disclosed herein. Suitable control means are provided at the punch press 101 to be operated by the cord positioning plate 35 in moving into the punch press station to cause the energization of the solenoid 115. This mechanism may be of any suitable construction and has been shown herein as a switch 116 (Fig. 2), the actuator button 117 of which lies in the path of a cam member 118. The cam member 118 is mounted upon a reduced shank 119 of a plunger 120 normally held in a retracted position opposite to that shown in Fig. 2 by a spring pressed latch 121. The latch 121 is provided with a trip finger 122, positioned to be actuated by camming finger 87 when the carriage 76 moves into the punch press. The plunger 120 is slidable in a bracket 123 suitably mounted on the frame of the punch press and is provided with a socket 124, in which a compression spring 125 is seated in a position surrounding the shank 119 and bearing against the base of the socket 124 and against a plate 126. In this manner, the plunger 120 is normally urged into the socket 89 in bracket 88 on the carriage 76. The amount of movement of the plunger 120 is limited by a collar 127 attached to the plunger and bearing against the plate 126. In addition to the collar 127, the shank 119 of the plunger has collar 128 attached to it, which is adapted to be engaged by the bifurcated end of a restoring lever 129, which, as will be described hereinafter, is operative to move the plunger against the action of the spring 125 to a position where it may be latched in a retracted position by the latch 121.

As pointed out hereinbefore, the operation of the trip solenoid 115 will cause the punch press to go through one complete cycle and then stop. In going through its complete cycle, the punch press will impart one complete rotation to a drive shaft 130 (Fig. 1) and through connections of the type usual in punch press mechanisms will impart one reciprocation to a ram 131 (Figs. 1 and 4). The shaft 130 carries a restoring cam 132 (Fig. 23) in position to engage a cam roller 133 mounted upon a lever 134. The lever 134

is fixed to a shaft 135 (Fig. 23) which is mounted for limited rotation in a bracket 136 and which has a lever 137 fixed to it adjacent its lower end. The lever 137 has pivotally connected thereto a link 138 and the end of the link opposite to the lever 137 is pivotally connected to the restoring lever 129 which is pivoted on the bracket 123. At the completion of a cycle of operation of the punch press 101, the cam 132 will be effective to restore the latching plunger 120 to normal position opposite to that shown in Fig. 2, and will also be effective to permit switch 116 to open, thus releasing the solenoid 115, just prior to the release of the carriage 76 by plunger 120.

The punch press 101 is mounted upon the main supporting base 44 (Fig. 1) and, in addition to the standard 103, includes a base 145, on which a base plate 146 is mounted to support a bolster plate 147 to which there are secured a pair of clamp plates 148 and 149 (Fig. 4) for holding a tool supporting plate 150 in position on the bolster plate 147. The tool supporting plate 150 has four shouldered apertures 151—151 formed in it for receiving tubular supporting plungers 152—152 provided with suitable shoulders co-operating with the shoulders in the apertures 151—151 to prevent upward movement of the plungers beyond a predetermined height. The lower ends of the apertures 151—151 are threaded to receive plugs 153—153, which serve to hold compression springs in the plungers 152—152 for urging the plungers to carry their shoulders into engagement with the shoulders in the shouldered apertures 151—151. These plungers 152 are so positioned that they tend to support a cord positioning plate 35 in an elevated position and also serve to guide the plate 35 when it is moved downwardly in the operation of the punch press so that it will not tend to tilt at an angle and tend to bind on the carriage 76.

The tool supporting plate 150, in addition to supporting the plungers 152—152, also supports a pair of liner sleeves 155 and 156 in alignment with liner pins 157 and 158 (Figs. 1 and 21) carried by the head of the press in a manner to be described hereinafter. The liner pins 157 and 158, in cooperation with the liner sleeves 155 and 156, serve to properly position the cord positioning plate 35 in the punch press and compensate for any wear or slight variations in the position to which the plate is moved.

Mounted upon the tool supporting plate 150 is a tool base carrying a tool holding block 160 (Figs. 3, 4 and 6) in which are positioned terminal cutting tools or punches 161, 162 and 163, wire cutting tools or punches 164 to 169, terminal forming tools 170 to 175, a stay band forming tool 176, and an S-hook forming tool 177. These tools are adjustably mounted in the tool holding block 160 and cooperate with other tools on the head of the press to cut the terminals from the strip 37, shown in Fig. 15, form the terminals around the conductors 31, 32 and 33, shear the conductors against the surface of the individual terminal members 36, shear the stay bands and S-hooks from a part of the formed strips thereof, and attach the stay bands and S-hooks to cordage 30 adjacent the points where the braid 34 has been severed.

The upper surface of the block 160 is cut away as shown at 180 (Figs. 3 and 6) to receive the conductors 31, 32 and 33 when the plate 35 is moved downwardly in the operation of the punch press, from the position shown in Fig. 8 to the position shown in Fig. 6. Cutouts are formed in the other portions of the block 160 to accommodate portions

of the plate 35 when the plate is moved by the punch press.

In the punch press, the forming tools 176 and 177 for forming stay bands and S-hooks and the terminal forming tools 170, 171, 172, 173, 174 and 175 are provided with shoulders 181—181, as illustrated in Figs. 9 and 11, for cooperation with shoulders 182—182 formed in the block 160 to position the forming tools in the block, the base of the tools resting on the tool base 144. The terminal forming tools 170, 171 and 172 are formed on the upper end of a tool blank 183, as illustrated in Fig. 11 and this blank is provided with the shoulders 181, which serve to position it on the tool base 144. The stay band forming tool 176, as shown most clearly in Figs. 6 and 8, is positioned in a conforming aperture 184 in the block 160 in position to engage the cordage 30 just to the left (Figs. 6 and 8) of the comb 65. The S-hook forming tool 177 is positioned in an aperture 185 in the block 160 in position to engage the cordage 30 just to the right of the cordage locating comb 66. The tool blank 183 is positioned in an aperture 184 adjacent the left side of the die bar 71, and a tool blank 186, similar to the tool blank 183, is mounted in an aperture 187 positioned to hold the tool just to the right of the die bar 71.

Since the cutting tools 164, 165, 166, 167, 168 and 169 will become dulled after operating for a time, these tools are mounted in the manner illustrated most clearly in Fig. 6. As shown in this figure, the wire cutting tools or punches 165 and 166 have their upper ends formed to comprise knife blades and have tapered surfaces 189 and 190 adapted to be engaged by cooperating angularly disposed surfaces 191 and 192 on adjusting members 193 and 194, which are freely slidable in apertures 195 and 196 formed in the tool base 144. While only the adjusting members 193 and 194 for the wire cutting tools 165 and 166 are shown in full in Fig. 6, there are provided three adjusting members 193 and three adjusting members 194 operating on tools disposed at opposite sides of the die bar 71, as indicated by the dotted line showing the adjusting members 193 and 194, which cooperate with the wire cutting tools 164 and 167. The adjusting members 193 and 194 are mounted in staggered relation in the tool base 144 and are adapted to be actuated by threaded plugs 197—197, which are threaded into the tool base 144 and are attached to the adjusting members 193 and 194, but freely rotatable with respect to the adjusting members. After the wire cutting tools 164 to 169, inclusive, have been adjusted to the proper height, where they will cut the wires of conductors 31, 32 and 33 against their associated terminals, the cutting tools may be locked in place by set screws 198—198, which are threaded into the tool base 144 and have reduced shank portions 199 movable to bear against the wire cutting tools, thus to lock them in place.

Since it is also necessary to adjust the height of the terminal cutting tools or punches to compensate for wear in these members, the punches are adjustably supported in the manner shown most clearly in Figs. 6, 7 and 14. As shown in these figures, particularly in Figs. 7 and 14, the bottoms of the terminal cutting tools or punches 161, 162 and 163 are cut at a slight angle to the horizontal and grooves 210, 211 and 212 are formed in the punches 161, 162 and 163, respectively, disposed at the same angle to the horizontal as the bottom of the punches. The bot-

toms of the punches rest upon a tapered shoulder 213 of a positioning member 214, which is slidable in the tool base 144. Cooperating with the positioning member 214 is a retaining member 215, which has a tapered projection 216, which enters the slots 210, 211 and 212 in the punches 161, 162 and 163 and serves to hold the punches against the tapered shoulder 213 of the positioning member 214. Fixed to the tool supporting plate 150 are a pair of U-shaped yokes 217 and 218, as shown most clearly in Figs. 3 and 14. These yokes have their bases threaded to receive set screws 219 and 220, which bear against the retainer member 215 and positioning member 214, respectively. By proper manipulation of the set screws 219 and 220, the height of the punches or terminal cutting tools 161, 162 and 163 may be adjusted with a high degree of accuracy.

Suitably attached to the ram 131 is a tool holder 226, which is provided with a shank 227 (Fig. 4) extending upwardly into the ram of the press whereby the tool holder may be attached to the ram. The tool holder is cut out as shown most clearly in Fig. 6, to receive tool positioning members 228 and 229, which serve to support the stay band forming and shearing tools 232 and 233 and tool positioning members 230 and 231, which serve to position the S-hook forming and shearing tool 234. The tool positioning members 228, 229, 230 and 231 are held in place in the tool holder 226 by a guide plate 235 and the members 229 and 231 are provided with apertures of smaller size than the apertures in the plates 228 and 230, as illustrated by the aperture 236 in plate 231 (Fig. 16) whereby the plates 229 and 231 cooperate to hold the tools 232, 233 and 234 in the tool holder 226.

In addition to the cutouts for receiving the tool positioning plates 228 to 231 and the upper ends of tools 232, 233 and 234, the tool holder 226 is cut out as shown at 247 (Figs. 6 and 14) to receive scrap cut from the interconnected strips 37 of terminals 36 by the terminal cutting tools 161, 162 and 163 in cooperation with a die 237 carried on the end of a die block 238, which is provided with apertures in alignment with the apertures in the die 237. The die block 238 is provided with shoulders 239 (Fig. 14), which nest in cooperating shoulders in the guide plate 235 to accurately position the die block with respect to the terminal cutting tools or punches 161, 162 and 163. The cutout 247 formed in the tool holder 226 is in alignment with a scrap receiving tube 244 and communicates with a downwardly extending passage 240 through which the scrap will be pushed by the terminal cutting tools or punches. The right end of the cutout 247 is reduced as shown at 241 and is in communication with a hose or pipe connection 242, which may be connected to a suitable source of compressed air whereby the scrap pushed up into the cutout 247 may be blown out through the scrap-receiving tube 244—244. In order to prevent the scrap from being carried straight upwardly against the upper surface of the cutout 247 in such manner that it would tend to jam the passage, a breaker blade 243, as shown in Fig. 6, is set into the cutout 247 to disengage the pieces of scrap one from another so that they will be blown out through the scrap receiving tube 244.

Also positioned in the tool holder 226, as shown most clearly in Figs. 6 and 14, are two sets of tool positioning slides 248, 249, 250 and 251. The tool positioning slides 248 and 250 are positioned between the upper surface of the guide plate 235 and the bottom surface of a slot 252 in the tool

holder 226, whereas the tool positioning slides 249 and 251 are positioned between the upper surface of the plate 235 and the bottom surface of a slot 253 in the tool holder 226. These tool positioning slides are similar to the positioning member and retaining member 214 and 215, which adjustably position the punches 161, 162 and 163 with respect to the tool holding block 160 and are adjustably positioned by means of set screws 254—254 threaded into the tool holder 226. As illustrated most clearly in Fig. 14, the tool positioning slide 249 is provided with a tapered projecting portion 256, which engages the base of a terminal forming tool 257 and cooperates with a tapered projecting portion 258 on the slide 251 to position the terminal forming tool 257. The terminal forming tool 257 has a slot 259 cut in it to receive the tapered projecting portion 258 of the slide 251. A terminal forming tool 260, similar to the tool 256, may be locked in position with respect to the tool holder by means of the slides 248 and 250 in a manner similar to that described for positioning the terminal forming member 257.

The lower end of the terminal forming tool 260, as shown most clearly in Fig. 11, is provided with a plurality of forming surfaces 261, 262 and 263, which cooperate with the terminal forming tools 170, 171 and 172 on the tool blank 183 to wrap conductor engaging portions of the terminal members 36 around the insulated conductors 31, 32 and 33. The terminal members as stated earlier in the description are fed to the apparatus in strip form, as shown at 37 (Fig. 21). An enlarged view of these terminals is shown in Fig. 15, wherein the terminals are shown as being partly formed and interconnected by a strip 264. In this view, the terminals are shown arranged over the punches 161, 162 and 163, the edge portions of which appear just outside the edges of the strip 264. Each of the terminals 36 in the strip 38 has a U-shaped portion 265 and when the terminals are interconnected in the strip 37, the connecting strips 264 interconnect portions of the terminal which are to be cut, along the dotted lines, by the punches 161, 162 and 163. The individual terminals 37 thus, in the operation of the apparatus, will be separated one from another by the co-action of the punches 161, 162 and 163 with the die 237, and the sleeve portion of the terminals, as indicated at 266, will be pressed onto the individually insulated conductors 31, 32 and 33 through the co-action of the terminal forming tools 170, 171 and 172 and the forming surfaces 261, 262 and 263 of tool 260.

As fed to the apparatus, the sleeve portions 266 of the terminals are partially formed, being of U-shaped configuration, and having V-shaped notches 267 and 268 formed in them to deform a triangular portion of the sleeve 266 so that it will extend into the interior of the U-shaped sleeve 266, and when the sleeve is forced onto a conductor, the inwardly projecting tips will pass through the insulation on the conductors and contact the core of conducting material therein.

The strip of S-hooks 33 (Figs. 4, and 16 to 21) comprises a plurality of U-shaped sleeve portions 270 interconnected by and integral with a feed strip 271. This feed strip serves to interconnect the S-hook sleeves 270 and aids in the guiding of them through the apparatus. At the end of each of the U-shaped sleeves opposite to the part where they are connected to the feed strip 271, the sleeve is deformed slightly (Figs. 19 and 20) to permit the attachment thereto of an

S-shaped hook 272 in such manner that when the S-hooks are attached to a cord and wrapped around the outer layer of insulation on the cord, the S-hook will not damage the cord or be bound so tightly in place that it cannot be moved slightly to facilitate the attachment of the cord to a supporting element in a piece of electrical apparatus in which the cord is to be used.

The stay bands 40 are formed in a manner somewhat similar to the S-hooks, as illustrated most clearly in Figs. 9, 10 and 21, in that they are formed integrally with a connecting strip 273 and have cord engaging sleeve portions 274 and attaching portions 275. In the stay band, the attaching portion 275 comprises a hook, which is in alignment with the sleeve portion, and thus the stay bands 40 are, unlike S-hooks 39, attached together adjacent their head portions.

Suspended from the tool holder 226 (Figs. 4 and 21) by means of a plurality of headed bolts 285—285 and 286—286 is a stripper plate assembly 287, which is normally urged to assume the position shown in Fig. 4 by compression springs 288, which bear against an upper surface of a main stripper plate 289, and are seated in pockets 290 formed in the tool holder 226 in position where they surround the bolts 285. The lower ends of the bolts 285—285 and 286—286 are threaded into the main stripper plate 289 and their heads rest on shoulders 291—291 and 292—292 formed in apertures 293—293 and 294—294, respectively, in which the bolts 285—285 and 286—286 are slidable. In this manner, the compression springs 288 normally urge the stripper plate assembly 287 to assume the position shown in Fig. 4, but when the plate engages the cord positioning plate 35 on the downward stroke of the ram 131, the stripper plate assembly may move relatively upwardly with respect to the ram and tool holder 226.

The stripper plate assembly 287 carries three brackets 296, 297 and 298 (Figs. 16, 4 and 14), respectively, in which are mounted bell crank levers 299, 300 and 301, which are operable to feed the S-hook strip 38, the stay band strip 41, and the strip of terminal members 37 step by step into the apparatus. The bell crank lever 299 is pivoted on a pivot pin 302 and is normally urged to rotate in a clockwise direction by a contractile spring 303, one end of which is attached to the bell crank lever and the other end of which is attached to a pin 304 in an auxiliary bracket 305 mounted on the main stripper plate 289. The amount of rotation imparted to the bell crank lever 299 is limited by a pair of set screws 306 and 307 threaded into cross members 308 and 309 of the bracket 296. The bell crank 299 is adapted to be rocked counter-clockwise against the action of the spring 303 each time the ram 131 moves to its lowermost position due to the engagement of the left end (Figs. 16 and 4) of the bell crank lever 299 with an abutment post 310 fixed in a suitable bracket 311 attached to a stationary portion of the press 312. The end of the bell crank lever 299, which extends in a substantially vertical direction, carries a feed pawl 313 pivotally mounted on a pin 314, attached to the lever 299. The feed pawl 313 is normally urged to rotate clockwise by a contractile spring 315 attached to the left end of the pawl 313 (Fig. 16) and to the bell crank lever 299. This pawl is adapted to engage one of the sleeve portions 270 of an S-hook and force it to the right (Fig. 16) each time the bell crank 299 is actuated by its engagement with the abutment post 310. Piv-

oted on a pin 316 mounted in the auxiliary bracket 304 is a retainer pawl 317, which is resiliently urged to rock clockwise by a compression spring 318 interposed between the left end of the pawl 317 (Fig. 16) and the base of a socket 319 formed in the plate 289. This retainer pawl 317 will engage the sleeve portion of the S-hooks to prevent their retraction when the spring 303 retracts the bell crank lever 299 to its normal position.

As illustrated most clearly in Fig. 4, the interconnected strip 38 of S-hooks 39, adjacent to the point where it engages the stripper plate assembly 287 is fed into the apparatus with the S-shaped hook 272 up on the top of the sleeve portion 270 of each S-hook 39. Formed integrally with or suitably attached to the plate 289 is a guide member 328, which is shaped as shown in Fig. 19 to move the S-shaped hook 272 from its full line position to its dotted line position, where the hook will rest upon a guide surface 329. The plate 289 has a slot 330 (Figs. 19 and 20) formed in it for receiving and guiding the sleeve portions 270 of the S-hooks 39 and the lower end of the slot 330 is closed by a plate 331 on which the sleeve portion 270 of the S-hooks slide in their travel to alignment with the S-hook forming and shearing member 234. The forming and shearing tool 234 is formed as shown most clearly in Figs. 8, 13, 16 and 18, that is, a rounded notch 332 is formed on its lowest surface for engaging and forming the sleeve portion 270 of the S-hook 39. At the center of the rounded notch 332, the lower end of the tool 234 has a slot 333 formed in it (Figs. 8 and 13), into which the hook 272 may extend without damaging the hook during the forming of the sleeve 270 by the cooperative action of the S-hook forming tool 177 and the S-hook forming and shearing tool 234.

As will be apparent by reference to Figs. 8 and 13, the S-hook strip 38 is carried into the position to be operated upon by the tools in a position above the cordage 30. When the tool 234 moves downwardly with respect to the stripper plate assembly 287, the tool 234 will engage the S-hook sleeve 270 and the right hand edge (Fig. 8) of the tool 234 in cooperation with an edge 334 of the plate 289 will shear the S-hook from the feed strip 271 and will force the S-hook onto the cordage 30, carrying the severed S-hook from the position shown in Figs. 8 and 16 downwardly to the position shown in Fig. 18 and clamping the sleeve thereof around the cordage 30. In order to prevent the S-shaped hook 272 from dropping down under the sleeve 270, the hook 272 is resiliently supported by a pair of leaf springs 335 and 336, which extend into a slot 337 in the plate 289 (Fig. 13). Thus, the S-shaped hook 272 will be forced through between the springs 335 and 336 by an extending shoulder 338 formed on the tool 234 during the transference of the S-hook from the interconnected strip to clamping engagement with the cordage 30.

Attached to the underside of the main stripper plate 289, as shown in Fig. 14, is an auxiliary plate 341 having a slot 342 formed in it for receiving the sleeve portions 266 of the strip of terminal members 37. Resiliently mounted in a portion of the slot 342 in the plate 341 is a support plate 343, along the upper surface of which the joined together U-shaped portions 265 and strips 264 ride in the operation of the apparatus. Since, in the shearing of the individual terminal members 36 from the strip 37 the strip is flexed somewhat, this

resilient support plate is utilized to guide the strip 37. The support plate 343 is resiliently mounted upon the base of the slot 342 in the auxiliary plate 341 by a plurality of compression springs 344 seated in opposed sockets 345 and 346 in the plate 341 and plate 343, respectively.

A similar feed mechanism to that described in connection with the feeding of the S-hooks is provided for feeding the strip 37 of interconnected terminals 36 and this comprises a feed pawl 347 (Fig. 14) pivoted on the lower end of the substantially vertically extending arm of the bell crank lever 301. The bell crank lever is mounted on a pivot pin 348 mounted in the bracket 298 and its movement is limited by set screws 349 and 350 fixed in the bracket 298. A contractile spring 351 attached to the bell crank lever 301 and to an auxiliary bracket 352 normally urges the bell crank lever to rock counterclockwise and a contractile spring 353 normally urges the feed pawl to rock counterclockwise. When the bell crank lever 301 is carried upwardly by the ram 131 moving upwardly, the substantially horizontally extending arm of the bell crank lever will engage an abutment post 354 (Fig. 1) and the bell crank lever will thus be rocked clockwise (Fig. 14) against the action of the spring 351 to feed six terminal members 36 attached by the strips 264 into position to be attached to the individually insulated conductors 31, 32 and 33. As the ram of the press moves downwardly, the spring 351 will return the pawl 347 and bell crank 301 to the position shown in Fig. 14 and during this returning of the pawl to position to feed a new length of strip 37 to the apparatus, a retainer pawl 355 will prevent the strip 37 from being drawn to the right (Fig. 14) due to the engagement of its lowermost end with the strip 37. The retainer pawl 355 is mounted in the auxiliary bracket 352, being pivoted on a pin 357 and being normally urged to rock counterclockwise by a compression spring 358.

As described hereinbefore, the scrap from the strip 37 of interconnected terminals is pushed up through the die block 238 and the scrap from the strip 38 of S-hooks, which, after the S-hooks have been sheared from it, comprises a continuous length of material, is fed out of the stripper plate assembly through a passage 365 (Fig. 21), which is, in effect, a continuation of the slot which received the feed strip 271 of the strip 38 of S-hooks, as shown in Figs. 19 and 20.

The mechanism for feeding the stay bands 40 into position to be clamped on the cordage 30 is similar to the mechanism utilized for feeding the terminals and S-hooks and comprises, as shown most clearly in Fig. 4, the bell crank lever 300 pivoted on a pivot pin 366 mounted in the bracket 297. A pair of set screws 367 and 368 limit the rocking movement of the bell crank lever 300, which is urged to rock clockwise by a contractile spring 369 attached to the bell crank lever and to an auxiliary bracket 370. The substantially vertically extending arm of the bell crank lever 300 has pivotally mounted upon it a feed pawl 371 urged into engagement with the stay band strip 41 by a contractile spring 372. A retainer pawl 373, pivoted in the auxiliary bracket 370, and urged into engagement with the stay band strip by a compression spring 374, prevents the strip 41 from being drawn backward by the pawl 371 when the pawl 371 moves to the right (Fig. 4). Feeding movement, that is, clockwise movement, is imparted to the bell crank lever 300 by an abutment post 375 as the ram 131 of

the press approaches its uppermost position. The bell crank lever 300 will thus be effective to feed one stay band into position over the cordage 30 each time the ram 131 approaches its uppermost position. The strip of stay bands 41 is carried into position to be attached to the cordage 30 by cooperating surfaces on the plate 289 and a guide plate 376 (Fig. 4), a slot 377 (Figs. 8, 9 and 21) being formed in the main stripper plate 289 to receive the sleeve portions 274 of the stay bands and a slot 378 (Fig. 8) being formed by cooperating portions of the plate 376 and the main stripper plate 289 to receive the attaching portions 275 of the stay bands. The flattened portion of the stay bands comprising attaching portion 275 and the connecting strip 273 extend into the slot 378, whereby the strip 41 of stay bands is carried to position over the cordage. As will be apparent by reference to Figs. 8, 9 and 12, the stay band shearing tool 233 cooperates with side walls 379 and 380 of the aperture 381 in the main stripper plate 289, in which the tools 232 and 233 are slidable to cut the stay band from its connecting strip 273 after the sleeve portion of the stay band has encircled the cordage 30. The stay bands will thus be sheared from the strip 273 and on the next feed stroke of the feed pawl 371, the extending end of the connecting strip 273, from which a stay band has been sheared, will enter into a passageway 382 (Fig. 21) in the plate 289 and will be carried out of the stripper plate assembly in this manner, the sheared-off lengths of connecting strips 273 being pushed through passageway 382 upon the entrance of a succeeding length attached to the strip 41.

When the ram 131 of the press moves downwardly to perform the various shearing and attaching operations, the cord positioning plate 35 must first be moved downwardly to rest upon the liner sleeves 155 and 156 (Figs. 4 and 6), thus to carry the cordage and individual conductors down to position to be operated upon. Accordingly, a series of pads 383, 384, 385 and 386 (Fig. 21) are carried on the underside of the main stripper plate 289 and these pads will engage the sides of the cord positioning plate 35, thus to compress the supporting plungers 152—152 (Figs. 2, 3 and 4) so that the stripper plate assembly 287 and cord positioning plate 281 will move downwardly as a unit until further downward movement of them is blocked by the liner sleeves 155, whereupon, the stripper plate assembly 287 will remain stationary as the ram 131 completes its downward movement. In addition to the pads 383, 384 and 385, the head portion of the press carries a pair of stripping plungers 387 and 388 (Figs. 8 and 21). These stripping plungers 387 and 388 are mounted in the block 238, in which they are slidably mounted, being urged downwardly by compression springs 389, one of which is shown in Fig. 14. The plungers 387 and 388 will engage the terminal member 36, which has been attached to the lefthand conductor 31. Plungers similar to the plungers 387 and 388 may be provided in alignment with each of the attached terminal members to aid in stripping them from the die 237, if necessary.

It is believed that a more complete understanding of the invention may be had by reference to the following brief description of the mode of operation of the apparatus.

Operation

In the operation of the apparatus, a supply of cordage 30, having been cut at the point where

the conductors extend through its braid cover 34 and having been positioned on the plate 35, and supplies of strips of terminals 37, strips of S-hooks 38, and a stay band strip 41 having been placed in the stripper palte assembly 287, the apparatus will be in condition for operation, it being assumed that the various tool adjustments have been made to place the shearing and forming tools in the punch press in position to perform their operations effectively. After the apparatus has thus been supplied with the material used in its operation, the apparatus may be started. In order to insure that the punch press will function properly at all times that cord positioning plates 35 are in position therein, to have the cords held thereby equipped with S-hooks, stay bands and terminal members, the punch press motor 102 must be started first.

The punch press motor 102 having been put in operation, the main driving motor 42 may be started to feed plates 35 to the punch press 101 with the cordage 30 on it as shown in Fig. 2. As the carriage moves into the punch press 101, the switch 116 (Fig. 2) will be operated due to the release of the plunger 120 by the camming finger 87 engaging the trip finger 122 and the plunger 120 entering the notch 442, thus to complete a circuit to the press trip solenoid 115. Operation of the press trip solenoid 115 will cause the punch press to move its ram 131 through one complete cycle, that is, downwardly and upwardly (Fig. 1). As the ram 131 moves down, the bell crank levers 299, 300 and 301 will be released by their abutment posts 310, 375 and 354, respectively, thus permitting their associated springs to retract them to position preparatory to feeding the strip of S-hooks 38, the strip of stay bands 41 and the strip of terminal members 37 the next time the ram returns to its uppermost position. As the ram 131 moves downwardly, the stripper plate assembly 277 will be moved with it to engage the pads 383, 384, 385 and 386 with the upper surface of the cord positioning plate 35 after the liner pins 157 and 158 have passed through the liner pin holes 75 and 74, respectively, in the cord positioning plate 35. As the ram 131 continues to move downwardly, the stripper plate 287 will push the cord positioning plate 35 downwardly to enter the liner pins 157 and 158 into the liner sleeves 155 and 156, thus to properly align the cord positioning plate in the punch press. The supporting plungers 152 will be depressed against the action of their springs 154 as the plate 35 moves downwardly and thus will prevent the plate from tilting during its downward movement. After the aligning pins 157 and 158 are properly seated in the liner sleeves 155 and 156, the ram 131, in continuing to move downwardly, will compress the springs 288 (Fig. 4) and thus the stripper plate assembly 287 will remain stationary as the ram 131 completes its stroke. As soon as the downward movement of the stripper plate assembly 287 is blocked, the cord positioning plate 35 being in its lowermost position at this time, the tools on the tool holder 226 will move relative to the main stripper plate 289. As the stay band shearing tool 233 and the S-hook forming and shearing tool 234 move downwardly, they will cut the stay bands and the S-hooks from the strips 38 and 41 and will carry a stay band 40 and an S-hook 39 into engagement with the cordage 30. In moving to engagement with the cordage 30, the sheared-off S-hook 39 will have the S-shaped hook 272 pushed through between the springs 335 and 336 (Figs.

8 and 13). As the tool holder 226 continues to move down, the forming tools 232 and 234, in cooperation with the forming tools 176 and 177 (Fig. 6), will wrap the sleeves of the stay bands and S-hooks, respectively, around the cordage. Concurrently with the wrapping of the S-hook and stay band sleeves around the cordage, the terminal cutting tools or punches 161, 162 and 163 (Figs. 3 and 8) will, in cooperation with the die 237, cut the terminal members 36 apart and the two sets of terminal forming tools on the tool blank 163 and tool 260 will form the sleeves of the terminal members 36 into gripping engagement with the individual conductors 31, 32 and 33. In the last fraction of an inch of movement of the die 237 downwardly, the terminal members 36 will carry the conductors 31, 32 and 33 into engagement with the wire cutting tools or punches 164, 165, 166, 167, 168 and 169, thus to trim the wire adjacent the sleeve portion of the terminal members 36. In this manner, the S-hooks, stay bands and terminal members will be attached to the cordage and the conductors 31, 32 and 33 will be cut as the ram 131 completes its downward movement. When the ram moves upwardly, the springs 288 will return the stripper plate assembly 287 to the position shown in Fig. 4 and the plungers 152 will return the cord positioning plate 281 to the position shown in dot and dash lines in Fig. 4. At the upper end of its travel, the stripper plate assembly 287 will carry the bell crank levers 299, 300 and 301 into engagement with their respective abutment posts and the bell crank levers will thus effect the feeding of predetermined lengths of S-hook strip, stay band strip and terminal strip to the apparatus preparatory to another reciprocation of the ram 131 and immediately thereafter the cam 132 (Fig. 1) will become effective to rock lever 134 clockwise, thereby to push the link 138 in a direction such that it will rock the restoring lever 129 counterclockwise (Fig. 2) and retract the plunger 120 from the notch or socket 89, thus to permit the door check mechanism 78 to return the carriage 76 to the position shown in Fig. 5. Thus the carriage 76 and cord positioning plate 35 will be moved rapidly out of the punch press 101 at the completion of the operation of the press.

What is claimed is

1. An apparatus for attaching metallic elements to electric cords, which comprises a stationary die, a die movable toward and away from the stationary die, a guide plate, means for urging the guide plate away from the movable die, a removable loading frame for holding a conductor in a predetermined position thereon, means for supporting the loading frame between the guide plate and the stationary die, means for urging the loading frame away from the stationary die, means for feeding a metallic element along the guide plate to a position in transverse alignment with a portion of a conductor held by the loading frame, and means for moving the movable die into engagement with the stationary die, said movable die serving as it is so moved to move the guide plate into engagement with the loading frame so that the metallic element is moved into engagement with said portion of the conductor and to move the loading frame to the stationary die so that said portion of the conductor and the metallic element are moved into engagement with the stationary die, whereby the metallic element is fastened to the conductor.

2. An apparatus for applying metallic elements

to portions of electric cords, which comprises a stationary platen, a movable platen, means for moving the movable platen toward and away from the stationary platen, a guide mounted floatingly on one of said platens and movable by the movable platen for guiding a strip of metallic elements, means for urging the guide away from the platen on which it is mounted, means for locating an electric cord between the guide and one of said platens, tools mounted on the platens for forming around a cord a portion of one metallic element of a strip guided by the guiding means, an escapement feed carried by the guide and having a feed stroke and a return stroke for advancing the strip through the guide, means for urging the feed to effect one of said strokes, and means operable through movement of the guide by the movable platen for moving the escapement feed to effect the other stroke thereof.

3. In an assembling press including means for locating a cord in the press and means for forming a U-shaped band of a metallic element having an S-hook pivotally attached to the band around the cord to clamp the band to the cord, the improvement which comprises means for feeding into the press to a position over a cord located therein such a metallic element having an S-hook thereof folded back upon the U-shaped band thereof, and a convolute cam for pivoting the S-hook of such an element away from the band thereof as the element is fed into the press by the element-feeding means.

4. In an assembling press including means for locating a cord in the press and means for forming a U-shaped band of a metallic element having an S-hook pivotally attached to the band around the cord to clamp the band to the cord, the improvement which comprises means for feeding into the press to a position over a cord located therein such a metallic element having an S-hook thereof folded back upon the U-shaped band thereof, cam means for pivoting the S-hook of such an element away from the band thereof as the element is fed into the press by the element-feeding means, and means for resiliently supporting the S-hook when the element is moved to said position over the cord.

5. In an assembling press including means for locating a cord in the press and means for shearing a U-shaped band of a metallic element having an S-hook pivotally attached to the band from a strip of such elements and forming the band around the cord to clamp the band to the cord, the improvement which comprises a guideway for guiding such a strip into the press, means for feeding along the guideway such a strip having S-hooks thereof folded back upon the U-shaped bands thereof, and an elongated convolute cam for pivoting the S-hooks of the elements away from the bands thereof as the strip is fed along the guideway by the strip-feeding means, a portion of said cam having a thin edge designed to project between the S-hooks and the bands to separate the adjacent portions of the S-hooks and the bands.

6. In an assembling press including means for locating a cord in the press and means for forming into a cylinder around the cord a U-shaped band of a metallic element having an S-hook pivotally attached to the band, the improvement which comprises means for feeding into the press to a position over a cord located therein such a metallic element having the S-hook thereof folded back upon the U-shaped band thereof, means for

pivoting the S-hook of such an element away from the band thereof as the element is fed to the press by the element-feeding means, and a pair of resilient fingers for supporting the S-hook when the element is moved to said position over the cord so that the hook does not interfere with the application of the band to the cord.

CARL J. HACKBARTH.

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