

Nov. 5, 1929.

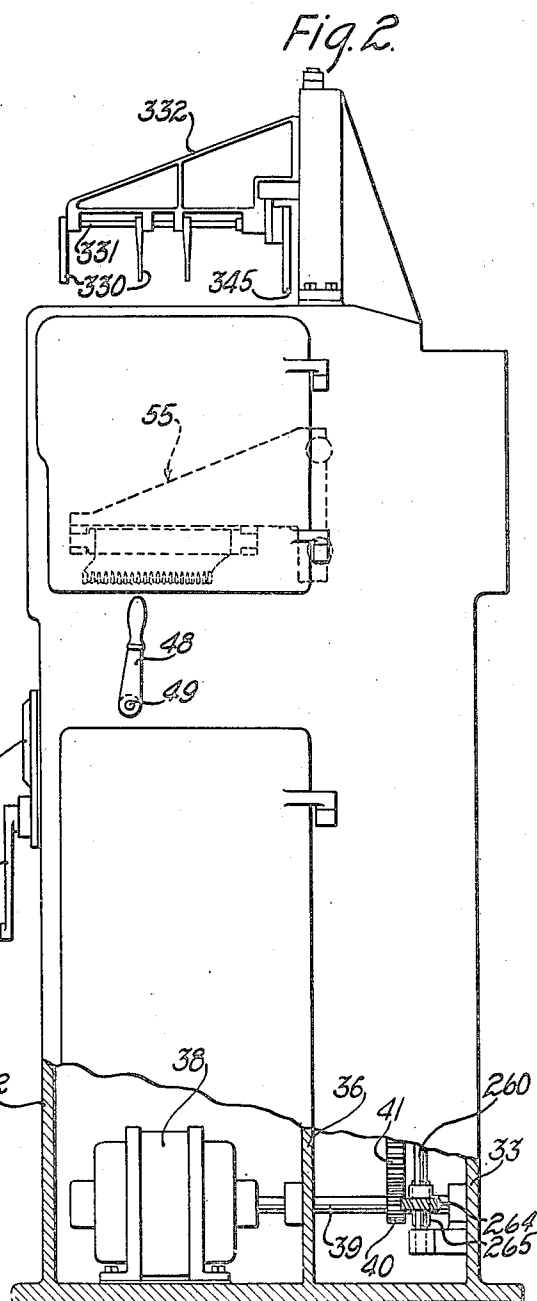
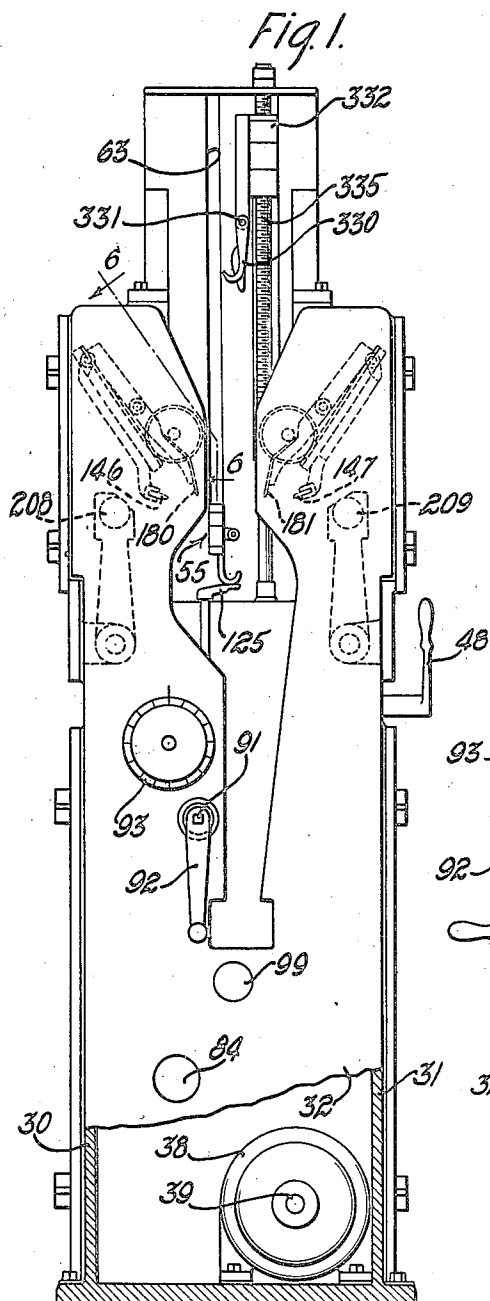
W. H. RAY

1,734,745

APPARATUS FOR REMOVING INSULATION

Filed June 30, 1926

11 Sheets-Sheet 1



Inventor
William H. Ray
by *H. Patterson* Att'y.

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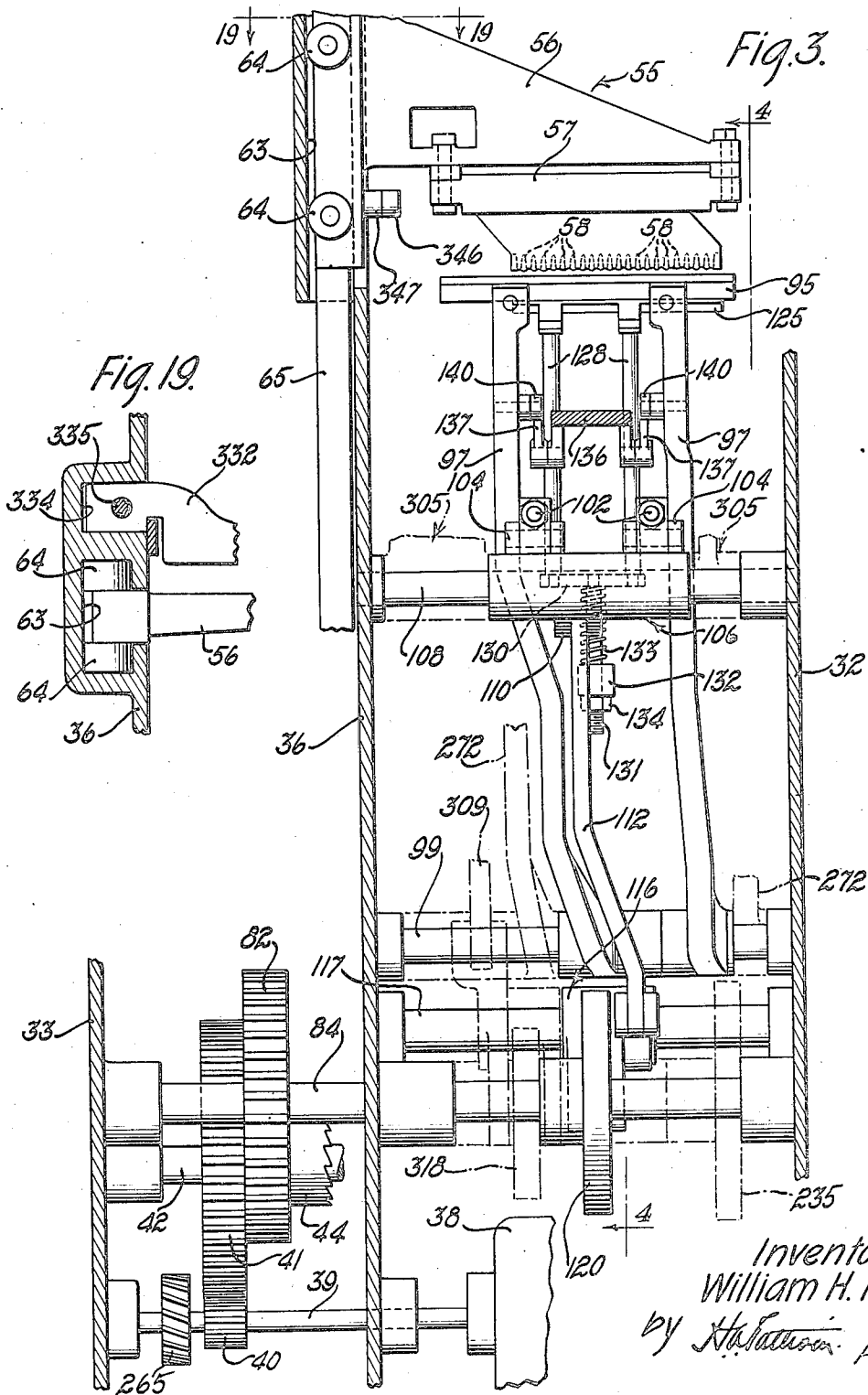
W. H. RAY

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APPARATUS FOR REMOVING INSULATION

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11 Sheets-Sheet 2



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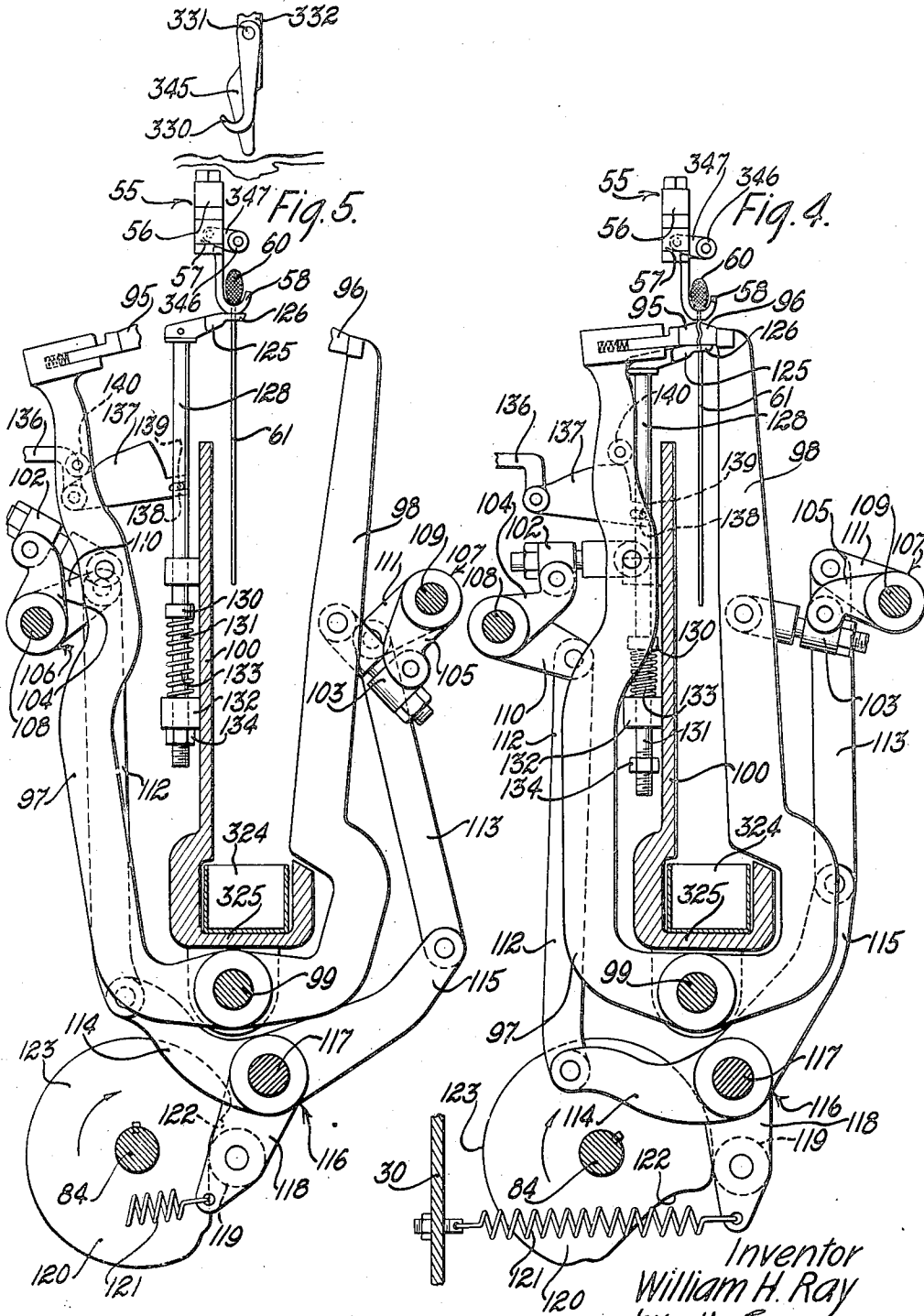
W. H. RAY

1,734,745

APPARATUS FOR REMOVING INSULATION

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11 Sheets-Sheet 3



Inventor
William H. Ray
by H. H. Hutton Att'y.

Nov. 5, 1929.

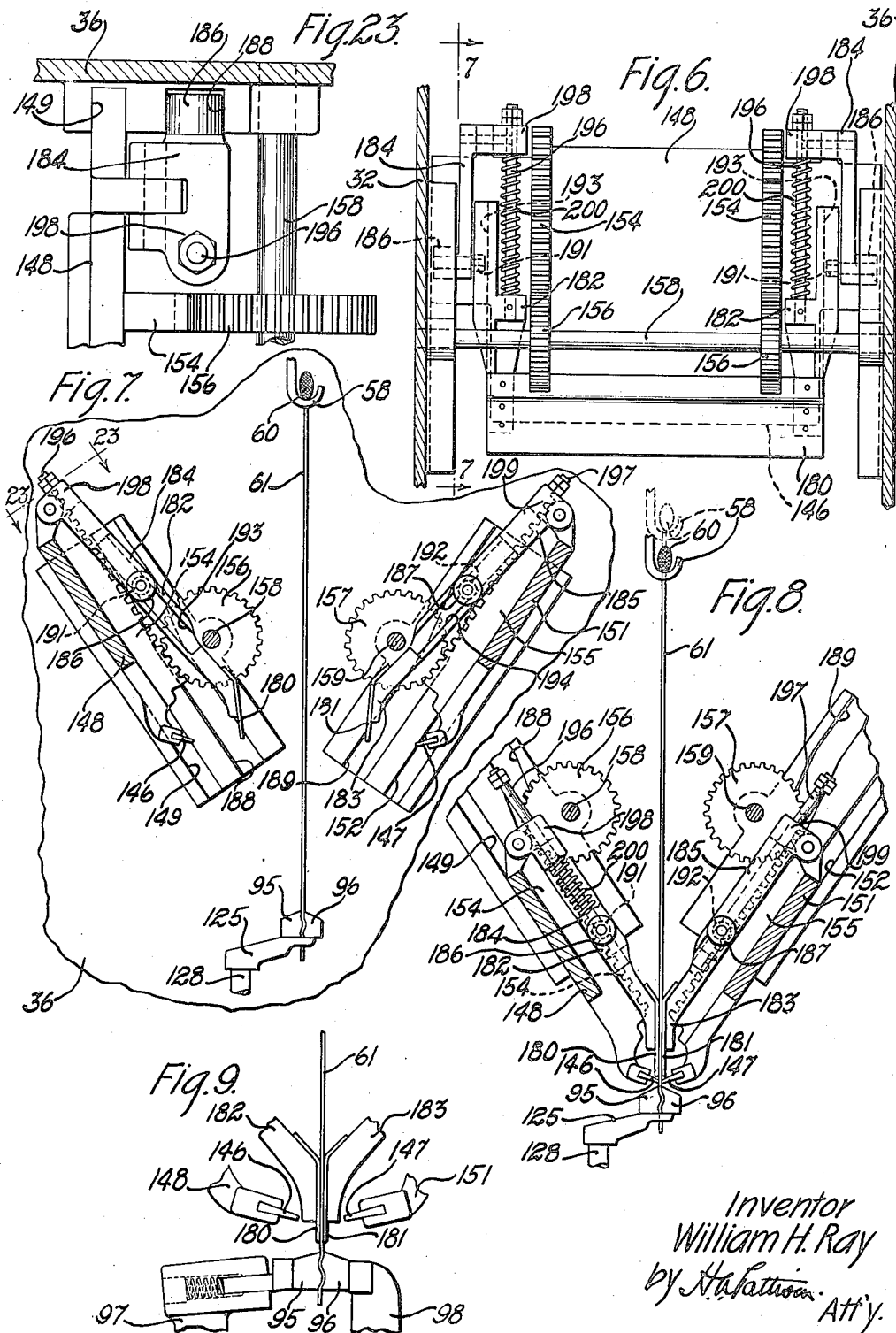
W. H. RAY

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APPARATUS FOR REMOVING INSULATION

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11 Sheets-Sheet 4



Nov. 5, 1929.

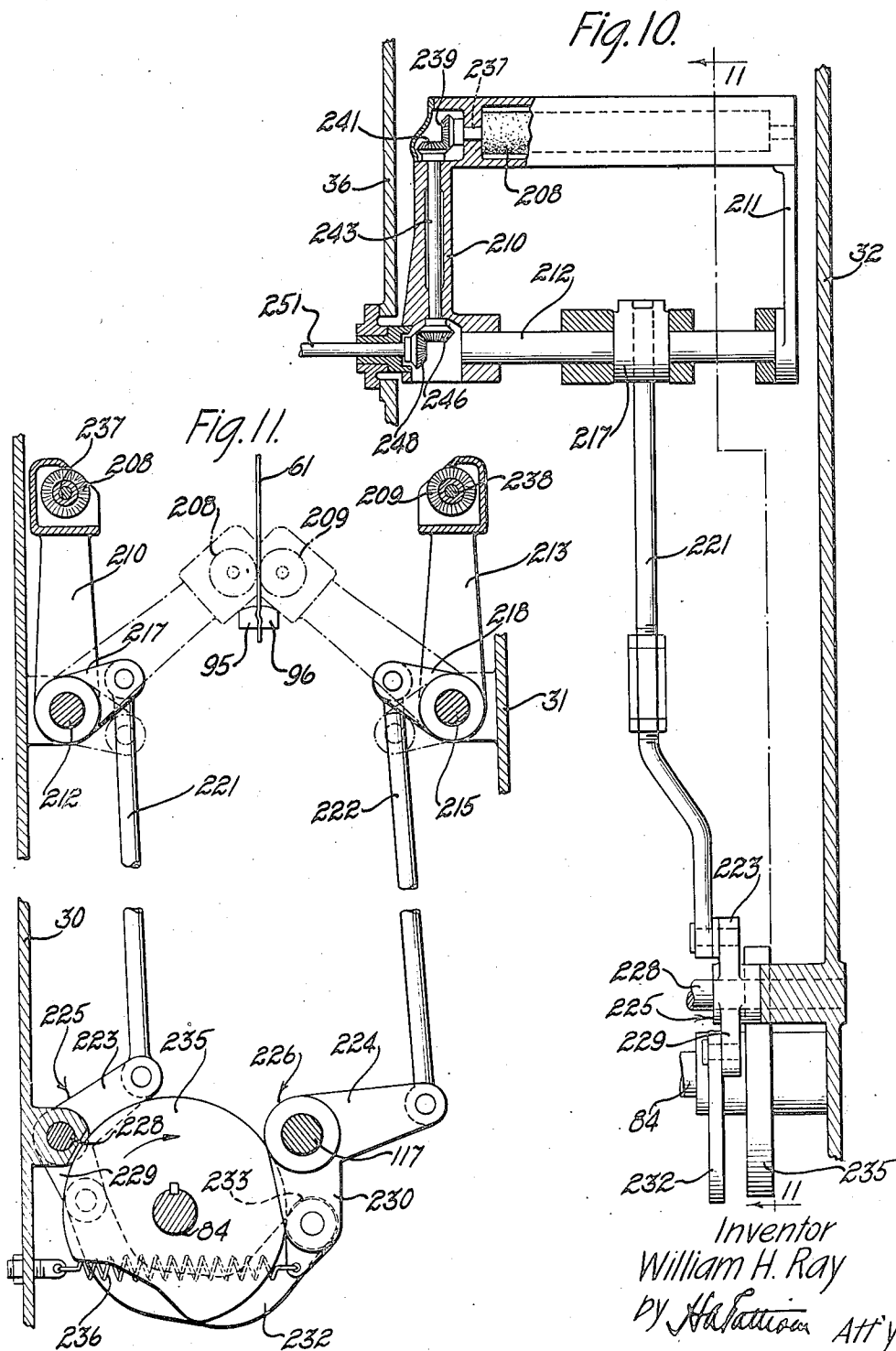
W. H. RAY

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APPARATUS FOR REMOVING INSULATION

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11 Sheets-Sheet 5



Inventor
 William H. Ray
 by *Harmon* Att'y.

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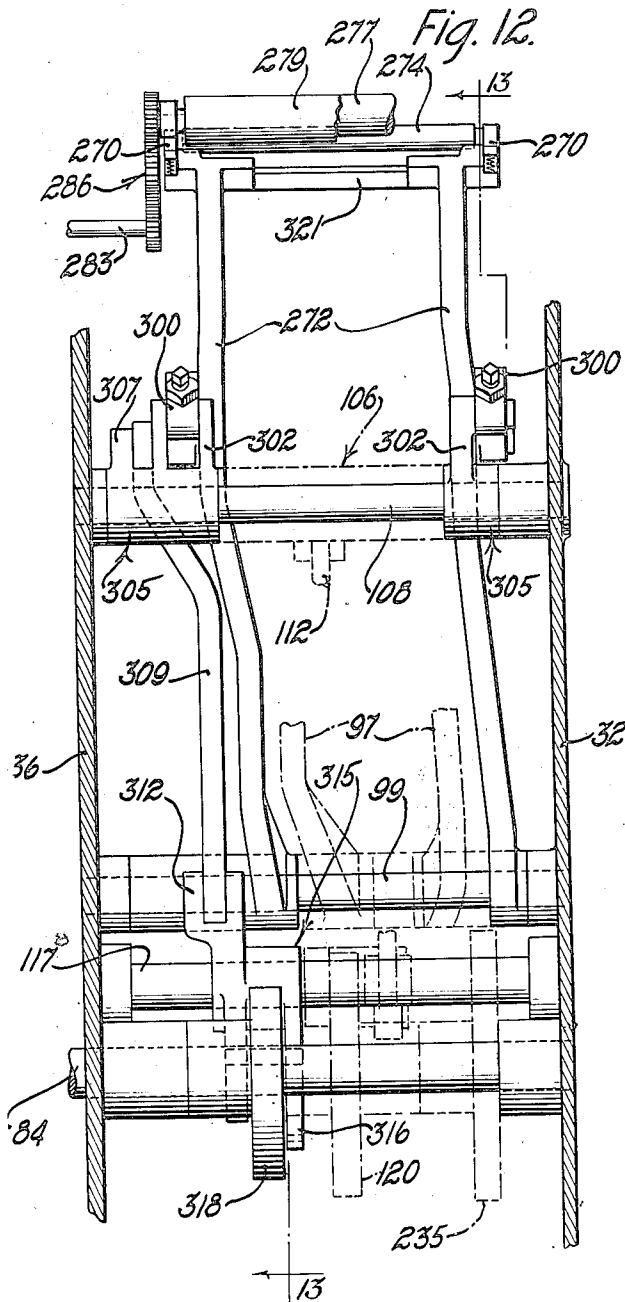
W. H. RAY

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APPARATUS FOR REMOVING INSULATION

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11 Sheets-Sheet 6



Inventor
William H. Ray
by *H. A. Patton* Att'y.

Nov. 5, 1929.

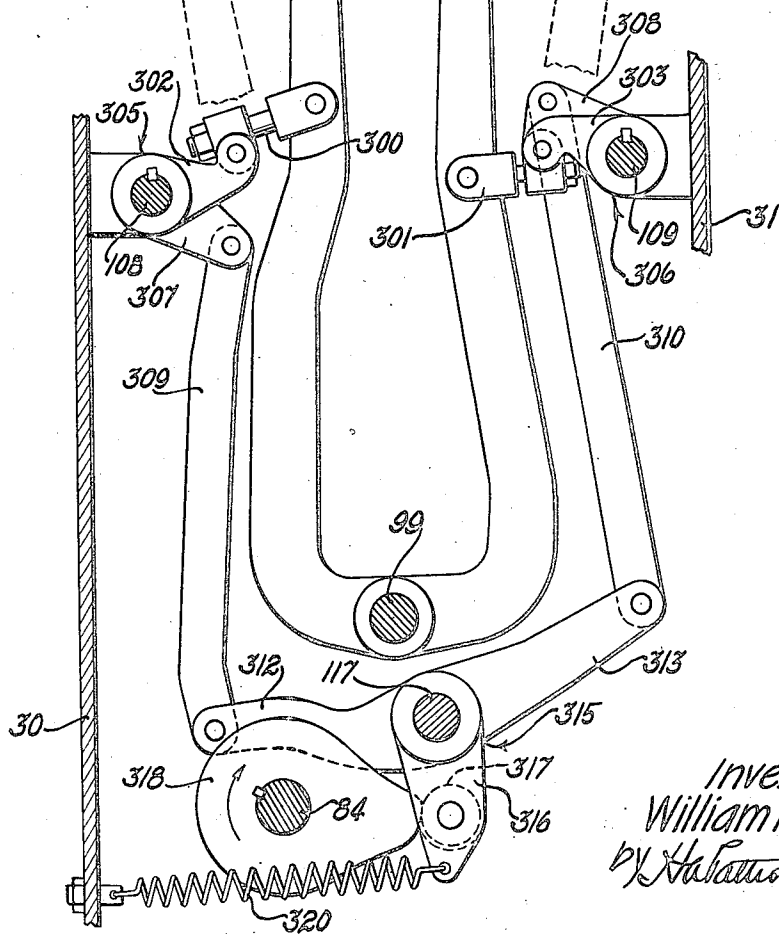
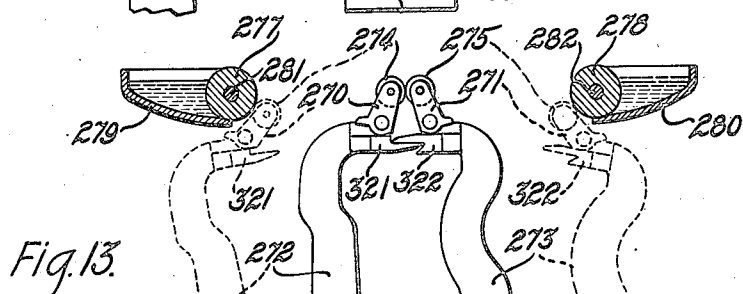
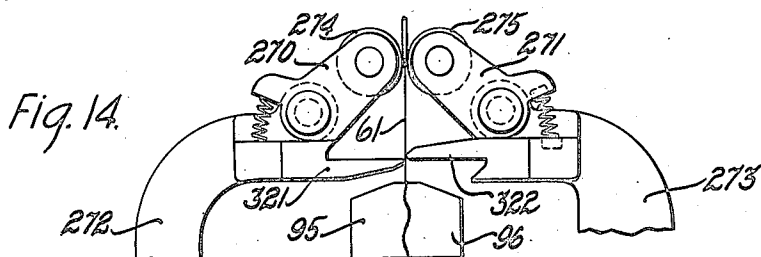
W. H. RAY

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APPARATUS FOR REMOVING INSULATION

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11 Sheets-Sheet 7



Inventor
William H. Ray
by *W. H. Ray* Att'y.

Nov. 5, 1929.

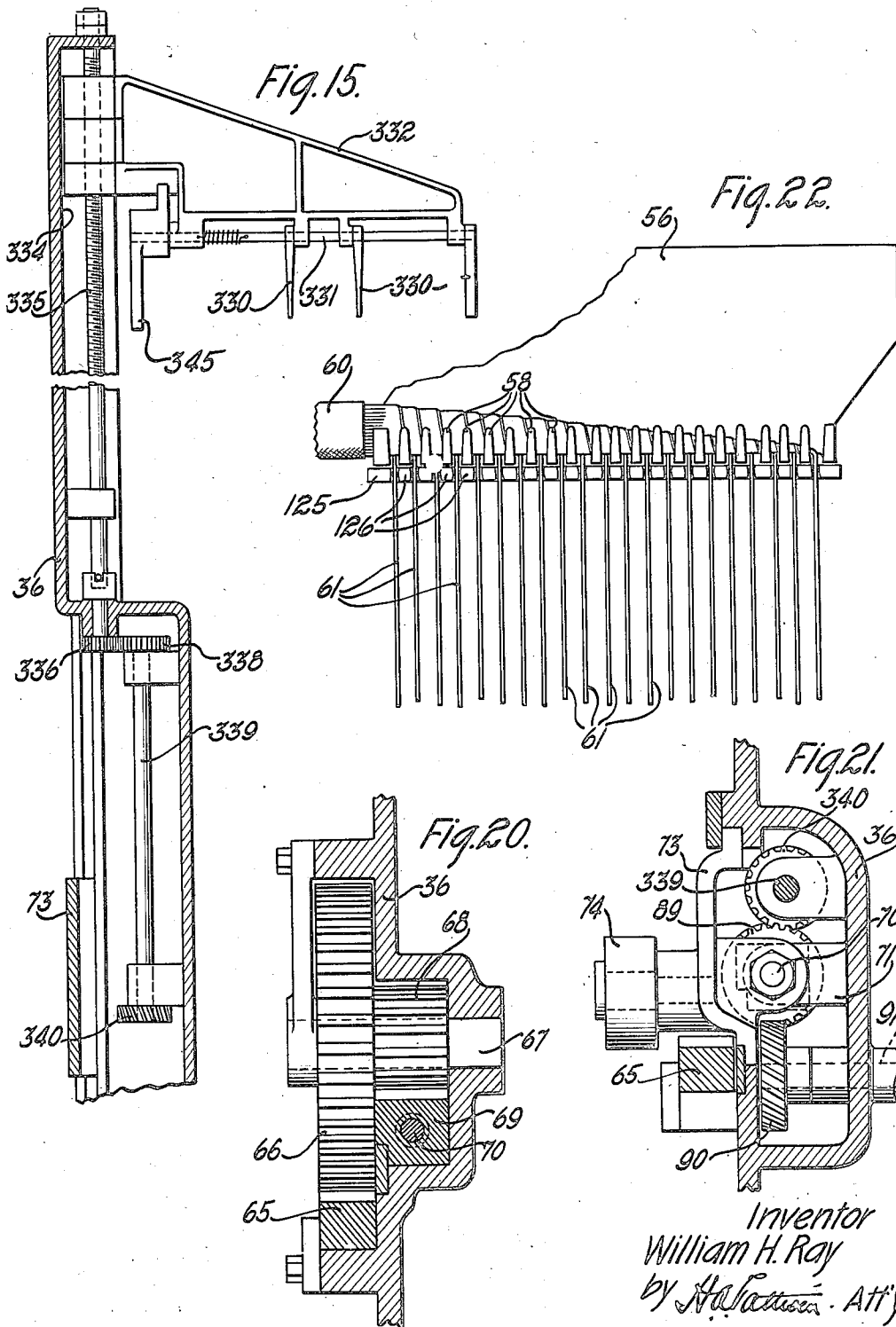
W. H. RAY

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APPARATUS FOR REMOVING INSULATION

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11 Sheets-Sheet 8



Inventor
William H. Ray
by *H. A. Harrison* - Att'y.

Nov. 5, 1929.

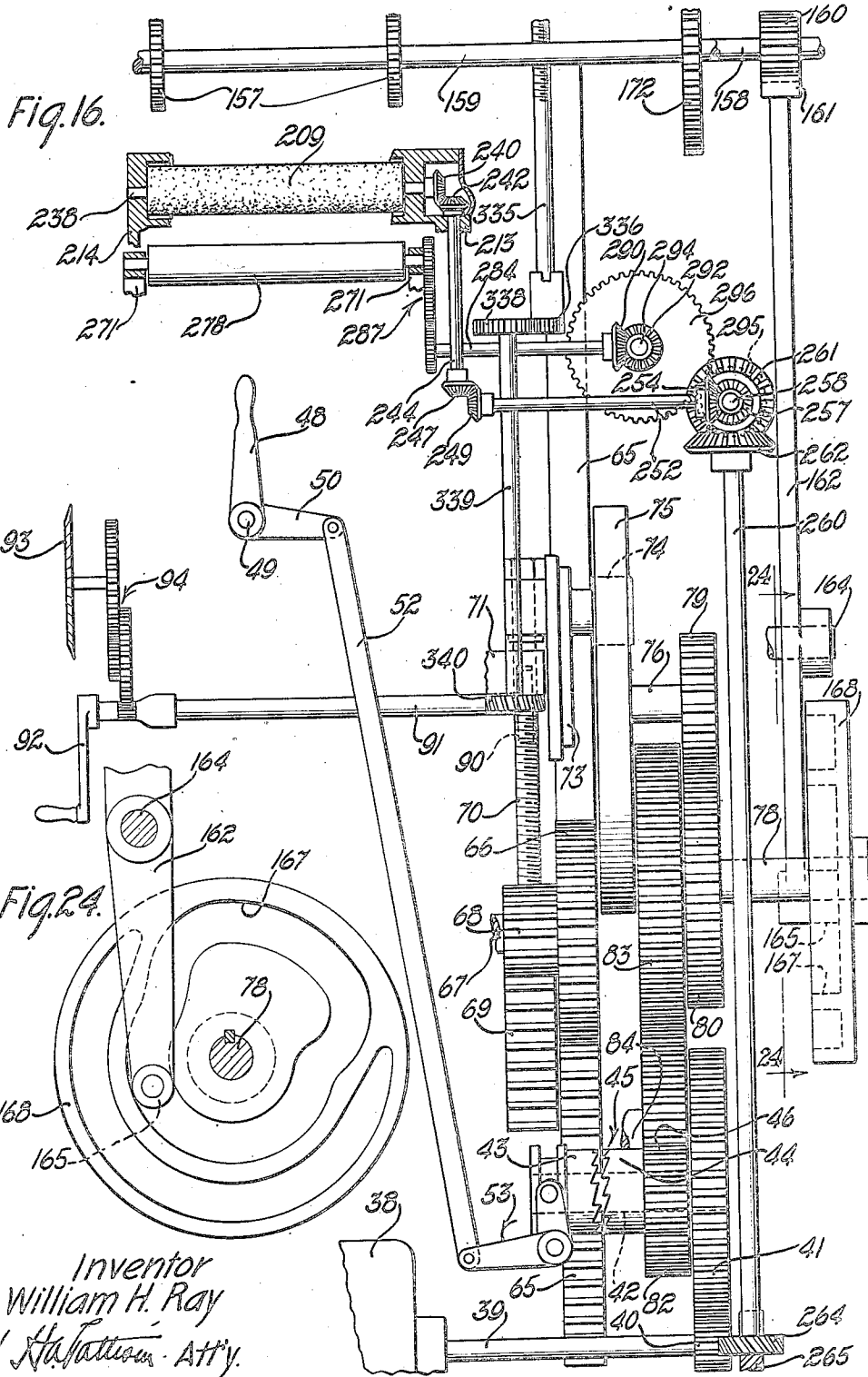
W. H. RAY

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APPARATUS FOR REMOVING INSULATION

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11 Sheets-Sheet 9



Nov. 5, 1929.

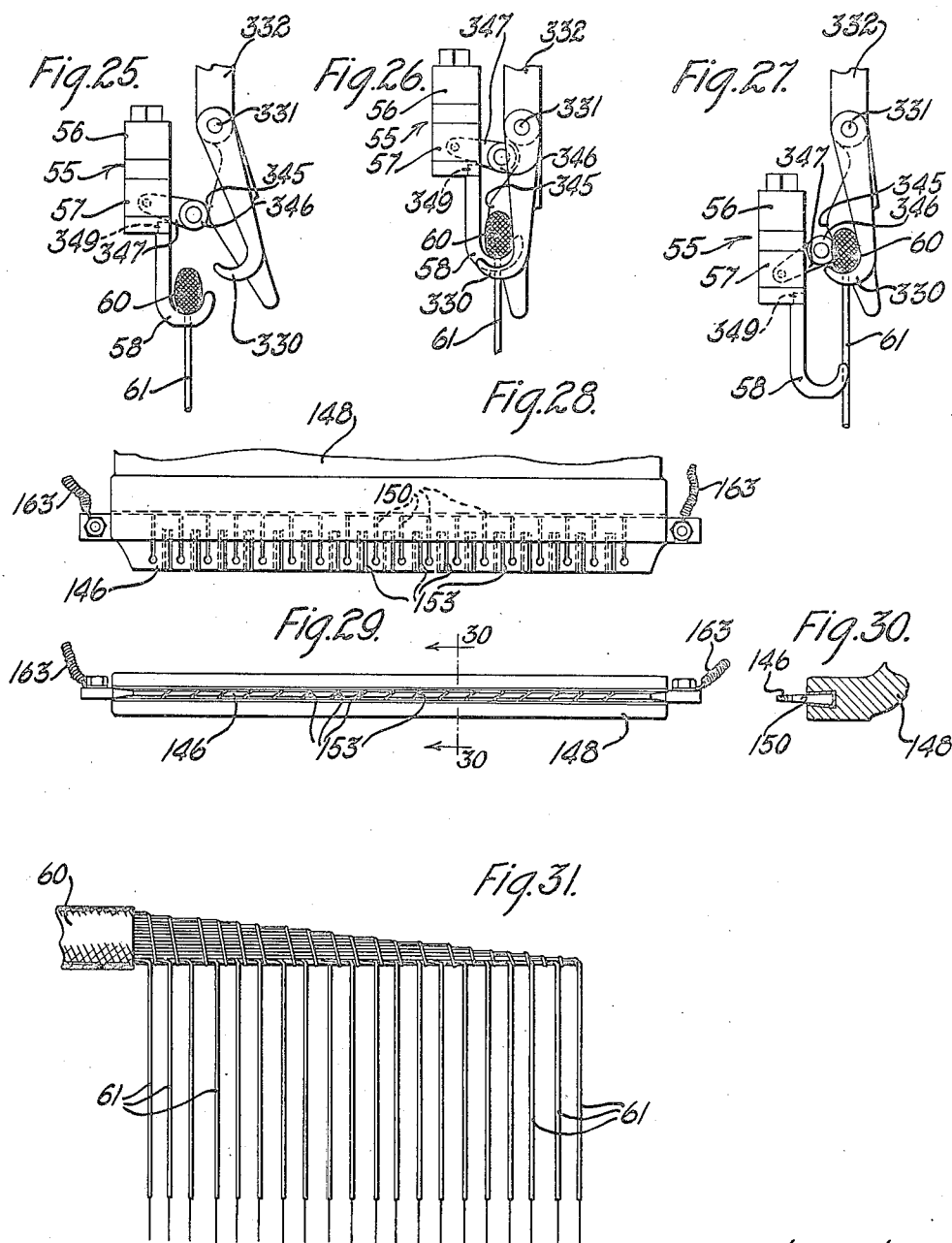
W. H. RAY

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APPARATUS FOR REMOVING INSULATION

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11 Sheets-Sheet 11



Inventor
William H. Ray
by *Harold A. Ray* ATT'Y.

UNITED STATES PATENT OFFICE

WILLIAM HARRY RAY, OF CHICAGO, ILLINOIS, ASSIGNOR TO WESTERN ELECTRIC COMPANY, INCORPORATED, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK

APPARATUS FOR REMOVING INSULATION

Application filed June 30, 1928. Serial No. 119,776.

This invention relates to apparatus for removing insulation, and more particularly to an improved apparatus for removing textile and enamel insulations from electrical conductors.

It is frequently desired to remove insulation from portions of electrical conductors in order to electrically interconnect them with other conductors or electrical apparatus. One instance of this nature occurs in the construction of manually operated telephone exchange equipments, wherein the telephone lines leading to the subscribers' stations are frequently provided with a plurality of multiple terminals accessible to a number of operators for establishing circuit connections therewith by means of telephone cords. These terminals which are called jacks are usually mounted in strip formation and the jacks of each strip are usually electrically interconnected with the preceding and succeeding jacks of the associated multiple arrangement by means of cables of electrical conductors soldered to the terminal portions of the jacks. Electrical conductors employed in this manner are frequently provided with a coating of insulating enamel which is superimposed by a textile covering. In order to insure good electrical connections between conductors of this type and the associated terminals it is necessary that both the textile and enamel insulations be completely removed from the contacting portions of the conductors.

The principal object of the present invention is to provide an improved apparatus for rapidly and efficiently removing insulation from electrical conductors.

An improved apparatus embodying the features of the invention comprises adjustable means for supporting the cable and the conductors formed therefrom and means for separating and straightening the conductors before the stripping operation. Electrically heated elements are provided for charring the insulation which is to be removed from the conductors, and a plurality of rotating wire brushes are provided for thereafter removing the charred textile insulation and the enamel coating from the conductors. A

pair of rolls which are normally in contact with a liquid cement are adapted to be moved in contact with the conductors, whereby the ends of the insulations remaining on the conductors are cemented in order to prevent fraying. A pair of cooperating knives are provided for cutting the ends of the conductors uniformly after the skinning operation.

Other features and advantages of the invention will become apparent in the following detailed description, reference being had to the accompanying drawings, wherein

Fig. 1 is a front elevation, partly in section, of an apparatus embodying the features of the invention;

Fig. 2 is a side elevation thereof, partly in section;

Fig. 3 is an enlarged fragmentary side elevational view, partly in section, showing the means for supporting the cable and the means for straightening and separating the conductor leads from which the insulation is to be removed;

Fig. 4 is a fragmentary vertical section taken substantially on line 4—4 of Fig. 3;

Fig. 5 is a vertical section similar to Fig. 4, showing the straightening means in normal position;

Fig. 6 is an enlarged fragmentary sectional view taken substantially on line 6—6 of Fig. 1, showing the means for charring the insulation;

Fig. 7 is a section taken on line 7—7 of Fig. 6;

Fig. 8 is a section similar to Fig. 7, showing the charring mechanism in operative position;

Fig. 9 is an enlarged fragmentary detail view of a portion of the mechanism shown in Figs. 7 and 8;

Fig. 10 is an enlarged fragmentary side elevational view, partly in section, showing the means for removing the charred insulation;

Fig. 11 is a fragmentary vertical section taken substantially on the line 11—11 of Fig. 10;

Fig. 12 is an enlarged fragmentary side elevational view, partly in section, showing

the means for cementing the ends of the insulation remaining on the conductors and the means for severing the conductors into uniform lengths;

Fig. 13 is a fragmentary vertical section taken substantially on line 13—13 of Fig. 12;

Fig. 14 is an enlarged fragmentary detail view of a portion of the mechanism shown in Fig. 13;

Fig. 15 is an enlarged fragmentary side elevational view, partly in section, showing the means for receiving the completed cable form;

Figs. 16, 17 and 18 illustrate diagrammatically the mechanism for driving the various operating parts of the improved apparatus;

Fig. 19 is a detail section taken on line 19—19 of Fig. 3;

Figs. 20 and 21 are enlarged fragmentary sections taken on lines 20—20 and 21—21, respectively, of Fig. 18;

Fig. 22 is an enlarged fragmentary detail view of the cable supporting hooks and the separating comb with a cable positioned therein ready for the skinning operation;

Fig. 23 is an enlarged fragmentary section taken on line 23—23 of Fig. 7;

Fig. 24 is a fragmentary section taken on line 24—24 of Fig. 16;

Figs. 25, 26 and 27 are enlarged fragmentary detail views illustrating the successive steps in the operation of the cable supporting and receiving mechanisms;

Figs. 28, 29 and 30 are enlarged fragmentary detail views of the burning elements, and

Fig. 31 illustrates a fragmentary portion of a cable form, showing the appearance of the conductor leads after the skinning operation has been completed.

As shown in Figs. 1 and 2 of the accompanying drawings, the main operating parts of the apparatus are mounted within a cabinet-like frame having side walls 30 and 31, front and rear walls 32 and 33, respectively, and an intermediate wall 36. Mounted near the lower portion of the frame is an electric motor 38 which is directly connected to a horizontally disposed shaft 39 rotatably journaled in suitable bearings formed in the walls 33 and 36.

Secured to the shaft 39 is a pinion 40 which drives a gear 41 secured to a horizontally disposed shaft 42 (Figs. 3, 16 and 17). A driving member 43 of a clutch 45 is slidably keyed to the shaft 42 and a driven member 44 of the clutch is rotatably mounted upon the shaft 42 and has formed integral therewith a pinion 46. The clutch 45 is operated by a handle 48 mounted on the right side of the machine within convenient reach of the operator. The handle 48 is secured to a pin 49 rotatably mounted in the side wall 31. An arm 50 is secured, at one end,

to the pin 49 and pivoted, at its other end, to one end of a link 52 (Fig. 16). The opposite end of the link 52 is pivoted to one arm of a bell crank lever 53, the other arm of which is bifurcated to straddle the clutch member 43 in the usual manner.

As illustrated in the drawings, an improved apparatus for removing insulation from the conductor leads of a multiple cable comprises a cable supporting unit, means for straightening the conductor leads, means for separating the conductor leads, means for charring the insulation, means for stripping the charred insulation, means for cementing the ends of the remaining insulation to prevent fraying, means for severing the conductor leads into predetermined uniform lengths, and means for receiving the completed cable form. In order that the construction and operation of the apparatus will be clearly understood, the various operating mechanisms will be desired separately in the above mentioned order and will be followed by a brief general statement of the operation of the apparatus.

Cable supporting unit

Referring particularly to Figs. 3, 4 and 5, the numeral 55 indicates, generally, a cable supporting unit comprising a bracket 56 carrying a member 57 having a plurality of spaced hook-like members 58 arranged in a horizontal plane and designed to accommodate and support a cable 60 in such manner that its conductor leads 61 thereof depend downwardly therefrom through the spaces between the hooks 58, as best shown in Fig. 22.

The bracket 56 is slidably supported in a vertical guideway 63 (Figs. 3 and 19) formed in the wall 36 of the cabinet. A plurality of rollers 64—64 rotatably carried by the bracket 56 engage the walls of the guideway 63 so that the friction therein is reduced to a minimum. Means is provided for moving the bracket 56 vertically in its guideway for a purpose which will be described in detail hereinafter. Slidably mounted in suitable guideways formed in the wall 36 is a vertically disposed rack 65 (Figs. 3, 16 and 18) which is secured at its upper end to the bracket 56. A gear 66 (Fig. 20) meshing with the rack 65 is keyed to a horizontally disposed stud shaft 67 to which is also secured a pinion 68 meshing with a rack 69. The rack 69 is threaded upon the lower end of a vertical shaft 70 (Fig. 18), which shaft is rotatably journaled in a bearing 71 (Fig. 21) formed in the wall 36. Fixed upon the upper end of the shaft 70 is a vertically movable slide 73 (Figs. 17, 18 and 21) carrying a roller 74 which is positioned to be peripherally engaged by a cam 75 secured to a horizontally disposed shaft 76.

The cam 75 is driven in a counter-clockwise direction (Fig. 17) from a horizontally

disposed shaft 78 by means of intermittent gears 79 and 80 secured to the shafts 76 and 78, respectively. The shaft 78 is in turn driven from the shaft 42 through an intermediate gear 82 meshing with the pinion 46 and a gear 83 secured to the shaft 78. The gear 82 is secured to a cam shaft 84 journaled in suitable bearings formed in the frame walls 32, 33 and 36 (Fig. 3), which cam shaft is geared to make one revolution for each cycle of operation of the apparatus.

It will be understood that movement of the slide 73 by the cam 75 is transmitted through the shaft 70, rack 69, pinion 68, gear 66, and rack 65 to move the bracket 56 in its guideway 63. The cam 75 is provided with a low portion 85 (Fig. 17), spiral portions 86 and 87, of gradually increasing radius, and an intermediate portion 88 of uniform radius. Due to this construction, it is obvious that during one complete revolution of the cam, the bracket 56 is moved upwardly to a predetermined position wherein it remains stationary for a predetermined length of time and then continues to move upwardly a short distance after which it returns by its own weight to its normal position. The reason for this construction will presently appear.

From the above description it should be understood that the traveling distance of the bracket 56 is determined by the relative position of the roller 74 with respect to the cam 75, it being obvious that by adjusting the roller further away from the cam it will be engaged by a lesser part of the spiral portion 86 of the cam during the rotation thereof and the traveling distance of the slide 73 (and therefore the bracket 56) is thereby decreased. Downward movement of the slide 73 is limited by the cam 75, its lowest possible position (and therefore the longest possible travel of the bracket 56) being that wherein the roller 74 normally engages the lowest portion 85 of the cam, as shown in Fig. 17.

Means is provided for varying the upward travel of the bracket 56 to accommodate cable forms having conductor leads of various lengths. Slidably keyed to the shaft 70 is a spiral gear 89 (Figs. 18 and 21) which meshes with a similar gear 90 secured to a horizontally disposed shaft 91 (Fig. 16) journaled in the frame walls 32 and 36. One end of the shaft 91 protrudes through the front wall 32 and is adapted to receive a crank handle 92 whereby the shaft 91 may be manually rotated to rotate the shaft 70 through the gears 89 and 90. Due to its threaded engagement with the rack 69 which is held stationary by the pinion 68, the shaft 70 (and therefore the slide 73) is moved either upwardly or downwardly when rotated, the direction of this movement being determined by the direction in which the

crank handle 92 is turned. By means of a suitably calibrated dial 93 operatively connected to the shaft 91 by a train of gears 94 (Fig. 16), the operator may readily and accurately adjust the roller 74 for conductor leads of any predetermined length.

Straightening means

The means for straightening the conductor leads comprises a pair of cooperating parallel bars 95 and 96 (Figs. 3, 4 and 5) mounted upon the upper ends of levers 97—97 and 98—98, respectively, which levers are pivoted at their lower ends upon a horizontally disposed shaft 99 journaled in suitable bearings formed in a central frame member 100 and the frame walls 32 and 36. A form of toggle arrangement is provided for moving the levers 97 and 98 towards each other to cause the straighteners 95 and 96 to engage opposite sides of the conductor leads, as shown in Fig. 4. Adjustable toggle arms 102 and 103 are pivoted at one end to the levers 97 and 98, respectively, and pivotally connected at their opposite ends in bifurcated arms 104 and 105 of toggle levers 106 and 107, respectively, which levers are rotatably mounted upon horizontally disposed shafts 108 and 109, respectively, supported in suitable bearings formed in the frame. Arms 110 and 111 of the toggle levers 106 and 107 are pivotally connected to the upper ends of vertically disposed links 112 and 113, respectively, which links are connected at their lower ends to arms 114 and 115, respectively, of a rocker member 116. The member 116 is rotatably mounted upon a shaft 117 journaled in suitable bearings formed in the walls 32 and 36 of the frame. Rotatably mounted in a bifurcated depending arm 118 of the member 116 is a roller 119 which is positioned to peripherally engage a cam 120 (Figs. 4 and 5) secured to the cam shaft 84. A tension spring 121 fastened at one end to the arm 118 and secured at its opposite end to the frame wall 30 serves to normally hold the roller 119 in contact with the periphery of the cam.

From the above description it will be understood that rotation of the cam 120 in a clockwise direction (Figs. 4 and 5) causes movement of the rocker member 116 in a counter-clockwise direction. This movement of the rocker arm 116 is transmitted through the links 112 and 113, the toggle levers 106 and 107, and the toggle arms 102 and 103, to move the levers 97 and 98 towards each other so that the straighteners 95 and 96 engage opposite sides of the conductor leads, as best shown in Fig. 4. It will be noted that the cam 120 is provided with a low portion 122 and a comparatively large high portion 123, and that the roller 119 normally engages the low portion 122 of the cam. Due to this construction it is obvious that

during one complete revolution of the cam, the straighteners 95 and 96 are moved from their normal positions, as shown in Fig. 5, to their operative positions (Fig. 4), wherein they remain for a predetermined length of time, after which they are returned to their normal positions until the next cycle of operation of the apparatus.

Separating means

The mechanism for separating the conductor leads of the cable will next be described. This mechanism comprises a comb-like member 125 (Figs. 3, 4, 5 and 22) having a plurality of teeth 126 for separating and spacing the individual conductors, as best shown in Fig. 22. The member 125 is supported upon the upper ends of a pair of vertically disposed parallel bars 128—128 which bars are slidably mounted in suitable bearings formed in the central frame member 100. The bars 128 are interconnected at their lower ends by a cross bar 130. Secured to the cross bar 130 is a vertical rod 131 which is slidable in a bearing 132 formed in the frame 100. A compression spring 133 encircling the rod 131 and disposed between the cross bar 130 and the bearing 132 serves to normally urge the separating comb 125 upwardly so that the teeth 126 thereof are in contact with the cable supporting hooks 58 and in vertical alignment therewith as best shown in Fig. 22. A nut 134 threaded upon the lower end of the rod 131 serves to limit the upward movement of the separating comb 125.

Pivottally supported by a bracket 136 secured to the frame wall 30 are a pair of cams 137—137 each of which is provided at its outer end with a bifurcated portion 138 designed to engage a pin 139 secured to the bars 128. Rollers 140—140 carried by the levers 97 are positioned to ride upon the upper surfaces of the cams 137 when the levers are moved towards each other. The cams 137 are so designed that they are rotated in a clockwise direction (Fig. 4) during the inward movement of the levers 97, thereby moving the separating comb downwardly against the tension of the spring 133. This permits the straighteners 95 and 96 to become positioned between the cable hooks 58 and the separating comb 125, as shown in Figs. 3 and 4. The reason for this construction will become more apparent as the description of the apparatus progresses.

Insulation charring means

Referring now particularly to Figs. 6, 7 and 8, the mechanism for charring or burning the insulation which is to be removed from the conductors comprises a pair of electrically heated burning elements 146 and 147 arranged to engage opposite sides of the con-

ductors, as shown in Fig. 8. As illustrated in detail in Figs. 28, 29 and 30, the burning elements 146 and 147 are wedge shaped and are each provided with a plurality of transverse narrow slots 150 and 153, the slots 153 being arranged diagonally in order to prevent passage of the conductors therein. These slots cause the current to flow along a serpentine path whereby a minimum amount of current is required to maintain the charring edges thereof at a temperature sufficiently high to char the insulation. The burning elements may be connected to any suitable source of electrical energy by means of leads 163 fastened to the ends thereof.

The burning element 146 is supported by a plate 148 mounted in guideways 149—149 formed in the frame walls 32 and 36, and the burning element 147 is supported by a plate 151 mounted in guideways 152—152. Racks 154—154 and 155—155 secured to the plates 148 and 151, respectively, mesh with gears 156—156 and 157—157 secured to horizontally disposed shafts 158 and 159, respectively, journaled in suitable bearings formed in the frame (Figs. 6 and 16). Secured to the shaft 158 is a pinion 160 (Figs. 16 and 17) which meshes with a gear sector 161 rigidly mounted at the upper end of a vertical lever 162. The lever 162 is pivoted intermediate its ends upon a stud shaft 164 suitably supported in the frame. A roller 165 carried at the lower end of the lever 162 engages a cam groove 167 formed in the face of a rotatable disk 168 (Fig. 24). The construction is such that rotation of the disk 168 imparts an oscillatory movement to the gear sector 161, thereby driving the shaft 158 first in one direction and then in the other. The shaft 159 is driven in a similar manner from the shaft 158 by means of a pair of intermeshing gears 171 and 172. This movement of the shafts 158 and 159 is transmitted through the gears 156 and 157 and the racks 154 and 155 to move the burning elements 146 and 147 towards and away from the conductors. The gearing is so arranged and the cam groove 167 is so constructed that during one complete revolution of the cam shaft 84, the burning elements are moved from their normal positions (Fig. 7) to their operative positions (Fig. 8) and returned to their normal positions wherein they remain until the next cycle of operation of the apparatus.

Referring to Figs. 16 and 17, it will be noted that the disk 168 is secured to the shaft 78, which shaft is driven from the cam shaft 84 through the gears 82 and 83, hereinbefore described. It should be observed that the gears 82 and 83 are of the same size and are provided with an equal number of teeth. Due to this construction, the shaft 78 is driven at the same speed as the shaft 84.

Means is provided for protecting the conductors during the charring operation to prevent burning of the insulation beyond a predetermined point. This means comprises a pair of cooperating guard plates 180 and 181 (Figs. 6, 7 and 8) which are arranged to engage opposite sides of the conductors as shown in Fig. 9. The plates 180 and 181 are secured to supporting members 182—182 and 183—183, respectively. Arms 184—184 and 185—185 are pivoted at one end to the plates 148 and 151, respectively, and carry, at their opposite ends, rollers 186 and 187, respectively. The rollers 186 and 187 engage cam grooves 188 and 189, respectively, formed in the frame walls 32 and 36. Rollers 191 and 192 also carried by the arms 184 and 185 engage guideways 193 and 194 formed in the guard supports 182 and 183, respectively. Guide rods 196 and 197 are secured, at one end, to the guard supports 182 and 183, respectively, and slidably journaled, at their opposite ends, in bearings 198 and 199 formed in the arms 184 and 185, respectively. Encircling the rods 196 and 197 and interposed between the guard supports 182 and 183 and the bearings 198 and 199 are compression springs 200. From this construction it will be understood that movement of the plates 148 and 151 causes movement of the guard plates 180 and 181. The arrangement is such that the guard plates 180 and 181 will engage the conductors before the burning elements 146 and 147 and will remain in contact with the conductors until after the burning elements have been removed, as shown in Fig. 9.

Stripping means

The means for stripping the charred insulation from the conductors comprises a pair of rotating wire brushes 208 and 209 (Figs. 10, 11 and 17) which are arranged to engage opposite sides of the conductors as shown in dotted outline in Fig. 11. The brush 208 is rotatably carried by arms 210 and 211 secured to a horizontally disposed shaft 212 rotatably journaled in suitable bearings formed in the frame wall 30. The brush 209 is similarly carried by arms 213 and 214 (Fig. 16) secured to a horizontally disposed shaft 215 rotatably journaled in suitable bearings formed in the frame wall 31. Arms 217 and 218 are secured at one end to the shafts 212 and 215, respectively, and pivotally connected at their opposite ends to one end of adjustable links 221 and 222, respectively. The opposite ends of the links 221 and 222 are pivotally connected to arms 223 and 224 of bell crank levers 225 and 226, respectively. The bell crank lever 225 is rotatably supported upon a stud shaft 228 (Fig. 11) mounted in suitable bearings formed in the frame. The bell crank lever 226 is rotatably supported upon the shaft 117. Arms 229 and 230 of the bell crank levers 225 and 226,

respectively, are operatively interconnected by a link 232. A roller 233 carried by the arm 230 of the bell crank lever 226 is positioned to peripherally engage a cam 235 secured to the cam shaft 84. A tension spring 236 secured, at one end, to the arm 230 and fastened, at its other end, to the frame wall 30 serves to normally hold the roller 233 in contact with the cam 235. The cam 235 is so designed that during one complete revolution thereof the brushes 208 and 209 are moved from their normal positions to their operative positions, as shown in dotted outline in Fig. 11 and returned to their normal positions, wherein they remain until the next cycle of operation of the apparatus.

The mechanism for driving the brushes 208 and 209 will now be described. Referring to Figs. 10 and 11, it will be noted that the brushes 208 and 209 are mounted upon horizontally disposed shafts 237 and 238, respectively, the shaft 237 being journaled in the upper ends of the arms 210 and 211 and the shaft 238 being carried by the arms 213 and 214. Bevel gears 239 and 240 (Fig. 17) secured to the shafts 237 and 238, respectively, mesh with bevel gears 241 and 242 secured at one end of the vertically disposed shafts 243 and 244 rotatably journaled in the arms 210 and 213, respectively. Secured at the opposite ends of the shafts 243 and 244 are bevel gears 246 and 247 (Fig. 16) which mesh with similar gears 248 and 249 secured at one end of horizontally disposed shafts 251 and 252, respectively, which shafts have keyed at their opposite ends, bevel gears 253 and 254, respectively. The gears 253 and 254 mesh with similar gears 256 and 257 secured at opposite ends of a horizontally disposed shaft 258 (Fig. 17), which shaft is driven from a vertically disposed shaft 260 by means of bevel gears 261 and 262 secured to the shafts 258 and 260, respectively. The shaft 260 is, in turn, driven from the main shaft 39 through spiral gears 264 and 265 secured to the shafts 260 and 39, respectively.

Cementing means

Rotatably mounted in arms 270—270 and 271—271 (Figs. 12, 13 and 14) pivotally supported upon the upper ends of levers 272—272 and 273—273, respectively, are a pair of rolls 274 and 275, respectively, which are arranged to engage opposite sides of the conductors, as best shown in Fig. 14. When in their normal positions, the rolls 274 and 275 engage rolls 277 and 278, respectively, (Fig. 13) which latter rolls are rotatably journaled in receptacles 279 and 280 containing a suitable cementing material. The rolls 277 and 278 are secured to shafts 281 and 282, respectively, which shafts are driven from shafts 283 and 284 (Fig. 17) through trains of gears 286 and 287, respectively. Bevel gears 289 and 290 secured to the shafts 283 and 284, respec-

tively, mesh with similar gears 291 and 292 secured at opposite ends of a horizontally disposed shaft 294, which latter shaft is driven from the shaft 258 by means of gears 295 and 296 secured to the shafts 258 and 294, respectively.

As shown in Fig. 13, the levers 272 and 273 are pivoted at their lower ends upon the shaft 99. A form of toggle arrangement is provided for moving these levers towards each other to cause the rolls 274 and 275 to engage the ends of the insulation remaining upon the conductors. Adjustable toggle arms 300 and 301 are pivoted at one end to the levers 272 and 273, respectively, and pivotally connected at their opposite ends in bifurcated arms 302 and 303 of toggle levers 305 and 306, respectively, which levers are secured to the shafts 108 and 109, respectively. Arms 307 and 308 of the toggle levers 305 and 306 are pivotally connected to the upper ends of vertically disposed links 309 and 310, respectively, which links are connected at their lower ends to arms 312 and 313, respectively, of a rocker member 315 rotatably mounted upon the shaft 117. Rotatably mounted in a bifurcated depending arm 316 of the member 315 is a roller 317 which is positioned to peripherally engage a cam 318 secured to the cam shaft 84. A tension spring 320 fastened at one end to the arm 316 and secured at its opposite end to the frame wall 30 serves to normally hold the roller 317 in contact with the periphery of the cam 318.

From the above description it will be understood that movement of the rocker member 315 in a counter-clockwise direction is transmitted through the links 309 and 310, the toggle levers 305 and 306, and the toggle arms 302 and 303 to move the levers 272 and 273 towards each other, thereby causing the rolls 274 and 275 to engage the ends of the insulation on the conductors, as shown in Fig. 14. It will be noted that the cam 318 is so designed that the cementing rolls 274 and 275 are operated near the end of each revolution of the cam shaft 84. This is to insure that the burners and brushes have completed their operations before the cementing rolls are operated to cement the ends of the insulation remaining upon the conductors.

Severing means

The means for severing the ends of the conductors uniformly comprises a pair of cooperating knives 321 and 322 (Figs. 12, 13 and 14) mounted near the upper ends of the levers 272 and 273, respectively. It will be understood that the severing operation takes place immediately after the completion of the cementing operation. A removable receptacle 324 (Figs. 4 and 5) supported upon a shelf 325 formed in the central frame mem-

ber 100 is provided for collecting the waste resulting from the skinning and severing operations.

Receiving means

Means is provided for receiving and supporting the cable form after the skinning operation has been completed. This means comprises a plurality of hook-like members 330—330 (Fig. 15) which are secured to a horizontally disposed bar 331 rotatably journaled in a bracket 332. The bracket 332 is slidably mounted in a vertical guideway 334 (Fig. 19) formed in the frame wall 36 and is threaded upon a vertically disposed screw member 335 rotatably journaled in the frame.

The bracket 332 is movable in its guideway 334 to accommodate cable forms having conductor leads of various lengths. Secured at the lower end of the screw member 335 is a gear 336 which meshes with a gear 338 secured at the upper end of a vertically disposed shaft 339. A spiral gear 340 secured at the lower end of the shaft 339 meshes with the spiral gear 89 (Fig. 21). From this construction it is obvious that by turning the crank handle 92, the bracket 332 is moved upwardly or downwardly in its guideway 334, the direction of this movement being determined by the direction in which the crank handle is turned.

Secured to the bar 331 is a cam 345 which is positioned so as to be engaged by a roller 346 carried by an arm 347 pivotally supported by the bracket 56. The arm 347 is free to rotate in a counter-clockwise direction (Fig. 25) but is prevented from turning in a clockwise direction by means of a stop 349 attached to or formed integral with the bracket 56. By reason of this construction the roller 346 engages the cam 345 during the upward movement of the bracket 56 causing the hooks 330 to be turned to the left, as shown in Fig. 25, thereby permitting the passage of the cable 60 and the supporting hooks 58. The cam is so designed that the hooks 330 are allowed to return to their normal positions when the bracket 56 is in its uppermost position (Fig. 26). When in this position, the hooks 330 are in vertical alignment with the hooks 58. Moreover, it will be understood that the hooks 330 remain in their normal positions during the downward movement of the bracket 56 since the roller 346 has no effect on the cam 345 during such movement by reason of the arm 347 being free to rotate in a counter-clockwise direction, as hereinbefore described. It will be apparent, therefore, that during the downward movement of the bracket 56 the cable positioned upon the hooks 58 will be caught by the hooks 330 which are designed to support it until removed by the operator.

The operation is as follows: Having first

adjusted the cable supporting and receiving mechanisms in accordance with the length of the conductor leads as hereinbefore described, the cable is positioned upon the supporting hooks 58 with the conductor leads 61 thereof hanging downwardly between these hooks and the teeth 126 of the separating comb 125. The motor 38 is then started, thus driving the shaft 39 which, in turn, drives the pinion 40 and the spiral gear 265 from the latter of which is driven the wire brushes 208 and 209 and the cement feeding rolls 277 and 278. By turning the handle 48 in a counter-clockwise direction (Fig. 16), the clutch 45 is actuated to start rotation of the shaft 42 and the pinion 46 which drives the gear 82, thus starting the rotation of the cam shaft 84 from which the straighteners, burners, knives and cable supporting mechanism are driven.

As hereinbefore described, the cam shaft 84 makes one revolution for each complete cycle of operation of the apparatus. It must be understood, of course, that the gearing arrangement is such that the rotation of the cam shaft is relatively slow.

The various operations which are completed during one cycle of operation of the apparatus will be described in the order in which they are performed. The straighteners 95 and 96 are first moved into their operative positions as shown in Fig. 4 by means of the cam 123 actuating through the toggle and lever arrangement hereinbefore described. Next the cable supporting unit 55 is moved upwardly to the position shown in Fig. 7. This operation is performed by the cam 87 actuating through the slide 73, rack 69, pinion 68, gear 66 and rack 65. During the upward movement of the cable supporting unit 55 the conductor leads 61 are separated and properly spaced by the separating comb 125. Due to the pressure of the straighteners 95 and 96 on the conductor leads, the conductors are also straightened during this upward movement of the supporting unit.

As the cam shaft 84 continues to rotate the burners 146 and 147 and the guards 180 and 181 are moved into their operative positions by means of the intermittent gears 79 and 80 and the cam 168 in the manner hereinbefore described. During the charring operation the cable supporting unit 55 moves upwardly to the position shown in Fig. 26. This movement of the cable supporting unit is produced by the high portion 87 of the cam 75. The distance of this latter movement of the cable supporting unit is determined by the amount of insulation which is to be removed from the conductors.

After the charring operation has been completed, the burning elements start returning to their normal positions and the brushes 208 and 209 are moved into their operative positions by the cam 235. The brushes 208 and 209

serve to remove the charred textile and enamel insulations from the conductors after which the cementing rolls 274 and 275 are moved into engagement with the conductors and the ends of the remaining insulation are cemented to prevent fraying. After the cementing operation, the knives 321 and 322 are actuated to sever the end portions of the conductor leads to a uniform predetermined length.

Upon the completion of the severing and cementing operations, the knives and cementing rolls are returned to their normal positions by means of the spring 320. The straighteners 95 and 96 are then returned to their normal positions by the spring 121 and the supporting unit 55 moves downwardly by its own weight, being retarded, however, due to the engagement of the roller 74 with the cam 75. During this downward movement of the cable supporting unit, the cable 60 is caused to become positioned within the receiving hooks 330, as shown in Fig. 27, thus completing one cycle of operation of the apparatus.

Although the invention as herein illustrated and described is particularly applicable for removing insulation from conductor leads of formed multi-conductor cables, it should be understood that the novel features thereof are capable of other applications and that the invention should be limited only by the scope of the appended claims.

What is claimed is:

1. In an apparatus for removing insulation from an electrical conductor, means for holding the conductor, a heating element for charring the insulation on the conductor, and a rotating member for removing the charred insulation.

2. In an apparatus for removing insulation from an electrical conductor, a rack for holding the conductor, means for charring such portion of the insulation on the conductor as is to be removed, and a pair of oppositely rotating wire brushes for removing the charred insulation.

3. In an apparatus for removing insulation from an electrical conductor, a rack for supporting the conductor, a heating element for charring a portion of the insulation on the conductor, a brush for removing the charred insulation, and means for cementing an end of the insulation remaining on the conductor.

4. In an apparatus for removing insulation from an electrical conductor, a rack for holding the conductor, a heating element for charring such portion of the insulation on the conductor that is to be removed, a pair of oppositely rotating wire brushes for removing the charred insulation, and intermittently operable rollers for cementing the end of the insulation remaining on the conductor.

5. In an apparatus for removing insulation from an electrical conductor, means for sup-

- porting the conductor, a burning element for charring a portion of the insulation on the conductor, oppositely rotating wire brushes for removing the charred insulation, a pair of cooperating rolls for cementing an end of the insulation remaining on the conductor to prevent fraying, and a pair of cooperating knives for severing the end portion of the conductor to a predetermined length. 70
6. In an apparatus for removing insulation from an electrical conductor, adjustable means for supporting the conductor in a taut vertical position, a pair of cooperating heated elements for charring the insulation on the conductor, a pair of oppositely rotating cooperating brushes for removing the charred insulation, and means for severing the end of the conductor to a predetermined length. 75
7. In an apparatus for removing insulation from a plurality of electrical conductors, means for supporting the conductors, means for charring the insulation on portions of the conductors, oppositely rotating wire brushes for removing the charred insulation, means for cementing the ends of the remaining insulation to prevent fraying, and means for severing the end portions of the conductors to a uniform predetermined length. 80
8. In an apparatus for removing insulation from conductor leads of a formed multi-conductor cable, adjustable means for supporting the cable and the conductor leads, means for straightening the conductor leads, means for separating the conductor leads, a cam for causing a relative movement between the supporting means and the straightening means to straighten the conductor leads, means for charring a portion of the insulation on the conductor leads, and means for removing the charred insulation. 85
9. In an apparatus for removing insulation from conductor leads of a formed multi-conductor cable, adjustable means for supporting the cable and the conductor leads, means for straightening the conductor leads, a comb-like member for separating the conductor leads, means for causing a relative movement between the supporting means and the straightening means to straighten the conductor leads, means for charring a portion of the insulation on the conductor leads, means for removing the charred insulation, and means for cementing the ends of the remaining insulation to prevent fraying. 90
10. In an apparatus for removing insulation from conductor leads of a formed multi-conductor cable, adjustable means for supporting the cable and the conductor leads, means for straightening the conductor leads, means for separating the conductor leads, means for causing a relative movement between the supporting means and the straightening means to straighten the conductor leads, means for charring a portion of the insulation on the conductor leads, means for removing the charred insulation, means for cementing the ends of the remaining insulation to prevent fraying, and co-operating knives for severing the end portions of the conductor leads to a uniform predetermined length. 95
11. In an apparatus for removing insulation from conductor leads of a formed multi-conductor cable, adjustable means for supporting the cable and the conductor leads, means for adjusting said supporting means to accommodate conductor leads of various lengths, means for charring a portion of the insulation on the conductor leads, and intermittently operable rollers for cementing the ends of the remaining insulation to prevent fraying. 100
12. In an apparatus for removing insulation from conductor leads of a formed multi-conductor cable, adjustable means for supporting the cable and the conductor leads, means for receiving the cable after the insulation has been removed from the leads and co-operating gears for adjusting the supporting means and the receiving means for conductor leads of a predetermined length. 105
13. In an apparatus for removing insulation from conductors, parallel bars for straightening the conductors, means for charring the insulation, means for removing the charred insulation, means for treating the ends of the remaining insulation, and means for effecting the co-operation of the aforementioned means in timed relation. 110
14. In an apparatus for removing insulation from conductors, adjustable means for holding the conductors, means for straightening the conductors, means for charring the insulation, means for removing the charred insulation, cement applying rollers for treating the ends of the remaining insulation, means for severing the ends of the conductors, and means for effecting the co-operation of the aforementioned means in timed relation. 115
- In witness whereof, I hereunto subscribe my name this 19th day of June, A. D. 1926.
WILLIAM HARRY RAY. 120
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