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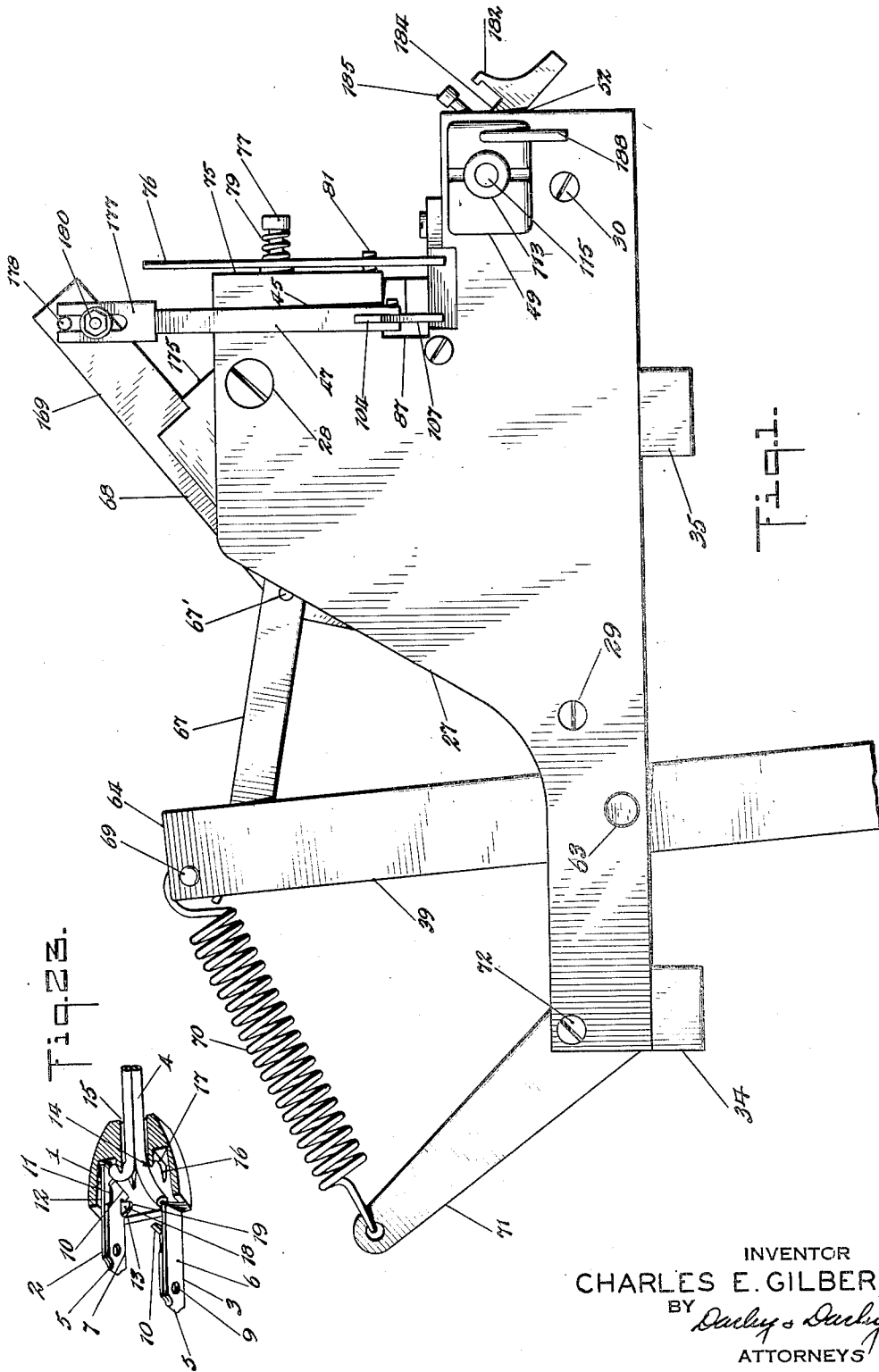
C. E. GILBERT

2,613,432

MACHINE FOR ASSEMBLING ELECTRICAL CONNECTORS

Filed June 13, 1947

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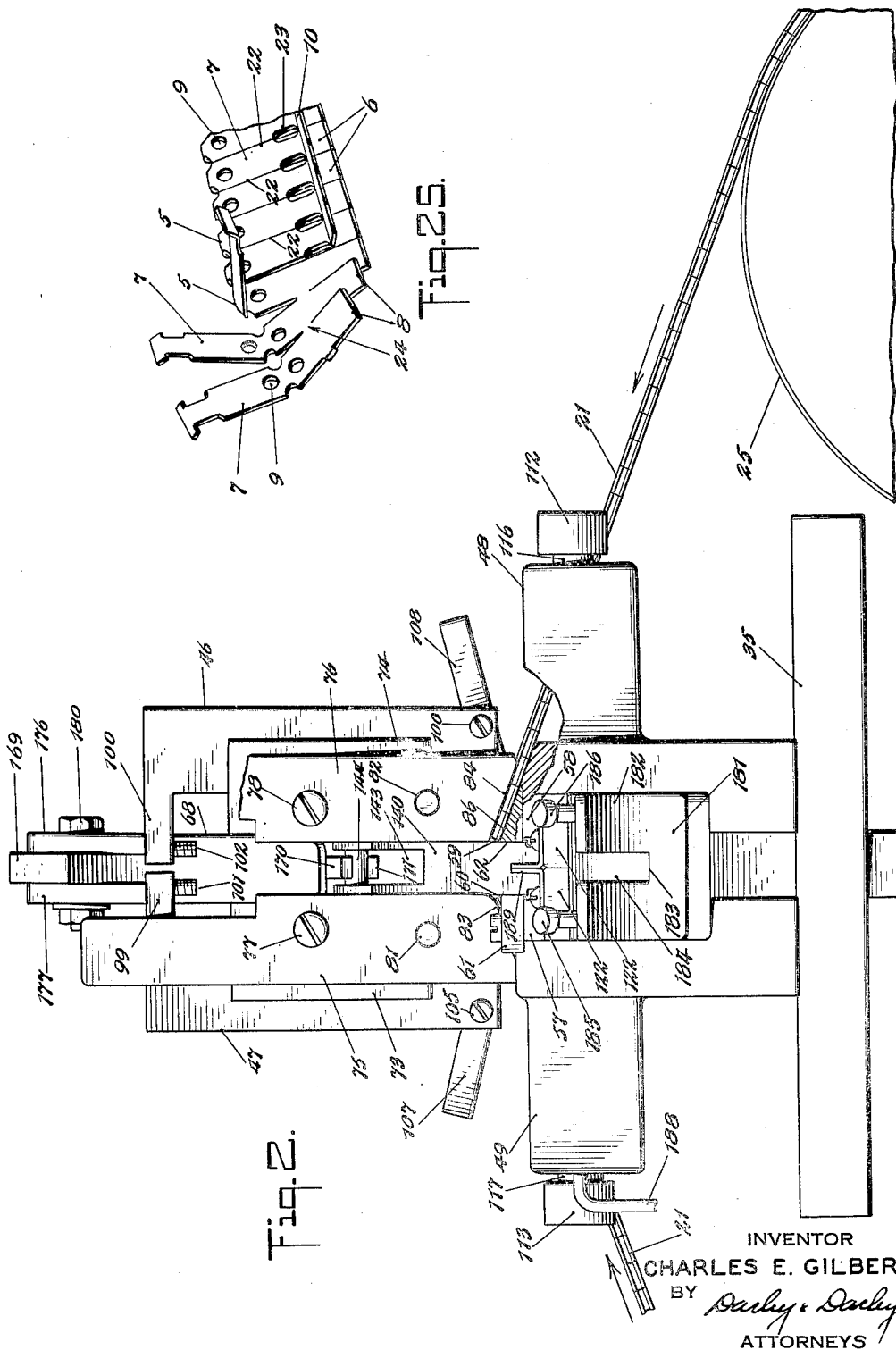
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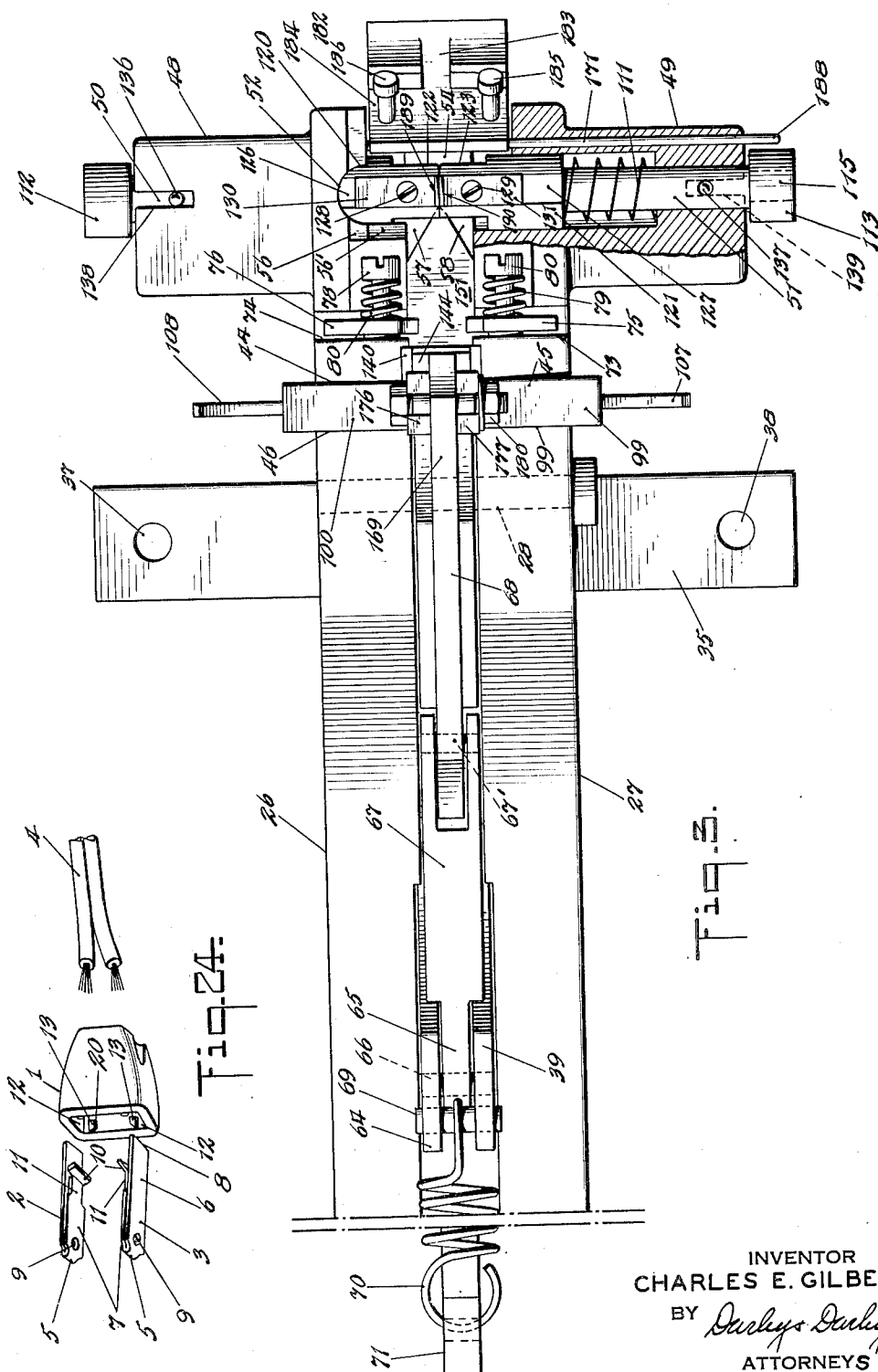
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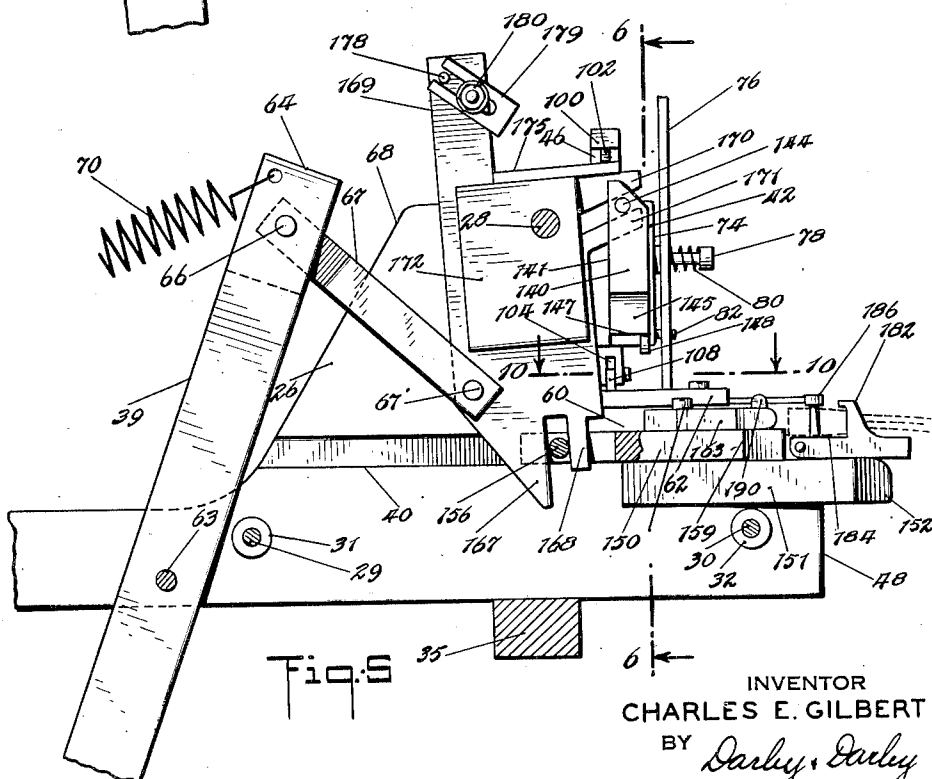
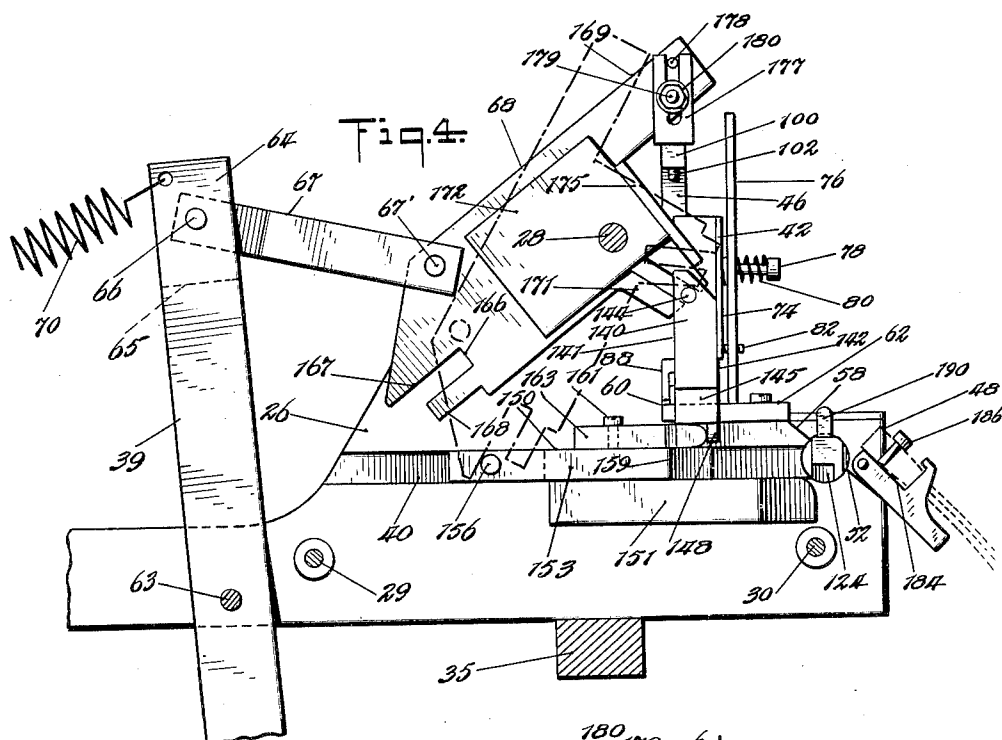
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8 Sheets-Sheet 4



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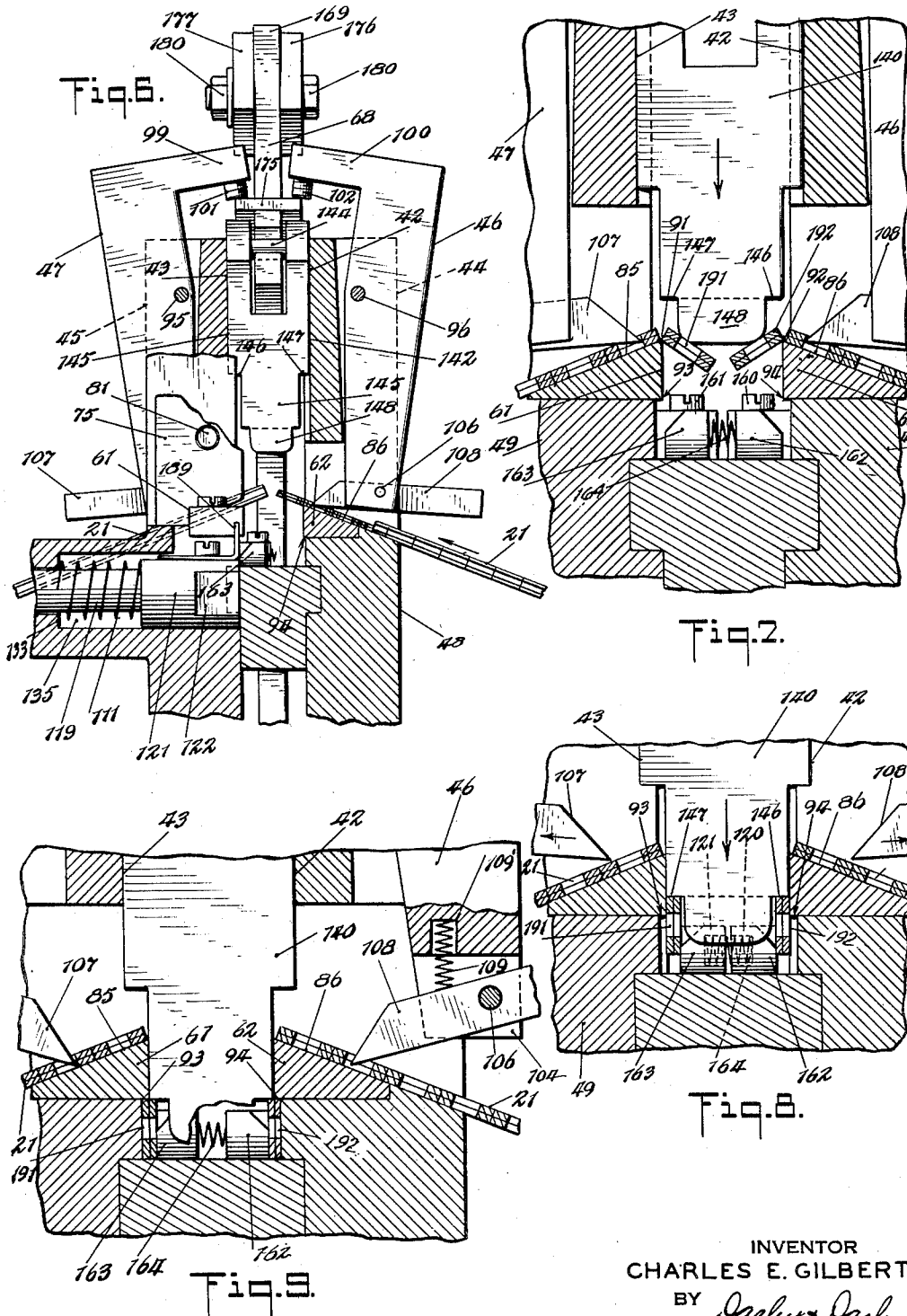
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MACHINE FOR ASSEMBLING ELECTRICAL CONNECTORS

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8 Sheets-Sheet 5



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MACHINE FOR ASSEMBLING ELECTRICAL CONNECTORS

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8 Sheets-Sheet 6

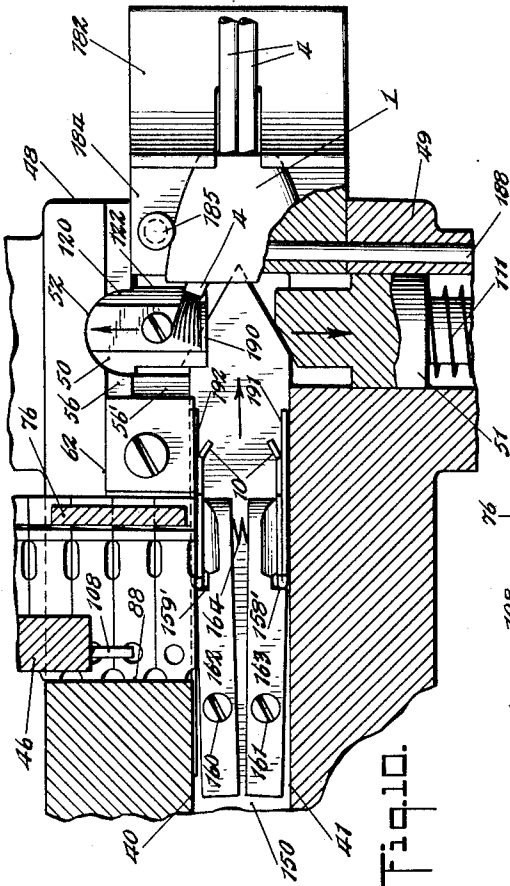


Fig. 10.

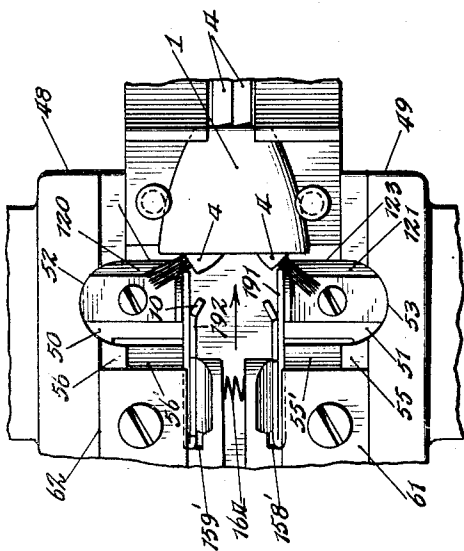
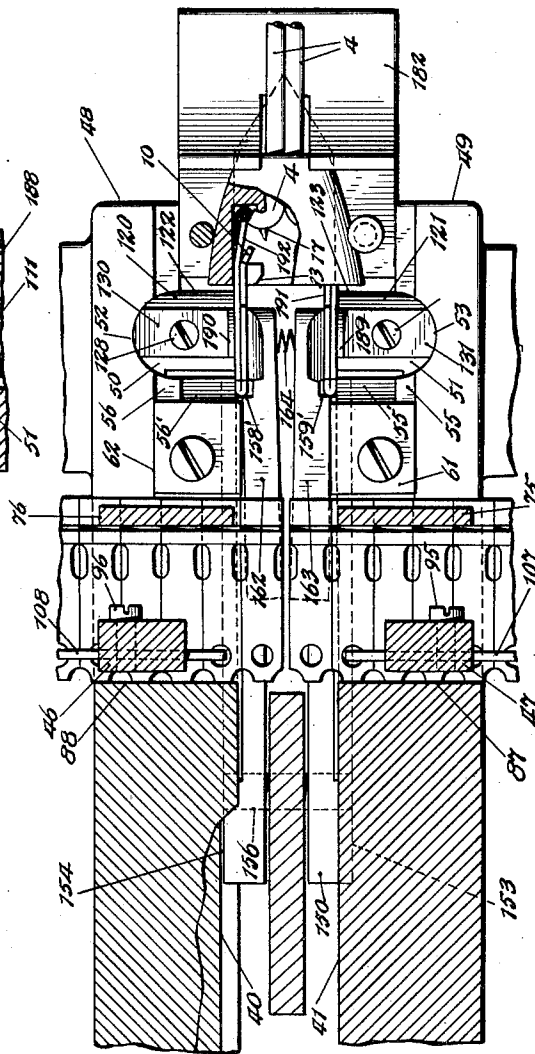


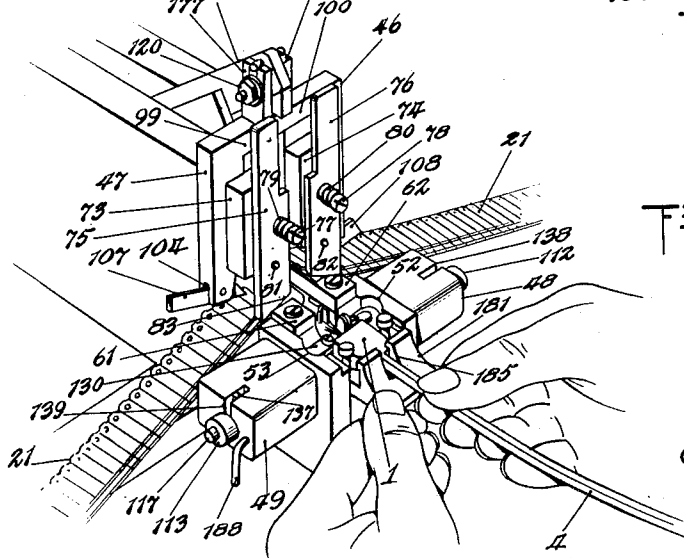
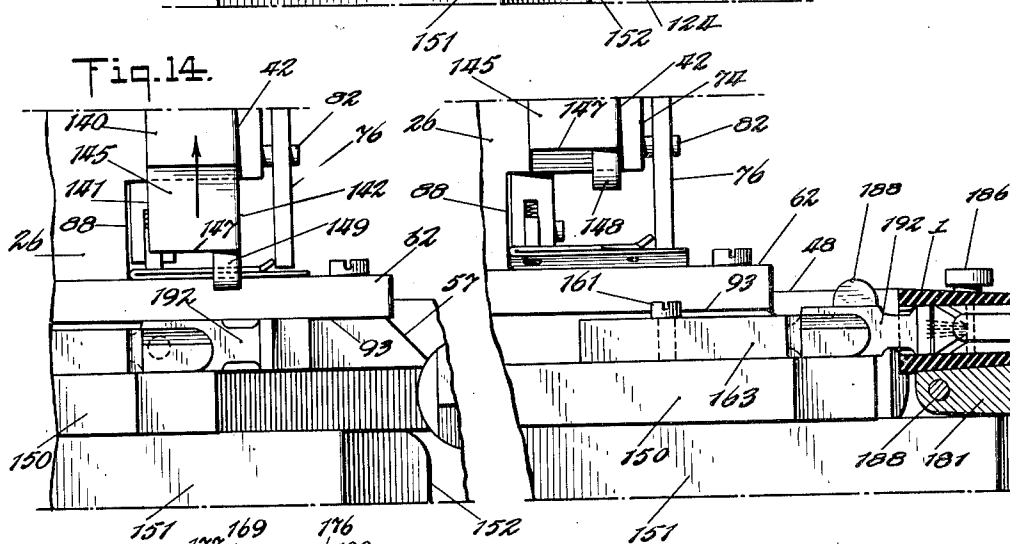
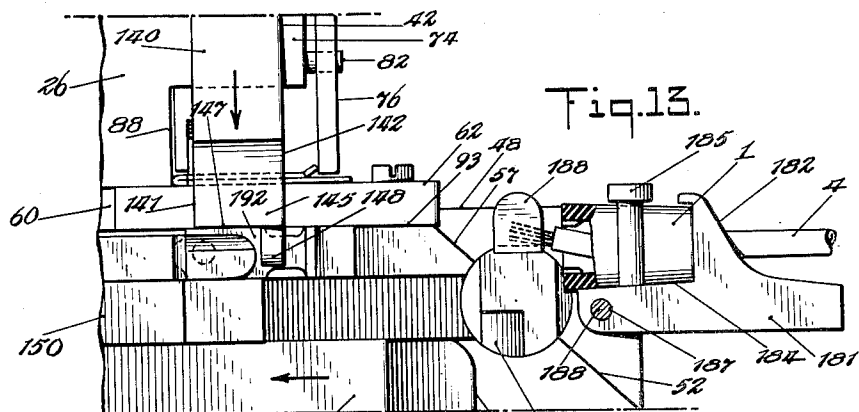
Fig. 11.



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MACHINE FOR ASSEMBLING ELECTRICAL CONNECTORS

8 Sheets-Sheet 7



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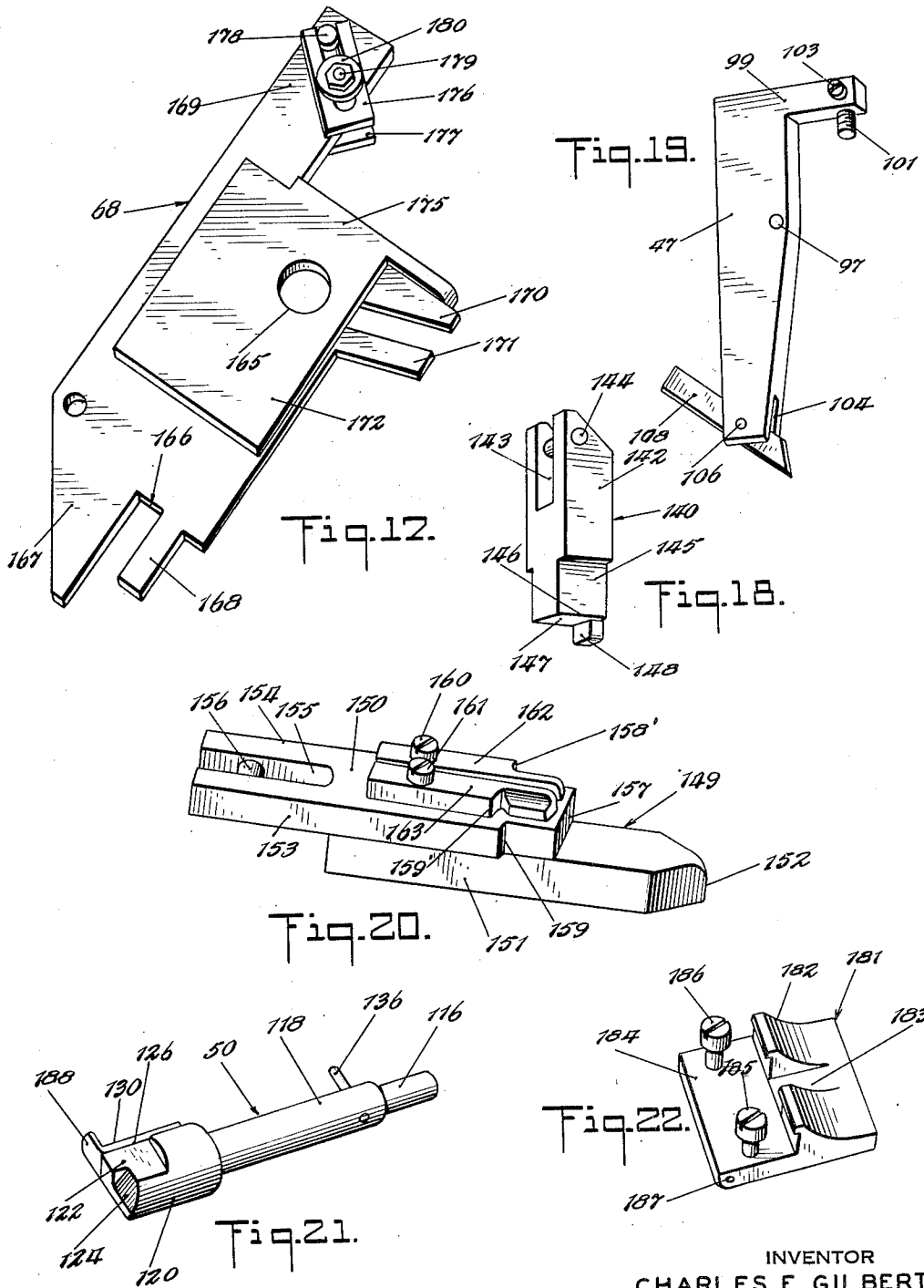
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MACHINE FOR ASSEMBLING ELECTRICAL CONNECTORS

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8 Sheets-Sheet 8



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UNITED STATES PATENT OFFICE

2,613,432

MACHINE FOR ASSEMBLING ELECTRICAL CONNECTORS

Charles E. Gilbert, Long Island City, N. Y.; Margaret Doris Gilbert, Norman Coates, and The Chase National Bank of the City of New York executors of said Charles E. Gilbert, deceased

Application June 13, 1947, Serial No. 754,468

6 Claims. (Cl. 29—206)

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This invention relates to a new and useful improvement in machines for assembling electrical connectors of the type disclosed in my Letters Patent No. 2,283,889 issued May 19, 1942.

In the above mentioned Letters Patent there is disclosed an electrical connector which is designed to be assembled manually and connected to an electrical conductor cord, without the use of any special tool. This connector construction is comprised of a one piece specially moulded plug body and two specially designed contact elements which are adapted to be securely positioned and retained in the plug body in correct alignment and also in secure contact with an electrical conductor cord without the use of screws, rivets or other attaching devices and the connection of the conductor cord to the contact elements is one of the steps in the assembly of the connector itself.

The main object of the present invention is to provide a machine which will eliminate all manual labor in connection with the assembly of these types of electrical connectors, and in the attachment of the electrical conducting cord thereto, and in which the assembly operation is carried out automatically and mechanically.

A further object of the invention is to provide a machine for assembling the electrical connectors of the type above mentioned, which will be relatively simple in construction, effectively rapid in operation, and which will automatically assemble the connectors in a substantially continuous manner.

For the purpose of illustrating the operation of the machine, I have selected the electrical connector construction which is shown and described in my Letters Patent No. 2,283,889, above referred to but it is to be understood however that the machine of the invention is not limited in its operation to the assembly of this type of electrical connector only, but may be readily adapted for use in assembling other types of connectors, such for instance as those disclosed in my Letters Patents Nos. 2,068,486 issued January 19, 1937; No. 2,229,288 issued January 21, 1941; and No. 2,019,532 issued November 5, 1935, and without departing from the scope of the invention.

Also, in illustrating the operation of the machine, I utilize strips of connected electrical connector contact elements which are formed so that they are adapted for use in plug bodies of the type disclosed in said Letters Patent No. 2,283,889, and these strips are made in accordance with the method disclosed and claimed in my Letters Patent No. 2,273,099 issued February 17, 1942.

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An illustrative embodiment of the invention is shown in the accompanying drawings in which—

Figure 1 is a side elevation of a machine made in accordance with my invention;

5 Figure 2 is a front elevation of the machine and showing a pair of contact element strips being fed thereto;

Figure 3 is a top plan view, with a part shown in section;

10 Figure 4 is a side elevation of the machine, with a side cover thereof removed, and showing the several parts of operating mechanism in their respective positions at the start of the assembly operation and indicating the position of the bellcrank lever of the mechanism in spaced broken lines just after the start of the said assembly operation;

Figure 5 is a view similar to Figure 4 but showing the position of the several parts of the mechanism at the finish of the movements thereof in assembling the electrical connectors;

Figure 6 is a sectional view of Figure 5 taken on the line 6—6 looking in the direction of the arrows;

25 Figure 7 is a partial sectional view of certain parts of the mechanism of the machine during the next sequence of the operation thereof and showing the shearing punch, forming part of the mechanism, as it is shearing off a pair of electrical contact elements from the contact element strips being fed to the machine;

Figure 8 is a partial front sectional view of certain portions of the mechanism and showing the next sequence of their operation and after the shearing punch has sheared off a pair of the contact elements from the strips, and as it pushes said contact elements downwardly between the frame of the machine and the spring biased dogs on the wedge slide device which is part of the operating mechanism;

40 Figure 9 is a partial front sectional view, somewhat similar to Figure 8, and showing the shearing punch at the completion of its downward movement and after the sheared off contact elements have been positioned for insertion into the plug body;

Figure 10 is a sectional plan view of a portion of the mechanism of the machine, taken on the line 10—10 of Figure 5, and looking in the direction of the arrows, and showing the shoulders on the spring biased dogs of the wedge slide device advancing the contact elements towards the plug body and also showing the slide wedge device pushing back the spreader plungers;

55 Figure 11 is a plan view of a portion of the

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mechanism shown in Figure 10, and showing the sheared off contact elements further advanced toward the plug body by the wedge slide device, and in the position they would be in just prior to being inserted into the said plug body;

Figure 12 is a plan view of a portion of the mechanism with the plug body shown partly in section, and showing the contact elements being finally inserted into the said plug body;

Figure 13 is a side elevational view of a portion of the mechanism and showing the shearing punch in its lowered position and after it has sheared off a pair of contact elements from the contact element strips, and also showing the lower end edges of the contact element strips guide pieces holding the strips against the back wall of the machine;

Figure 14 is a side elevational view similar to Figure 13, and indicating the shearing punch as it is rising towards its upward position, and also showing the sheared off contact elements being advanced in their slides by the wedge slide device for insertion into a plug body;

Figure 15 is a side elevational view similar to Figures 13 and 14, and showing the shearing punch in its uppermost position and the sheared off contact elements being inserted into the plug body by the wedge slide device;

Figure 16 is a perspective front view of the machine and showing the strips of contact elements being fed thereto and a plug body and connector and being positioned in the machine by an operator;

Figure 17 is a perspective view of the bell crank lever which forms part of the operating mechanism;

Figure 18 is a perspective view of the shearing punch used in the machine mechanism;

Figure 19 is a perspective view of one of the feed levers which feed the contact element strips to the machine;

Figure 20 is a perspective view of the slide wedge device which is a part of the operating mechanism of the machine;

Figure 21 is a perspective view of one of the spreader plungers;

Figure 22 is a perspective view of the plug body holder;

Figure 23 is a sectional view of a plug body and showing one of the contact elements in operative position therewith and clamping one of the conductor cords in place, and also indicating the other contact element partially inserted into the plug body;

Figure 24 is a perspective view of the elements which are assembled by the machine to provide the complete electrical connector; and

Figure 25 is a perspective view of a portion of a contact element strip of the type which is fed to the machine and showing several of the contact elements partially broken away from the strip.

Before describing the mechanism of the machine and its operation, reference will first be made to the details of construction of the electrical connectors which are intended to be assembled thereby. Reference will also be made to the construction and arrangement of the contact element strips which are fed to the machine during its assembling operation.

The connector to be assembled is shown in detail in Figures 23 and 24, and consists of four parts, namely, a plug body 1, the two contact elements 2 and 3, and a connector cord 4. The plug body is moulded from "Bakelite" or other

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suitable insulating material. The contact elements are made of a suitable conducting material which is bent upon itself as at 5 (more clearly shown in Figure 25) to form a two legged blade adapted to be inserted into an electrical outlet source. One leg 6 of the contact element is made so that it is somewhat longer than the other leg and terminates in a square end 8. The leg 6 is also provided with an opening 9 which is positioned so that it will be slightly above the point at which the contact element emerges from the body when the plug is in its assembled condition. The free end of the other leg 7 is formed with a latch 10 joined to the main part of the leg by a constricted neck 11, which is formed by stamping out portions of each edge of the said leg. The latch is offset outwardly at an acute angle to the general plane of the leg 7. The plug body is so moulded that it is formed with recesses 12, for the reception of each contact element. The inner end of each of these recesses is closed and the other end opens through the bottom of the plug. Each of these recesses is rectangular in shape and is of solid wall construction with the exception of the inner wall which is formed with a pair of opposed bosses 13, adjacent the open end of each recess, and another pair of opposed bosses 14, at the closed end of each recess. The bosses 13 and 14 form, with the other recess, a groove of substantially the same width as the width of the contact element and slightly thicker than the thickness of leg 6 of said contact element. The height of each boss 13 and 14 is limited to that required to form adequate guides and supports for the leg 6 so that ample space is left between them for the passage of the insulated conductor cord 4. The plug body is also provided with an opening 15 communicating with the interior of the plug and through this opening the conductor cord 4 is inserted. The opening 15 is separated from the bottom of each recess by a partial wall 16 which is cut away at the points opposite the recesses by V-shaped grooves 17 which are slightly narrower than the diameter of the connector cord.

When the connector is to be assembled, and the connector cord is to be connected thereto, by the operation of the machine of the present invention, the two insulated cord conductors are first separated and the insulation removed from their ends and they are then inserted through the opening 15 in the plug body until the bared ends project a little above the end of the plug body. The plug body is then positioned in the plug body holder of the machine, which will be more fully described hereinafter, and the machine is then operated to simultaneously effect the insertion of the contact elements into the plug body and to clamp the bare wire of each cord around the free end 8 of the long leg 6 of the contact element, and so that said wire will be positioned in the plug body as shown in Figure 23, and pinched between the outer wall of the recess 12 and the side of leg 6. In addition, when the contact elements have become fully inserted into the plug body, the insulated portion of the conductor cords just beyond the bared portions of the wire will become jammed into the V-shaped grooves 17 and bent sharply over the bottom edge of said groove before it enters the opening 15. When the legs 6 of the contact elements are being inserted into their recesses, by the operation of the machine, the offset latches 10 of the short legs 7 are caused to come in contact with the slop-

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ing faces 18 of the bosses 13. These bosses will thus act as cams to swing these legs inwardly and as the contact elements are further inserted into the plug body, the ends of legs 7 slide down the faces 19 of bosses 13 until their lower ends are reached and then the latches 10 snap under the lower ends 20 of the bosses and assume the position shown in the upper portion of Figure 23. The contact elements are then positioned so that they are rigidly held in accurate alignment by the walls of the recesses and bosses of the plug body and are locked against longitudinal displacement.

In Figures 16 and 25, I have shown the electrical contact element strips which are fed to the machine during its connector assembling operation. These contact element strips are made of a strip of thin conducting material such as indicated generally at 21 in Figure 2, and which has a width equal to the over-all length of the contact elements and a length which is sufficient to accommodate a plurality of contact elements to be fed to the machine. By one or more punching and stamping operations in forming the strip, the individual contact elements are formed in the manner above described and the strip is transversely slit as indicated at 22, each slit passing through the center of the stamped out portion 23. These slits are spaced apart a distance equal to the width of a single contact element and so that the contact elements are separated except for a slight portion 24, near the center of the width of the strip, and so that the strip will be held intact by the unsevered portion thereof. Thereafter, the strip is folded upon a line running longitudinally thereof as at 5, and when it is thus folded it comprises a plurality of completely formed contact elements wholly severed from each other except at their middle portions. The dimensions of the unsevered parts of the contact elements are such that it permits the individual contact elements to be readily sheared apart. The strips of contact elements, being self-supporting, are capable of being mounted around a pair of rotatable drums 25 (one of which is shown in Figure 2) and the two strips of the attached contact elements are automatically fed to the assembling machine during its operation, and the individual contact elements are caused to be sheared off from the strips by the operating mechanism of the machine and then inserted into the plug bodies in the manner to be hereinafter described.

The operating mechanism of the connector assembling machine, as particularly shown in Figures 1, 2 and 3 is supported by the two castings 26 and 27, which are secured together in spaced relation to each other, by the bolts 28, 29 and 30 and the spacer collars 31, 32 and 33 mounted on said bolts. The two castings are fixedly secured to the horizontally extending arms 34 and 35 which are adapted to be secured to a bench-top support (indicated generally at 36 in Figure 16) by suitable machine bolts and nuts inserted through openings 37 and 38 extending through said arms and through corresponding holes provided in said bench top support.

In securing the machine to the bench top support, the front horizontally extending arm 35 is fastened to the bench top so that it will lie flush with the front edge thereof and so that the supporting arms for the reels 25, which carry the strips of contact elements 21, may be secured to said front bar by suitable head screws. It is also intended that the bench top support be pro-

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vided with a slotted opening positioned at the rear of the machine so that the operating lever bar 39 of the machine mechanism will extend downwardly therethrough and can be operated from underneath the bench support by a suitable foot pedal which is not shown.

The inside faces of the two castings 26 and 27 are formed with cutaway portions forming slideways and recesses in which the several mechanisms of the machine are positioned and operate. These slideways and recesses are indicated in the drawings by the numerals 40, 41, 42 and 43. The outer faces of the castings are also formed with slotted recesses 44 and 45, in which are mounted the feed levers 46 and 47, which operate to feed the contact element strips from the reels 25, to the operating mechanism of the machine.

The forward lower portions of the castings 26 and 27 are formed with the housings 48 and 49, in which the spreader plungers 50 and 51, forming part of the operating mechanism, are slidably supported. The forward ends of the castings are also provided with the further cutaway portions indicated at 52, 53, 54, 55, 56, 55', 56', 57 and 58, the purposes of which will be more fully explained later on herein. The castings 26 and 27 are also provided with the slotted recesses 59 and 60, in which are positioned the hardened steel inserts 61 and 62, which will also be more specifically described hereinafter.

The operating lever bar 39 is rotatably mounted between the castings 26 and 27 on a bolt 63, and, as above stated, extends downwardly through an opening provided in the bench top support where its lower end is provided with an operating foot pedal. The upper end 64, of the operating lever, is slotted as at 65 (see Figure 3) and is pivotally mounted in the said slot, on a pinion 66, is one end of a lever 67. The other end of said lever 67 is connected as at 67' to a bell crank lever, indicated generally by the numeral 68 and which will be described more in detail hereinafter. Also secured to the upper end 64 of the operating lever bar, on a pinion 69, which extends through the slotted portion 65, is one end of a spring 70. The other end of said spring is secured to the upper end of a bar 71, which has its lower end fixedly secured between the ends of the castings 26 and 27 by a screw bolt 72 and so that its lower end edge will be supported on the bar 34.

Mounted on the front end faces 73 and 74 of the castings 26 and 27, are two guide pieces 75 and 76, which function to guide the two contact element strips 21, as they are fed into the machine from the reels 25. These guide pieces are held in resilient position on the front faces 73 and 74 of the castings, by the screw bolts 77 and 78, and the springs 79 and 80, and also by the pins 81 and 82. The lower end of each of said guide pieces is cut at an angle as at 83 and 84 (see Figures 2 and 6), to correspond with the inclined faces 85 and 86, of the hardened steel insert members 61 and 62, which are positioned and secured in the slotted recesses 59 and 60, in the castings, and the lower ends of the guide pieces are adapted to abut against the short up-turned portion 10 of the contact elements and so that the contact element strip will be held against the back walls 87 and 88 of the castings. The hardened steel insert members 61 and 62 are secured in the recesses 59 and 60 by means of the screw bolts 89 and 90, and are positioned so that their inner edges will slightly overlap the

edges of the slotted recesses and provide shearing edges 91 and 92 and the lower overhanging edges 93 and 94 (see Figures 6, 7 and 8) which form a grooveway with the walls of the castings.

Positioned in the slotted recesses 44 and 45 of the castings, and directly behind the guide pieces 75 and 75, are the contact element feed levers 46 and 47. These feed levers are pivotally mounted on the pins 95 and 96, which extend through openings 97 and 98 provided through said levers and through the side walls of the slotted recesses, and thus have a rocking movement with respect to said slotted recesses. The upper ends of said feed levers are formed with the horizontally extending arms 99 and 100, which are provided with the screw abutments 101 and 102, adjustably secured to the under faces of the arms by means of the set screws 103 (see Figure 19). The lower ends of said feed levers are slotted as at 104 and pivotally mounted in said slots, on pins 105 and 106, are the feed lever pawls 107 and 108 which are normally held in contact with the contact element strips by the springs 109, which are positioned so that each has one end abutting against a recess 109' formed in the slotted portion of a feed lever, and the other end secured to one of said pawls (see Figure 9).

Slidingly positioned in the housings 48 and 49 are the spreader plungers 50 and 51. The inner ends of these plungers are normally maintained in abutting relation with each other, as shown in Figures 2 and 3, by means of the springs 110 and 111, and may be manually moved away from each other against the action of said springs, by means of the knobs 112 and 113, which are secured to the ends 114 and 115 of the plungers. The plungers 50 and 51 are formed with the reduced portions 116 and 117 to the ends of which, as above stated, the knobs 112 and 113 are secured; the enlarged intermediate body portions 118 and 119; and the enlarged head members 120 and 121. The enlarged head members are formed with the cutaway portions 122 and 123 on the sides thereof; the angularly cut away parts 124 and 125 at the ends; and the flat top portions 126 and 127 the purpose of which will be hereinafter explained. Secured to the top flat portions 126 and 127, by the screws 128 and 129, are the spacer members 130 and 131. The springs 110 and 111 are positioned so that they surround the enlarged intermediate body portions 118 and 119 of the plungers, and with one end abutting against the outer ends of the enlarged head members 120 and 121, and the other ends of said springs abut against the end walls 132 and 133, of the enlarged chambers 134 and 135, formed in the housings 48 and 49. Thus, the head members 120 and 121 of the plungers are normally maintained by said springs in resilient abutting contact with each other by said springs. The plungers are also provided with the guide pins 136 and 137 which are positioned in the slots 138 and 139 formed in the housings 48 and 49. The detailed construction of one of the plungers is clearly shown in Figure 21 of the drawings.

Slidingly mounted in the grooves 42 and 43 of the castings, is a punch member, indicated generally by the numeral 140. The punch member construction is most clearly shown in Figure 18 of the drawings and is formed with a rectangularly shaped upper portion having the side faces 141 and 142, which are positioned to slide in the grooves or recesses 42 and 43, formed in the cast-

ings, and also has a slot 143 in which is positioned a pinion 144. The lower end of the punch member is formed with the reduced portion 145 which provides the overhanging ledges 146 and 147 and 145' and 147', the purpose of which will be more fully explained hereinafter. The bottom face of the reduced portion 145, is formed with the punch piece 148.

In the slideways 40 and 41, formed in the castings 26 and 27, is positioned the wedge slide device of the operating mechanism and which is indicated generally in the drawings by the numeral 149. The construction of the wedge slide device is more clearly indicated in Figure 20 where it is shown as formed with a rectangularly shaped upper portion 150 mounted on a lower portion 151 which is provided with the wedge point 152. The side faces 153 and 154 of the upper portion 150 are adapted to overhang the side faces of the lower portion 151 and to have sliding engagement in the grooves 40 and 41 of the castings. The rear end of said upper portion of the wedge slide device is provided with a slot 155 in which is fixedly positioned a pin 156 and the front end of said upper portion is formed with a reduced portion 157 which provides the shoulders 158 and 159. Pivotally secured to the top face of the upper portion of the wedge slide device, by the screw bolts 160 and 161, are the spring biased dogs 162 and 163 which have the spring 164, positioned therebetween. The spring biased dogs are also provided with the shoulders 158' and 159' the purpose of which will be described later on herein.

The bell crank lever 63 of the operating mechanism is mounted to rotatively operate between the castings 26 and 27 on the bolt 28, which passes through the opening 165, provided through said lever. The construction of the bell crank lever is best shown in Figure 17 of the drawings. One end of the lever is provided with a slotted portion 166 forming the fingers 167 and 168. The other end of the lever, at its upper part is formed with the arm 169, and at the lower intermediate portion of the lever there is provided the downwardly extending spaced fingers 170 and 171. The side faces of the lever may be formed with the raised portions 172 and 173 to properly space the lever between the two castings. Secured to the front edge 174 of the lever construction is a flat metallic piece 175. The arm 169 has secured thereto, on each side face thereof, the slotted abutment members 176 and 177, which are held in position on the arm in a desired adjusted position by means of the pin 178, and the screw bolt 179 and nut 180.

The bell crank lever 68, as above stated, is connected to the lever 67, which in turn is connected to the operating lever bar 33, so that when the operating lever bar is operated it will cause the bell crank lever to be rotated on the bolt 28. The fingers 167 and 168 of the bell crank lever are positioned so that they will engage the pinion 156 in the slotted portion 155 of the wedge slide device when the lever bar 33 is operated, and thus the bell crank lever will cause the wedge slide to be reciprocated backwards and forwards in the slide ways 40 and 41 of the castings. Also the fingers 170 and 171 of the bell crank lever are adapted to engage with the pinion 144, positioned in the slotted portion of the punch member 140, and thus the movements imparted to the bell crank lever will cause the punch member to be upwardly and downwardly in its grooves 42 and 43.

The abutment members 176 and 177, mounted on the arms 169 of the bell crank lever, are so

positioned that during the movements imparted to the bell crank lever they will strike against the top faces of the horizontally extending arms 99 and 100 of the contact element feed levers 46 and 47, and cause said levers to be rocked so that their lower ends and the pawls 107 and 108 thereof will be forced outwardly. Also the movements imparted to said bell crank lever will cause the plate 175 thereof to strike against the under faces of the screw abutments 101 and 102, secured to the arms 99 and 100 of the contact element feed levers, and thus cause said feed levers to be rocked in their grooves so that the lower ends thereof, and their pawls 107 and 108 will be forced inwardly. Thus, the movements of the bell crank lever will intermittently cause the pawls 107 and 108 of the contact element feed levers to advance the strips of contact elements in timed intervals, and for predetermined distances into the machine during its operations.

Removably mounted at the lower part of the machine is the plug holder 181, in which the electrical contact plug bodies 1 are placed during the assembly of the electrical connectors. The construction of the plug holder is most clearly illustrated in Figure 22 and consists of a metallic casting formed with an inclined portion 182 having a slotted opening 183 extending therethrough and in which the electrical conductor cord 4, to be assembled with the plug and contact elements, is placed, and a flat portion 184 upon which the plug body is adapted to be positioned. On the flat portion 184 there are mounted the spacer bolts 185 and 186, and the plug body is held between these bolts when it is inserted into the holder. The plug holder is also provided with a hole 187 therethrough, and is rotatively and removably held on the front portion of the machine between the housings 48 and 49, by means of the removable key 188 which is inserted through a hole 171 by extending through the housing 49 and into the housing 48. The plug holder is intended to normally rest upon the inclined cut away faces 52 and 53 which are formed at the front of the castings 26 and 27 and so that the plug bodies may be readily positioned with respect thereto, before the assembly operation of the machine is started. If at any time during the operation of the machine the contact elements should become jammed during the shearing operation or during their movements while being inserted into the plug bodies and it is necessary to remove said contact elements from the machine, the entire plug body holder assembly may be removed by simply removing the key 188 from the hole 171 and the hole 187 of the plug holder.

The operation of the several mechanisms of the machine in effecting the assembly of an electrical connector, and as clearly shown particularly in Figures 4 to 15 of the drawings, is as follows:

When the machine is to start the assembly operation, the several mechanisms thereof are positioned as indicated in Figures 1, 2, 3 and 4. The operating lever 39 is in its released spring retracted position with the bell crank lever 68, to which it is connected by the lever 67, positioned with its fingers 167 and 168 unengaged with the pinion 156 of the wedge slide device 149, and with its adjustable abutments 176 and 177 pressing against the arms 99 and 100 of the feed levers 46 and 47, and holding them down so that the lower ends of said feed levers will have their pawls 107 and 108, positioned as indicated in

Figures 2, 8 and 16. The fingers 170 and 171 of the bell crank lever will be holding the punch member 140 in its lowered position in the slide ways 42 and 43, and the wedge slide device 149 will be in its retracted position in its slide ways 40 and 41. The spreader plungers 50 and 51 are also being held in their housings 48 and 49 in their advanced positions by the springs 110 and 111, and with their upstanding spreader projections 189 and 190 abutting against each other. Also the plug holder 181 is positioned so that it is resting upon the inclined surfaces 52 and 53 of the front portion of the castings 26 and 27.

The ends of the two contact element strips 21, which are wound on the reels 25, are then caused to be inserted into the machine, and so that they will be supported upon the inclined faces 85 and 86 of the steel inserts 61 and 62 and with the said ends abutting against the side walls 141 and 142 of the punch member 140 (see Figure 2). The two guide pieces 75 and 76 of the machine are then positioned so that their lower ends 83 and 84 will abut against the short upturned latch portion 10 of the contact elements, as clearly shown, particularly in Figures 13 to 15, and so that said guide pieces will be holding the contact element strips against the back walls 87 and 88 of the castings 26 and 27. In placing the contact element strips in position in the machine, the upper ends of the guide pieces 75 and 76 are caused to be manually pressed inwardly against the action of the springs 79 and 80 to cause the lower ends thereof to move outwardly sufficiently so that a free insertion of the contact element strips into the machine may be effected.

A plug body 1, with the conducting cords 4 inserted therein, and with the bared ends of the cords extending from the end of the plug body, is then placed in the plug holder 181 and with the conductor cords extending through the slotted portion 183 thereof and so that the plug body is held on the flat portion 184 of the plug holder by the spaced headed bolts 185 and 186. The bared ends of the conductor cords are then positioned so that they will be separated from each other by the upstanding spreader projections 189 and 190 of the spreader plungers 50 and 51.

The lower end of the operating lever 39 is then caused to be pushed backwardly by the foot pedal attached thereto, and during this backward movement the operating lever, through lever 67, causes the bell crank lever to be rotated on its pinion 28. During the movement of the bell crank lever it first moves into the position indicated by the broken lines in Figure 4. At this point in its movement the fingers 170 and 171 thereof which are in engagement with the pinion 144 of the punch member 140, raise the said punch member upwardly in its slide ways and out of the path of the wedge slide device 149.

As the lower end of the operating lever 39 is pushed further backwardly by the foot pedal, as shown in Figure 5, and with the spring 70 fully loaded, the punch member 140 is caused to be raised to its full extent in its slide ways by the fingers 170 and 171 of the bell crank lever, and at the same time the fingers 167 and 168 of said bell crank lever will become engaged with the pinion 156 of the slide wedge device and will cause said device to be advanced in its slide ways, and towards the front of the machine. This further movement imparted to the bell crank lever causes the abutments 176 and 177 thereof, which have been pressing the arms 99 and 100 of the contact element feed levers 46 and 47 down-

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wardly, to move upwardly and away from said arms and to cause the plate 175 of the bell crank lever to strike against the screw abutments 101 and 102 secured to the under faces of the said arms, and cause the feed levers to be rocked in their grooves and so that their pawls 107 and 108 will be forced inwardly and operate to advance the contact element strips into the machine, as shown in Figure 6, the distance of one contact element for each strip indicated at 191 and 192, and so that each of said contact elements 191 and 192 will be positioned in the path of the punch member 140 on its next downward movement.

As the punch member 140 is again moved downwardly by the operation of the bell crank lever, its punch piece 148 strikes the two contact elements 191 and 192 and shears them off from the contact element strip (see Figure 7). In shearing off the contact elements 191 and 192, they are forced against the shearing edges 91 and 92 of the hardened steel insert 61 and 62, by the punch piece 148, and are separated from the strips along the line of transverse slits 22 formed in said strips.

As the punch member continues its downward movement, and after the contact elements 191 and 192 have been sheared off the strips, the said sheared contact elements are caused to be pushed downwardly by the shoulders 146 and 147 of the punch member as shown in Figure 8.

During the movement of the punch member in shearing off the contact elements 191 and 192, the bell crank lever 68 is, at the same time, moving the sliding wedge device rearwardly in its slide ways, and as the contact elements are being moved downwardly by the shoulders 146 and 147 of the punch member, the spring biased dogs 162 and 163 of the wedge slide device operate to push the said contact elements under the overhanging edges 93 and 94 of the steel inserts 61 and 62 which function to form, with the walls of the castings, guiding grooves in which the said contact elements are caused to travel towards the plug body during the next forward movement imparted to the wedge slide device.

As the wedge slide device is again advanced by the bell crank lever, the shoulders 153' and 159' of the spring biased dogs 162 and 163 are brought into contact with the inner ends of the contact elements and said contact elements are then simultaneously moved forwardly by the wedge slide device and towards the plug body, as shown in Figures 10, 11, 12, 13, 14 and 15, and until they have been finally inserted into said plug body as shown in Figure 12.

When the wedge slide device is advanced forwardly by the crank lever, the pointed end 152 thereof moves under the plug holder 181 and causes it to be raised into the position shown in Figure 5, and so that the plug body 1 will be positioned as shown in Figures 10, 11, 12, 13 and 15, to receive the contact elements 191 and 192 therein.

As the pointed end 152 of the wedge slide device moves forward under the plug holder its sides engage the cut away portions 124 and 125 of the enlarged head portions 120 of the spreader plungers 50 and 51, and cause said plungers to be cammed back from each other and against the action of the springs 110 and 111, and as the wedge device further advances, the spreader plungers are caused to be cammed further away from each other, and with the upstanding spreader projections 189 and 190, on the portions

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130, of the enlarged head portions 120 and 121, spreading the bared ends of the conductor cords 4 into a proper position so that they will lie in the path of the ends of the advancing contact elements 191 and 192.

When the wedge slide device has been advanced to the limit of its forward travel by the bell crank lever, the cut away side faces 123 of the enlarged head portions 120 and 121 of the spreader plungers will abut against the shoulders 158 and 159 of the upper portion 150 of the wedge slide device and said head portions of the plungers will thus be held in their cammed back positions and the plug body which is held by the plug holder 181 will have its end portion abutting against the cut away side faces 122 of said enlarged head portion of the plungers.

As clearly shown in Figures 11 and 12, the wedge slide device in advancing the contact elements 191 and 192, into the plug body, causes the ends of the longer legs of the contact elements, to bear against the bared ends of the connector cords 4, and force the same into the plug body so that they will be locked therein with the insulated portions of the cords jammed into the U-shaped grooves 17 formed on the interior of the plug body (see Figure 12) and the contact elements become locked in the plug body with the latches 10 thereof held under the bosses 13.

As is obvious, when the operating lever is further manipulated by its foot lever the several mechanisms of the machine are returned to their initial position, and the assembled connector is then removed from the machine and a new plug body and conductor cord is inserted in the plug holder and the assembly operation of the contact elements with the new plug body is repeated.

It will be understood that the specific description of the machine heretofore given is solely for the purpose of explaining the nature of my invention and that the invention is not limited in any way thereby, but is susceptible to many modifications in detail without departing from the scope of my invention.

What is claimed is:

1. A machine for assembling electrical connectors comprising a frame, a pair of reels operatively secured to said frame and each adapted to support thereon a strip of semi-connected electrical contact elements, a pair of movable levers pivotally mounted in slotted recesses formed in said frame and each having feeding pawls operatively positioned on the lower end thereof and adapted to engage and feed said strips from said reels toward each other and into the machine substantially horizontally, a punch mechanism slidably positioned in slideways formed in said frame for shearing off contact elements from said strips, one contact element at a time from each strip, as said strips are fed into the machine by said feeding pawls, said punch mechanism including means for rotating sheared off contact elements into substantially vertical planes, pivotally mounted means for supporting an electrical connector plug body and an electrical conductor cord in the machine so that in one position thereof the contact elements sheared from said strips may be assembled with the plug body and connector cord, mechanism slidably mounted in slideways formed in said frame for advancing sheared off contact elements into assembled relation with respect to a connector plug body and connector cord when they are mounted on said supporting means and for positioning said supporting means for said plug body and connector.

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cord so that the plug body and connector cord will receive said contact elements, a lever rotatively mounted in said frame and provided with means for engaging the punch mechanism, and the mechanism for moving the contact elements and positioning the plug body and conductor cord supporting means, and the contact element feed levers to cause the same to be operated in timed relation to each other, and means for effecting the operation of said lever.

2. A machine for assembling electrical connectors comprising a frame consisting of a pair of spaced castings formed with hollow housings on the front end thereof, a pair of reels operatively secured to said frame each adapted to support thereon a strip of semi-connected electrical contact elements, a pair of movable levers pivotally mounted in slotted recesses formed in said castings for feeding said contact element strips from said reels and towards each other into the machine substantially horizontally, said feed levers each having horizontally extending arms at their upper portion provided with screw abutments adjustably secured to the under faces thereof and a pawl member pivotally secured to the lower end thereof for contacting and feeding said contact element strips into the machine, means adjustably secured between said castings forming guideways for said strips as they are fed into the machine, guide means resiliently mounted on the castings for guiding the travel of said strips in said guideways, a punch member slidably mounted in slideways formed in said castings, and positioned so that it will operate in the pathway of said strips as they are fed into the machine and progressively shear off contact elements, one from each strip, said punch member being formed with shoulders for positioning the sheared off contact elements in the machine in substantially vertical position for insertion into an electrical plug body, a movable holder mounted on the machine for receiving and supporting thereon an electrical connector plug body and an electrical conductor cord, a member slidably supported in slideways formed in said castings having a wedge point at its forward end and spring biased dogs mounted on the top face thereof, said member being adapted to be moved in its slideways so that said spring biased dogs thereof will cause said sheared off contact elements to be advanced into assembled condition with a connector plug body and a conductor cord when they are positioned on said holder and said wedge point will cause said holder to be positioned so that the connector plug body and conductor cord will receive said contact elements, and means operatively positioned between said castings for effecting the operation of said feed levers, punch member, and said member for advancing said contact elements and for positioning said connector plug body, in timed relation to each other, and means for effecting the operation of said levers.

3. A machine for assembling electrical connectors comprising, in combination, mechanism for feeding two separate strips of semi-connected electrical contact elements substantially horizontally towards each other into the machine, mechanism for simultaneously and progressively shearing contact elements from the free ends of each of said strips as said strips are intermittently advanced into the machine by said feeding mechanism, said shearing mechanism also serving to turn said sheared contact elements into parallel vertical planes, means for receiving said sheared contact elements and for inserting said elements

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into an electrical connector body, means for supporting an electrical connector body and an electrical conductor cord on the machine in operative position to receive said contact elements from said inserting means, and means for effecting the operation of said feeding, shearing and inserting mechanisms in timed relation to each other.

4. A machine for assembling electrical connectors comprising, in combination, mechanism for feeding two separate strips of semi-connected electrical contact elements substantially horizontally towards each other into the machine, mechanism for simultaneously and progressively shearing contact elements from the free ends of each of said strips as said strips are intermittently advanced into the machine by said feeding mechanism, said shearing mechanism also serving to turn said sheared contact elements into parallel vertical planes, means for receiving said sheared contact elements and for inserting said elements into an electrical connector body, means for supporting and positioning an electrical connector body and an electrical conductor cord on the machine, means forming part of said contact inserting means for positioning said connector body positioning means for reception of said contact elements by the connector body, and means for effecting operation of said feeding, shearing and inserting mechanisms in timed relation to each other.

5. A machine for assembling electrical connectors comprising a pair of movable levers having feeding pawls mounted thereon for horizontally feeding two separate strips of semi-connected electrical contact elements toward each other into the machine, a vertically reciprocatory punch for shearing off individual contact elements from the end of each of said strips simultaneously, said punch also serving to position sheared-off contact elements in vertical parallel planes, a horizontally movable contact receiving element, said contact receiving element receiving the contacts sheared from the strip by said punch and inserting them in a connector body, means for pivotally supporting a connector body together with an electrical conducting cord on said machine, means comprising a wedge-shaped portion on said horizontally movable element for rocking said supporting means about its pivot to position a connector body for reception of contact elements from said horizontally movable contact-inserting means, and a common actuator for said feeding pawls and said horizontally movable element, said common actuator serving to operate said elements in timed relationship to each other.

6. A machine for assembling electrical connectors comprising, in combination, mechanism for progressively feeding two strips of semi-connected electrical contact elements substantially horizontally towards each other into the machine, means mounted on the machine for guiding the travel of said strips as they are fed into the machine, mechanism for progressively shearing off individual contact elements from the free ends of said strips, one from each strip, during the intermittent advance of said strips into the machine, a holder pivotally mounted on the machine for supporting an electrical plug body together with an electrical cord having bared wire ends, means for positioning sheared off contact elements in parallel vertical planes, mechanism for receiving sheared off contact elements while in said vertical parallel planes and for moving said contact elements toward a plug

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body mounted on said supporting means, means operable by said contact element moving means for moving said supporting means to position the plug body thereon to receive contact elements carried thereby, means also operable by said contact element moving means for positioning the bared ends of a conductor cord into the path of the contact elements as they are moved into the plug body, and means for effecting the operation of said strip feeding mechanism, contact element shearing mechanism and plug body positioning and contact moving mechanism in timed relationship each to the other.

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