

March 20, 1951

K. H. ANDREN
MECHANISM FOR APPLYING ELECTRIC
TERMINALS TO STRANDED WIRES

2,545,756

Filed May 24, 1947

4 Sheets-Sheet 1

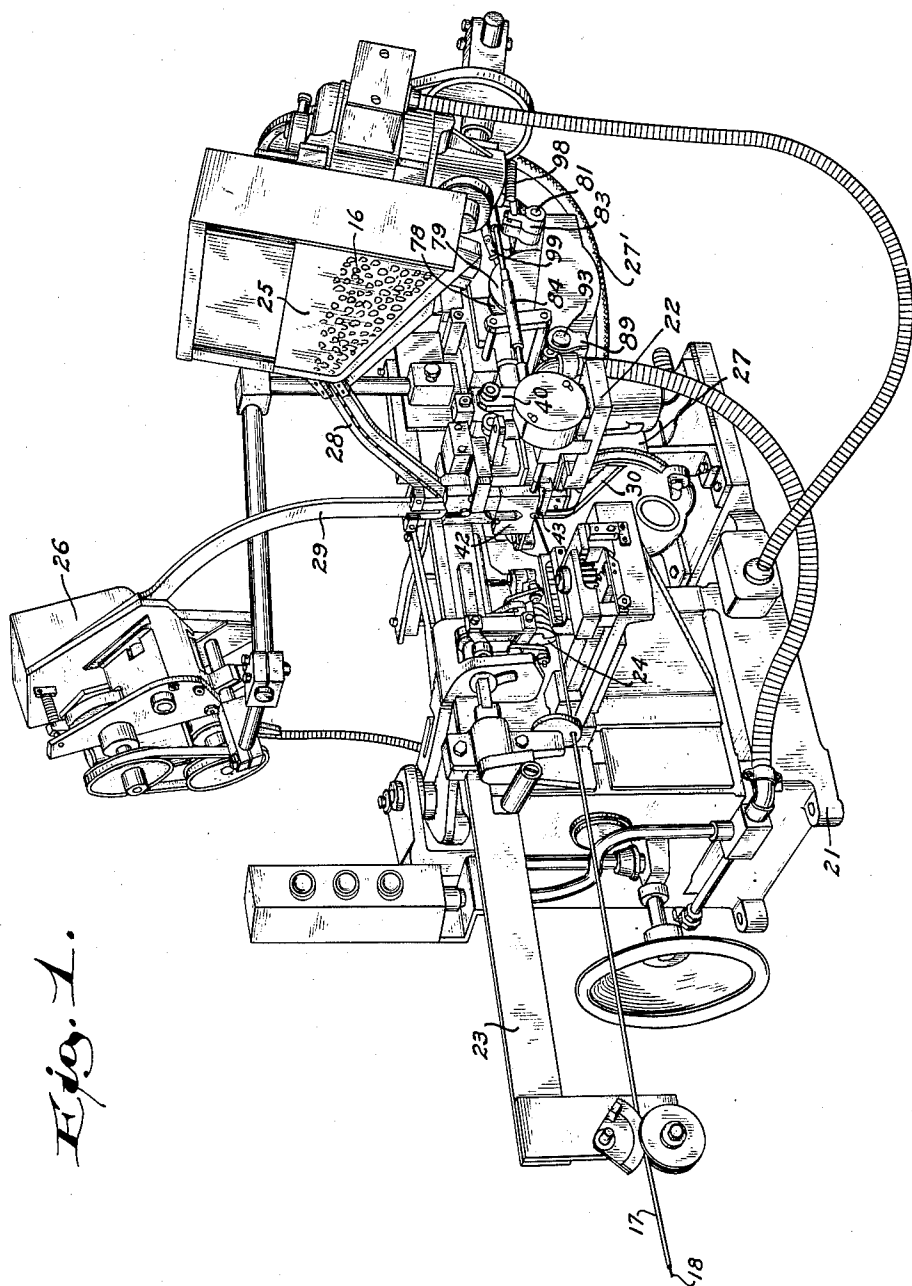


Fig. 1.

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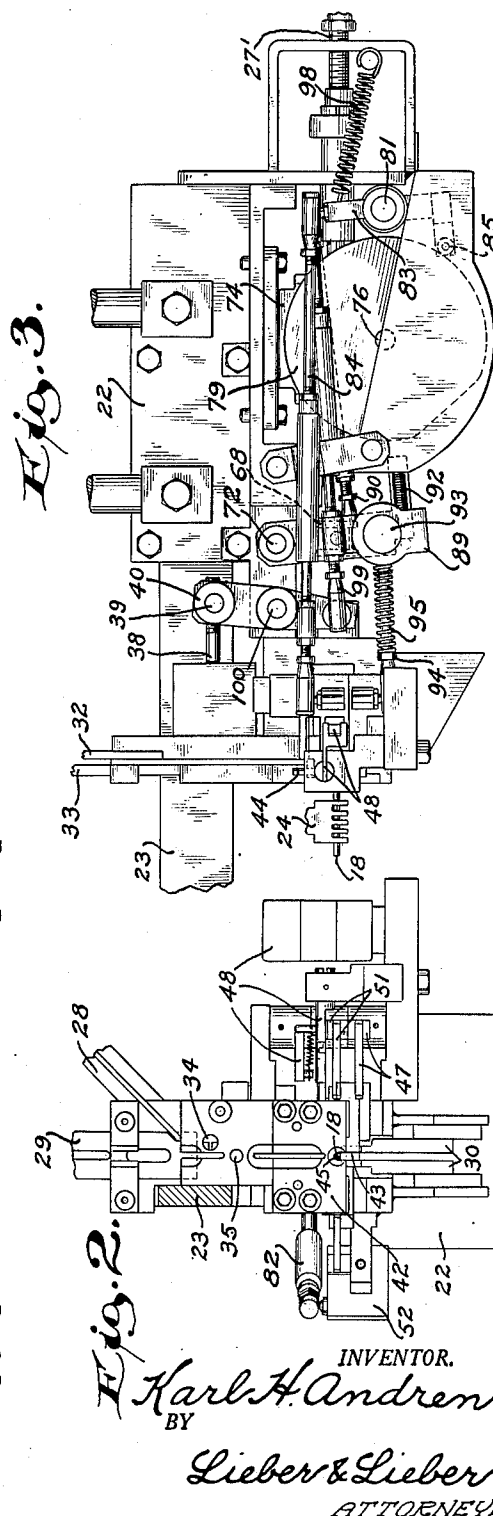
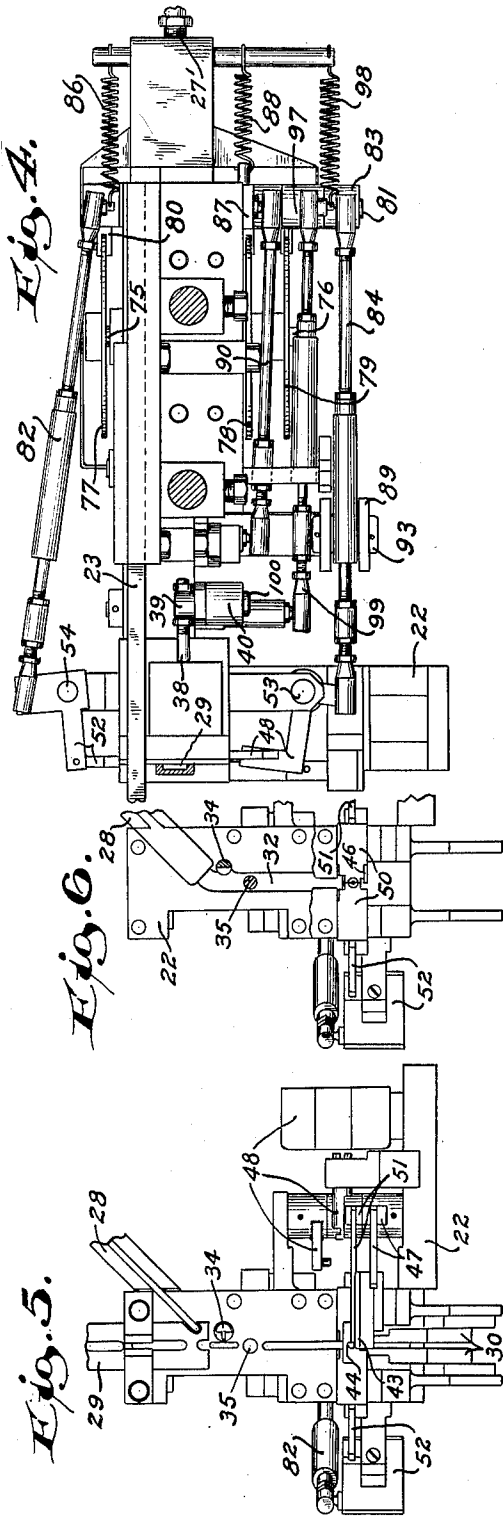
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4 Sheets-Sheet 3

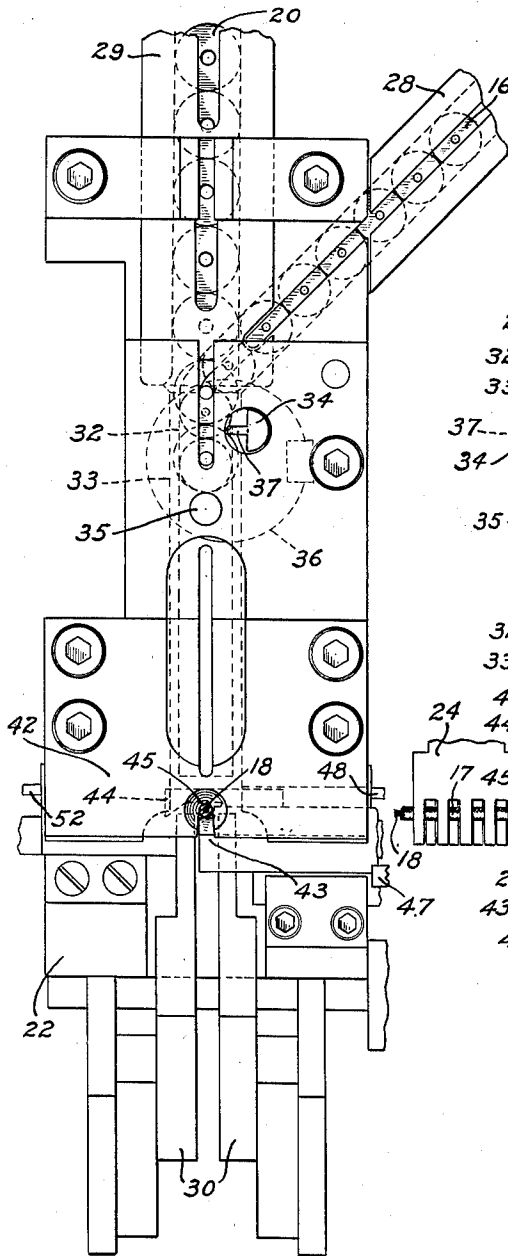


Fig. 7.

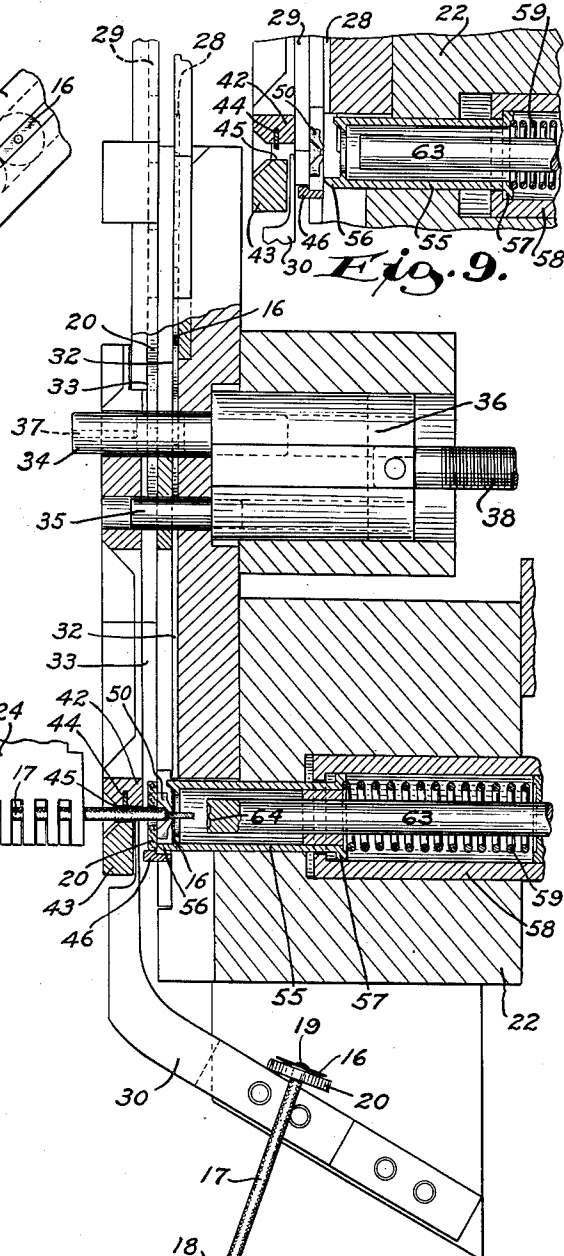


Fig. 8.

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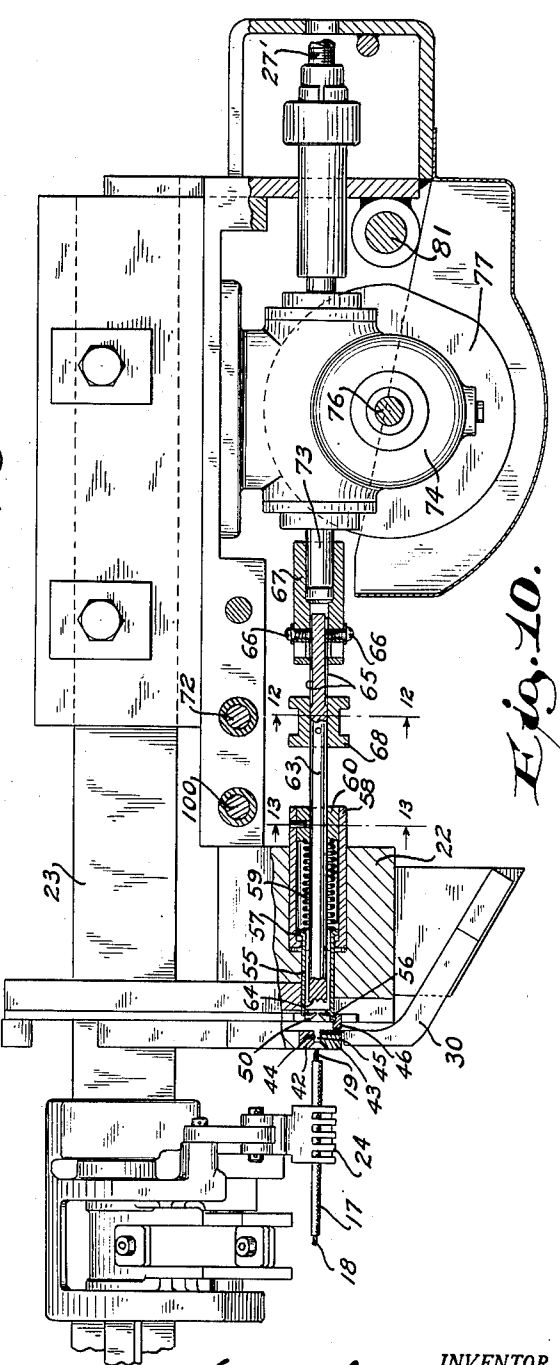
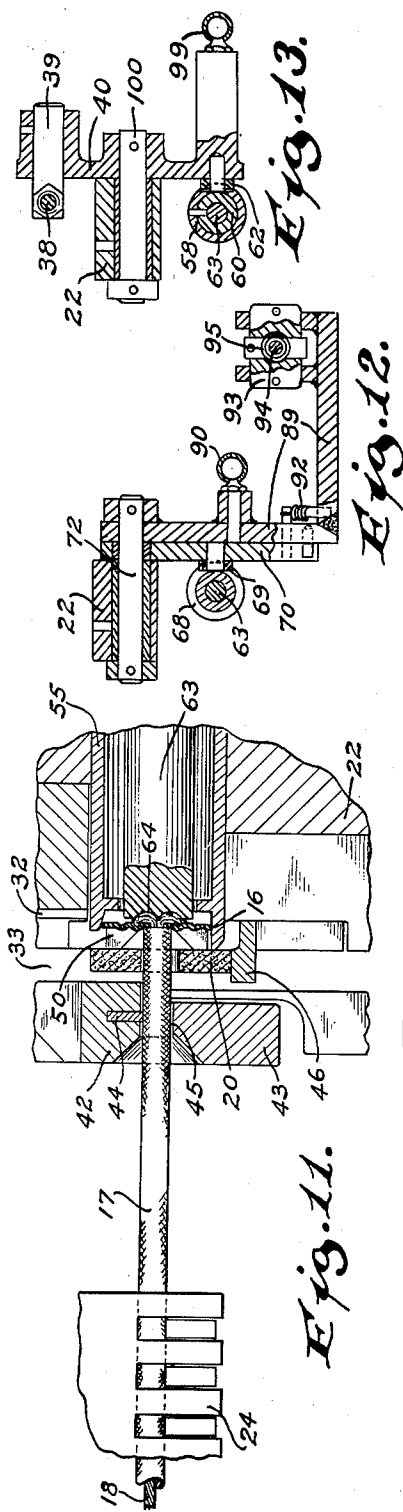
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4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,545,756

MECHANISM FOR APPLYING ELECTRIC
TERMINALS TO STRANDED WIRES

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Application May 24, 1947, Serial No. 750,195

4 Claims. (Cl. 153—1)

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The present invention relates in general to improvements in the art of manufacturing composite electric terminals or the like, and relates more specifically to improved apparatus for producing electric terminal assemblages of the type having a contact disk firmly attached to the stripped end of an insulated wire which is embraced adjacent to the disk by an insulating washer.

The primary object of my invention is to provide improved mechanism for producing special composite electric terminals.

It is desirable in certain industries and especially in the manufacture of radios and automobiles, to provide composite terminals each consisting of a transverse metal contact plate or disk pierced by and firmly secured to the stripped end of a short length of insulated stranded wire, the insulated portion of which is loosely embraced adjacent to the metal disk by an insulating washer. The metal disks of these terminals must not only be firmly and conductively attached to the metallic stranded wires, but each disk must also snugly engage or abut the adjacent end of the wire insulation, and since many thousands of these composite terminals are constantly required, the speed of production thereof must be enhanced to a maximum while the manufacturing cost should be minimized, without danger of producing defective assemblages due to such quantity production. The prior methods of manufacturing such composite terminals was not only slow and tedious, but it was also unreliable because it failed to insure proper contact between the metal disk and the adjacent ends of the wire and its insulation in each assemblage, and this previous assembly method also made the cost of production excessive.

It is therefore a more specific object of my present invention to provide simple yet highly efficient instrumentalities for producing such special electric terminals, in rapid succession and in a dependable manner.

Another specific object of this invention is to provide durable and reliable apparatus for effecting automatic production of electric terminals for stranded and insulated wires.

A further specific object of the invention is to provide improved mechanism for attaching disk contacts or plates to the stripped ends of wires, in a manner whereby the disks properly abut the adjacent ends of the wire insulation, and are also firmly and conductively secured to the wires.

Still another specific object of my invention

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is to provide an automatic terminal producing unit which functions with minimum attention to properly assemble and to produce perfect composite terminals from parts fed en-masse to the unit.

An additional specific object of the present invention is to provide improved apparatus for manufacturing composite stranded wire and disk terminals from insulated wire and rigid disks, both speedily and at minimum cost.

These and other objects and advantages of the invention will be apparent from the following specific description.

A clear conception of the several steps involved in my new system of terminal production, and of the construction and operation of apparatus for carrying on commercial exploitation of the system, may be had by referring to the drawings accompanying and forming a part of this specification in which like reference characters designate the same or similar parts in the various views.

Fig. 1 is a perspective view of the improved automatic terminal assembly unit or mechanism, showing the unit cooperating with an insulated wire cutting and stripping machine;

Fig. 2 is a part sectional end elevation of the terminal assembly mechanism, especially adapted for coaction with a wire cutting and stripping machine, the mechanism being viewed in the direction of travel of the successive wire segments, and the upper portions of the disk and washer feed chutes having been broken away;

Fig. 3 is a side elevation of the same mechanism, with the switch box and parts supply hoppers omitted, and also having portions of the feed chutes and wire clamp broken away;

Fig. 4 is a part sectional top view of the mechanism shown in Figs. 2 and 3;

Fig. 5 is a view similar to that of Fig. 2 with parts omitted so as to reveal the final terminal ejector or knock out device;

Fig. 6 is another view similar to that of Figs. 2 and 5, but with additional parts of the assemblage removed so as to reveal the interior of the metal disk feed chute and the wire strand guiding slides which are shown in closed position;

Fig. 7 is an enlarged fragmentary end elevation similar to Fig. 2, but showing more details of construction of the disk and washer feeding devices;

Fig. 8 is a likewise enlarged central vertical section showing the washer and disk feeding pins in holding position and an end stripped

wire just after it has been advanced through a previously positioned washer and threaded through a complementary disk, and also showing a completed terminal assemblage being delivered from the unit;

Fig. 9 is a fragmentary section similar to that of Fig. 8 but showing the position of the assembly parts shortly after a completed terminal has been discharged therefrom and before a subsequent washer, disk and wire have been delivered thereto;

Fig. 10 is a somewhat smaller but still enlarged part sectional side elevation similar to that of Fig. 3 with various parts omitted in order to clearly reveal the wire feeding clamp, the disk locating plunger in action, the wire strand guides, and the end strand spinning and pressing rod;

Fig. 11 is a considerably enlarged fragmentary section through the terminal assembly elements, similar to that of Fig. 10, but showing the parts in action to finally unite the wire and contact disk;

Fig. 12 is a transverse section through the mechanism taken along the line 12—12 of Fig. 10, and showing the actuating connection for the strand spinning and pressing rod; and

Fig. 13 is another transverse section through the mechanism taken along the line 13—13 of Fig. 10, and showing the actuating connection for the disk locating plunger.

While the improvement has been shown and described as being especially adapted for the production of composite terminals each having an insulated wire loosely embraced by an insulating washer and provided at its stripped end with a contact disk held firmly against the end of the wire insulation by twisting and compressing of the wire strands, it is not my desire or intention to unnecessarily limit the invention by virtue of this restricted embodiment, since the improved apparatus may also be advantageously utilized in terminals wherein the insulating washer is omitted and in which contact members other than circular metal disks are attached to the stripped ends of stranded or solid insulation covered wires.

In accordance with the improved terminal assembly system involved in the present invention, I assemble composite electric terminals each having a contact member or disk 16 abutting the end of the insulation 17 adjoining the stripped end of a stranded wire 18, by initially positioning and holding the disk 16 in fixed position, by thereafter advancing the insulated stranded wire 18 longitudinally with its stripped end 19 approaching the disk 16 and by guiding the strands of the stripped wire end 19 through a constricted passage in order to consolidate these end strands while they are being threaded through a central perforation in the disk 16, by subsequently holding the wire against further longitudinal displacement while forcing one face of the disk into snug engagement with the adjacent end of the wire insulation 17 to thereby cause the stripped wire end 19 to protrude well beyond the opposite face of the disk 16, and by finally simultaneously twisting and spreading the strands of the protruding wire end 19 while forcing these strands against the opposite disk face preparatory to the application of solder. The insulation washer 20 included in the specific terminal assemblage disclosed, is applied to each wire while it is being initially advanced toward the held contact disk, and the wires 18 used in these terminals may be of any

desired length depending upon the intended ultimate use of the completed terminal assemblages. The successive steps of this improved terminal assembly system may be expeditiously and automatically performed in rapid succession by means of an improved unit which may be readily applied to a wire cutting and stripping machine such as disclosed in my prior patent, No. 1,787,658, granted January 6, 1931.

A typical embodiment of mechanism for effecting commercial exploitation of my improved terminal assembly system, is illustrated in the drawings, and the unit shown comprises in general a main frame 22 adapted to be associated directly with the guide bar 23 for the wire advancing clamp 24 of a cutting and stripping machine, and providing a support for a contact disk supply bin 25, an insulation washer supply hopper 26, feeding and positioning structure for the successive disks 16 and washers 20, guiding and attaching elements for the successive lengths of wire 18, and propelling mechanism for the various parts operable through a shaft 27' by an electric motor 27 either supported on a separate base 21, or directly upon the frame 22, see Fig. 1. The wire feeding clamp 24 is adapted to move back and forth along the guide bar 23 of the cutting and stripping machine in a well known manner so as to advance the successive length of wire 18 with the stripped end 19 of each segment pointing toward the terminal assembly zone of the unit, and the metallic contact members or disks 16 are ordinarily centrally perforated and are adapted to be delivered by gravity from the supply bin 25 toward the assembly zone through a downwardly directed incline chute 28, while the fibrous insulation washers are adapted to be likewise delivered from the supply hopper 26 through a downwardly oppositely inclined chute 29. The successive completed terminal assemblages are also adapted to be delivered by gravity away from the assembly zone along inclined discharge rails 30, and these various supply and discharge members are adjustable relative to the supporting frame 22 in order to insure proper cooperation with the terminal assembly zone, see Figs. 1, 3, 7 and 10.

The inclined disk supply chute 28 communicates at its lower end with the upper end of a vertical guide slot 32 the lower extremity of which terminates at the assembly zone, and the inclined washer supply chute 26 likewise communicates with the upper end of a somewhat wider guide slot 33 disposed laterally of but adjacent to the slot 32 and also terminating at the zone of assembly, see Figs. 7 and 8. The parallel slots 32, 33 are adapted to be spanned by parallel upper and lower disk and washer feed control pins 34, 35 respectively, both secured to a horizontally reciprocable plug 36, and the longer upper pin 34 is semi-cylindrical in cross-section directly adjacent to the plug 36 but is provided with a horizontal fin 37 at its outer free end beyond the end of the pin 35, while this lower short pin 35 is cylindrical throughout its entire length. As illustrated in Fig. 8, both of the feed control pins 34, 35 span both of the slots 32, 33, and thus prevent dropping of any disks 16 or washers 20, but the spacing and the length of these pins is such, that when the plug 36 is moved toward the right sufficiently to withdraw the lower pin 35 from the slots, only one disk and one washer will descend down the slots toward the assembly zone, the columns of disks and washers above the upper

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pin 34 being supported and prevented from descending by the fin 37. However, when the plug 36 and pins 34, 35 are returned to the position shown in Fig. 8, the lower pin 35 will span the slots 32, 33 thus limiting the downward movement of the disk and washer columns to the height of one disk 16 and one washer 20, while the semi-circular portion of the upper pin 34 will permit these columns to thus drop into engagement with the pin 35. The plug 36 is provided with a threaded actuating rod 38 projecting rearwardly therefrom and which is engaged by a transverse shaft 39 coacting with the upper end of a lever 40, and which is operable at properly timed intervals as will be later explained, see Figs. 3, 4, 8 and 13.

The wire advancing clamp 24 which is reciprocable along the guide bar 23, forms a part of the wire cutting and stripping machine, and is adapted to advance the successive end stripped lengths of stranded wire 18, longitudinally toward the terminal assembly zone located at the lower extremities of the slots 32, 33, with the stripped wire ends 19 pointing toward the center of this zone. A wire directing and releasing assemblage comprising an upper stationary member 42 and a lower transversely movable guiding and wire clamping member 43, and a wedge-shaped terminal ejector 44 mounted upon the member 43 and being slidable transversely within the upper member 42, is located outwardly in advance of the lower extremity of the washer conducting slot 33; and the members 42, 43 of this assemblage are recessed to provide a conducting passage 45 for the successive wire lengths and are also provided with tapered socket portions converging toward this passage 45, as clearly shown in Figs. 7 and 8. The space beneath the lower extremity of the slot 33 is provided with a laterally removable ledge or stop element 46 which is adapted to position the successive insulation washers 20 delivered from the slot 33, with the central openings of these washers in axial alignment with the passage 45. The lower member 43 of the wire directing assemblage is periodically reciprocable by a connection and lever 47, while the terminal ejector 44 which is attached to the member 43, is likewise reciprocable by this connection and lever. The improved unit is also provided with parts 48 adapted to automatically stop the machine if no terminal producing constituents are delivered to the assembly zone. When the wire guiding and releasing parts are in the position illustrated in Figs. 7 and 8, the tapered converging socket leading into the passage 45, will conduct the successive wire segments into the terminal assembly zone, and these segments will be held and clamped against displacement by the members 42, 43 and will also be prevented from moving longitudinally by the clamp 24 during final terminal assembly. The lower member 43 and the stop element 46 together with the disk positioning plunger, are however adapted to be withdrawn from beneath the wires 18, washers 20, and disks 16, and the ejector 44 is adapted to be actuated, so as to positively eject the successive completed terminals downwardly from the assembly zone.

The directing and ejecting assemblage just described, serves merely to guide the wires 18 through the successive washers 20 deposited upon the element 46, and to firmly hold these wires during final attachment of the disks 16, and to thereafter positively discharge the completed terminals; and since the stripped ends 19 of the

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standard wires 18 consist of brush-like groups of loose strands, it is imperative that these stranded ends 19 be carefully, neatly, and positively threaded through the central openings or perforations of the successive contact disks 16. In order to insure such threading, I provide a pair of relatively separable guiding slides 50 to one of which the ledge element 46 is directly attached as shown in Figs. 6, 8, 9, 10 and 11, and each having a tapered converging socket portion forming a converging strand compressing and conducting surface adapted to coact with the stripped wire ends 19 of the successive wires 18 after they have penetrated the washers 20 and as they enter the final terminal attaching zone. These slides 50 are movable toward and away from each other at timed intervals by means of connections and bell cranks 51, 52 pivotally associated with shafts 53, 54 respectively located on opposite sides of the assembly zone, and the levers 47, 48 may both be secured to the pivot shaft 53 which provides a bearing for the independently operable bell crank 51. Whenever a wire 18 is being fed toward the assembly zone, the slides 50 are in closed position as in Fig. 6, but during attachment of the disks 16 and also during delivery of the successive assembled terminals, the slides 50 together with the ledge element 46, should be separated and removed, and these slides are in fact removed before removal of the member 43 from beneath the completed terminals is effected.

In order to insure proper and rapid threading of the stranded wire ends 19 through the central disk openings, the successive disks 16 must also be properly located relative to the slides 50, and for this purpose a hollow horizontally movable positioning plunger 55 is provided. This plunger 55 is provided at its forward end with a lower disk positioning lip 56 adapted to extend into the assembly zone beneath the delivery end of the disk supply slot 32, and is provided at its opposite end with an outwardly directed flange 57, while its medial portion is slidable in a bore of the frame 22. The flange 57 is slidable within a sleeve 58 and is engaged by a helical compression spring 59 which reacts against an end closure bushing 60 secured to the sleeve 58, and the side of the sleeve 58 near the bushing 60 has a vertical groove therein which is engaged by a sleeve actuating roller 62 carried by the lever 40, as shown in Fig. 13. The spring 59 normally acts as a safety device tending to force the plunger projection or lip 56 into the terminal attaching zone and beneath the slot 32, but the roller 62 coacting with the side groove of the sleeve 58 is adapted to positively move the plunger 55 in opposite directions and to withdraw this plunger during ejection of each completed terminal assemblage, so that free falling or dropping of these terminals is not interfered with. The lipped end of the plunger 55 is also provided with a socket for holding each disk 16 in proper centralized position during attachment thereof to a wire end 19, and the slides 50 must be withdrawn from the assembly zone before the disks 16 enter the plunger end socket, as indicated in Fig. 11.

The final attachment of the disks 16 to the stripped ends 19 of the successive wires 18 is effected by a pressure rod 63 which is both rotatably and slidably confined within the sleeve closure bushing 60 and is disposed centrally of the sleeve 58 and hollow plunger 55. One end of this pressure rod 63 is provided with an annular strand twisting and spreading recess 64 hav-

ing a central point directed toward the center of the attaching zone, and the opposite end of the rod 63 is provided with spline grooves 65 which slidably coact with screws 66 carried by a rotary driving sleeve 67, while the medial portion of the rod 63 has a grooved collar 68 firmly secured thereto. The annular groove in the collar 68 is engaged by a roller 69 carried by a lever 70 swingably suspended from a pivot shaft 72 carried by the frame 22, thus providing means for longitudinally reciprocating the rod 63 at timed intervals. The sleeve 67 is adapted to be constantly rotated by a shaft 73 driven by the motor 27 through a speed reducer 74, so that the pressure rod 63 is also continually rotated during its longitudinal movement, see Figs. 3, 10 and 12. During feeding and delivery of the successive wires 18, washers 20 and disks 16 to and from the terminal assembly zone, the rod 63 will be retracted as shown in Fig. 10, but when the various constituents of each composite terminal have been properly positioned and the strand guiding slides 50 have been withdrawn so as to permit the plunger 55 and rod 63 to push the disk 16 into snug contact with the end of the wire insulation 17 adjoining the stripped and protruding wire end 19 as shown in Fig. 11, then the rotating rod 63 is forced into the assembly zone axially of the wire 18 with predetermined pressure so as to cause the spinning rod recess 64 to twist and force the wire strands into firm engagement with the outer face of the disk 16.

Promptly upon completion of each disk attaching operation, the pressure rod 63 and the plunger 55 are retracted, and the slides 50 and ledge 46 remain withdrawn, while the member 43 is also withdrawn together with its ejector 44 to positively remove each completed terminal assembly from the unit preparatory to final soldering or welding of the spun and spread wire ends strands. The mechanism for thus actuating the various movable parts including the washer and disk feeding plug 36, is also operable by the electric motor 27 through the shaft 27' and speed reducer 74, and for this purpose the reducer is provided with transverse constantly rotatable shafts 75, 76 having rotary cams 77, 78, 79 secured thereto, see Figs. 3, 4 and 10. The cam 77 which is secured to the shaft 75 is co-operable with a bell crank 80 secured to one end of a rock shaft 81, and has an arm connected to the bell crank lever 52 by means of a connection 82, while the opposite end of the shaft 80 carries a lever 83 the swinging end of which is likewise connected to the bell crank lever 51 by another connection 84. The cam 77 is provided with a peripheral flat portion and coacts with the bell crank 80 through an anti-friction roller 85 carried by the latter, and the bell crank 80 is constantly urged in one direction so as to maintain contact between the roller 85 and the cam periphery at all times, by means of a helical tension spring 86, thus providing mechanism for actuating the slides 50 and the washer positioning ledge 46 so as to open and close these slides at properly timed intervals.

The cam 78 which is secured to the rotary shaft 76 directly adjacent to the speed reducer 74, is likewise cooperable with another bell crank lever 87 through a similar anti-friction roller 85, and this lever 87 is constantly urged in one direction by another helical tension spring 88 and is freely rockable upon the shaft 81. The upper swinging end of the lever 87 is connected to a swing bracket 89 attached to the pivot shaft 72,

by a connection 90, and this bracket 89 coacts with the swinging lower end of the pressure rod actuating lever 70 through a spring or resilient connection 92, as shown in Figs. 3, 4 and 12. The resilient connection 92 serves to control the pressure delivered by the rod 63 against the terminal assemblies by permitting relative swinging of the lever 70 and the bracket 89 about the pivot shaft 72, and the swinging end of the bracket 89 carries a pivot block 93 which is operatively connected to the lever 47 for actuating the member 43 with its ejector 44, and the switch control 48 in unison, by means of a connection 94. This connection 94 is embraced by a helical compression spring 95 which eliminates lost motion and protects the various parts against excessive stress, and the cam 78 and lever 87 thus provide means for automatically reciprocating the rod 63 and for periodically actuating the wire positioning and ejecting parts of the unit.

The cam 79 which is attached to the rotary shaft 76 remote from the speed reducer 74, is similarly cooperable with still another bell crank lever 97 through a similar anti-friction roller 85, and this lever 97 is also constantly urged in one direction by a third spring 98 and is also freely rockable upon the shaft 81. The upper swinging end of the lever 97 is connected to the lower swinging end of the lever 40 by means of a connection 99, and the medial portion of the lever 40 is swingably mounted upon a pivot 100 carried by the frame 22. As previously indicated, the upper swinging end of the lever 40 is connected to the washer and disk feed plug 36 by means of the rod 38 and pivot pin 39, and the lower end of the lever 40 carries the roller 63 which coacts with the side recess in the plunger actuating sleeve 58, so that swinging of the lever 40 by the cam 79 and lever 97 will simultaneously actuate both the feed pins 34, 35, and the plunger 55. Both of the cams 78, 79 are likewise provided with flat peripheral portions adapted to operate their respective actuated parts in properly timed relation to each other, and all of the connecting links 82, 84, 90, 94, 99 are adjustable in length while the bell cranks and levers are protected by suitable springs against possible damage due to abnormal conditions of operation. While the main frame 22 has been generally referred to as a unitary structure, it will be noted that this frame is in fact composed of numerous rigidly united parts, and the bin 25 and hopper 26 are adjustably supported from this frame.

During normal operation of the improved terminal assembly mechanism to carry on the successive steps of my improved system, the bin 25 should be amply supplied with metal disks 16, and the hopper 26 should also be abundantly supplied with insulation washers 20; and the masses of these parts should preferably be agitated in any suitable manner in order to insure proper entry of the successive disks and washers by gravity into their respective chutes 28, 29. When the cutting and stripping machine is operating to deliver the successive wire segments or lengths to the terminal assembly zone of the assembly unit, the feed clamp 24 will advance the insulation covered end stripped wires 18 in succession toward the assembly zone, and during each forward feeding of a wire 18, the feed plug 33 will be operated to simultaneously deliver one disk 16 down the slot 32 and one washer 20 down the slot 33 toward the assembly zone. The plunger 55 will then function to properly position

the disk 16 and the slides 50 and stop element 46 will likewise function to position the washer 20, and these slides 50 will be closed so that the members 42, 43 and the slides 50 will definitely center and properly guide each longitudinally advancing wire 18 and will cause the stripped end 19 to be effectively threaded through the washer and the central disk perforation.

After the stripped end 19 of the wire segment has been thus projected through the central opening in the washer 20 and disk 16, the slides 50 and ledge 46 will be promptly withdrawn and the feed clamp 24 will be held stationary so as to prevent reverse longitudinal movement of the wire. The members 42, 43 will also snugly engage the wire insulation 17, and the plunger 55 will thereafter immediately become effective to force the disk 16 against the end of this wire insulation 17 adjoining the stripped end 19, whereupon the rotating spreading rod 63 will be moved toward the attaching zone and the recess 64 thereof will twist and spread the strands of the stripped wire end 19 and will force these strands into intimate contact with the outer face of the disk 16 as clearly indicated in Fig. 11, thus completing the assembly operation. Immediately following such completion, the plunger 55 and the rod 63 will be withdrawn, and while the slides 50 and the ledge 46 remain separated or withdrawn, the clamp 24 will be released, and the member 43 will be withdrawn from beneath the terminal assemblage. As soon as the completed terminal assemblage has been thus released, the ejector 44 will become effective to push such completed assemblage away from the assembly zone, and the assembled terminal will thereafter drop away from the machine and will advance by gravity along the discharge rails 30 as depicted in Fig. 8.

After a completed terminal has been thus ejected, the member 43, slides 50 together with the supporting element 46, and the plunger 55 will be quickly restored preparatory to a repetition of the cycle, and subsequent disks 16, washers 20 and wires 18 will be systematically delivered to the unit and united into subsequent terminal assemblages. All of these steps are carried out positively, automatically and effectively, and all of the terminal assemblages are therefore of like construction, and these assemblages may be subsequently finally completed by soldering, welding, or otherwise permanently attaching the twisted and spread strands coacting with the outer central portion of the disks 16. The method may obviously be carried on in connection with solid as well as stranded insulation covered wires 18, and the washers 20 need not necessarily be utilized, while the contact members or disks 16 may also assume various shapes.

From the foregoing detailed description, it will be apparent that my present invention provides an improved mechanism for assembling disk terminals whereby the contact disks 16 are firmly pressed against the adjacent ends of the insulation 17 and are also firmly attached to the stranded wire ends 19. The invention also provides automatically functioning apparatus for quickly and effectively assembling the successive terminals from constituents delivered in rapid succession to the assembly unit. The parts of the improved mechanism are conveniently adjustable so as to insure most efficient operation thereof, and these parts are also amply protected against damage due to abnormal conditions of operation. The improved structure has

proven highly satisfactory and successful in actual commercial use, especially for the purpose of exploiting my improved assembly system, and is adapted to produce successive perfect terminals at exceptionally high speed, thereby reducing to a minimum the cost of production of such terminals.

It should be understood that it is not desired to limit the present invention to the exact details of construction of the mechanism herein shown and described, for various modifications within the scope of the appended claims may occur to persons skilled in the art; and it is also intended that specific descriptive terms used herein be given the broadest possible interpretation consistent with the disclosure.

I claim:

1. In a mechanism for assembling a composite electric terminal having a metallic disk abutting the insulation adjoining the stripped end of a stranded wire, means forming an assembly zone, means for delivering a centrally perforated metallic disk in predetermined position into said zone, a hollow plunger having a lip for holding the disk in said predetermined position within said zone, means for threading the stripped end of an insulated stranded wire through the central disk perforation and for thereafter holding the wire against longitudinal movement, means for subsequently moving said hollow plunger toward the wire to push one face of the disk into snug engagement with the adjacent wire insulation, a longitudinally movable rod having a central end point cooperable with the strands of the stripped wire end to spread these strands laterally, and means for revolving said rod to twist the spreading strands into firm coaction with the opposite face of the disk.

2. In a mechanism for assembling successive electric terminals each having a metallic disk abutting the insulation adjoining the stripped end of a stranded wire, means forming an assembly zone, means for delivering successive centrally perforated metallic disks in predetermined position into said zone, a hollow plunger having a lip for holding the successive disks in said predetermined position within said zone, means for threading the stripped end of each of a succession of insulated stranded wires through the central perforation of each pre-positioned disk and for thereafter holding each wire against longitudinal movement, means for subsequently moving said hollow plunger toward each wire to push one face of the pre-positioned disk into snug engagement with the adjacent wire insulation, a rod movable longitudinally within said plunger and having an end point cooperable with the strands of each stripped wire end to spread these strands laterally, and means for revolving said rod to twist the spreading strands of each wire into firm coaction with the opposite face of each pre-positioned disk.

3. In a mechanism for assembling a composite electric terminal having a metallic disk abutting the insulation adjoining the stripped end of a stranded wire and a washer embracing the insulation adjoining the disk, means forming an assembly zone, means for simultaneously delivering a washer and a centrally perforated disk in predetermined coaxial position into said zone, means for holding said washer in said predetermined position within said zone, a hollow plunger having a lip for likewise holding said disk within said zone, means for threading the stripped end of an insulated stranded wire through the cen-

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tral disk perforation while simultaneously advancing the adjacent end of the insulation snugly within said washer and for thereafter holding the wire against longitudinal movement, means for subsequently moving said hollow plunger toward the washer to push one face of the disk into snug engagement with the adjacent wire insulation, a longitudinally movable rod having a central end point cooperable with the strands of the stripped wire end to spread these strands laterally, and means for revolving said rod to twist the spreading strands into firm coaction with the opposite face of the pre-positioned disk.

4. In a mechanism for assembling successive electric terminals each having a metallic disk abutting the insulation adjoining the stripped end of a stranded wire and also having a washer embracing the insulation adjoining the disk, means forming an assembly zone, means for simultaneously delivering successive sets each comprising a washer and a coaxial centrally perforated metallic disk in predetermined position within said zone, means for holding each of said washers within said zone, a hollow plunger having a lip for likewise holding the disk of each set within said zone, means for threading the stripped end of successive insulated stranded wires through the central perforation of successive pre-positioned disks while simultaneously advancing the adjacent end of the wire insula-

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tion snugly within the complementary washer and for thereafter holding each wire against longitudinal movement, means for subsequently moving said hollow plunger toward each washer to push one face of the disk of the complementary set into snug engagement with the adjacent wire insulation, a rod movable longitudinally within said plunger and having an end point cooperable with the strands of the successive stripped wire ends to spread these strands laterally, and means for revolving said rod to twist the spreading strands of each wire into firm coaction with the opposite face of each pre-positioned disk.

KARL H. ANDREN.

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