

[72] Inventor **Sidney Levy**
Norwalk, Conn.
[21] Appl. No. **869,304**
[22] Filed **Oct. 24, 1969**
[45] Patented **Dec. 14, 1971**
[73] Assignee **Burndy Corporation**

2,293,920	8/1942	Replogle	302/65
2,366,233	1/1945	Berg	294/19
2,668,625	2/1954	Garland	212/55
2,996,330	8/1961	Hutto	294/88
3,219,376	11/1965	Peters	294/16
3,456,376	7/1969	Chappell	43/6

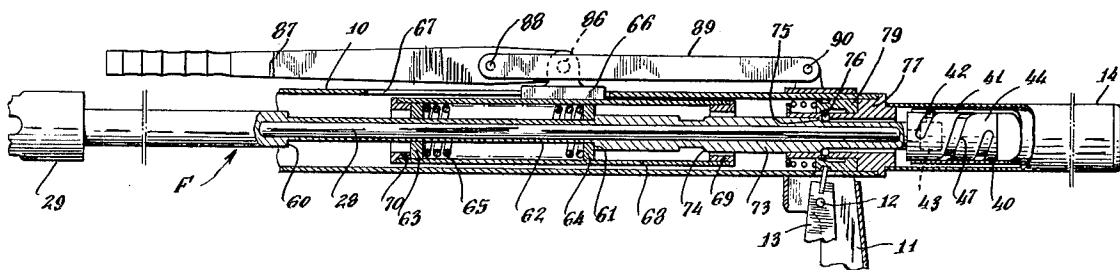
Primary Examiner—Evon C. Blunk
Assistant Examiner—W. Scott Carson
Attorney—Howard S. Reiter

[54] **TOOL FOR REMOVING AND APPLYING CONNECTORS**
17 Claims, 12 Drawing Figs.

[52] U.S. Cl. **294/16,**
29/203 D, 29/203 H, 29/244, 81/3.8, 124/31,
294/19 R, 294/116
[51] Int. Cl. **B25b 27/14,**
B23p 19/04
[50] Field of Search 29/203 DT,
203 R, 203 H, 206, 244, 203 D; 32/61; 43/6;
81/3.8; 124/31; 212/55, 127, 129; 294/19, 16, 88,
116

[56] **References Cited**
UNITED STATES PATENTS
784,747 3/1905 Lobit 43/6
2,291,593 7/1942 Hubbard 294/19

ABSTRACT: A tool for swiftly applying a connector such as a terminator, to a contact bushing on a transformer and for also removing the terminator. A push or pull firing piece can be moved into one or the other of opposed end positions in the casing in which it is locked by a detent while a spring is compressed against the firing piece. When the detent is moved by a trigger, it releases the firing piece for swift movement by the spring. The firing piece will move either to remove the terminator from the contact bushing or to apply the terminator to the bushing depending on its locked position and the compression of the spring. The firing piece carries a gripper which is movable by a hand grip on the casing for gripping the terminator to the firing piece, and for releasing the terminator from the firing piece.



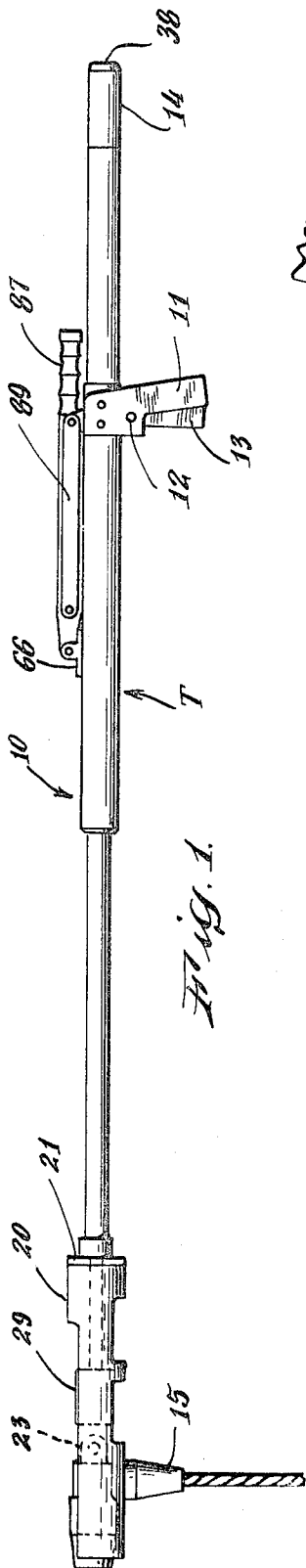


Fig. 1.

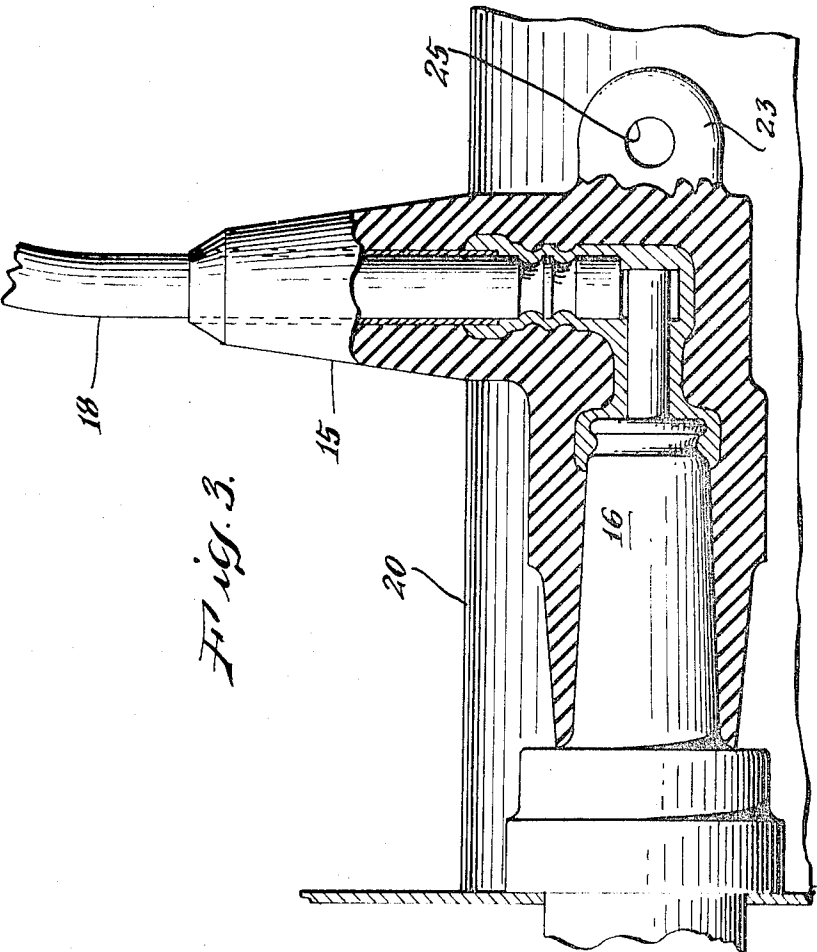
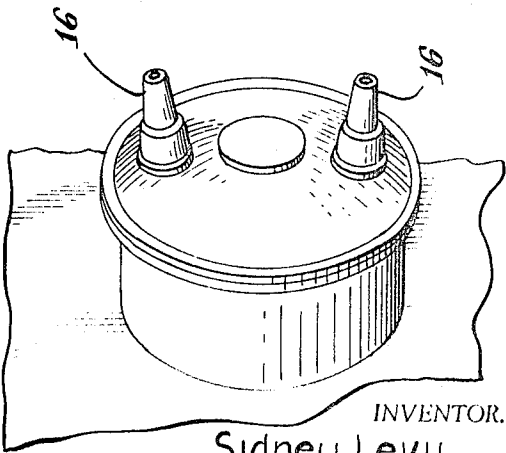
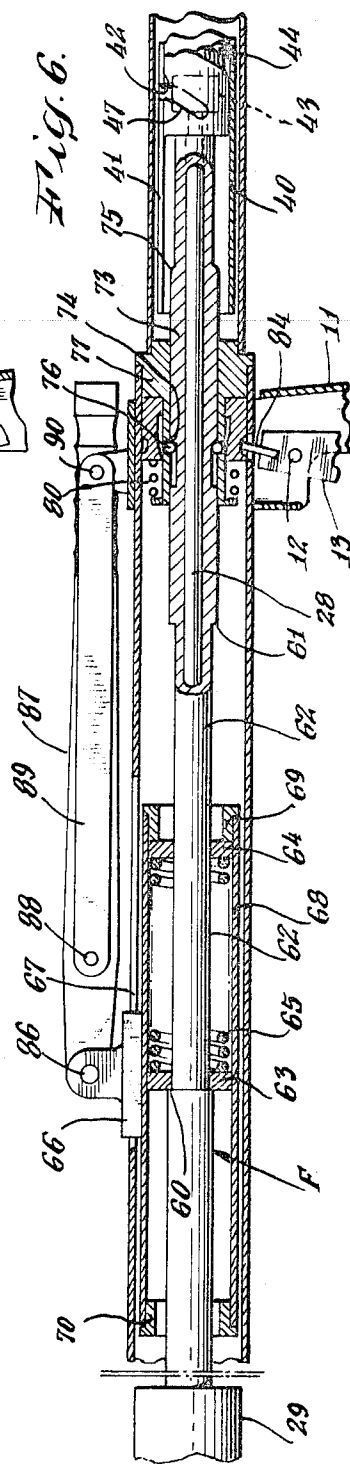
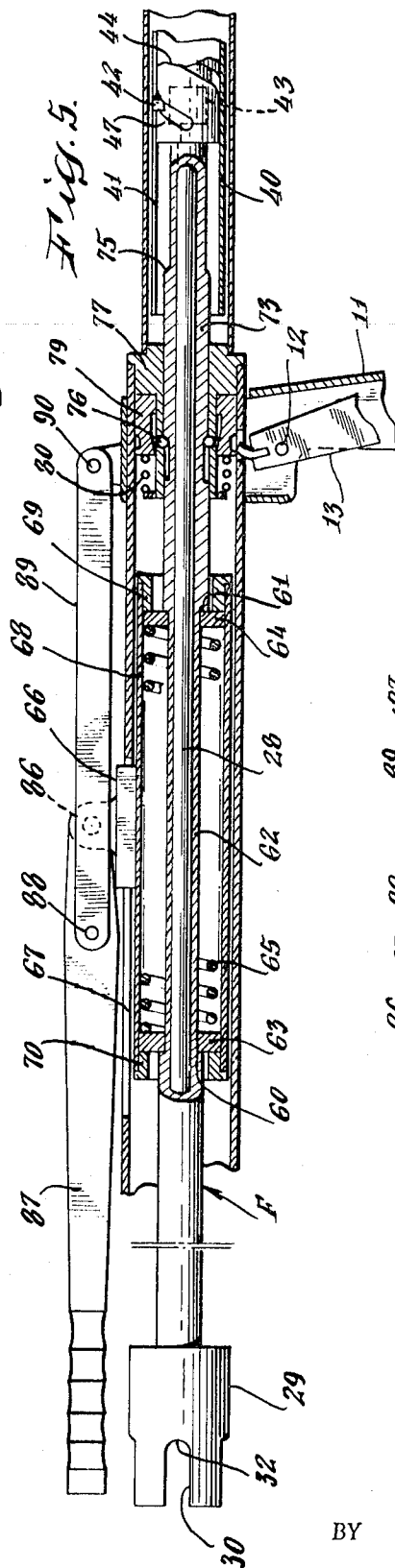
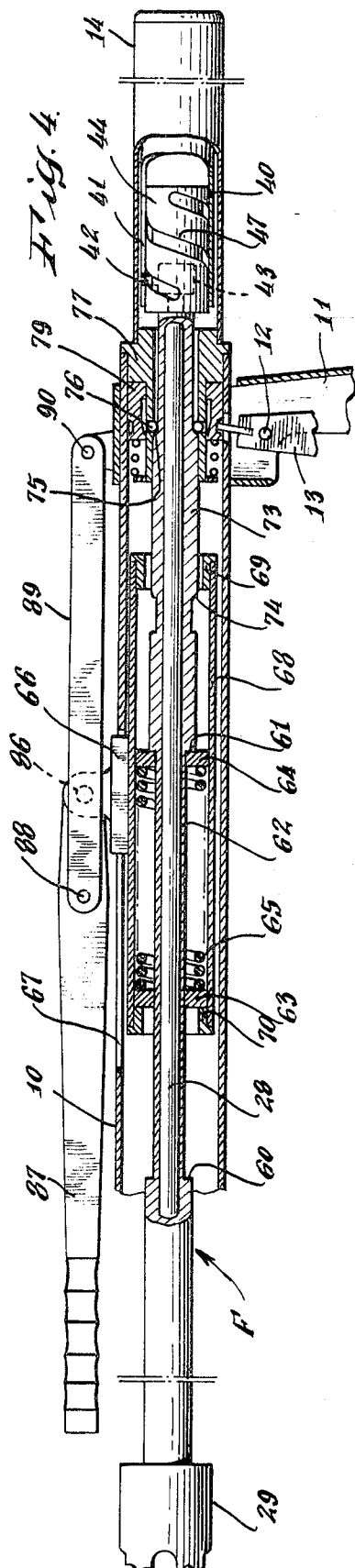


Fig. 3.

Fig. 2.



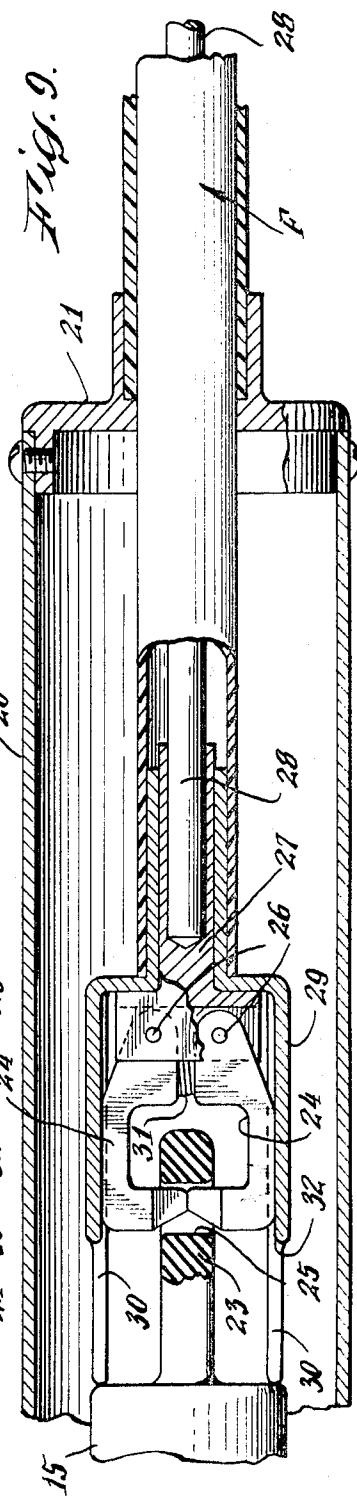
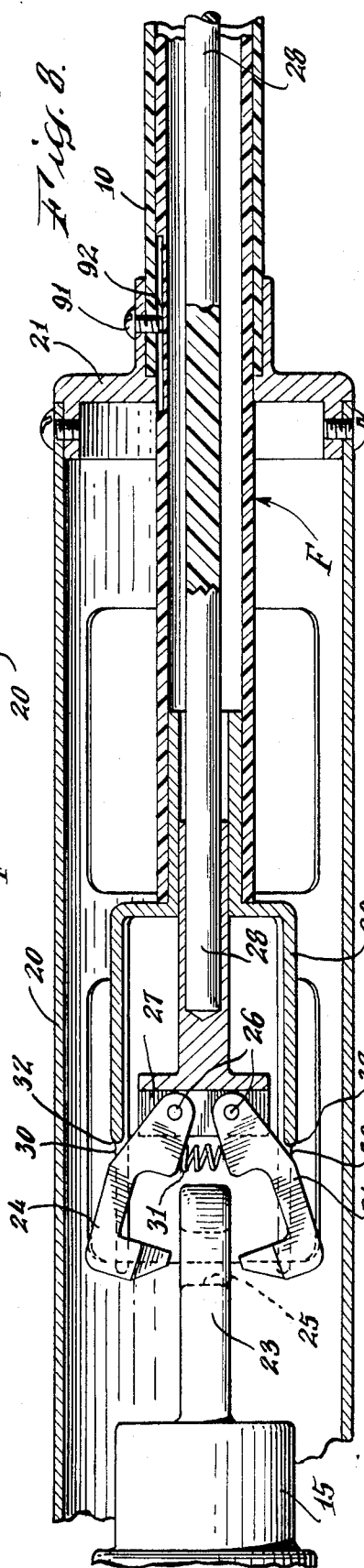
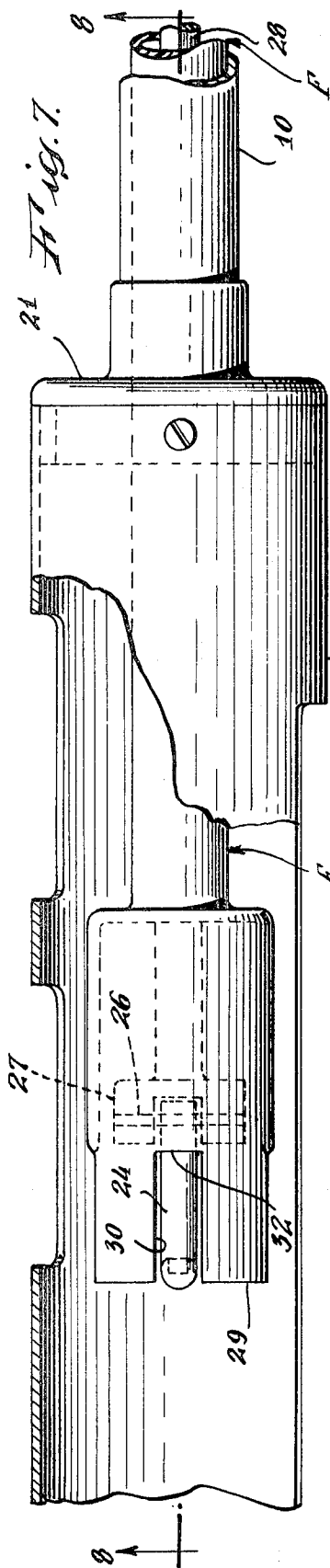
INVENTOR.
Sidney Levy
BY Howard K. Reiter
ATTORNEY.



INVENTOR.

BY

ATTORNEY.



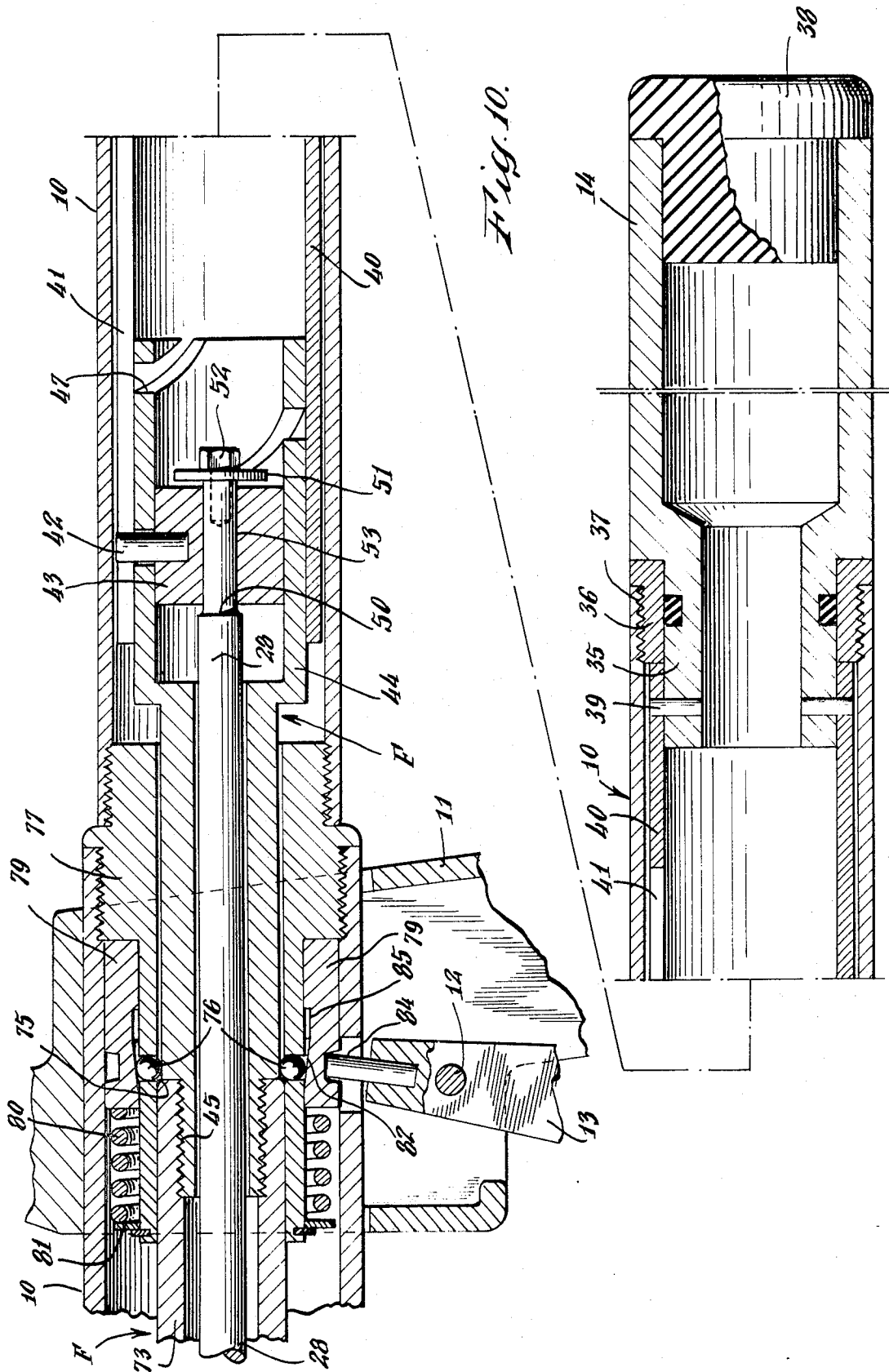


Fig. 11.

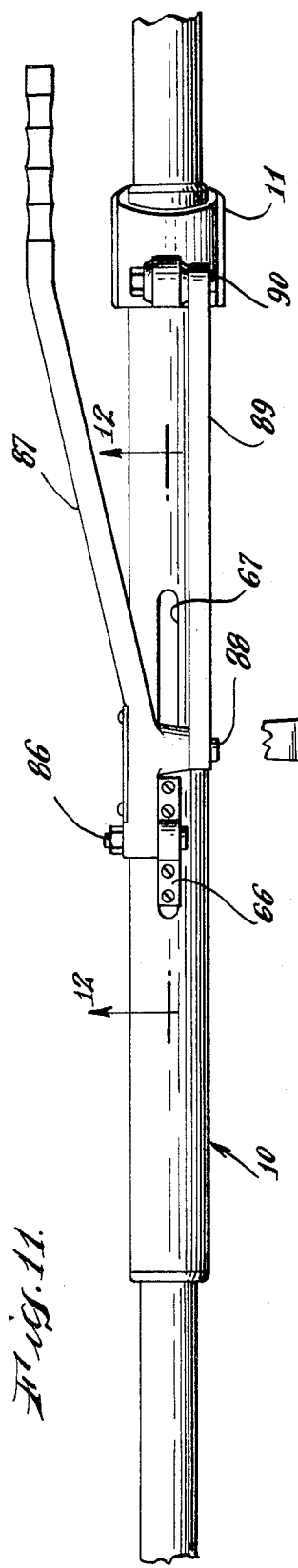
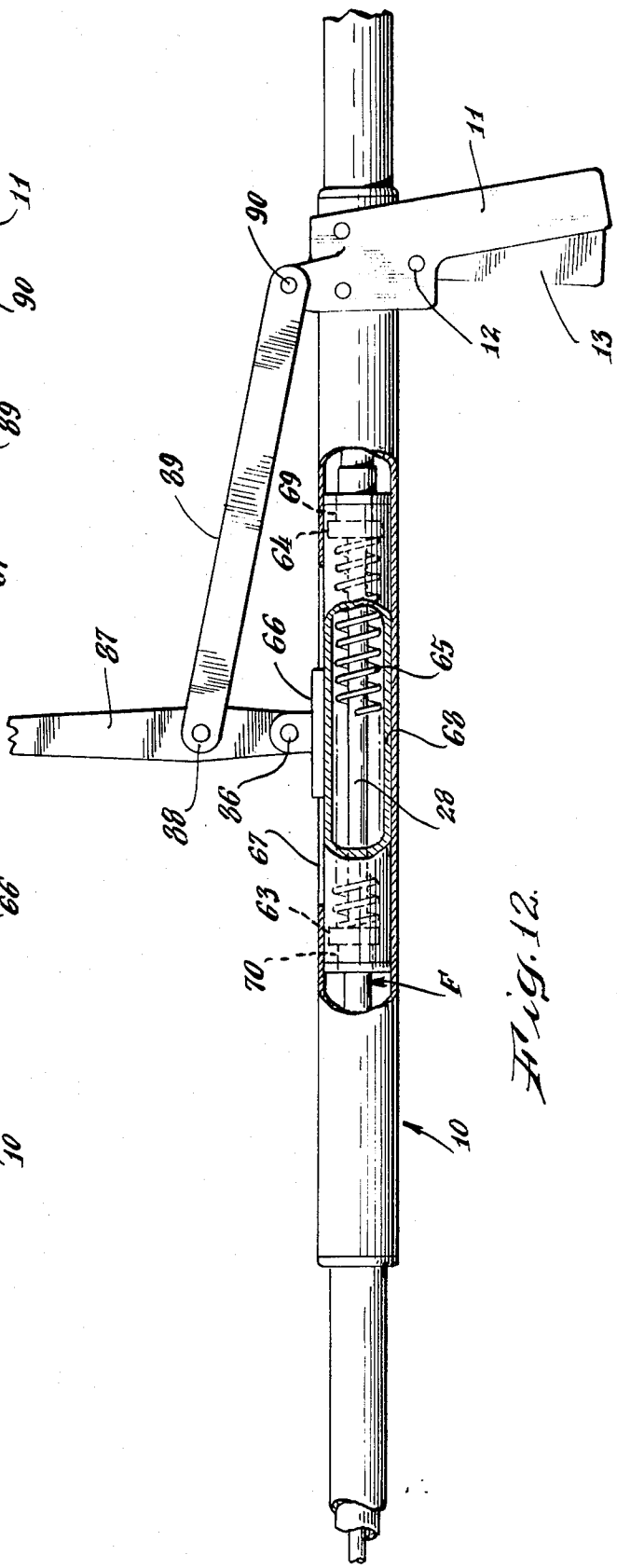


Fig. 12.



TOOL FOR REMOVING AND APPLYING CONNECTORS

BACKGROUND OF INVENTION

This invention relates to a tool to be used in applying and removing one electrical device from electrical engagement and contact with a second electrical device. The tool is particularly adapted to bring about the assembly or disassembly of two electrical devices such as connectors between which a high voltage electric current is to flow when the devices are assembled. Obviously, in order to bring about the engagement and disengagement of the devices, their movement relatively to one another should be swift in order to prevent serious arcing. The tool of my invention is particularly adapted for the purpose of bringing an elbow type of connector, known as a terminator, into assembled relation to a terminal bushing such as is found in a transformer. My invention provides a very simple and effective mechanism for moving the elbow swiftly out of engagement with the bushing, and also, to bring the elbow swiftly into engagement with the bushing, when that is required.

PRIOR ART

So far as I know, no inventor working in this art has provided a power mechanism for effecting either swift engagement or swift disengagement of a bushing such as found on a transformer, and an elbow to be fitted on the bushing or to be removed therefrom.

OUTLINE OF INVENTION

My invention contributes a very simple mechanism that is operable both for applying an elbow terminator to the bushing of a transformer, and for removing the elbow from the bushing. Each operation is carried out at relatively high speed through use of a power mechanism that I prefer shall take the form of a spring. As a feature of the invention, what I term a firing piece, is mounted in a casing, and is propelled by power in either of opposed directions, so that the same firing piece may be utilized to apply the elbow to the bushing, or to remove the elbow from the bushing. As a particular feature of the invention, the firing piece can be locked, as by detent mechanism, in either of opposed spaced positions. Obviously, through release of the detent mechanism, as by a trigger, the firing piece may be propelled in either of opposed directions. Where a spring is utilized as the power means for propelling the firing piece, the spring may be stressed in either of opposed directions by simple mechanism which I prefer shall be a toggle linkage.

As a further particular feature of the invention, I utilize a holding rod that is adapted to move relatively to the firing piece or to be locked to the firing piece for integral movement therewith. The holding rod, when moved relatively to the firing piece, either releases or locks to the firing piece, the elbow that is to be moved by the firing piece.

As a further feature of my invention, I utilize a very novel form of hand grip for moving the holding rod so as to lock it relatively to the firing piece, and I mount the hand grip on the casing in which the firing piece is adapted to slide in either of opposed directions.

DESCRIPTION OF DRAWINGS

Referring now to the drawings,

FIG. 1 is an elevation of the tool of my invention showing it applied to a standard form of elbow terminator which is to be assembled by the tool to a standard form of transformer bushing.

FIG. 2 is a perspective view of part of a typical transformer showing a pair of typical bushings to which a pair of elbows are to be assembled.

FIG. 3 shows an elbow of standard construction assembled to a bushing, the elbow being shown partially in section.

FIG. 4 is a partial vertical section of the tool of my invention with certain parts thereof cut away because it is impossible to

show in proper size relationship the various parts in view of the length of the tool.

FIG. 5 is a view similar to FIG. 4 but showing the firing piece after it has been fired and moved to the right from its position of FIG. 4.

FIG. 6 is similar to FIGS. 4 and 5, except that in FIG. 6 the spring that is utilized to propel the firing piece has been stressed for moving the firing piece from the position of FIG. 5 to the left, upon release of the detent mechanism.

FIG. 7 is an enlarged view of the end of the firing piece showing the transparent positioning shield fixed to the casing of my tool together with the end of the firing piece and the gripping jaws.

FIG. 8 is a section taken along line 8—8 of FIG. 7 illustrating the gripping jaws in release position relatively to an elbow terminator.

FIG. 9 is a view similar to FIG. 8 but illustrates the manner in which the gripper jaws are moved by the holding rod of my invention so as to engage the ring of a terminator elbow for securing the elbow to the firing piece for integral movement therewith.

FIG. 10 is an exploded section of one end of the tool of my invention showing the control of the firing piece by trigger and detent, and also the manner of moving the holding rod relatively to the firing piece by a handle grip mounted on the casing of the tool.

FIG. 11 is a view looking downwardly on a part of the tool shown in FIG. 1, and illustrates the toggle linkage for compressing the spring that forms the power mechanism for propelling the firing piece.

FIG. 12 is a partial section and side view of the parts of FIG. 11 showing the linkage when the spring is in a neutral position. Movement of the toggle linkage to the position of FIGS. 4 or 6, will now compress the spring for moving the firing piece in either of opposed directions.

DESCRIPTION OF A PREFERRED MODIFICATION OF THE INVENTION

Referring now more particularly to the drawings, and especially FIGS. 1, 2 and 3, the tool of my invention is designated generally by the reference letter T. The casing of the tool is designated generally by the reference numeral 10, and for ease of manufacture, it may be made of several parts that are suitably held together by various means, all as those skilled in the art will appreciate. Fixed to the casing 10 is a handle 11, and pivoted at 12 on the handle 11 is a trigger 13, this trigger being used to release the firing piece for movement in either of opposed directions as will be made clear presently. A handle grip 14 is suitably mounted on the casing 10 and as will be explained presently, is utilized for moving the holding rod relatively to the firing piece so as to secure the terminator elbow to the firing piece for movement therewith.

The terminator elbow itself is illustrated in FIG. 3 where it is designated by reference 15. It is naturally suitably insulated and contains contacts adapted to engage contacts of the transformer bushing. No description of the elbow and bushing are here necessary. It is merely well to know that a contact of the elbow 15 will enter an opening in a standard bushing 16 so as to complete an electrical circuit.

Referring now to FIGS. 7, 8, and 9 as well as FIG. 1, it will be seen that the elbow 15 is adapted to be inserted into what I term a positioning shield that is designated by reference numeral 20. This shield is secured through a part 21 to the casing 10 as is probably best shown in FIGS. 8 and 9. The positioning shield will preferably be formed of a transparent material that is nonconducting. As a matter of fact, it will be appreciated that the entire instrument of my invention must be formed so as not to conduct electricity. Since, as already indicated, the suitable designing of the parts for this purpose and for fabrication is something that can be done by anyone skilled in the art, further reference will not be made as to the types of material required or utilized by me in the invention.

In any event, it is important to know that the positioning shield, which is transparent, is integral with the casing 10 of the tool. The elbow 15, as is probably best illustrated in FIGS. 1 and 8, is inserted into the positioning shield 20 with a ring 23 thereof in a position for acceptance by a pair of grippers 24. These grippers 24 enter the opening 25 of the ring 23 as probably best illustrated in FIG. 9 and secure the elbow 15 to the firing piece as will be described.

Each of the grippers 24 is pivoted at 26 to a part 27 that is integral with what I term a holding rod 28. This holding rod 28 is movable longitudinally relatively to the firing piece of my invention designated generally by the reference letter F. This firing piece F may be assembled of several parts, but does have a central bore or opening through which the holding rod 28 extends, for the purposes to be set forth presently. In any event, in so far as I have already described the invention, the longitudinal movement of the holding rod 28 relatively to the firing piece F will bring about movement of the part 27 from its position of FIG. 8 to its position of FIG. 9.

At the end of the firing piece F there is an open mouthed part 29, which, as best illustrated in FIG. 7, is formed with two slots 30 located 180° apart. As illustrated in FIG. 8, the two jaws 24 move in these slots, a spring 31, best seen also in FIG. 8, being adapted to hold the jaws in their separated position shown in FIG. 8 when the holding rod 28 is in an outward left position relatively to the firing piece F. When the holding rod is moved to the right from its position of FIG. 8 to its position in FIG. 9 longitudinally relatively to the firing piece F, it obviously moves the jaws 24 therewith and relatively to the part 29. The jaws 24 are then cammed by the end surfaces 32 of the slots 30, so as to be brought into the position of FIG. 9. This movement of the jaws 24 brings about the gripping of the ring 23 of the elbow 15, and obviously secures the elbow 15 to the firing piece F, through the part 29 that is integral with the firing piece. I shall presently describe the manner in which the holding rod 28 is moved longitudinally relatively to the firing piece F for the purpose of securing elbow 15 through its ring 23 and jaws 24 to the firing piece F, and also for releasing it by reverse motion.

Referring now to FIGS. 1 and 10, it will be noted that the handle grip 14 is formed with a cutaway bearing portion 35 through which it rotates relatively to a part 36 that through threads 37 is secured to the casing 10 of the tool. A rubber bumper 38 is forced into the open end of the grip 14 and naturally protects the tool as those skilled in the art will appreciate. A pin 39 secures to the hand grip 14 a sleeve 40 that is slotted at 41. Fitted into the slot 41 is a pin 42 that is integral with a rotating cylindrical block 43. The cylindrical block 43 is mounted for rotation within a sleeve 44 that is integral with the firing piece F. Thus, in FIG. 10, sleeve 44 is shown secured to another part of the firing piece F through screw threads 45. As was earlier set forth, it is only necessary to know that the firing piece F, as well as the casing 10 of my tool are formed of a series of parts suitably assembled in manner to contribute an effective insulated operating mechanism.

The sleeve 44 has a helical slot 47 within which fits the pin 42 integral with the cylindrical block 43. The firing piece F, as will be presently set forth, is not permitted to rotate within the casing 10, although naturally, it is adapted for sliding movement in order to carry out its firing function. Because the firing piece F is not rotatable in the casing 10, the sleeve 44 integral therewith will also not rotate, so that the helical slot 47 will be stationary. Upon rotation of the handgrip 14, the pin 42 will be rotated with the handgrip because it fits also in the slot 41 of the part 40 fixed to the hand grip. This rotation of the pin 42 will cause it to move in the helical slot 47 of the sleeve 44, and this movement will naturally bring about longitudinal movement of the cylindrical block 43 which is adapted to rotate with the pin 42. The cylindrical block 43 is bored at 53 to rotate on holding rod 28 between an end surface 50 of the holding rod 28 as shown in FIG. 10, and a disc 51 secured to the end of the holding rod 28 by a bolt 52. During rotation of the block 43 relatively to the rod 28, the lon-

gitudinal movement of the block 43 by pin 42 will obviously move the rod 28 back and forth relatively to the firing piece F.

The longitudinal movement of the rod 28 relatively to the firing piece F thus described with regard to FIG. 10, will obviously cause the back and forth movement of the rod 28 described earlier with regard to FIGS. 7, 8 and 9. This movement of the rod 28 will naturally secure the elbow 15 to the firing piece or will release the elbow 15 from the firing piece. It will also be appreciated that in all positions of the holding rod 28 relatively to the firing piece, it will be locked by the pin 42 lying in the helical slot 47 relatively to the locking piece. Therefore, the rod 28 will at all times move with the firing piece F, except when rotation of the handgrip 14 effects rotation of the block 43 through the pin 42 for moving the holding rod 28 relatively to the firing piece F. Thus, it will now be understood that while the holding rod 28 may move longitudinally relatively to the firing piece F for the purpose of securing the elbow 15 to the firing piece, the rod 28 and firing piece will move together at all other times to cause movement of the elbow 15 on and off relatively to a bushing 16 shown in FIGS. 2 and 3.

I shall now describe the means for propelling the firing piece in one direction or the other, depending upon whether or not the elbow is to be removed or applied to a bushing 16. Referring now to FIGS. 4, 5, and 6, the firing piece F is well illustrated, and also well illustrated is the holding rod 28 lying in a central bore in the firing piece F. The helical slot 47 formed in the sleeve 44 is also well shown in FIGS. 4, 5, and 6, and in those figures I also show the block 43 rotatable relatively to the rod 28 while moving the rod 28 endwise relatively to the firing piece.

Firing piece F, as clearly shown in FIGS. 4, 5, and 6 is formed with a firing shoulder 60 at the left end of a portion 62 thereof of decreased diameter, and with a firing shoulder 61 at the other end of said decreased diameter portion. Shown slidably mounted on the said relatively smaller section 62 of the firing piece are opposed rings 63 and 64. A compression spring 65 fits on the portion 62 of the firing piece F and presses at its opposed ends against the rings 63 and 64. The spring 65 is of sufficient size, so that when allowed to expand to its normal position, it will hold the ring 63 against the shoulder 60, and ring 64 against the shoulder 61 of the firing piece F.

A spring compressing slide 66 moves in a slot 67 formed in the casing 10 as well seen in FIGS. 4, 5 and 6. A sleeve 68 is secured to slide 66 and has at one end an inwardly projected ring 69 and at its other end an inwardly projected ring 70. It is obvious that the ring 69, as shown in FIG. 5, will, in the expanded position of the spring 65, lie against the outer right-hand surface of the ring 64 while the ring 70 will lie against the outer left hand surface of the ring 63. It is further obvious that movement of the slide 66 will be adapted to applied pressure to the spring 65 through certain of the rings set forth so as to compress the spring 65 toward the right or the left, depending on the movement of the slide 66 and sleeve 68. The control of spring 65 and the operation of firing piece F will be set forth in more detail presently.

Formed integrally with the firing piece F is a detent coacting portion 73. This detent coacting portion 73 has at each end a very small rounded shoulder, the shoulder at the left end in FIG. 4 being designated by reference numeral 74, while the shoulder at the right hand end is designated by reference numeral 75. Referring now to FIG. 10, it will be noted that the rounded shoulder 75 at the right hand end of the part 73 of the firing piece F will lie against balls 76. Actually, the rounded shoulder 75 is circular, and there will be a series of balls 76 coacting with this shoulder 75. The balls 76 lie in a circular slot formed in a part 77 that is integral with the casing 10. As seen in FIG. 10, there is a space between a portion of part 77 and the casing 10 for the mounting of a sliding sleeve 79, a coil spring 80 pressing the sleeve 79 toward the right into the position of FIG. 10 against an end surface of the part 77. Spring 80 is maintained under compression by a spring ring 81 that is

held assembled to the part 77 and, therefore, integral with casing 10.

The part 79 is in the form of a sleeve, having a holding surface 82 that lies normally against the balls 76 as shown in FIG. 10, to prevent the balls from moving relatively to the part 77. When so held, the balls 76 will obviously prevent the shoulder 75 and detent coating part 73 from moving to the right from its position in FIG. 10, and also from movement to the right from its position of FIG. 4. The part 79 is adapted for movement by the trigger 13, which, as will be remembered from FIG. 1, is pivoted at 12 relatively to the handle 11. Obviously, upon movement of the trigger 13 about its pivot 12, a pin 84 secured to the trigger as shown in FIG. 10, will move the part 79 against the pressure of the compression spring 80. Such movement will bring a cut away surface 85 of part 79 opposite the balls 76, so that the balls will be free to move away from the rounded shoulder 75 of the part 73 of the firing piece F. The firing piece will then be propelled by spring 65.

Referring now particularly to FIGS. 11 and 12, I shall describe the means for moving the slide 66, this being the part that acts to compress the spring 65 as was described with regard to FIGS. 4, 5, and 6. If FIGS. 4, 5 and 6 are examined with relation to FIGS. 11 and 12, it will be noted that the slide 66 is pivoted at 86 to a handle 87. The handle 87 is pivoted at 88 to a link 89 that is pivoted at 90 to the casing 10 through handle 11. The handle 87, pivoted at 86 to the slide 66 and pivoted at 88 to the link 89, forms with the several parts a toggle mechanism whereby the slide 66 may be moved either to the right or to the left from a normal central position in which it is placed when the toggle mechanism is centered. Thus, one extreme position of the slide 66 is illustrated in FIG. 4. In this position of the parts, the slide 66 has been moved by the handle 87 through the toggle mechanism described, so as to move sleeve 68 to propel the ring 63 through ring 70 away from the shoulder 60 of the firing piece F. This action has compressed the spring 65 as is clearly shown in FIG. 4, with the spring holding the ring 64 against the shoulder 61 of the firing piece. The firing piece F cannot move to the right from its position of FIG. 4 under the influence of the spring 65 because of the arrangement of the several locking balls 76 and their coaction with the rounded shoulder 75, as was fully set forth with regard to FIG. 10.

If now, in the position of the parts in FIG. 4, the trigger 13 is pulled, the sleeve 79 will be moved against the action of the spring 80 bringing the surface 85 opposite the several balls 76. These balls will now move away from the shoulder 75 and this will release the firing piece for movement to the right from its position of FIG. 4 to its position of FIG. 5. Obviously, the spring in FIG. 5 has brought about a swift movement of the firing piece from its position of FIG. 4. This movement has naturally moved the part 29 fixed to the firing piece F as shown in FIG. 5, and this has brought about the movement of the elbow 15 away from its assembled relation to the bushing 16 illustrated in FIG. 3.

Let us say now that with the parts in position of FIG. 5, it is desired to assemble an elbow to a bushing. The elbow will be inserted into position in the transparent shield 20, as shown in FIG. 8, this being accomplished after the handle grip 14 has been rotated in order to rotate the pin 42, and through the helical slot 47 move the holding rod 28 endwise to its position of FIG. 8. Thereafter, reverse movement of the grip 14 will cause the pin 42 to move in a reverse direction relatively to the helical slot 47 and this will move the holding rod 28 to the right from its position of FIG. 8 to its position of FIG. 9 so as to cause jaws 24 to grip the elbow 15 as is well illustrated in FIG. 9. The operator now must make certain that the trigger 13 is restored from its position of FIG. 5 to its position of FIG. 6 and also its position of FIG. 10, in which position the balls 76 are placed in locking relation to the shoulder 74 of the firing piece F. It will be remembered that when the firing piece moves to the position of FIG. 5, the shoulder 74 will move into detent relation relatively to the balls 76. Thus, locking balls 76 constitute a detent mechanism which will now hold the firing piece F in its position of FIG. 6 against movement to the left.

The handle 87 is now moved from its position of FIG. 4 and FIG. 5 to its position of FIG. 6. This will cause movement of the slide 66 to the left of its position of FIG. 5, and the sleeve 68 moving with the slide 66 will cause the ring 69 integral therewith to move the ring 64 mounted about the firing piece section 62. This movement of the ring 64 will compress spring 65 so that the spring will react against the ring 63, and will press the said ring 63 against the shoulder 60 of the firing piece. This is actually the relationship of the parts in FIG. 6, and it will be obvious that the firing piece will now be urged to the left to apply the elbow 15 to a bushing 16 of the transformer 17. The firing piece will not move, however, until the trigger 13 is again moved so that its pin 84 will move the sleeve 79 against the pressure of the spring 80 to carry the release surface 85 opposite the balls 76 as can well be understood from FIG. 10. The balls 76 will now move away from the shoulder 74, and the spring 65 will propel the firing piece F to the left to effect the assembly of the elbow 15 to a bushing 16.

It will be remembered that I indicated that the firing piece F while mounted for sliding movement relatively to the casing 10 cannot rotate relatively to that casing 10. In order to prevent rotation of the firing piece, a stud 91, shown in FIG. 8 extends into a slot 92 of the firing piece. Obviously, parts operating as do the stud 91 and the slot 92 may be placed anywhere for holding the firing piece against rotation while permitting effective movement under the force of the spring 65.

I shall now summarize the invention so that it will be well understood. Through utilization of the pin 42 in helical slot 47 of the sleeve 44 secured to the firing piece F, the holding rod 28 may be moved endwise relatively to the firing piece to bring about engagement or disengagement of the grippers 24 relatively to the ring 23 of an elbow 15. It will also be understood that in all positions of the pin 42 in the helical slot 47, the holding rod 28 will be locked against endwise movement relatively to the sleeve 44 of the firing piece. Endwise movement of the holding rod 28 relatively to the firing piece can only be obtained by rotation of the handle grip 14 mounted on the casing and adapted to move pin 42 therewith. It will also be further understood that the sliding of the slide 66 by the operation of the handle 87 and its associated toggle parts, will compress the spring 65 either to the left or to the right so that the firing piece will be moved to the left or to the right by the release of the several balls 76. These balls coact with a rounded shoulder 74 or a rounded shoulder 75 on the firing piece so as to lock the piece for spring firing to the right or to the left as may be desired, this firing being accomplished upon release of the balls 76 from the shoulders 74, 75, by operation of the trigger 13. I believe that with this final summary of the invention, and with the detailed description presented, those skilled in the art will fully appreciate my contribution to the art.

I claim:

1. In a combination of the class described, a movably mounted firing piece, detent means for locking said firing piece against movement in either of opposed directions, spring power means for moving said firing piece in either of said opposed directions, and means for releasing said detent means whereupon said power means moves said firing piece in one of said opposed directions.

2. In the combination of claim 1, the feature that said detent means locks said firing piece in either of two opposed positions, and said power means moving said firing piece in one direction from one position and in an opposed direction from the other position when said firing piece is released.

3. In the combination of claim 2, the feature that said power means are spring means movable bodily with said firing piece into two opposed positions, and means for moving a portion of said spring means when said firing piece is in either one of said opposed positions to predispose said spring means to project said firing piece toward the other one of said opposed positions.

4. In the combination of claim 1, the feature that said spring means is a compression spring lying between opposed end sur-

faces of said firing piece, and means for compressing said spring against one or the other of said end surfaces.

5. In the combination of claim 4, the feature that said detent means locks said firing piece against movement by said spring as said spring is being compressed.

6. In the combination of claim 5, the feature that said detent means is a single detent coacting with spaced parts of said firing piece for locking it in either of two opposed positions as said spring is compressed against one or the other of said end surfaces.

7. In the combination of claim 1, the feature that said firing piece is slidably mounted within a tubular casing, a rod extending through said firing piece, means for sliding said rod relatively to said firing piece, and a terminator gripper movable by the sliding of said rod relatively to said firing piece.

8. In the combination of claim 7, the feature that said means for sliding said rod relatively to said firing piece is a cam mechanism that holds said rod to said firing piece for movement therewith when said firing piece is actuated.

9. In the combination of claim 7, the feature that the end of the tubular casing in which the terminator gripper moves is transparent so that the gripper may be observed.

10. In the combination of claim 1, the feature that said firing piece is slidable within a tube or the like and is formed generally as a cylindrical member with spaced shoulders between which is positioned a compression spring whereby said spring and firing piece slide together in said tube between predetermined positions, said detent locking said firing piece coacting with spaced portions of said cylindrical firing piece for locking it in either of said predetermined positions in said tube, and means mounted on said tube for coacting with either end of said compression spring for compressing said spring against one or the other of said shoulders when said firing piece is locked in one of said predetermined positions whereby said firing piece will be moved by said spring in one direction from one of said predetermined positions when released from said detent means.

11. In the combination of claim 10, the feature that said detent is a ball movable against one or the other of spaced locking surfaces on said firing piece, and said means for releasing said detent means presenting an opening to said ball into which said ball moves for releasing said firing piece.

12. In the combination of claim 10, the feature that a rod extends through a central opening in said firing piece, means for sliding said rod relatively to said firing piece, and a terminator gripper movable by the sliding of said rod relatively to

said firing piece.

13. In the combination of claim 12, the feature that said means for sliding said rod relatively to said firing piece is a cam mechanism that secures said rod to said firing piece for movement therewith when said firing piece is actuated by said spring.

14. In the combination of claim 12, the feature that said means for sliding said rod is a handpiece rotatably mounted on said tube, cam means rotatably mounted on said rod rotated by said hand piece, and cooperating cam means on said firing piece coacting with said cam means on said rod for sliding said rod relatively to said firing piece and locking said rod in effect to said firing piece for movement with said firing piece by said power means.

15. In the combination of claim 1, the feature that said casing is tubular, one end of the casing being open and formed of transparent material whereby the end of said firing piece lying in said one end of the casing is visible.

16. In a combination of the class described:

a tubular casing;

a generally cylindrical firing piece mounted for slidable relative movement within said casing and having a central opening for a rod;

a rod slidably mounted within said opening in said firing piece for relative motion thereto;

a gripper coupled to said rod for movement between a gripping position and an open position upon motion of said rod relative to said firing piece;

a handpiece movably mounted to said casing;

means slidably coupling said handpiece, said rod and said firing piece for moving said rod into a fixed position relative to said firing piece;

a detent means for locking said firing piece against movement relative to said casing; and

power means for moving said firing piece relative to said casing while said rod remains in fixed position relative to said firing piece, upon release of said detent means.

17. In the combination of claim 16, the feature that said rod is connected to said firing piece by cam mechanism including an operating part rotatable on said rod and movable bodily axially therewith, relatively to a part of said cam mechanism forming part of said firing piece, whereby rotation of said operating part relatively to said firing piece moves said operating part and rod endwise of said firing piece to actuate said gripper, and means whereby said hand piece rotates said operating part.

* * * * *

50

55

60

65

70

75