

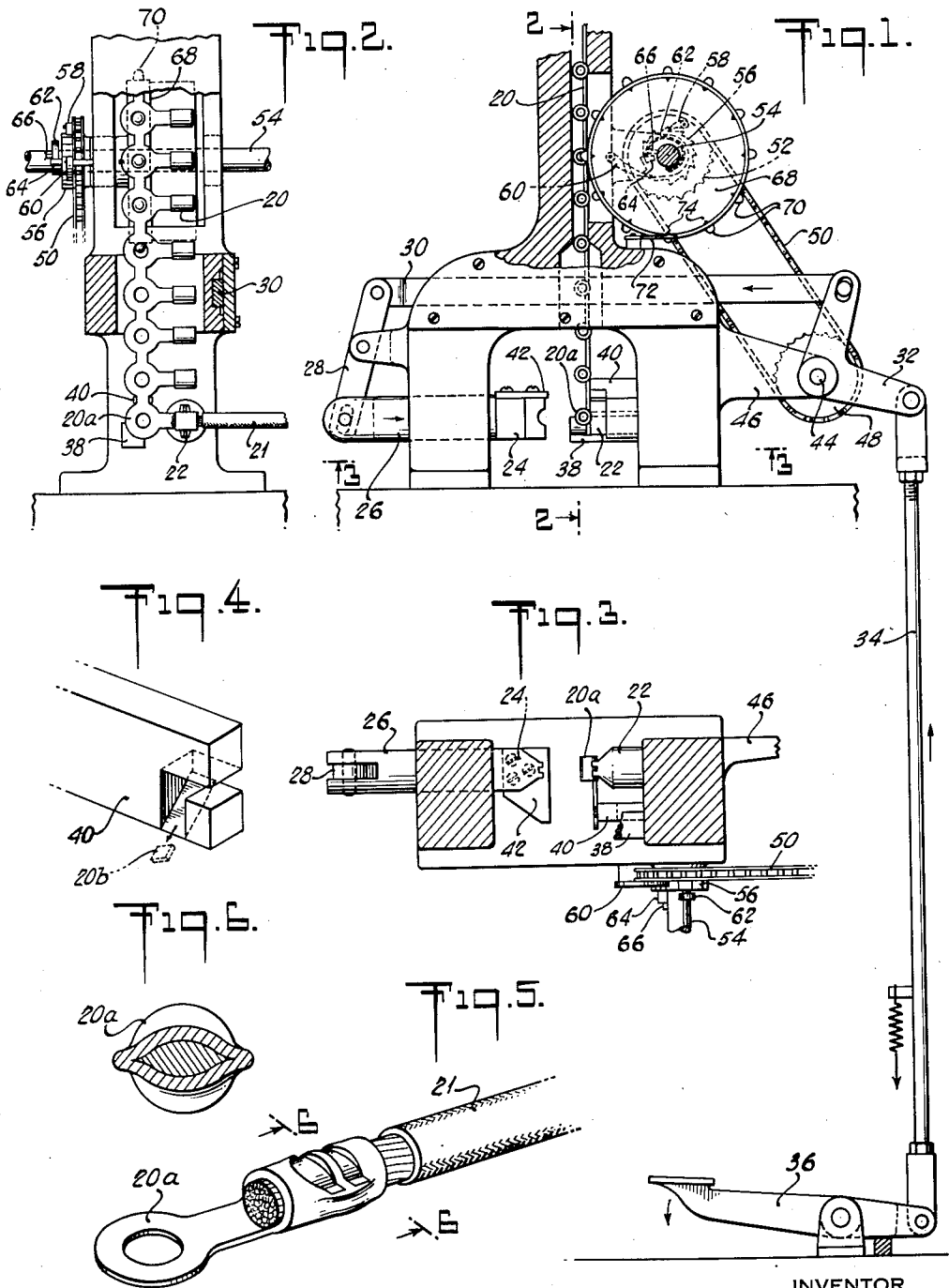
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APPARATUS FOR SEVERING AND CRIMPING ELECTRICAL CONNECTORS

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APPARATUS FOR SEVERING AND CRIMPING
ELECTRICAL CONNECTORSVernon E. Carlson, Camp Hill, Pa., assignor to
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This invention relates to apparatus for severing and crimping electrical connectors. More particularly it has to do with apparatus for serially feeding a procession of similar electrical connectors into operative relationship with a pair of crimping dies and crimping the connectors onto the ends of electrical conductors.

Heretofore most electrical apparatus such as control systems, networks, radios, etc., have depended upon soldered connections, until comparatively recently, when crimped connections came into extensive use. In making these connections, the end of a conductor was inserted into a ferrule or other conductor-receiving element of the electrical connector and there soldered or crimped in place. For the most part these operations were performed by hand, although there have been attempts made at performing some of the operations semi-automatically. Thus, it is fairly common today to find power-operated presses for carrying out routine crimping operations. Such prior equipment has not been wholly satisfactory, however, because of the fact that the parts to be crimped and operated upon are all small and difficult to handle. Each connector had to be individually positioned upon the conductor and then the assembled connector and conductor had to be positioned within closely specified limits in operative relationship between the crimping dies before the press could be actuated.

It is an object of the present invention to provide means for feeding a series of connectors to a region of operation wherein each connector may be correctly crimped to the end of an electrical conductor. A further object is the provision of apparatus for performing a crimping operation where relatively large numbers of crimped connectors are required and wherein the crimped connections must conform to exacting standards. Another object is the provision of means for feeding a strip-type of multiple connector wherein the crimping operation is combined with a shearing operation so as to complete the formation of a connector and simultaneously crimp it directly onto an electrical conductor. An additional object is the provision of apparatus for feeding and crimping strips of connectors wherein the strips fed into the machine are of a large enough size to be handled easily and from which lightweight electrical connectors may be individually sheared and crimped in a manner such as to avoid individual handling of the small connectors which are a part of the finished product. Other objects will be in part pointed out

as the description proceeds and will in part become apparent therefrom.

In the application of William S. Watts, Serial No. 514,214, filed December 14, 1943, there is disclosed and claimed a type of electrical connector wherein the connectors are formed in long strips, each individual connector (except the two end connectors) being integral with two other connectors, one on either side thereof. The present invention provides apparatus peculiarly well suited to feeding strip-type connectors such as disclosed and claimed in said application, and for crimping the end connector of the strip directly onto the end of an electrical conductor. Means are provided for feeding the strip of connectors so as to place the end connector in a predetermined fashion between two dies so that in closing upon the connector the dies may at the same time sever the connector from the strip and crimp the connector onto the end of the conductor. In addition means are included for assuring that the end connector is properly positioned with each repeated cycle of the machine so that no time is lost in positioning the end of a conductor within the ferrule or conductor receiving portion of the connector.

In this specification and the accompanying drawing, I have shown and described a preferred embodiment of my invention and various modifications thereof; it is to be understood that these are not intended to be exhaustive nor limiting of the invention, but on the contrary are given for the purpose of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify and adapt it in various forms, each as may be best suited to the conditions of a particular use.

In the accompanying drawing, in which only one form of the invention is specifically illustrated:

Figure 1 is a side elevation with parts broken away showing the machine with a strip of electrical connectors therein in position for operation of the machine to begin;

Figure 2 is a sectional view of part of the machine taken along the line 2—2 of Figure 1 in the direction of the arrows;

Figure 3 is a sectional view of part of the machine taken along the line 3—3 of Figure 1 in the direction of the arrows;

Figure 4 is a perspective view of one of the shearing dies of the machine illustrated in Figures 1-3;

Figure 5 is a perspective view of an electrical connector crimped onto an electrical conductor by the apparatus illustrated in Figures 1-4; and Figure 6 is a sectional view taken along the line 6-6 of Figure 5 in the direction of the arrows.

In Figure 1, a strip of connectors generally indicated by the numeral 20 is shown extending downwardly through the central portion of the apparatus to a position between a stationary crimping die 22 and a movable crimping die 24. Die 24 is reciprocable toward and away from stationary die 22 by means of a die member 26 operated by a rocker arm 28 and a connecting link 30. Link 30 is actuated by a bell crank lever 32 connected to a push rod 34 which in turn is movable through a pedal 36. Adjacent to stationary die 22 is a ferrule stop 38 (see also Figure 2) for positioning the end of the strip of connectors in the desired relationship with respect to the die. A stationary shearing die 40 is positioned above stationary die 22 and stop 38, and a movable shearing die 42 is rigidly fixed to movable crimping die 24 in a manner so as to cooperate with die 40 to sever the end connector 20a from the strip of connectors during a crimping operation.

Bell crank lever 32 is mounted upon a shaft 44 carried by a bracket 46 extending from the frame of the machine. A sprocket wheel 48 is mounted upon shaft 44 so as to be rotated counterclockwise with each downward operation of pedal 36. A sprocket chain 50 extends from wheel 48 upwardly and to the left, as viewed in Figure 1, to a second sprocket wheel 52. Wheel 52 is freely rotatable upon a countershaft 54 mounted in brackets upon the machine frame. A ratchet 56 is positioned freely upon shaft 54 beside sprocket wheel 52 (see also Figure 2). A driving pawl 58 is fixed upon sprocket wheel 52 in driving relationship with ratchet 56 so as to turn the ratchet counterclockwise with each downward operation of pedal 36. A locking pawl 60, mounted upon the frame of the machine, engages ratchet 56 to prevent it from rotating clockwise upon the return of pedal 36. One end of a draw spring 62 is attached to a stud 64 carried by ratchet 56. The other end of the draw spring is attached to countershaft 54. The arrangement is such that each time ratchet 56 turns counterclockwise it tends to wind the end of draw spring 62 in a counterclockwise direction around countershaft 54 (since countershaft 54 is not free to rotate until later in the cycle, as will be described hereinafter). Countershaft 54 is provided with a stop 66 (see also Figure 2) which prevents countershaft 54 from ever turning counterclockwise with respect to ratchet 56 more than a predetermined amount.

A feed wheel 68 is keyed to countershaft 54 and is provided around its outer periphery with a series of sprockets 70. These sprockets are spaced so as to cooperate with openings in the ferrules and hence feed them downwardly each time feed wheel 68 turns in a counterclockwise direction. In the connector illustrated (see Figure 5) the openings which cooperate with sprockets 70 serve also to receive a binding post when an electrical contact is to be made by the connector.

The frame of the machine carries a detent 72 positioned below feed wheel 68 so as to engage with seats 74 located around the exterior of the feed wheel adjacent sprockets 70. These seats are related to the spacing of the electrical connectors so that the detent will engage in a seat with a slight camming action at the end of a

feeding operation and hence aid in positioning the strip of electrical connectors and so that the end connector 20a is correctly located with respect to stationary die 22 and against stop 38. Stop 38 prevents wheel 68 from overfeeding, and detent 72 and stops 74 aid draw spring 62 in assuring that the strip of connectors is not permitted to back away slightly from stop 38.

In operation, a strip of electrical connectors is fed to the machine and the end connector 20a is nicely positioned against stop 38. One of the sprockets 70 is in alignment with the opening in one of the electrical connectors so that when rotation of feed wheel 68 is permitted, the strip of connectors will be fed downwardly to position another connector in the correct relationship between the dies. When pedal 36 is pressed downwardly by the operator, or when it is operated automatically, as by a pneumatic cylinder, for example, the motion is transmitted through the linkages described and die member 26 is forced to the right, as illustrated in Figure 1, so that shearing die 42 cooperates with shearing die 40 (see also Figure 4) to punch out a piece 20b and sever connector 20a from the strip, and movable crimping die 24 closes upon connector 20a to crimp its ferrule onto the end of an electrical conductor, such as the conductor 21 illustrated in Figure 5. As soon as the end connector is removed, countershaft 54 and feed wheel 68 are free to move under the influence of draw spring 62 to position the next connector in operative crimping relationship. Draw spring 62 is loaded through the pawl and ratchet arrangement each time pedal 36 is moved downwardly and has sufficient strength, when loaded, to unseat detent 72 from its stop 74.

The crimp itself may be of any desired type and preferably is of the type disclosed and claimed in the co-pending application of U. A. Whitaker, Serial No. 455,039, filed August 17, 1942. Other forms of connector may be used with equal success. The electrical conductors may be positioned within the connector ferrules either manually or automatically.

As various embodiments may be made of the above invention and as changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawing is to be interpreted as illustrative and not in a limiting sense.

I claim:

1. In apparatus of the character described and adapted to sever an electrical connector from a strip of connectors and crimp it onto an electrical conductor, the combination including a stationary die and a movable die, each die having a crimping portion and a shearing portion, whereby a connector may be crimped and sheared with a single closing of the dies, and feeding means for successively positioning the end connector of a strip of connectors between said dies, said feeding means comprising a draw spring and power-operated means for loading said draw spring, whereby said draw spring may be power-loaded and thereafter may perform a feeding operation.

2. In apparatus of the character described and adapted to sever an electrical connector from a strip of connectors and crimp it onto an electrical conductor, the combination including a pair of dies movable toward one another whereby a connector may be crimped therebetween, power means for closing said dies, and feeding means for successively positioning the end connector of

a strip of connectors between said dies, said feeding means comprising a draw spring and means for loading said draw spring from said power means, whereby said draw spring may be power-loaded during a crimping operation and thereafter may perform a feeding operation.

3. In apparatus of the character described and adapted to feed a series of electrical connectors toward a crimping position and to crimp the leading connector onto a conductor at said position, the combination including a pair of dies movable toward one another, whereby a connector crimping operation may be performed, and feeding means for successively positioning the leading connector of a series of connectors between said dies.

4. In apparatus of the character described and adapted to feed a series of electrical connectors toward a crimping position and to crimp the leading connector onto a conductor at said position, the combination including a pair of dies movable toward one another, whereby a connector crimping operation may be performed, and feeding means for successively positioning the leading connector of a series of connectors between said dies, said feeding means comprising a draw spring.

5. In apparatus of the character described and adapted to feed a series of electrical connectors toward a crimping position and to crimp the leading connector onto a conductor at said position, the combination including a pair of dies movable toward one another, whereby a connector may be crimped therebetween, power means for closing said dies, and feeding means for successively positioning the leading connector of a series of connectors between said dies, said feeding means

comprising a draw spring and means for loading said draw spring from said power means, whereby said draw spring may be power-loaded during a crimping operation and thereafter may perform a feeding operation.

6. In apparatus of the character described and adapted to sever an electrical connector from a strip of connectors and crimp it onto an electrical conductor, the combination including, means for feeding a strip of electrical connectors to a point of operation, indexing means for assuring that the strip of connectors assumes a predetermined position with each feeding operation, and die means for crimping and severing one of the connectors at said point of operation, said means for feeding comprising a feed wheel having sprocket-like means around its periphery for engaging and feeding successive connectors.

7. In apparatus of the character described and adapted to sever an electrical connector from a strip of connectors and crimp it onto an electrical conductor, the combination including, means for feeding a strip of electrical connectors to a point of operation, indexing means for assuring that the strip of connectors assumes a predetermined position with each feeding operation, and die means for crimping and severing one of the connectors at said point of operation, said means for feeding comprising a feed wheel having sprocket-like means around its periphery for engaging and feeding successive connectors, and said indexing means comprising detent-like means engageable with said feed wheel to stop said feed wheel positively and thus determine the extent of each feeding operation.

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