March 15, 1966 E. W. WAGNER 3,239,924

ELECTRICAL TERMINAL APPLICATOR

Filed Feb. 9, 1965 4 Sheets-Sheet 1

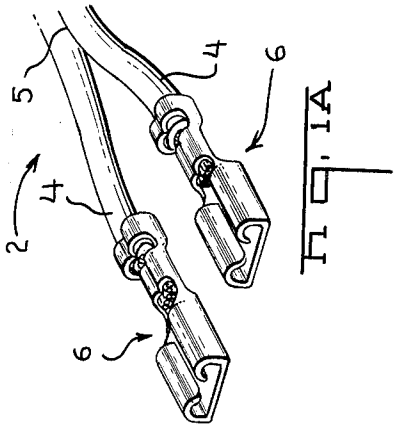

FIG. 1A

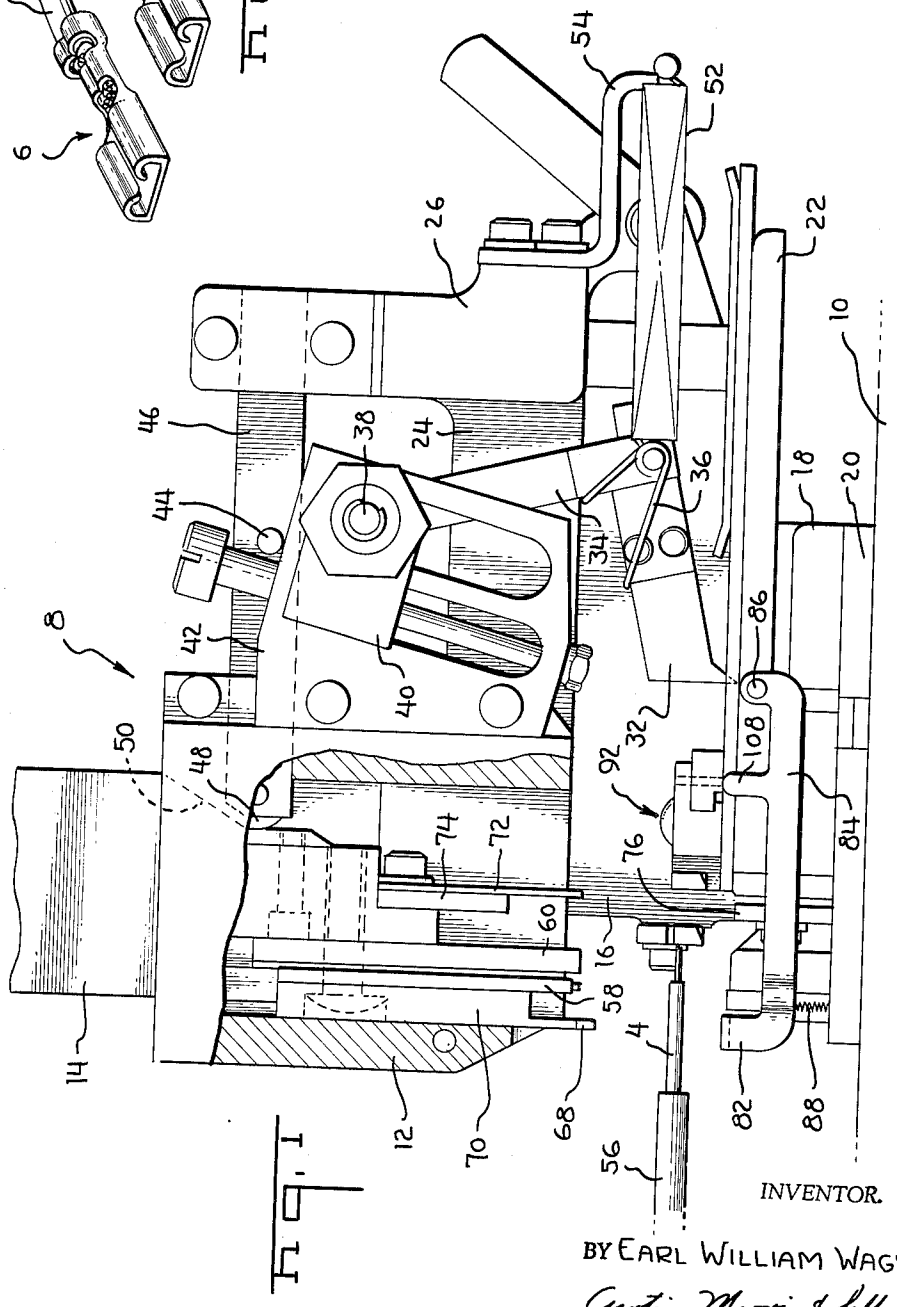

FIG. 1

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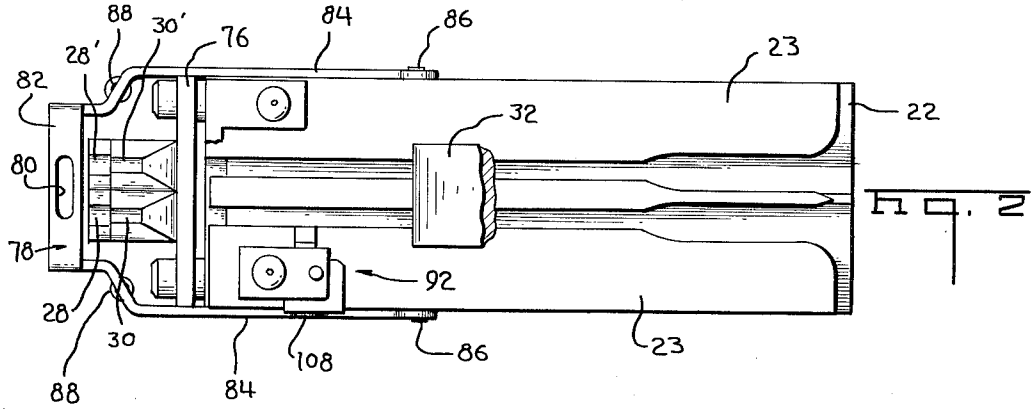

Fig. 2

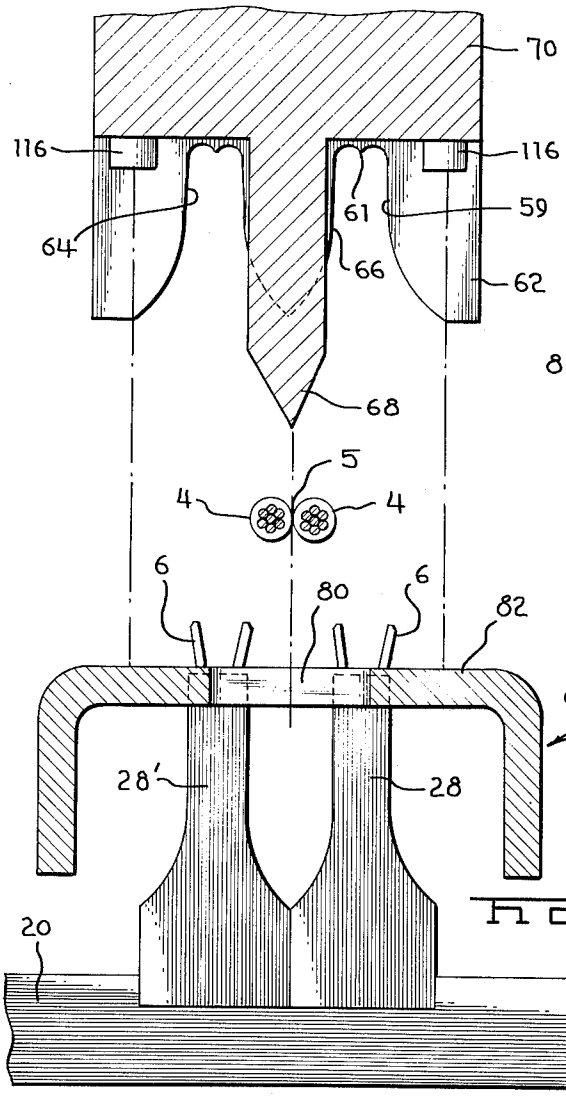

Fig. 7

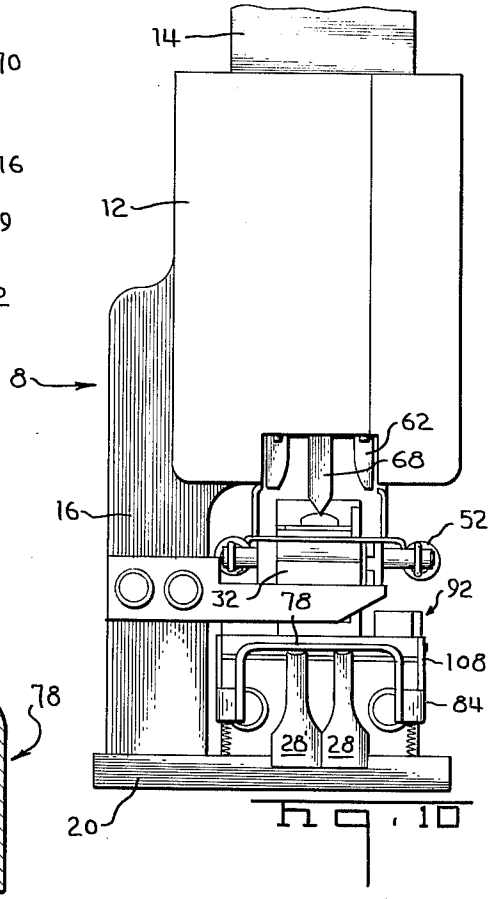

Fig. 10

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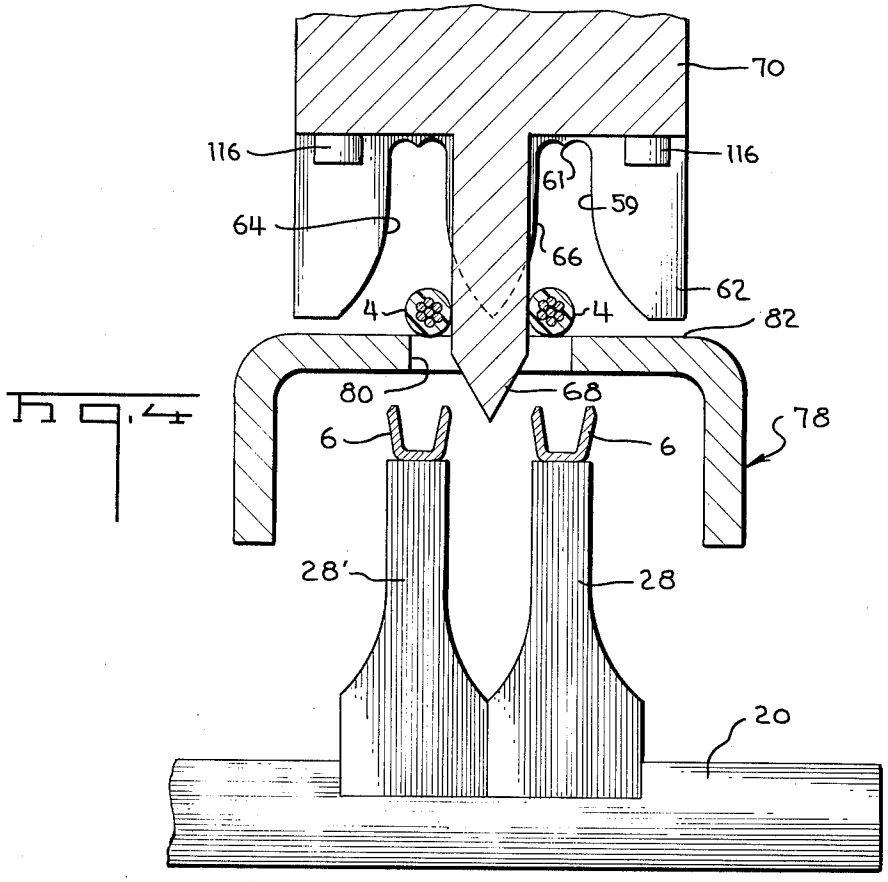

Fig. 4

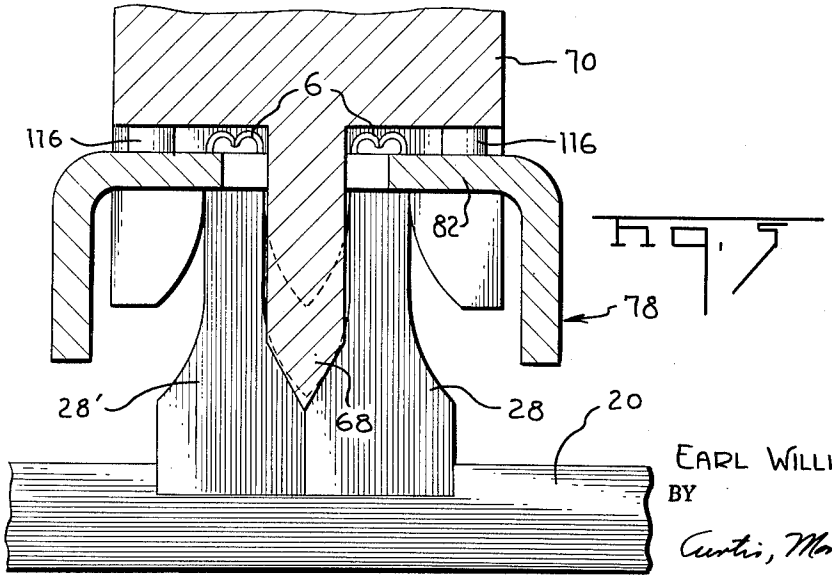

Fig. 5

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ELECTRICAL TERMINAL APPLICATOR

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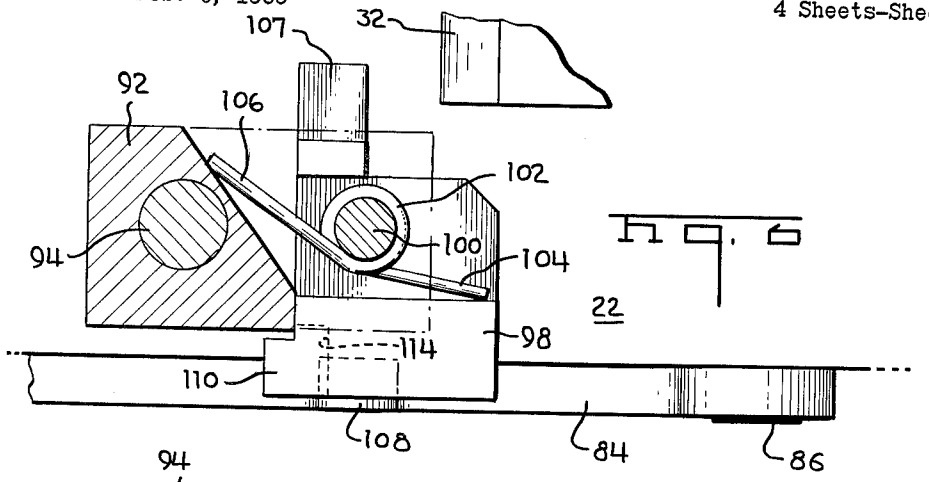

Fig. 6

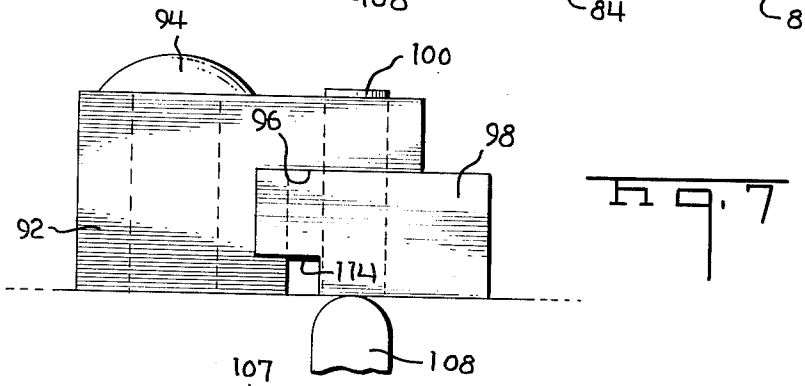

Fig. 7

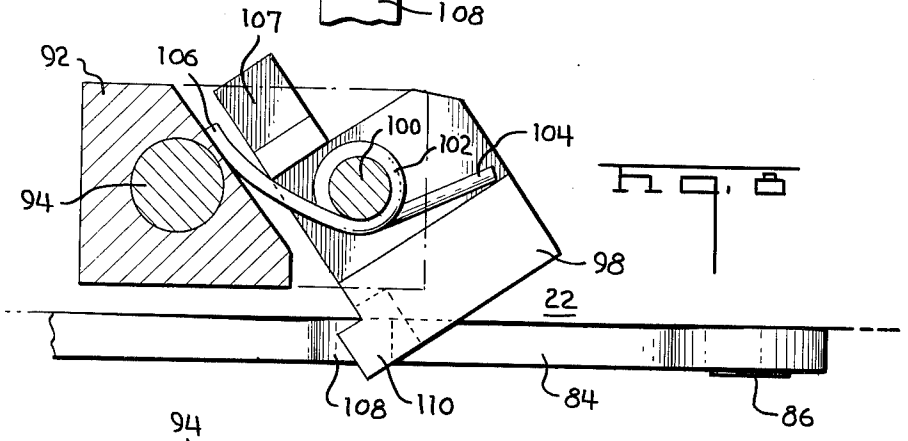

Fig. 8

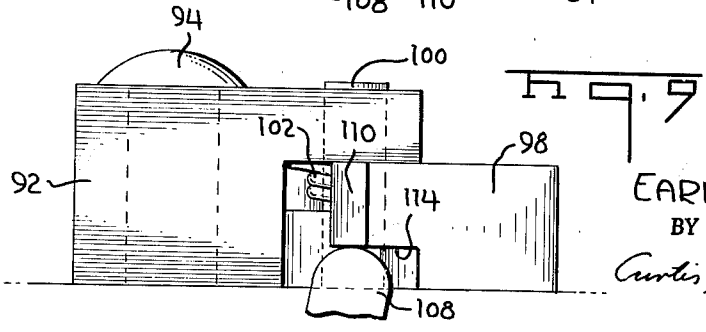

Fig. 9

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3,239,924

ELECTRICAL TERMINAL APPLICATOR

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Filed Feb. 9, 1965, Ser. No. 431,323
5 Claims. (Cl. 29—203)

This invention relates to crimping machines or applicators for crimping electrical terminals onto the ends of wires.

The U.S. patent to Kerstetter et al., 3,030,694 and the U. S. patent to Schwalm et al., 3,019,679 each discloses a fully automatic lead-making machine of a general type in which wire is fed from a reel past a wire-cutting and stripping zone where a lead is severed from the end of the fed wire and the insulation on the trailing end of the lead and the insulation on the leading end of the wire are circumferentially cut adjacent to the plane of cutting the wire. The trailing end of the lead and the leading end of the wire are then moved axially in these machines while the insulation cutting knives remain closed thereby to strip insulation from the trailing end of the lead and the leading end of the wire. Machines of this general type are also provided with suitable transfer mechanisms which grip the lead and the wire adjacent to the stripped ends and transfer these ends laterally to present them to crimping machines or applicators disposed on each side of the path of wire feed. Terminals are then crimped onto the ends of the wire and the cut lead by the crimping machines.

The present invention relates to an improved applicator or crimping machine which is particularly adapted for use in lead-making machines of the type disclosed in U.S. patents 3,019,679 and 3,030,694. Particularly, the present invention contemplates a terminal applicator which is adapted to be used where parallel conductors are being processed in the lead-making machine during operation. The two conductors may comprise conventional twin conductor cord, commonly known as ripcord, conventional twin antenna cord, or may comprise two individual conductors which are not joined to each other.

It is accordingly an object of the invention to provide an improved crimping apparatus for use in an automatic lead-making machine. A further object is to provide a crimping apparatus which is particularly adapted to the crimping of a pair of terminals onto a pair of parallel conductors. A further object is to provide an applicator having improved conductor separating and positioning means which is operative immediately prior to the crimping operations to separate a pair of conductors to which terminals are to be crimped and to locate the ends of the conductors in previously fed terminals on the crimping anvils of the applicator.

These and other objects of the invention are achieved in a preferred embodiment comprising an applicator having a pair of anvils in parallel side-by-side relationship and a pair of crimping dies which are movable relatively towards and away from, and cooperable with, the anvils to crimp terminals onto a pair of side-by-side conductors. A conductor-supporting platform is provided beside the anvils and crimping dies and is normally disposed in a first position in which its supporting surface is substantially on the same level as that of the terminal-supporting surfaces of the anvils. This platform is movable to a second position in which its supporting surface is disposed in a plane extending between the crimping dies and anvitls. Latch means are provided for retaining the supporting platform in its first position so that a pair of wires can be moved laterally of their axes and located between the dies and anvils without interference by the platform. Means are provided for releasing the latch means at the beginning of the crimping cycle in a

manner such that the platform moves to its second position and supports the wires during the initial stages of the operating cycle. A wire separator in the form of a narrow plate is movable with the dies towards the anvils and in advance of the dies, the function of this separator being to move between the two wires and separate them by a predetermined amount so that they will be in alignement with the terminals positioned on the crimping dies. During the final portion of the crimping operation, the supporting platform is automatically lowered until it returns to its first position and the wires supported on the platform are guided towards the terminals on the anvils in a manner such that the stripped ends of the wires will be accurately located in the ferrule-forming portions of the terminals.

In the drawing:

FIGURE 1 is a side view with parts broken away of a preferred form of terminal applicator in accordance with the invention;

FIGURE 1A is a perspective view of a pair of twin conductors having terminals crimped onto their ends;

FIGURE 2 is a plan view taken along the lines 2—2 of FIGURE 1 and showing the terminal feed track, crimping anvils, and the wire-supporting platform;

FIGURE 3 is a fragmentary frontal view showing the anvils, the wire-supporting platform, the crimping dies, and the wire separating means, the parts being shown in this view in the positions they occupy in the beginning of the crimping cycle;

FIGURES 4 and 5 are views similar to FIGURE 3 but showing the positions of the parts after partial closure of the dies and anvils (FIGURE 4) and at the conclusion of the crimping operation (FIGURE 5);

FIGURE 6 is a sectional plan view, taken along the lines 6—6 of FIGURE 1 showing details of a latch mechanism which holds the wire-supporting platform in its depressed or first position;

FIGURE 7 is a side view of the latch mechanism shown in FIGURE 6 taken along the lines 7—7 of FIGURE 6;

FIGURES 8 and 9 are views similar to FIGURES 6 and 7 respectively but showing the positions of the parts of the latch mechanism when the latch is disengaged from the wire-supporting platform; and

FIGURE 10 is a front view of the apparatus of FIGURE 1.

Referring first to FIGURE 1A, a common type of twin conductor cable **2** comprises a pair of insulated wires **4** with the insulation of the wires being bonded along a common side **5**. The apparatus of the present invention is adapted to apply terminals **6** onto stripped ends of the wires **4** which, as shown in the drawing, have been separated from each other for a short distance at the end of the cable. Since the end portions of the wires **4** are relatively non-rigid, they must be closely controlled while they are being positioned in the terminal applicator.

Referring now to FIGURES 1, 2 and 10, an applicator **8**, in accordance with the invention, is adapted to be used in a lead-making machine of the general type disclosed in the previously identified U.S. Patent 3,019,679. In accordance with the teachings of this patent, the wires to which terminals are being attached are moved laterally of their axes from a cutting and stripping zone to position the stripped wire ends between the crimping dies and the anvils of applicator. Thus in FIGURE 1, it can be assumed that the wires **4** have been moved laterally towards the plane of the paper until the end portions of the wires are disposed between the crimping dies and anvils as shown. The applicator **8** comprises a frame coating **16**, **24** having a housing **12** thereon in which a reciprocable ram **14** is contained. This ram will normally be coupled to the ram of a suitable crimp-

ing press (not shown) as disclosed in U.S. Patent 3,019,679. The sidewall portions **16**, **24** of the frame are mounted on suitable support plates **18**, **20** on the surface **10** of the lead-making machine. Two strips of terminals are fed over the upper surface of a plate **22** mounted on the plate **18** along a path defined by a pair of parallel guide plates **23**.

Feeding is accomplished by means of a feed finger **32** which is pivoted to one end of a lever **34**, the opposite end of this lever being pivotally connected at **44** to a slide member **46**. Lever **34** is pivoted intermediate its ends at **38** to an adjustable block **40** mounted in bracket means **42** extending from the housing **12**. This slide member **46** is moved to and fro during each operating cycle by means of a cam surface **50** on the ram **14** which engages a roller **48** on the inner end of the slide. Slide **46** is supported on its right-hand end as viewed in FIGURE 1 in a support **26** of the frame which extends upwardly from the side portion **24**. The feed finger **32** is normally biased in a counterclockwise direction towards the surface of the plate **22** by means of a torsion spring **36** and the lever **34** is normally maintained in its retracted position by springs **52** secured at one end of the lever and at their opposite ends to a bracket **54** on the frame section **26**. It will thus be apparent that upon downward movement of the applicator **14** from the position of FIGURE 1, the slide member **46** will be moved rightwardly causing the lever **34** to swing in a clockwise direction about its pivotal axis **38** thereby to advance the feed finger **32**.

The terminal strips are fed during each cycle to position the leading terminals of the strips on a pair of spaced-apart supporting anvils **28**, **30**, **28'**, **30'**. The anvils are cooperable with spaced-apart crimping dies provided in plates **58**, **60** to crimp the previously fed terminals onto the wire ends upon downward movement of the ram **14** from the position of FIGURE 1. The dies are thus provided with generally convergent surfaces **59** which are reversely curled towards each other as shown at **61** to form a cusp. It will be understood that two separate anvils **28**, **30** and two separate dies are provided for each of the terminals being crimped in order to crimp both the wire barrel portion of each terminal and the insulation support portion. A depending arm **66** on each of the die plates **58**, **60** separates the two crimping dies in each plate. These arms are tapered at their lower ends to assist in maintaining the spacing between the wires although separation of the wires is controlled primarily by a separator device described below.

The initial separation of the wires is accomplished by means of a tapered spreading member **68** which depends from a plate **70** mounted on the applicator ram **14** in front of the die plates. Thus, if the two conductors are disposed relatively close to each other in the beginning of the operating cycle, the pointed end of the spreading member **68** will move between the conductors and align them with the spaced-apart dies of the plates **58**, **60**.

At the time of crimping, it is necessary to sever the leading terminals of the two strips from the strip, an operation which is accomplished by a shear blade **72** mounted on the applicator ram and against a spacer **74** and which cooperates with a shear block **76** mounted on the plate **18**.

Since the wires **4** are relatively limp or flexible, they would not necessarily be separated or spread apart but merely lowering the spreading member **68** and moving it against the end portions of the wires. Accordingly, there is provided a support platform **78** in front of the anvils **28**, **28'** which is adapted to support the wires while the separating operation is taking place. This support platform is formed on the end of a generally U-shaped bracket member **82**, **84** the sides of which are bent downwardly and outwardly and extend along each side of the feed track plate **22**. The inner ends of this member are pivoted to the plate **22** as shown at **86** to permit movement of the platform section **78** upwardly from the position of FIGURE 1 to the position shown in FIGURE 4. Platform **78** is normally urged upwardly by springs **88** interposed between the sides of the section **82** of the platform and the surface of the plate **20**.

Platform **78** is normally retained in its depressed or first position by means of a latch mechanism shown in detail in FIGURES 6–9 and comprising a block **92** secured to the plate **23** and the right-hand side thereof (as viewed in FIGURE 10) by a pin **94**. Block **92** is cut away on its underside as shown at **96** and a latch block **98** is pivotally mounted on a pin **100** extending through the recess **96**. Latch block **98** is normally biased by a torsion spring **102** to the position shown in FIGURE 6 in which it projects laterally beyond the side of the plate **22** and over the portion **84** of the platform bracket. An upwardly extending ear **108** on the platform bracket bears against the underside of block **98** so that this block, when the parts are in the positions of FIGURE 6, latches the platform and its bracket in its lowered position.

Block **98** has an inwardly extending ear **107** which intersects the path of reciprocation of the finger **32**, the arrangement being such that when the feed finger moves leftwardly from the positions of FIGURES 1 and 6, the block **98** will be swung in a counterclockwise direction and its underside will be disengaged from the arm **108**. The platform is then permitted to move upwardly about its pivotal axes **86** under the influence of the springs **88** until the top of the ear **108** moves into recess **114** on the underside of the block **98**.

The wire carrier **56**, as previously noted, is movable laterally of its axis and into the plane of the paper of FIGURE 1 to position the end portion of the wires between the dies and anvils. This wire carrier may take a variety of forms, one type of carrier and associated actuating mechanism being shown in detail in U.S. Patent 3,019,679. For purposes of the present disclosure it is sufficient to state that the function of this carrier is to hold the wires adjacent to their ends and transport them laterally from the insulation stripping station to the position shown in FIGURE 1 where the stripped ends are disposed between the applicator dies anid anvils.

If it is thus assumed that the initial wire cutting and insulation stripping operations have been carried out in an automatic lead-making machine and the ends of the wires are located as in FIGURE 1, the operating cycle is as follows. As the ram **14** descends, the lever **34** is swung about its pivotal axis **38** in a clockwise direction to advance the feed finger **32** and to feed a terminal to each of the anvil assemblies **28**, **30**, **28'**, **30'**. During the feeding operation, the feed fingers engages ear **107** to swing the latch block **98** from the position of FIGURES 6 and 7 to the position of FIGURES 8 and 9 thereby to permit upward movement of the platform until it is in supporting relationship to the conductors **4**. As the ram descends, the separating tool **68** moves between the conductors and through the opening **80** of the surface of the platform. The conductors will thus be spread apart by a distance substantially equal to the space between the axes of the two anvil assemblies so that upon further descent of the ram, these conductors will be moved downwardly into the uncrimped terminals. The terminals will thereafter be crimped into surrounding relationship with the conductors as shown in FIGURE 5. The platform is depressed during the final portion of the cycle by bosses **116** which engage the platform on each side of the central opening **80**. When the platform is depressed, the block **98** returns to its normal position (FIGURES 6 and 7) under the influence of the spring **102** to latch the platform in its depressed condition.

The invention is not limited to use with twin conductor cables of the type in which the two conductors of the cable or the insulation of these conductors is bonded or otherwise joined together along the length of the conductor. The invention can also be used in a conventional

lead-making machine with two separate conductors being fed through the machine simultaneously and during each operating cycle rather than a single lead as in previously known lead-making machines. A salient feature of the invention is that it permits accurate control in positioning of each of two leads disposed in a crimping zone of the applicator in a manner such that the ends of the leads are located in the appropriate terminals on the anvils.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only. The actual scope of the invention is intended to be defined in the following claims when viewed in their proper perspective against the prior art.

I claim:

1. Apparatus for crimping terminals onto a pair of parallel conductors in side-by-side relationship comprising, crimping anvil means having terminal-supporting surfaces for supporting a pair of terminals in side-by-side relationship, crimping die means movable towards and away from said anvil means, said die means comprising a pair of spaced-apart crimping dies, wire spreading and positioning means disposed between, and movable in advance of and with said dies, wire support means disposed beside said die and anvil means, said support means having a wire supporting surface which is substantially coplanar with said terminal-supporting surfaces of said anvil means, means for raising said support surface during initial movement of said wire spreading and positioning means to support said wires during initial movement of said spreading means towards said anvil means having a wire supporting surface which is subspreading means and positioned in terminals on said anvil means during movement of said crimping dies.

2. In an apparatus for crimping a pair of conductors onto a pair of terminals of the type comprising a pair of anvils in parallel side-by-side relationship, a pair of crimping dies movable relatively towards and away from said anvils, the improvement to said apparatus comprising, conductor supporting means normally disposed in a first position in which said supporting means is substantially coplanar with said anvils, means resiliently biasing said supporting means to a second position in which said supporting means is between said dies and anvils when said dies and anvils are apart, latch means for retaining said supporting means in said first position, and means responsive to relative movement of said dies towards said anvils for disengaging said latch means whereby said supporting means moves to said second position and into supporting relationship with a pair of conductors positioned between said dies and anvils, wire spreading means extending in advance of, and between said dies to spread conductors supported on said supporting means, and means movable with said dies for moving said supporting means against the force of said resilient means towards said anvils during movement of said dies towards said anvils.

3. In an apparatus for crimping a pair of conductors onto a pair of terminals of the type comprising a pair of anvils in parallel side-by-side relationship, a pair of crimping dies movable relatively towards and away from said anvils, the improvement to said apapratus comprising, a conductor supporting platform disposed beside, and in front of, said anvils, said platform being movable from a first position, in which said platform is substantially coplanar with said anvils, to a second position, in which said platform is between said dies and anvils when said dies and anvils are apart, spring means biasing said platform to said second position, latch means for holding said platform in said first position, means responsive to the relative movement of said dies towards said anvils for disengaging said latch means whereby said platform moves to said second position during movement of said dies towards said anvils, and a wire spreader mounted on, and between, said dies and extending towards said platform whereby, a pair of conductors supported on said platform are spread apart by said spreader and positioned in terminals on said anvils.

4. A device as set forth in claim 3 including terminal feeding means for feeding terminals to said anvils, said terminal feeding means being engageable with said latch means to disengage said latch means from said platform.

5. A device as set forth in claim 3 wherein said latch means comprises a pivotally mounted block, said block being normally in engagement with said platform when said platform is in said first position, said means for disengaging said latch means being engageable with said block to disengage said block from said platform.

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