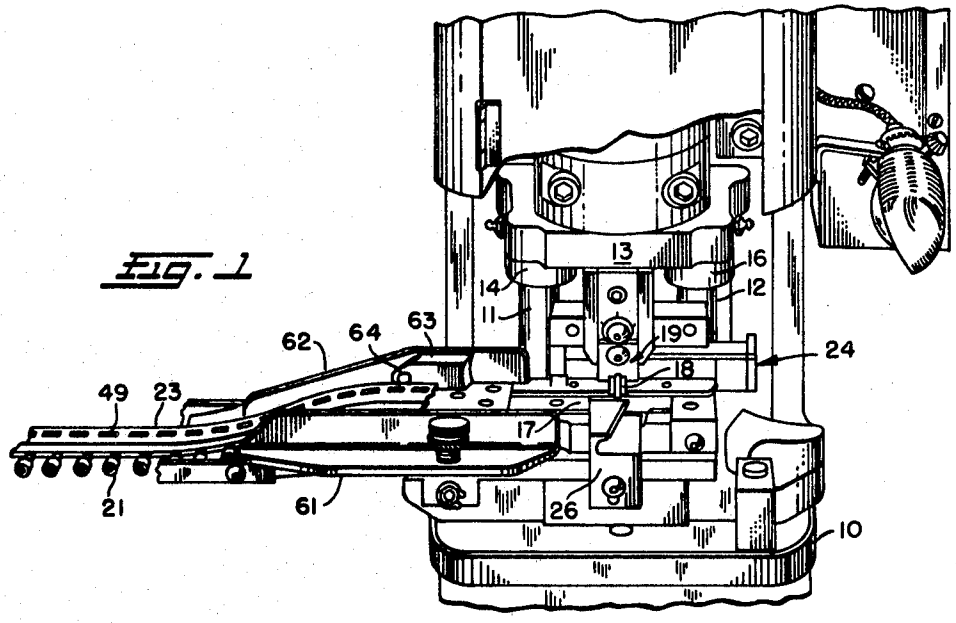
July 2, 1968 F. FRASTACI 3,390,567

CRIMPING PRESS WITH AUTOMATIC FEED

Filed March 1, 1965 3 Sheets-Sheet 1

Fig. 1



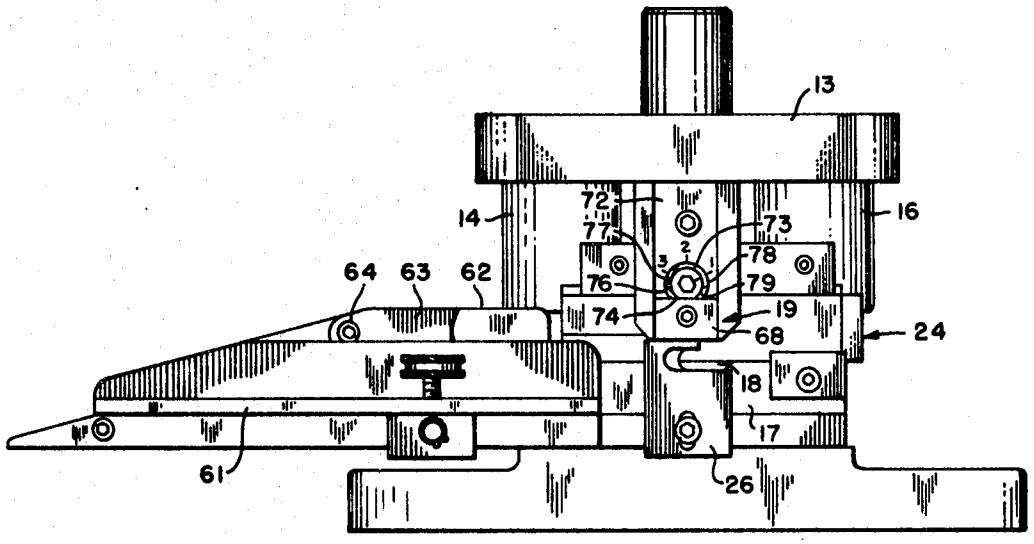


Fig. 2

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July 2, 1968 F. FRASTACI 3,390,567

CRIMPING PRESS WITH AUTOMATIC FEED

Filed March 1, 1965 3 Sheets-Sheet 2

Fig. 3

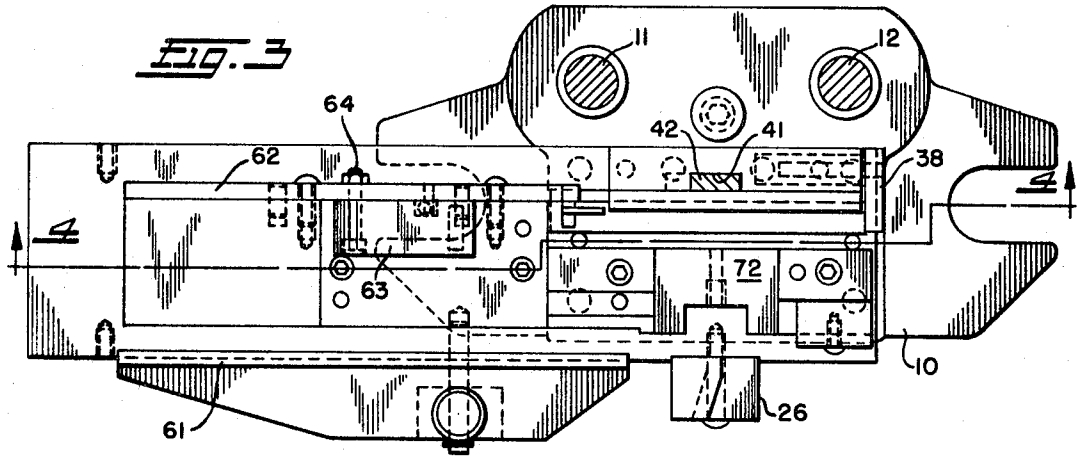
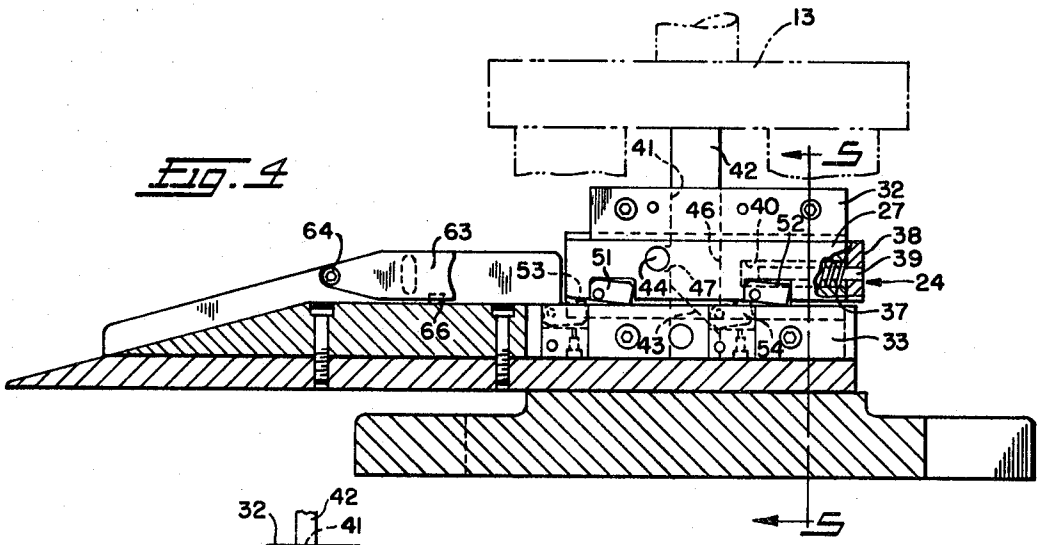


Fig. 4



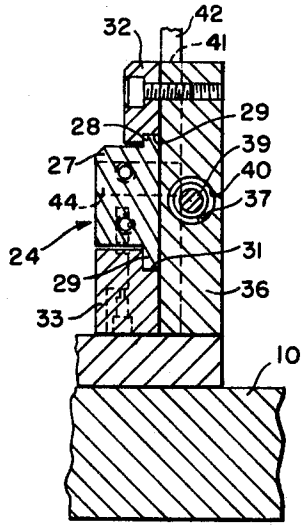


Fig. 5

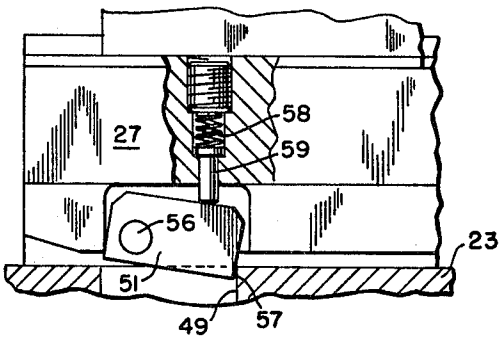


Fig. 6

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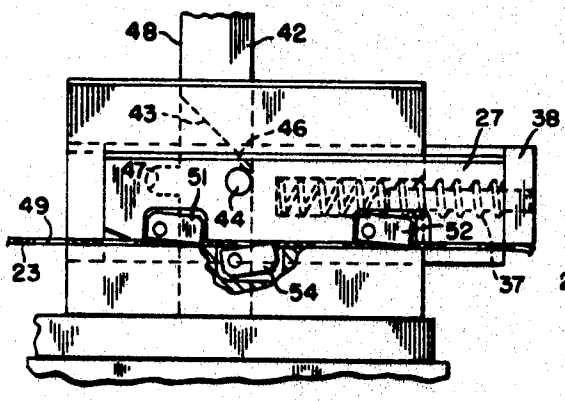


Fig. 8

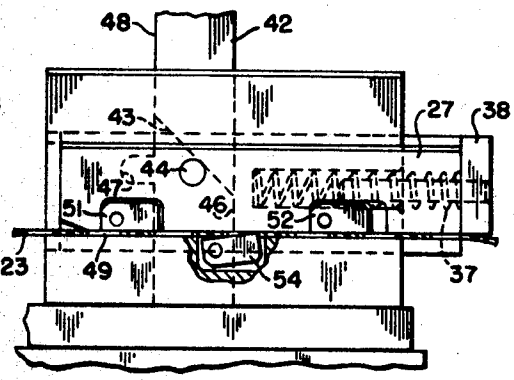


Fig. 9

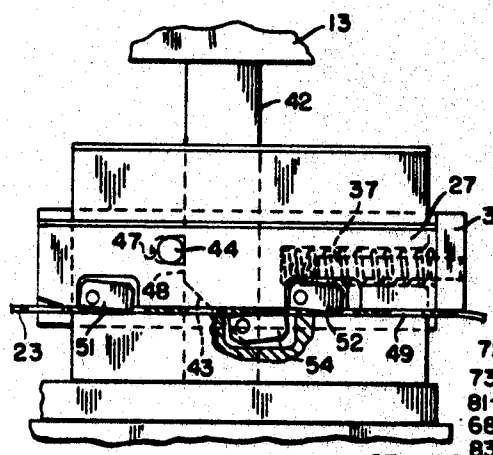


Fig. 10

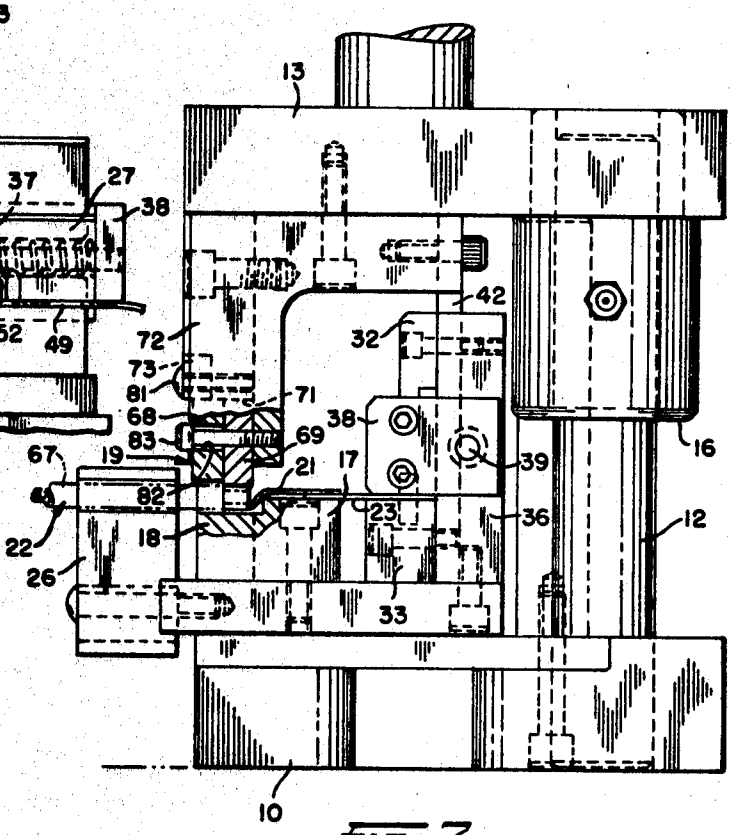


Fig. 7

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3,390,567

CRIMPING PRESS WITH AUTOMATIC FEED

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Filed Mar. 1, 1965, Ser. No. 435,945
8 Claims. (Cl. 72—421)

ABSTRACT OF THE DISCLOSURE

A crimping press for successively crimping tape mounted terminals and connectors having a fixed crimping die, a crimping die mounted on a movable ram, and a tape feed mechanism for feeding successive tape mounted terminals and connectors to the crimping dies in response to movement of the ram away from the fixed die.

This invention relates generally to terminal crimping presses and more particularly to a crimping press for electrical terminals, or the like, provided with feed means for automatically feeding connectors into crimping position wherein the supply of connectors is carried by a perforated tape.

It is widespread practice to mount various types of electrical terminals or connectors on electrical conductors by inserting the bared end of the conductor wire into the connector and crimping the connector so that it is permanently mounted on the end of the wire and is provided with a good electrical connection therewith. Since the unmounted connectors are quite often small they provide a handling problem, particularly when relatively large numbers of crimping operations must be performed.

To reduce the handling problem and provide rapid, uniform, and high quality crimping the present invention includes a power operated crimping press having means operable to automatically feed tape mounted connectors into the proper position for crimping. Therefore, with the present invention the user merely inserts the end of the conductor into a wire guide so that the end of the conductor is properly positioned in a connector which is previously automatically positioned in the proper place within the machine. The machine is then actuated through one cycle of operation during which the connector is crimped onto the conductor and the subsequent connector is automatically positioned to receive the subsequent conductor for crimping. Therefore, the machine automatically feeds the connectors into position for crimping and the operator is merely required to place the end of the conductor in the wire guide. With the illustrated machine relatively high production rates are possible and as a result the cost of assembling the connector on the conductor is greatly reduced.

The illustrated embodiment of this machine includes a reciprocating ram on which is mounted a movable crimping die which cooperates with a fixed crimping die mounted on the bed or frame. A cam drive mechanism powers the feed for the terminal mounting tape utilizing the reciprocating movement of the ram for the feed power. This structure inherently provides the proper timing between the operation of the ram and the feeding of the tape. The elements of the cam drive are arranged to provide extreme simplicity, durability, and long life so that initial costs and maintenance problems are minimized.

The actual feeding of the tape is accomplished by a feed slide reciprocable on the main frame in a plane normal to the direction of ram movement. Positive control insures exact positioning of each terminal preventing over or under feeding and insuring uniform high quality results.

It is an important object of this invention to provide a novel and improved crimping press incorporating automatic tape feeding means for accurately and positively positioning an article such as an electrical connector in the machine on each operation thereof.

It is another important object of this invention to provide a novel and improved crimping press for electrical connectors and the like enabling the operator to rapidly and easily assemble and crimp electrical connectors on electrical conductors wherein the supply of connectors is mounted on a tape automatically fed into the machine.

It is another important object of this invention to provide a novel and improved crimping press having a reciprocating die carrying ram connected to automatically operate the feed mechanism for articles being crimped in timed relation to the operation of the ram.

It is another important object of this invention to provide a novel and improved crimping press having a reciprocable die carrying ram and a feed mechanism for automatically positioning articles to be crimped in the machine wherein cam means connected between the ram and the feed mechanism automatically operate the latter in response to reciprocating movement of the ram.

It is still another object of this invention to provide a crimping press having a reciprocating die carrying ram with a drive cam mounted thereon which engages a follower on a reciprocating feed mechanism and automatically operates the feed mechanism in timed relation to the ram reciprocation.

It is still another object of this invention to provide a novel and improved crimping press having tape feed means automatically and positively positioning articles to be crimped which are carried by the tape in crimping position and automatically removing the crimped article from the crimping position after the completion of the crimping operation.

Further objects and advantages will appear from the following description and drawings wherein:

FIGURE 1 is a fragmentary perspective view of a preferred form of crimping press incorporating this invention illustrating the physical relationship between the die carrying ram and the tape feed mechanism;

FIGURE 2 is a fragmentary front elevation of the ram and feed mechanism with the dies and wire guide illustrated;

FIGURE 3 is a plan view of the machine taken along a section above the feed mechanism with parts removed for purposes of illustration;

FIGURE 4 is a side elevation taken along 4—4 of FIGURE 3 illustrating the feed mechanism structure;

FIGURE 5 is a fragmentary section taken along 5—5 of FIGURE 4 illustrating the mounting of the feed slide;

FIGURE 6 is an enlarged fragmentary view, partially in section, illustrating the structure and mounting of the drive pawl of the feed mechanism;

FIGURE 7 is and end elevation, partially in section, illustrating the machine with a terminal in position on the end of a conductor and the dies at the moment the crimping operation commences;

FIGURE 8 is a fragmentary section illustrating the cam drive for the feed mechanism with the ram spaced above the cam engaging position;

FIGURE 9 is a view similar to FIGURE 8 illustrating the elements at a midpoint in the cam operation wherein the feed slide is pressed rearward preparatory to gripping and feeding a subsequent terminal into the crimping position; and

FIGURE 10 is a view similar to FIGURES 8 and 9 illustrating the elements in the position they assume when the ram reaches its bottom dead center position at the completion of the crimping operation.

Referring to FIGURE 1, the basic crimping machine includes a base frame 10 on which are mounted vertically

extending parallel ram guide rods 11 and 12. A ram 13 is supported on bearings 14 and 16 for vertical reciprocation along the guide rods 11 and 12. The powering actuation for the ram 13 may be of any suitable type known in the art, such as, but not limited to, a crankshaft connecting rod linkage driven by a flywheel through suitable clutch and brake means intermittently operable to drive the ram downwardly from its top dead center position to its bottom dead center position, during which the crimping occurs, and back to its top dead center position. The clutch and brake mechanism is preferably arranged so that each time a trip switch is operated the brake releases and the clutch engages to drive the ram through one cycle and back up to its top dead center position at which time the brake automatically engages while the clutch automatically disengages.

Supported by the frame 10 is a die breast 17 on which is mounted a lower or fixed die 18. An upper die assembly 19 is mounted on the ram 13 and cooperates with the fixed die 18 to crimp a connector 21 on a conductor 22 (illustrated in FIGURE 7) when the ram is carried down to its bottom dead center position. The supply of conductors 21 is mounted on a perforated tape 23 which is progressively moved into crimping position by a feed assembly 24 in a manner so that a conductor is positioned at the crimping station each time the ram 13 completes one cycle and returns to its top dead center position.

A wire guide member 26 is mounted on the machine frame adjacent to the fixed die 18 and is shaped so that the operator merely inserts the end of the conductor 22 along the guide 26 into the end of the uncrimped connector located at the crimping station so that the connector and the conductor are properly positioned relative to each other and relative to the crimping dies. The guide 26 is open on its right side, as viewed in FIGURE 1, so that the connector is free to move out of the guide and away from the crimping station as the ram returns to its top dead center position and a subsequent connector is fed into position.

Referring to FIGURES 4 through 6, the feed mechanism 24 includes a slide element 27 formed with lateral flanges 28 and 29 which fit into mating recesses 29 and 31 in mounting plates 32 and 33, respectively. The plates 32 and 33 are in turn bolted to a vertical plate 36 on the machine frame 10. The slide 27 is reciprocable in a horizontal direction perpendicular to the vertical direction of movement of the ram 13.

In order to bias the slide 27 to the right, as viewed in FIGURE 5, a compression spring 37 is mounted in a bore 40 in the plate 36 and engages an end plate 38 bolted to the end of the slide 27. A guide pin 39 is mounted on the end plate 38 and extends into the spring 37 to cooperate with the bore 40 in guiding the spring.

The vertical plate 36 is formed with a vertically extending channel 41 which guides a vertically moving cam 42 mounted for reciprocation with the ram 13. The lower end of the cam 42 is formed with an inclined camming surface 43 which engages a lateral pin 44 mounted on the slide 27 and extending rearwardly therefrom. The pin 44 functions as a cam follower and cooperates with the camming surface 43 to produce movement to the left (as viewed in FIGURE 5) of the slide 27 when the cam 42 is carried downwardly with the ram 13. The pin 44 also engages the wall 46 of the channel 41 when the cam 42 is raised clear of the pin by upward movement of the cam. When the cam 42 engages the wall 46 it limits movement of the slide 27 under the influence of the spring 37 and determines the right-hand extreme or forward position of the slide. When the cam 42 is in the lowermost position, as illustrated in FIGURE 5, the pin 44 is located in a lateral recess 47 formed in the plate 36 and the slide 21 is in its left-hand extreme or rearward position.

The operation of the cam 42 in moving the slide 27 is best illustrated in FIGURES 8, 9 and 10. When the ram is at its top dead center position (illustrated in FIGURE 8) the cam 42 is spaced above the pin 44 so the action of the spring maintains the pin 44 in engagement with the wall 46 and the slide in its right-hand or forward extreme position.

As the ram starts to move down to perform a crimping operation the cam 42 moves downwardly until the camming surface 43 engages the pin 44. At this time further downward movement of the cam causes the pin 44 and in turn the slide 27 to move to the left toward its rearward position against the action of the spring. FIGURE 9 shows the elements in an intermediate position wherein the downward movement of the cam 42 causes the pin 44 to ride to the left along the camming surface 43 moving the slide 27 to the left.

As the ram continues to carry the cam 42 downward to the bottom dead center position (illustrated in FIGURE 10) the camming surface 43 is carried past the pin 44 which then engages the left vertical wall 48 of the cam 42. At this time the pin 44 is located in the lateral recess 47 and the slide 27 is in its rearward or left-hand extreme position.

The camming surface 43 has a vertical extent which is less than the stroke of the ram 13 so that the camming surface 43 will be spaced above the pin 44 when the ram is in the top dead center position and will have been carried down past the pin (as illustrated in FIGURE 10) when the ram 13 is in the bottom dead center position. This permits overtravel of the cam 42 and produces the movement of the slide 27 during the downward movement of the ram while the dies are still spaced apart. This is important since the return of the slide 27 to the right-hand or forward extreme position of FIGURE 8 does not commence until the upper or movable die assembly 19 has raised away from the crimped connector 21 so that feeding of the tape will not be prevented by die interference.

As the cam 42 is carried back up to the top dead center position by the ram 13 the first part of the travel of the cam 42 in an upward direction merely causes the pin 44 to ride along the vertical wall. Therefore, the slide 27 remains in a fixed position during this phase of ram retraction which lifts the movable die assembly 19 up away from the crimped connector. Then as the ram 13 continues to carry the cam 42 upward the camming surface 43 moves into alignment with the pin 44 and the spring returns the slide 27 to its forward extreme position (illustrated in FIGURE 8). It is during this phase of the operation that the tape is carried forward to position a subsequent connector at the crimping station.

The perforated tape 23 is formed with spaced rectangular openings 49 (best illustrated in FIGURE 1) with a spacing of the opening 49 equal to the spacing of the connector 21 mounted on the tape. A pair of pawls 51 and 52 are carried by the slide 27 and similar and opposing pawls 53 and 54 are mounted on the mounting plate 33. The structure of all four of the pawls 51 through 54 is identical excepting that the lower pawls 53 and 54 face upwardly and the upward pawls 51 and 52 face downward.

Referring to FIGURE 6, the pawl 51 is pivoted on a pin 56 mounted on the slide 27 with its forward end 57 biased downwardly against the tape 23 by a spring 58 acting through a plunger 59. When the forward edge 57 of the pawl 51 moves into a position over an opening 49 the forward edge 57 drops into the opening permitting engagement with the forward wall thereof so that it can carry the tape 23 to the right as the slide 27 returns to its forward position.

The two upper pawls 51 and 52 are provided at spaced points on the slide 27 to engage spaced openings 49 in the tape 23 so that the tape is gripped for feeding movement at two spaced points. On the backstroke of the slide 27 as the cam moves downward the pawls 51 and 52 ride up over the tape between the openings and the tape is pre-

vented from moving rearwardly with the slide **27** by the operation of the pawls **53** and **54**. The width of the cam **42** is selected so that the stroke of the slide **27** is greater than the distance the tape is to be moved in each cycle to insure that the pawls **51** and **52** will clear the edge of the opening and drop down when the slide reaches the rearward position of FIGURE 10. When the tape is fed forward with the slide **27** the pawls **53** and **54** cam down against their respective springs and ride along the lower surface of the tape between the openings again snapping into the openings at the completion of the forward feed.

The connectors **21** are located with respect to the openings **49** and the pawls **51** through **54** are located with respect to the dies so that when the slide **27** is in the forward extreme position of FIGURE 8 a connector **21** is properly positioned for crimping. As the ram **13** carries the dies together for crimping the slide **27** is moved to the left to its retracted position, but the tape is held against rearward movement by the pawls **53** and **54**. On the upstroke of the ram **13** after the completion of the crimping operation the slide **27** returns to its forward position and the pawls **51** and **52** carry the tape forward to position a subsequent connector for crimping.

An adjustable guide **61** is positioned in front of the tape and a rearward guide **62** engages the rearward edge of the tape to direct the tape into the machine. A drag member **63** is pivoted on the rearward guide **62** by a pivot bolt **64** and is provided with a friction pad **66** to engage the tape resisting overtravel and also insuring that the tape lays flat along the guides as it approaches the feed assembly **24**.

In many instances the connector **21** is provided with an insulating sleeve which fits over the forward end of the insulation **67** of the conductor **22**. In such instances a double crimp is provided. The forward crimp is forward of the end of the insulation **67** and the rearward crimp presses the insulation portion of the connector into gripping relationship with the end of the insulation **67** of the conductor. For such crimping operations the die assembly **19** is provided with two die elements **68** and **69**. Normally the die element **69** is seated against a fixed reaction surface **71** on a backup block **72** and the movable die element **68** is positioned against an adjustment cam **73**.

In the illustrated embodiment the cam **73** is provided with three flats **74**, **76** and **77**, as illustrated in FIGURE 2. These flats are spaced from the axis of the cam **73** by varying distances and vertical adjustment of the adjustable die element **68** is provided by rotating the cam **73** to selectively position the desired flat in engagement with the movable or adjustable die **68**. Thus the die can be adjusted vertically to compensate for variations in thickness of the insulation material **67** on the conductor.

The flats **74**, **76** and **77** are adjacent to each other and are arranged so that they extend around the surface of the cam **73** through an arc of less than 180°. A cylindrical surface **78** is provided on the cam through an arc of greater than 180°. This cylindrical surface **78** has a diameter closely fitting a cylindrical surface **79** in the die holder **72** and provided innerengaging surfaces to support the crimping loads on the adjustable die **68**. Because the surface **78** extends around the cam through an arc of more than 180° a portion of the surface **78** is located opposite each flat and is positioned at the top of the cam to support the crimping loads regardless of the adjusted position of the cam. This insures that a screw **81** used to fasten the cam **73** in position does not support the crimping loads. The adjusting die **68** is formed with an axial slot **82** permitting vertical adjustment of the cam element with respect to the mounting bolt **83**.

In operation the end of the tape **23** is positioned in the machine and fed forward until the first connector **21** is positioned for crimping. The conductor **22** is then inserted into the guide **26** which positions the stripped end of the conductor **22** in the connector **21**. The machine is then cycled to cause the ram **13** to move from a top dead center position down through its bottom dead center position and back to its top dead center position. During the downward movement of the ram **13** the feed assembly slide **27** is carried to the left by the cam **42** but the tape **23** remains stationary. When the ram reaches the bottom dead center position the crimping action is performed and the connector and conductor are joined. On the upstroke of the ram **13** the slide **27** moves to the right moving the tape **23** to the right positioning a subsequent connector for crimping. The operator then inserts a second or subsequent conductor in the guide **26** and the cycle is repeated. In this way accurate crimping of the connectors on the conductors is achieved in each operation and the operator does not have to perform any manual operations to feed the connectors into position.

Although a preferred embodiment of this invention is illustrated, it is to be understood that various modifications and rearrangement of parts may be resorted to without departing from the scope of the invention as defined in the following claims.

I claim:

1. A crimping machine for crimping connectors carried by a perforated tape comprising a frame, a reciprocable ram on said frame movable between first and second positions, dies on said frame and ram operable to crimp a connector at a crimping station when said ram reaches said first position, feed means including a reciprocable slide on said frame and rectilinearly movable between spaced positions, said slide having a finger engageable with said perforations of said tape operable upon rectilinear movement of said slide in one direction to move said tape and sequentially position connectors at said crimping station, and cam means interconnected between said ram and slide moving said slide in said one direction in response to movement of said ram toward said second position.

2. A crimping machine for crimping connectors carried by a perforated tape comprising a frame, a reciprocable ram on said frame movable between first and second positions, dies on said frame and ram operable to crimp a connector at a crimping station when said ram reaches said first position, feed means including a reciprocating slide on said frame and rectilinearly movable between spaced positions, said slide having a finger engageable with said perforations of said tape operable upon rectilinear movement of said slide in one direction to move said tape and sequentially position connectors at said crimping station, and cam means interconnected between said ram and slide moving said slide in said one direction in response to movement of said ram from an intermediate position spaced from both said first and second positions to said second position.

3. A crimping machine for use with perforated tape supporting a supply of connectors comprising a frame, a ram reciprocable on said frame between said first and second positions, cooperating dies on said ram and frame operable to crimp a connector located at a crimping station when said ram reaches said first position, a feed slide reciprocable on said frame and rectilinearly movable between a rearward position and a forward position, cam means carried by said slide and ram operable to cause movement of said slide to said forward position in response to movement of said ram, and pawls on said slide and frame engaging said perforations on said tape and cooperating to carry said tape forward as said slide moves toward said forward position and preventing movement with said slide when it moves toward said rearward position.

4. A crimping machine for use with a perforated tape supporting a supply of connectors comprising a frame, a ram reciprocable on said frame between first and second positions, cooperating dies on said ram and frame operable to crimp a connector located at a crimping station when said ram reaches said first position, a feed slide reciprocable on said frame and rectilinearly movable between a rearward position and a forward position, cam means carried by said slide and ram operable

to cause movement of said slide to said forward position as said ram moves from an intermediate position spaced from said first position to said second position, and pawls on said slide and frame engaging said perforations and cooperating to carry said tape forward as said slide moves toward said forward position and preventing movement with said slide when it moves toward said rearward position whereby a subsequent connector is positioned at said crimping station each time said ram moves from said intermediate position to said second position.

5. A crimping machine for use with perforated tape supporting a supply of connectors comprising a frame, a ram reciprocable on said frame between first and second positions, cooperating dies on said ram and frame operable to crimp a connector located at a crimping station when said ram reaches said first position, a feed slide reciprocable on said frame and rectilinearly movable between a rearward position and a forward position, spring means urging said feed slide toward said forward position, cam means carried by said slide and ram operable to move said slide to said rearward position as said ram moves from said second position toward said first position and allow return of said slide to said forward position as said ram returns to said second position, and pawls on said slide and frame engaging said perforations and cooperating to carry said tape forward as said slide moves toward said forward position and preventing movement with said slide when it moves toward said rearward position whereby a subsequent connector is positioned at said crimping station each time said ram moves to said second position.

6. A crimping machine for use with perforated tape supporting a supply of connectors comprising a frame, a ram reciprocable on said frame between first and second positions, cooperating dies on said ram and frame operable to crimp a connecter located at a crimping station when said ram reaches said first position, a feed slide reciprocable on said frame and rectilinearly movable between a rearward position and a forward position, spring means urging said feed slide toward said forward position, cam means carried by said slide and ram operable to move said slide to said rearward position as said ram moves from said second position to an intermediate position spaced from said first position and return said slide in said rearward position when said ram is between said intermediate position spaced from said first position and return said slide in said rearward position when said ram is between said intermediate position and said first position, and pawls on said slide and frame engaging said perforations and cooperating to carry said tape forward as said slide moves toward said forward position and preventing movement with said slide when it moves toward said rearward position whereby a subsequent connector is positioned at said crimping station each time said ram moves from said intermediate position to said second position.

7. A crimping machine for crimping electrical connectors carried by a perforated tape comprising a frame, a ram vertically reciprocable on said frame between an upper position and a lower position, dies on said frame and ram operable when said ram approaches said lower position to crimp a conductor located at a crimping station, a feed slide horizontally reciprocable between rearward and forward positions, a spring urging said feed slide in one horizontal direction, a cam and a cam follower with one carried by said slide and the other carried by said ram, said cam being formed with a vertically facing inclined surface and a vertical surface extending from one end of said inclined surface, vertical movement of said ram causing engagement between said inclined surface and follower resulting in movement of said slide to said forward position, said follower engaging said vertical surface in all positions between said lower position and an intermediate position spaced from both said upper and lower positions, and means on said feed slide engageable with said perforations for moving a subsequent connector to said crimping station each time said slide moves from said rearward position to said forward position.

8. A crimping machine for crimping electrical connectors carried by a perforated tape comprising a frame, a ram vertically reciprocable on said frame between an upper position and a lower position, dies on said frame and ram operable when said ram approaches said lower position to crimp a conductor located at a crimping station, a feed slide horizontally reciprocable between rearward and forward positions, a spring urging said feed slide toward said forward position, a cam carried by said ram, a cam follower carried by said feed slide, said cam being formed with a downward facing inclined surface and a vertical surface extending upwardly from one end of said inclined surface, downward movement of said ram from said upper position causing engagement between said inclined surface and follower resulting in movement of said slide to said rearward position, said follower engaging said vertical surface in all positions between said lower position and an intermediate position spaced from both said upper and lower positions, and means on said feed slide engageable with said perforations for moving a subsequent connector to said crimping station each time said slide moves from said rearward position to said forward position.

References Cited

UNITED STATES PATENTS

2,876,452	3/1959	Herman et al.	72—421
3,051,213	8/1962	Batcheller	72—413
3,283,558	11/1966	Henkel et al.	72—421 X
1,346,089	7/1920	Hasselstrom	83—278 X
3,167,107	1/1965	Ustin et al.	72—421 X

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