

[54] **TERMINAL APPLICATOR**  
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 [21] Appl. No.: **253,426**

[52] U.S. Cl. .... **29/203 B**  
 [51] Int. Cl. .... **H05k 13/04**  
 [58] Field of Search..... 29/203 B, 203 D, 203 DT,  
 29/203 TS, 203 P; 81/9.51

3,571,924 3/1971 Collins ..... 29/203 B X  
 3,605,237 9/1971 Bakermans..... 29/203 B

*Primary Examiner*—Thomas H. Eager  
*Attorney, Agent, or Firm*—Thomas Hooker

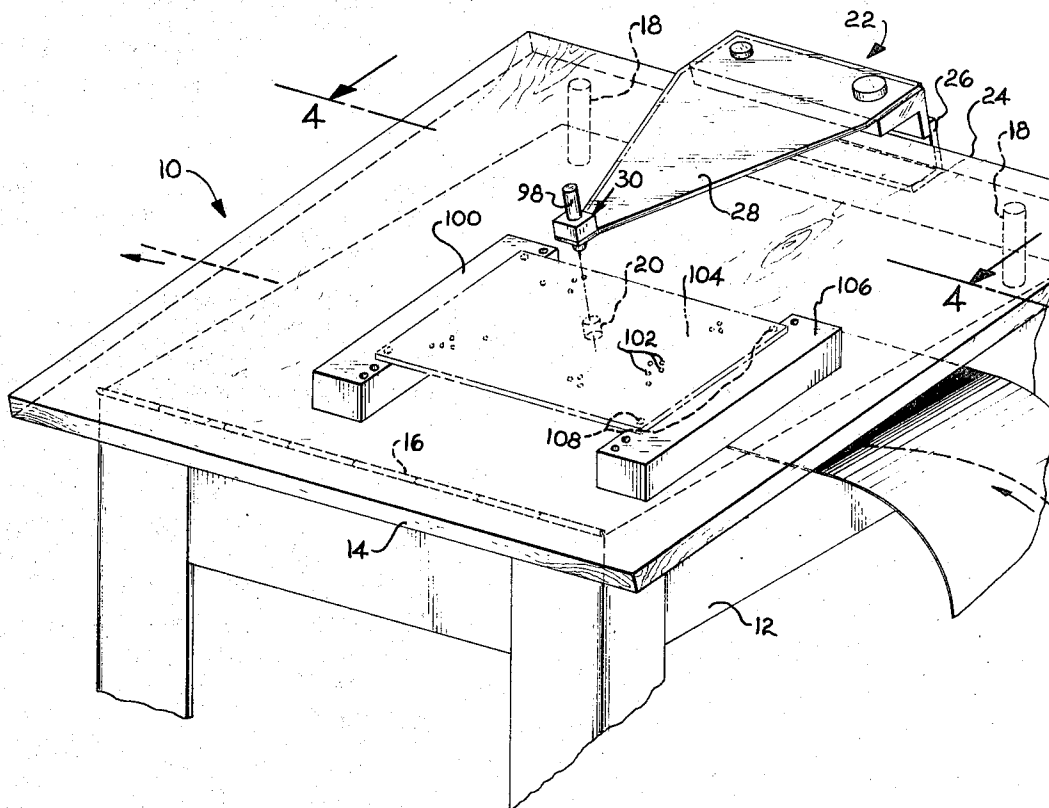
[57] **ABSTRACT**

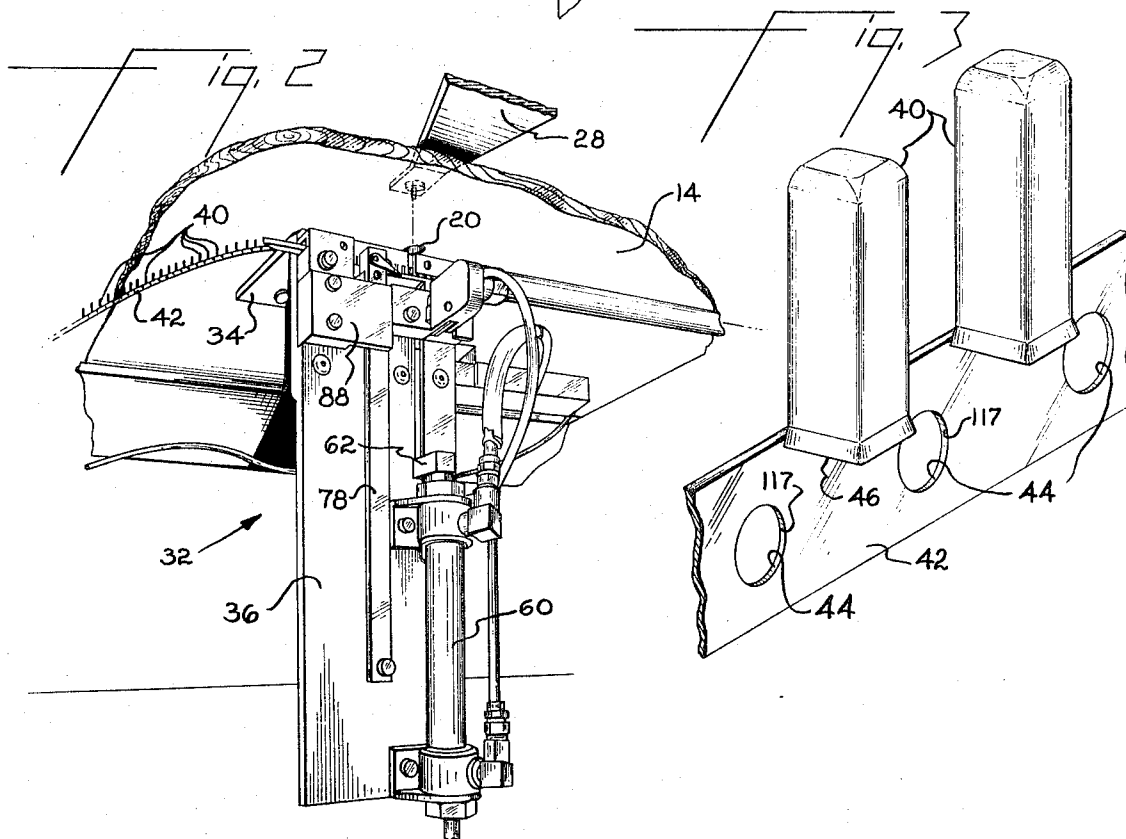
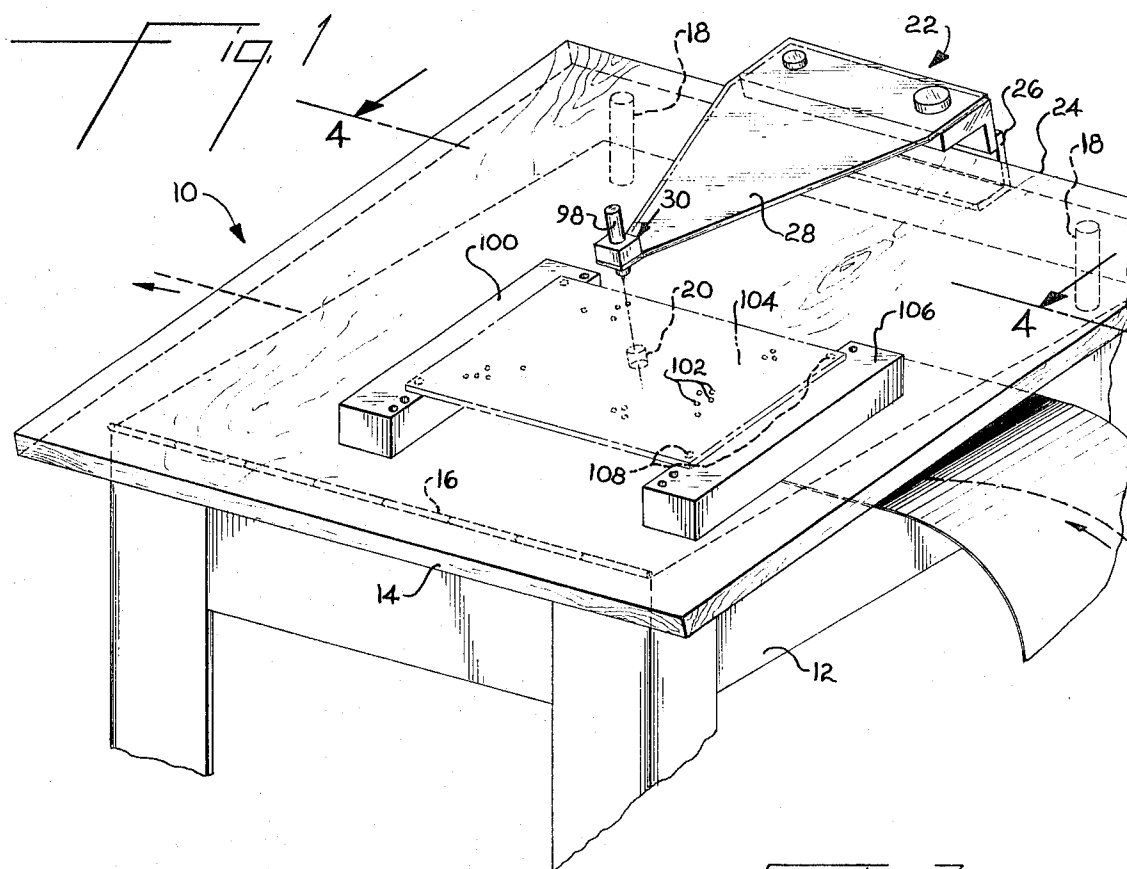
A terminal applicator having an extendable ram for severing a terminal from a carrier strip and mounting the terminal on a circuit board. An elongate feed arm extends generally parallel to the ram and is pivoted in a plane parallel to the carrier strip in response to extension of the ram so that the feed pawl sweeps back and forth across the carrier strip feed path in a shallow arc to index the lead terminal on the strip to a pick-up position.

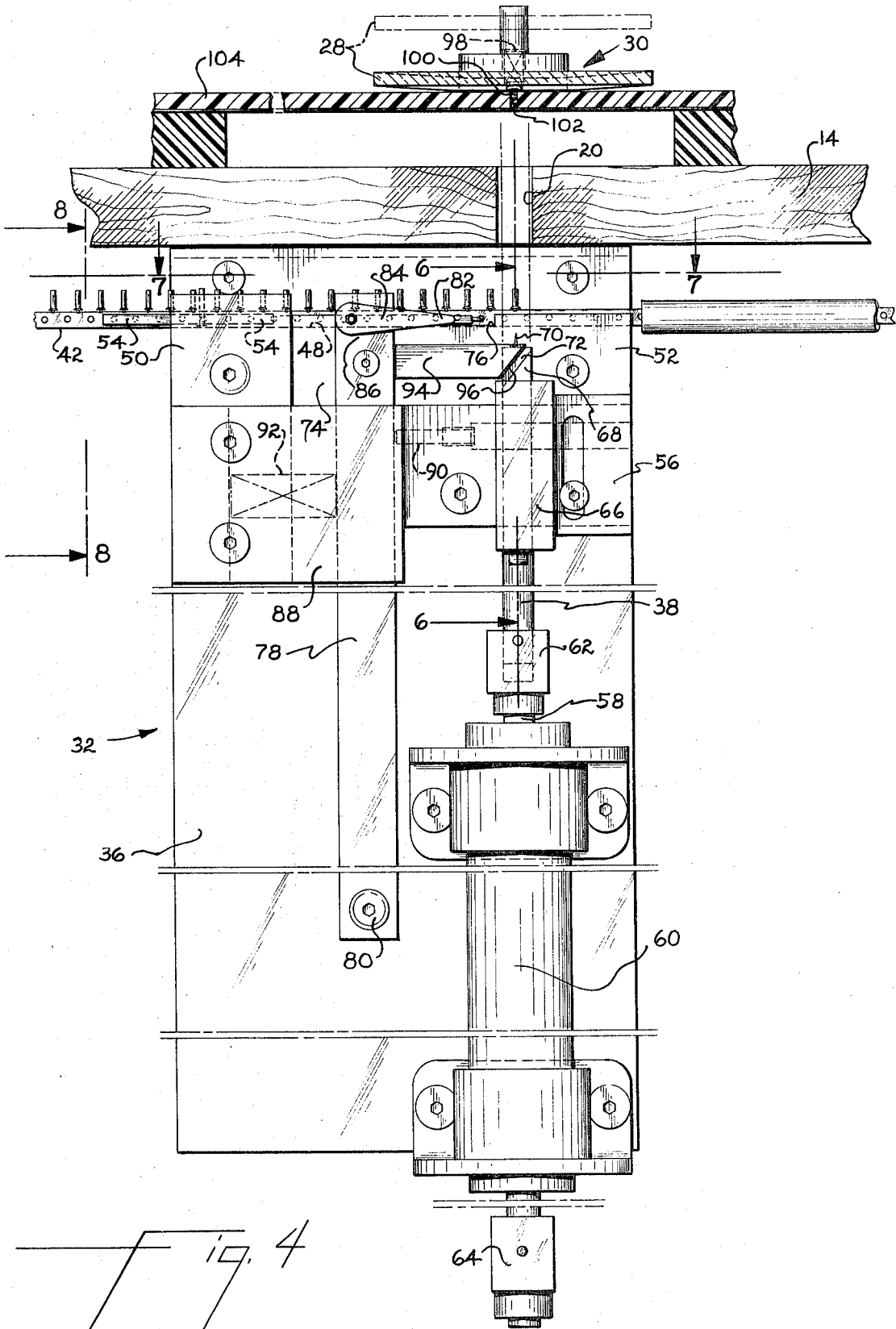
[56] **References Cited**  
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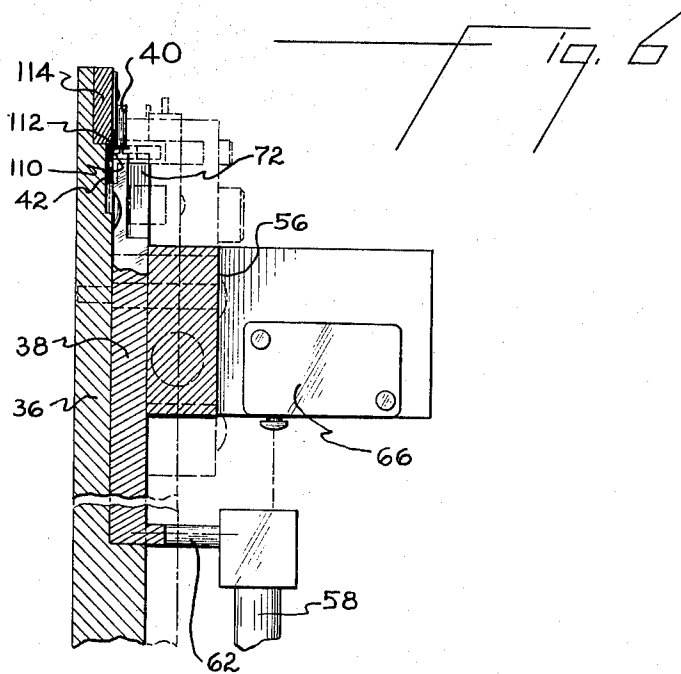
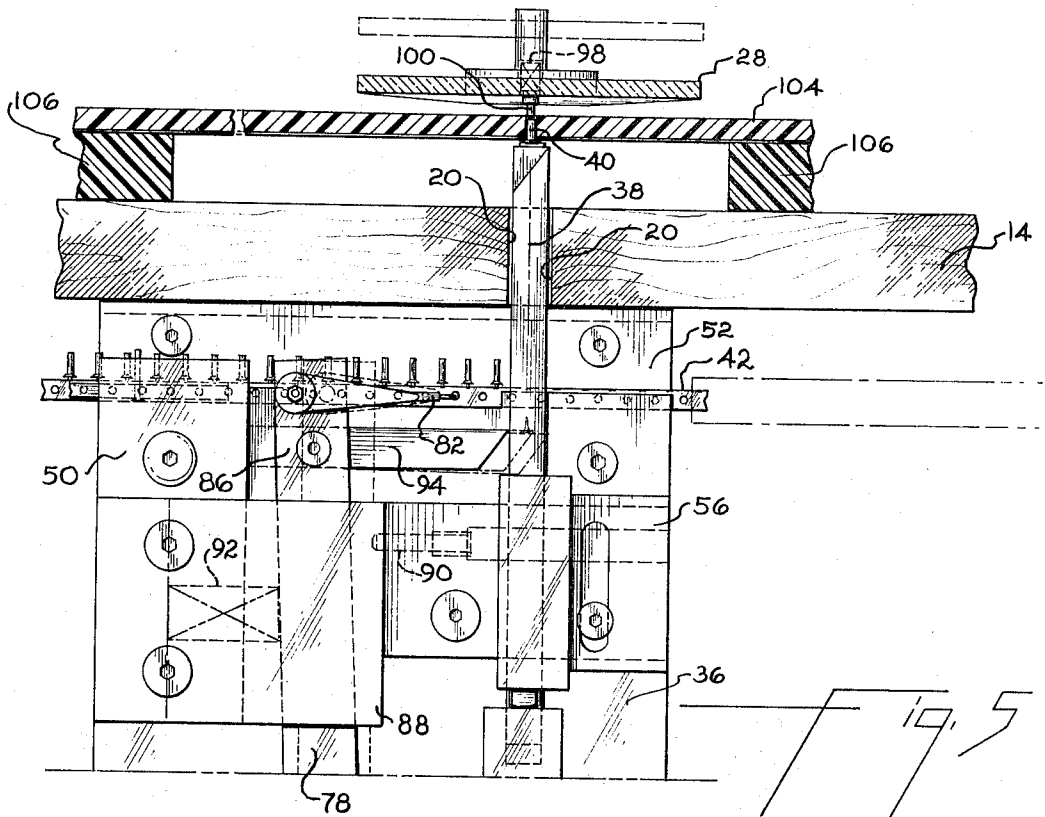
3,307,244	3/1967	De Shong .....	29/203 B
3,538,581	11/1970	Collins et al. ....	29/203 B

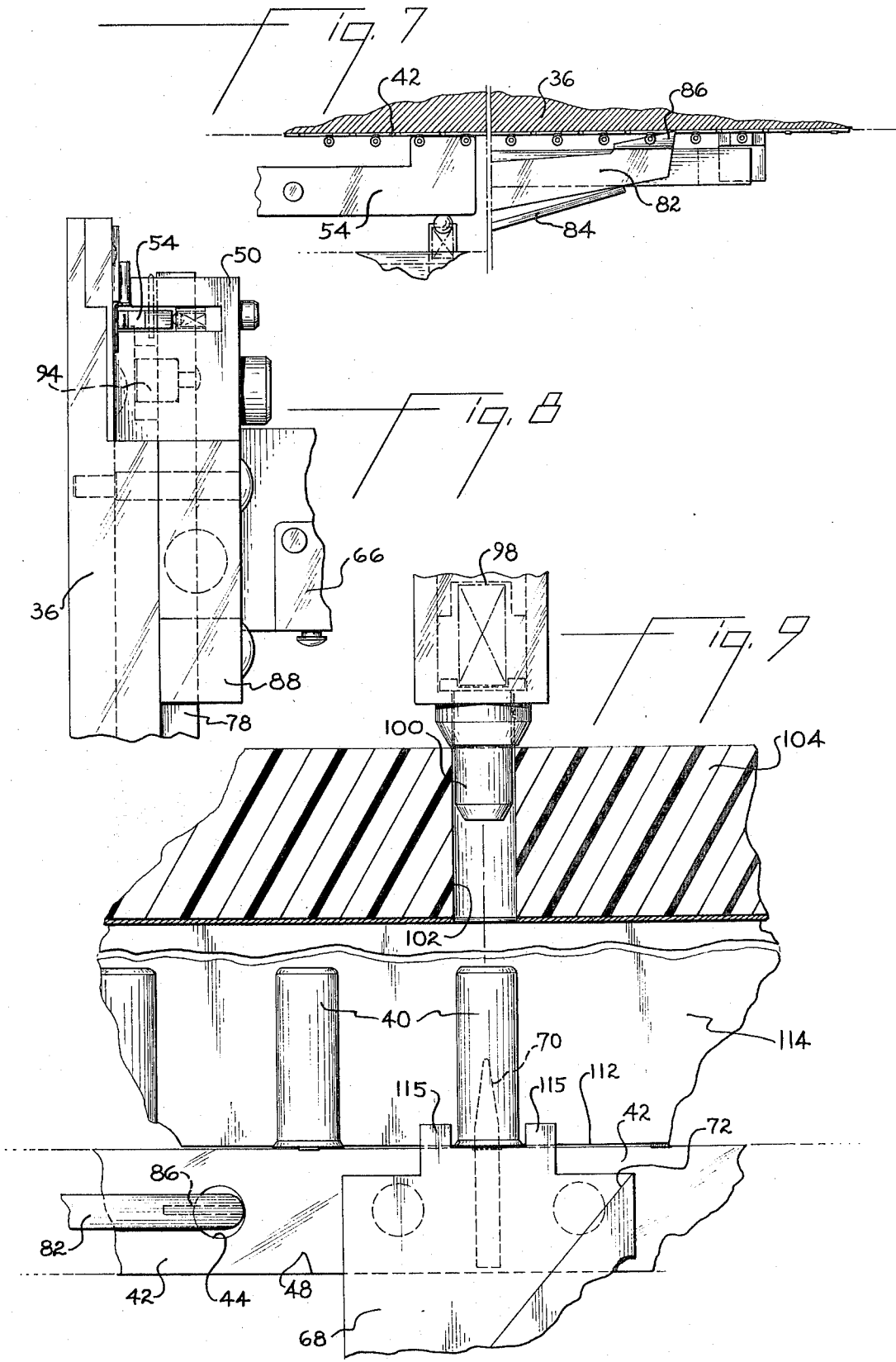
**13 Claims, 9 Drawing Figures**











## TERMINAL APPLICATOR

The invention relates to an inexpensive and reliable terminal applicator for mounting terminals on a circuit board. The applicator includes an extendable ram and an elongate feed arm located to one side of the ram and extending generally parallel thereto. A feed finger on the free end of the arm engages a terminal strip confined in a feed path running past the path of extension of the ram. The feed arm is pivotally mounted on the applicator away from the feed path and includes a cam member engagable with a cam surface on the ram so that extension of the ram pivots the feed arm in one direction. Upon retraction of the ram a spring pivots the feed arm in the opposite direction. The feed arm and finger pivot in a plane generally parallel to the plane of the terminal strip. A pawl on the feed finger engages pilot holes in the terminal strip to index terminals on the strip to the cut-off position in the path of extension of the ram.

Applicators for mounting terminals on circuit boards through the use of an extendable ram are disclosed in U.S. Pat. Nos. 3,307,244, 3,538,581, 3,571,924 and 3,605,237, all of which are assigned to the assignee of the present invention. The terminals are carried on a strip and are fed to the cut-off or work position by means of a feed finger which is moved back and forth along the axis of the feed path. Cam or air cylinder drive means are used to index the feed finger through the feed stroke and for withdrawing the same.

The disclosed terminal applicator includes a terminal feed having an elongate pivotal feed arm with a feed finger on the free end of the arm. The arm is sufficiently long so that the feed finger is pivoted through a relatively flat arc. During feeding the slight lateral movement of the feed finger across the width of the strip does not affect the feeding operation. At the end of the feeding cycle the lead terminal is accurately located for pick up by the ram. This is assured by providing a relatively thin pawl which engages the downstream surface of the carrier strip pilot hole. Use of the pivot-type feed arrangement greatly simplifies the design and cost of constructing the terminal applicator.

The applicator utilizes a flat circuit board locating surface with a ram hole in the surface. The circuit board is manually moved about on the top of the surface until a terminal receiving hole is in approximate alignment with the axis of the ram and the ram hole in the surface. A spring backed locating pin is then lowered on to the board and the operator adjusts the board to locate the pin in the hole to assure accurate location of the hole with regard to the ram axis. With the pin in the hole the applicator is actuated and automatically secures the terminal in the located circuit board hole. As the terminal is seated in the hole it engages the spring backed locating pin to move the same from the hole. This construction provides a large clear working space with the mechanical apparatus located out of the way below the locating surface.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjunction with the accompanying drawings illustrating the invention, of which there are four sheets.

## IN THE DRAWINGS

FIG. 1 is a perspective view of the top of the terminal applicator according to the invention;

FIG. 2 is a perspective view of the lower portion of the applicator;

FIG. 3 is an enlarged perspective view of a portion of the terminal strip as used by the applicator in FIG. 1;

FIG. 4 is a partially broken away view of the applicator taken along line 4—4 of FIG. 1;

FIG. 5 is a view similar to the view in FIG. 4 showing the applicator with the staking ram extended;

FIG. 6 is a partially broken away view taken along line 6—6 of FIG. 4;

FIG. 7 is a view taken generally along line 7—7 of FIG. 4 illustrating the feed finger and terminal strip drag;

FIG. 8 is a view taken along line 8—8 of FIG. 4; and

FIG. 9 is an enlarged partially broken away sectional view illustrating the staking operation.

Terminal applicator 10 illustrated in FIG. 1 includes a support table 12 with a flat top 14 secured thereto by means of a hinge 16. A pair of supports 18 are provided on table 12 away from hinge 16 so that the top 14 slopes downwardly toward the hinge for ease of operation. Ram extension hole 20 is provided in the center of top 14.

A hole locating assembly 22 is secured to the edge 24 of top 14 adjacent supports 18 by bracket 26 and includes a flexible plastic arm 28 which extends from the bracket over the table top 14. Spring pin unit 30 is mounted on the end of arm 28 above hole 20. A terminal staking unit 32 illustrated in FIGS. 2 and 4 is mounted on the under-surface of top 14 by means of bracket 34. The unit 32 includes a support frame 36 which extends away from the top 14 at right angles thereto. Frame 36 carries a terminal staking ram 38 axially aligned with hole 20 and extendable through the hole to attach a terminal to a circuit board.

The terminal applicator 10 is used to secure terminals 40 illustrated in FIG. 3 in circuit board holes. The terminals 40 may be socket or eyelet type and are secured at regular intervals along a carrier strip 42 having spaced pilot holes 44. Terminals 40 are hollow with open ends 46 and are secured to strip 42 by severable connections (not illustrated) at one side of ends 46 so that the terminals are positioned laterally of the strip.

The support frame 36 of staking unit 32 defines one side of a terminal strip feed path 48 extending across the frame 36 adjacent the lower surface of table top 14. The strip 42 is confined in path 48 by blocks 50 and 52 with the upstanding individual terminals 40 spaced away from the surface of frame 36 and with the open ends 46 facing away from top 14. A spring backed drag 54 is pivotally mounted in block 50 to hold the strip 42 against frame 36 and prevent upstream movement of the strip.

The elongate ram 38 is mounted on frame 36 by guide block 56 and suitable cover plates to permit longitudinal movement along the axis of the hole 20 extending through table top 14. The lower end of the ram is secured to piston rod 58 of air cylinder 60 by means of link connection 62 so that extension and retraction of the air cylinder extends and withdraws the ram. An

adjustable stop 64 on the other end of piston rod 58 below air cylinder 60 is provided to limit the extension of the cylinder. When the cylinder is fully extended the end of the piston rod engages the trigger of control microswitch 66 to close the same. At this time ram end 68 is extended through hole 20 to engage the bottom of a circuit board hole on the upper surface of table top 14. A terminal pick-up pin 70 extends from ram end 68 and is in axial alignment with hole 20. Sloped cam surface 72 is provided on the side of ram end 68 away from frame 36.

Feed path 48 runs between the ram 38 and frame 36. Cover plate 74 extends between blocks 50 and 52 to confine the terminal strip 42 in the feed path. Feed window 76 is provided in plate 74 adjacent the path of extension of ram 38. An elongated feed arm 78 is pivotally mounted to the lower portion of frame 36 by bolt 80 and extends upwardly along the plate with feed finger 82 and feed finger spring 84 mounted on the free end 86 thereof adjacent feed window 76. The spring 84 biases the feed finger 82 so that feed pawl 86 on the end of the finger is forced against the terminal strip 42 exposed in window 76.

The feed arm rotates about pivot 80 with the upper end confined between frame 36 and retaining plate 88 mounted on block 50. As viewed in FIG. 4 clockwise movement of the feed arm is limited by adjustable stop 90. Spring 92 is mounted in a recess in block 50 and engages the feed arm to bias the feed arm against stop 90. Cam member 94 is secured to the free end of arm 78 and extends toward ram 38 so that when the ram is extended from the position of FIG. 4 cam surface 72 engages follower surface 96 and forces the arm 78 in a counter-clockwise direction to move feed finger of pawl 86 upstream relative to the carrier strip. Rotation of arm 78 moves the pawl in an arc along window 76. Because of the length of arm 78, the movement of the pawl is substantially along the axis of path 48.

The spring pin unit 30 on flexible arm 28 includes a handle 98 mounted on the top of the strip and a spring backed locating pin 100 which normally extends a distance below the bottom of strip 28. Pin 100 lies on the axis of hole 20 and ram 38.

Terminal applicator 10 is used to seat terminals 14 in holes 102 formed through the thickness of circuit board 104. The board is mounted on a pair of slide blocks 106 by means of locating pins 108 so that the operator may shift the position of the board on top 14 to locate individual holes 102 on the axis of hole 20. After the operator has located the hole in approximate axial alignment spring pin unit 30 is lowered and the projecting pin 100 is positioned in a hole 102 to assure accurate location of the hole on the axis of the ram. FIG. 4 illustrates the applicator 10 in the start position with air cylinder 60 retracted.

With the terminal receiving hole in proper position the operator actuates a starting switch a shift a control valve thereby supplying air to the retracted air cylinder 60 so that the cylinder is extended. Upward movement of ram 38 from the position of FIG. 4 brings cam surface 72 into engagement with follower surface 96 to rotate the feed arm 78 in a counter-clockwise direction away from the ram and move pawl 86 upstream on strip 42. The pawl moves from one pilot hole 44 to the next upstream pilot hole. Drag 54 prevents the entire strip 42 from being carried upstream with upstream movement of the feed finger. In practise the upstream stroke

of the feed finger may be slightly greater than the spacing between adjacent pilot holes in strip 42. While the pawl sweeps in a flat arc, this does not affect feeding of the strip. Continued upward movement of the ram seats pick-up pin 70 in the mouth 46 of lead terminal 40 and severs the lead terminal from the carrier strip. Ram cutting edge 110 and cutting edge 112 of block 114 cooperate to sever the lead terminal 40 from the strip 42. See FIG. 6. The lead terminal is held in place on ram end 68 between posts 115 with pin 70 extending into the interior of the terminal.

Further extension of the ram moves the freed terminal on finger 70 through opening 20 and seats the terminal in the aligned circuit board hole 102. As the terminal is seated in the hole in engages spring pin 100 to retract the same into unit 30 against the backing spring. Posts 115 limit the depth of insertion of the terminal.

When the ram is fully extended and the lead terminal has been seated in the circuit board hole, the end of piston rod 58 engages the trigger of switch 66 to close the same and thereby shift the control valve to retract the air cylinder. As the air cylinder is retracted the ram is withdrawn and the cam bar 94 falls down cam surface 72 to permit spring 92 to rotate the feed arm through a feed stroke back toward the ram. During the feed stroke, pawl 86 engages a pilot hole 44 on strip 42 to feed the next terminal 40 to the pick-up position in alignment with the axis of the ram and hole 20. The extent of the feed stroke is determined by adjustable stop 90. The cam bar does not ride down surface 72 until after the pick-up finger 70 is retracted below terminals 80 thereby permitting completion of the feed stroke without interference between the terminals and the ram or pick-up finger. At one end of the feed stroke the thin pawl engages the downstream surface 117 of the pilot hole to assure accurate location of the lead terminal.

Upon retraction of the ram the cycle of operation is completed and the operator may reposition the board 104 to locate another terminal receiving hole 102 in proper alignment with the axis of hole 20 and ram 38, and initiate a new cycle of operation.

The use of the pivoting feed bar 78 simplifies the construction and operation of the applicator. In conventional applicators a feed finger is moved along the axis of the feed path to feed terminals on a carrier strip to a work station. In applicator 10 the terminals are fed by a feed finger rotated in a plane parallel to the plane of the strip. The length of the feed arm minimizes movement of the pawl across the width of the strip. At the end of the feed stroke the pawl engages the downstream surface 117 of the pilot hole to assure accurate location of the terminal. With this feeding arrangement, the feed arm can be operated by a cam and follower connection on the ram without additional slide blocks, air cylinders and other conventional feed structures.

The pivotal movement of the arm is described as being in a plane parallel to the terminal strip in the feed path. This means that each part of the feed arm rotates in a plane parallel to the feed path. The pawl moves along the feed path in a flat arc.

While I have illustrated and described a preferred embodiment of my invention, it is understood that this is capable of modification, and I therefore do not wish to be limited to the precise details set forth, but desire

to avail myself of such changes and alterations as fall within the purview of the following claims.

What we claim as our invention is:

1. A terminal applicator including a base; an extendable ram on said base; a feed path on said base generally perpendicular to the ram and running past the ram when retracted; an elongate feed arm generally parallel to the ram to one side thereof having a free end adjacent said feed path and an end away therefrom connected to said base to permit rotation of the arm relative to the base; a feed finger on the free end of the feed arm engagable with a terminal strip in the feed path for indexing the same toward the ram upon rotation of the feed arm about the connection with the base; and linkage means between said ram and feed arm for rotating the feed arm upon extension and retraction of the ram whereby said feed finger feeds terminals on the carrier strip to a pick-up position in the extension path of the ram.

2. A terminal applicator as in claim 1 wherein said linkage means includes a cam surface on said ram and a follower surface on said arm located for engagement with the cam surface upon extension and retraction of the ram.

3. A terminal applicator as in claim 2 wherein said linkage means includes a spring on said base biasing the arm toward the ram.

4. A terminal applicator for mounting terminals on a circuit board or like member comprising a flat circuit board support surface; and opening extending through said surface; means above said surface for accurately locating a hole in the circuit board on the surface in alignment with said opening; applicator apparatus below said surface and secured relative thereto including a ram extendable through said opening for securing a terminal to the circuit board hole located in alignment therewith, and feed means for successively indexing terminals to a position between said ram when retracted and said opening whereby extension of the ram picks up a terminal, moves the terminal through the opening and seats the terminal in the circuit board hole.

5. A terminal applicator as in claim 4 wherein said means above the surface comprises a retractable pin adapted to be positioned in the circuit board hole to locate the same and to be driven from the hole upon seating of the terminal.

6. A terminal applicator as in claim 5 wherein said means includes a flexible arm spaced above said surface and secured to one side thereof, said pin being carried by said arm above said opening.

7. An applicator for mounting terminals in holes extending through the thickness of circuit boards or like members comprising a circuit board support; a base on one side of said support; a ram on the base extendable along an axis perpendicular to the support including a terminal engaging means on the lead end of the ram; means for moving the ram toward and through the support to engage a circuit board on the other side of the support; a terminal strip feed path on the base extending transversely past said axis adjacent the support; an elongate feed arm extending generally parallel to said axis pivotally mounted on said base at a point away from the circuit board; the free end of the feed arm being located adjacent said feed path and including a feed finger extending into said path for engagement

with a strip of terminals on the path; a cam member on said feed arm including a cam surface normally located in the path of extension of said ram toward the circuit board for engagement with said ram upon extension thereof toward the circuit board to pivot the feed arm away from said axis; means for pivoting the feed arm back toward said axis upon retraction of the ram away from the circuit board; the feed finger engaging said strip to feed a lead terminal on the strip toward said axis upon pivotal movement of said feed arm whereby upon extension of the ram by said drive means said engaging means picks up the lead terminal and carries the same through the support for mounting in a circuit board hole.

8. An apparatus as in claim 7 including means for positioning a board on said support with a circuit board hole on said axis.

9. Apparatus as in claim 8 wherein said means includes a spring backed finger adapted to be inserted in a circuit board hole on the side of the circuit board away from said ram and mounting means permitting movement of said finger toward and away from the circuit board.

10. Apparatus as in claim 9 wherein said mounting means comprises a flexible arm extending over said support with said finger on the free end of the arm.

11. Apparatus as in claim 7 wherein said feed finger engages said feed path upstream of said ram and feeds the terminal strip as the ram is retracted away from the circuit board.

12. Apparatus as in claim 7 wherein said feed finger feeds the terminal strip upon retraction of said ram away from the circuit board.

13. A terminal applicator for mounting terminals on a circuit board comprising a flat circuit board support; an opening extending through said support; locating means on the top of the circuit board support for positioning a hole in the circuit board in alignment with said opening; and a terminal staking unit on the other side of the support; said unit including a base, a ram on the base extendable toward the circuit board support, through the opening therein and retractable therefrom; means for extending and retracting the ram, a terminal feed path located between the circuit board support and the lead end of the ram when retracted and extending perpendicular to the axis of the ram. An elongate feed bar pivotally mounted on said base away from the circuit board support and extending generally along the axis of the ram toward the circuit board support, a feed finger on the end of said feed bar engagable with a terminal strip on said path for indexing a terminal on the strip into axial alignment with the ram when the ram is retracted, cam linkage means connecting the arm and ram for pivoting the arm away from the ram during extension of the ram and pivoting the arm back toward the ram during retraction of the ram to effect feeding of the terminal strip, terminal engaging means on the lead end of the ram for engaging said lead terminal, and cutting means for severing said lead terminal from said strip during extension of the ram, the extended position of the ram positioning the lead end thereof adjacent the bottom surface of the circuit board to seat said lead terminal in the circuit board hole positioned on said axis by said locating means.

\* \* \* \* \*



UNITED STATES PATENT OFFICE  
CERTIFICATE OF CORRECTION

Patent No. 3,797,091

Dated March 19, 1974

Inventor(s) John H. Gavin

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the Specification:

Column 2, line 27, delete "thehinge" and substitute  
--the hinge--.

Column 4, line 15, delete "in", second occurrence,  
and insert --it--.

Column 5, line 3, change "we" to --I-- and "our"  
to --my--.

Column 6, line 16 after "a", first occurrence,  
insert --circuit--.

Signed and sealed this 10th day of September 1974.

(SEAL)  
Attest:

McCOY M. GIBSON, JR.  
Attesting Officer

C. MARSHALL DANN  
Commissioner of Patents