United States Patent [19]

Royse et al.

[11] **3,710,480**

[45] **Jan. 16, 1973**

[54] **TERMINAL PIN INSTALLING MACHINE**

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[73] Assignee: **Warwick Electronics Inc.,** Chicago, Ill.

[22] Filed: **June 18, 1970**

[21] Appl. No.: **47,367**

[52] **U.S. Cl.** **29/203,** 29/625

[51] **Int. Cl.** **H01r 9/00**

[58] **Field of Search** ..... 29/211 C, 211 R, 203 B, 625, 29/203 D

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Assistant Examiner—James W. Davie
Attorney—Roger A. Marrs

[57] **ABSTRACT**

The terminal pin installing machine employs straightened pin stock which is cut to length and driven through an imperforate substrate insulation board. The nose, with a terminal pin guide channel therein, directly abuts the board during the insertion stroke to permit straight pin driving directly through the unperforated board.

8 Claims, 25 Drawing Figures

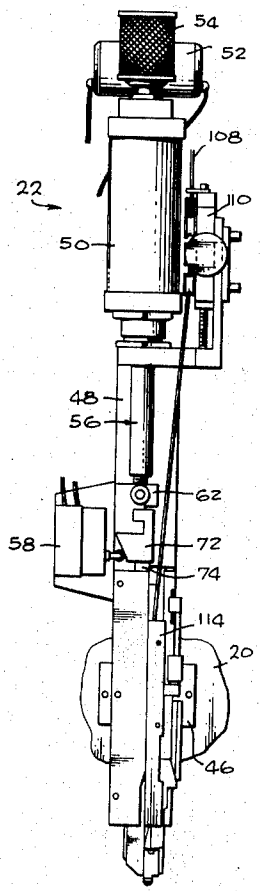


Fig. 1

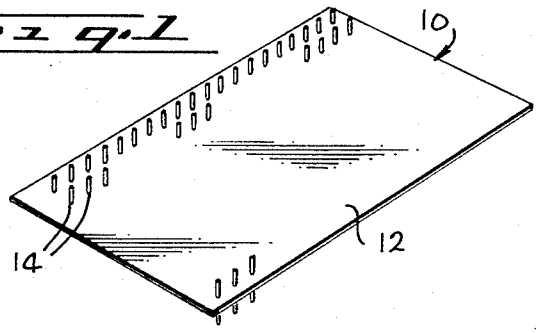
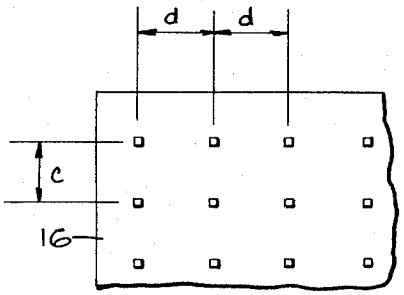


Fig. 2

PRIOR ART



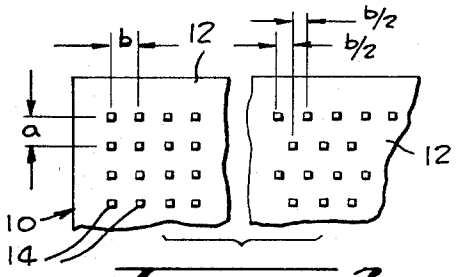


Fig. 3

Fig. 5

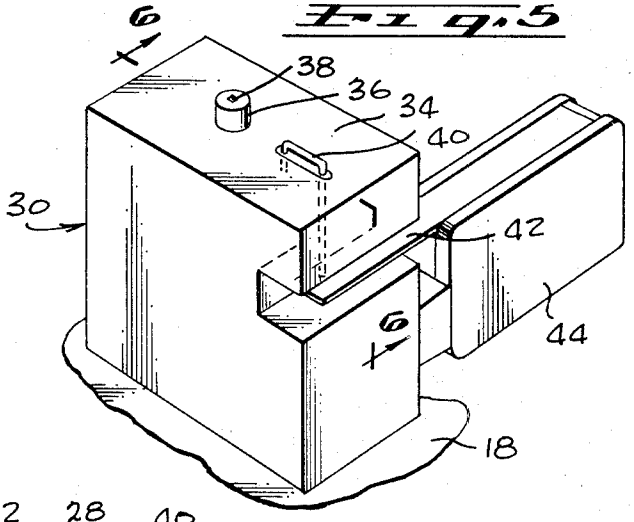
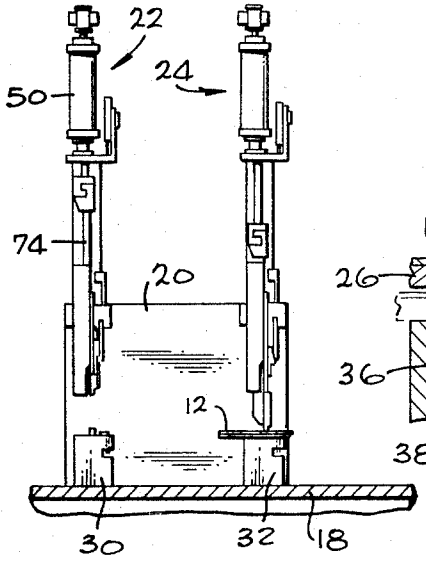


Fig. 4



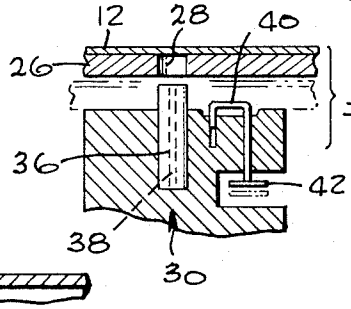


Fig. 6

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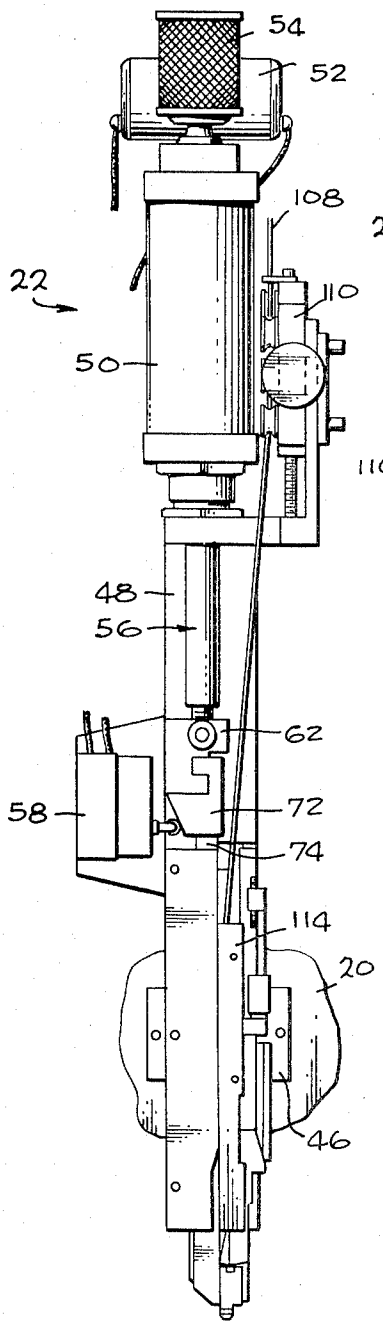


Fig. 7

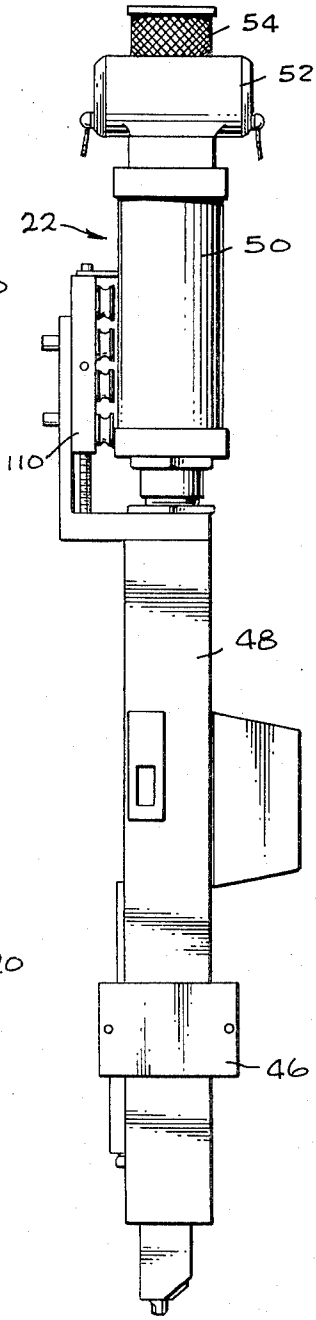


Fig. 8

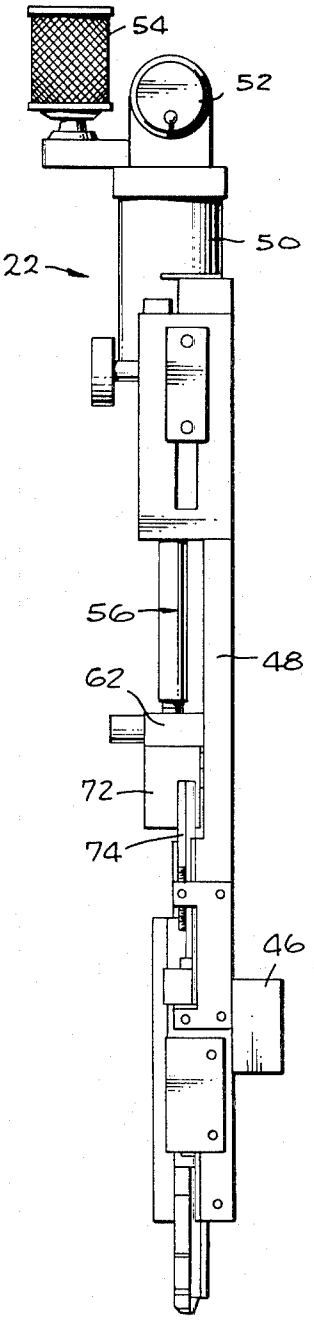


Fig. 9

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Fig. 10

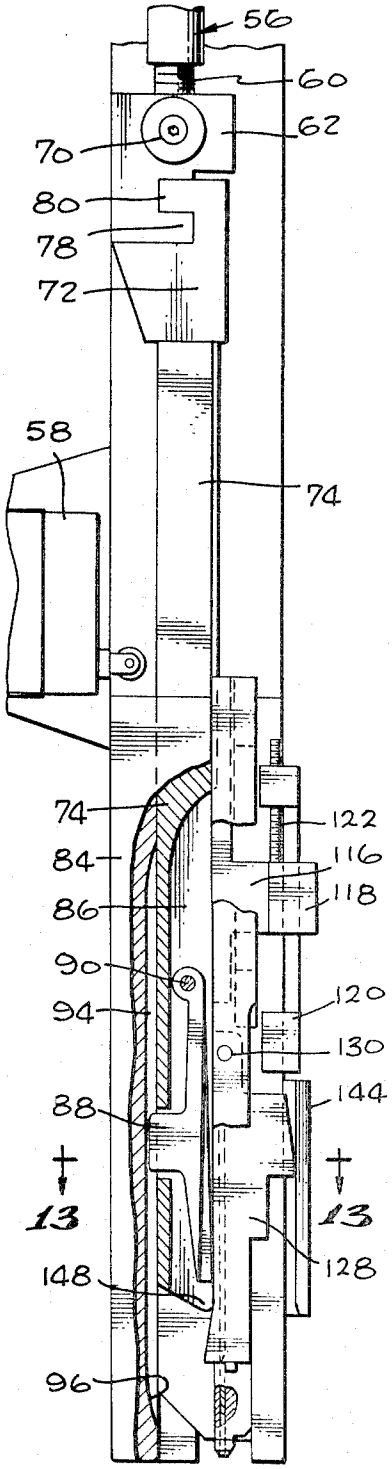


Fig. 11

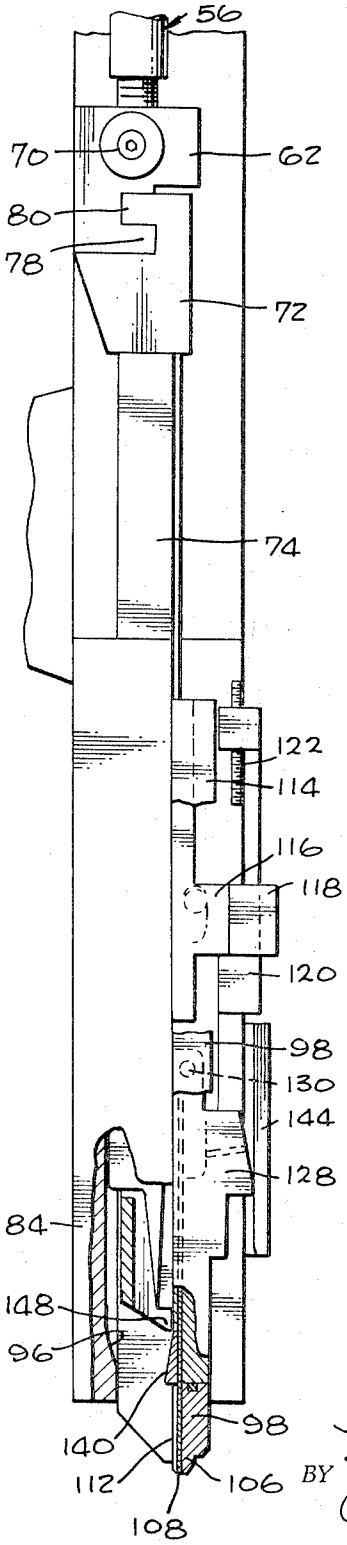


Fig. 13

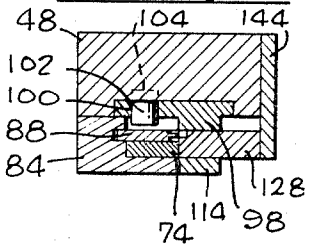
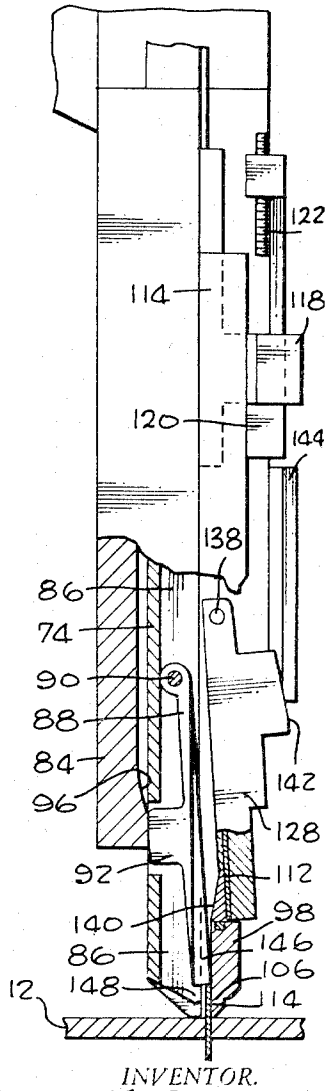


Fig. 12



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Fig. 14

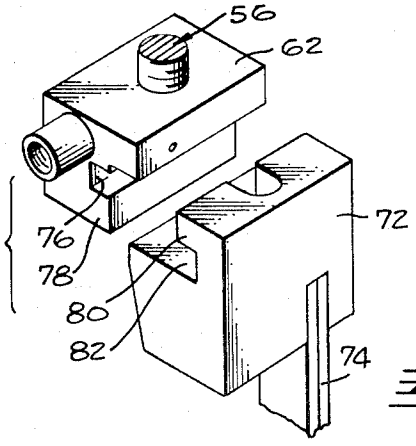


Fig. 15

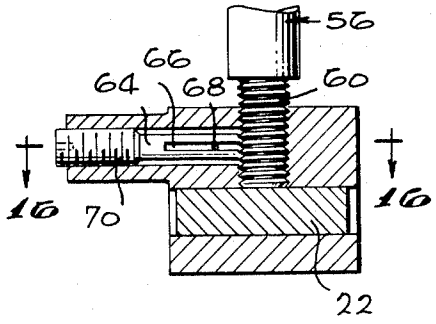


Fig. 17

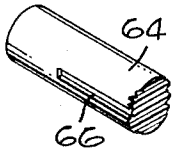
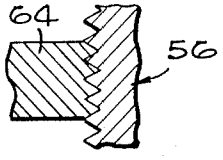


Fig. 18



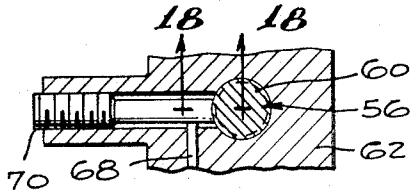


Fig. 16

Fig. 20

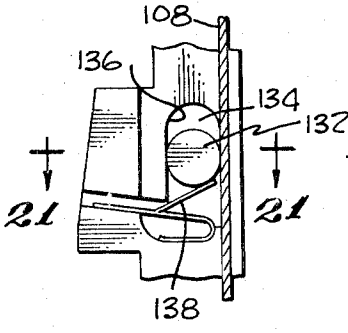


Fig. 22

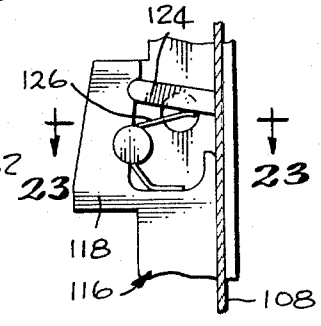


Fig. 19

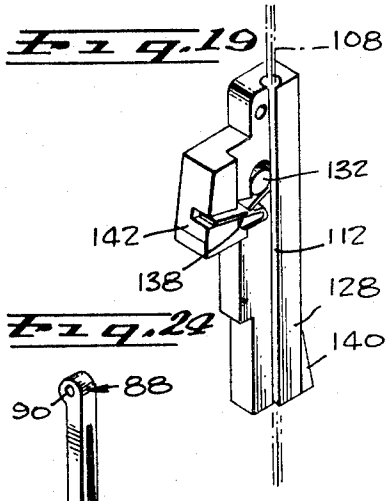


Fig. 23

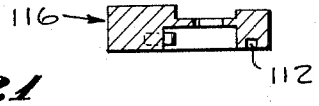


Fig. 24

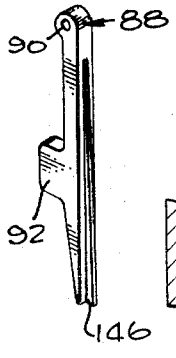
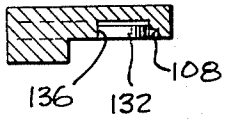


Fig. 21



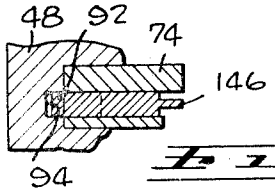


Fig. 25

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TERMINAL PIN INSTALLING MACHINE

BACKGROUND OF THE INVENTION

This invention is directed to a terminal pin installing machine which cuts to length and drives electric terminal pins through unperforated insulation board.

In a number of classes of work in today's electronic equipment, it is helpful to employ terminal boards which carry a large number of terminal pins. These terminal pins extend out of both sides of the board, and one side is employed for the connection of components, while the other is employed for the connection of further components or interconnection with other parts of the circuit. Additionally, some of these pins can be employed for plug-in purposes to permit the board to become a unitary card which can be simply installed and detached with respect to the balance of the circuit. Such cards are well-known and have been employed in numerous types of circuit applications, especially those requiring a large number of contacts or those requiring economic manufacture, as well as ease of plug-in.

The prior art cards require the preperforation of holes through the substrate insulation board, which holes permit the insertion or installation of the contact pins. The drawback to preperforation stems from the basic need for two operative steps; first, perforation of the insulation board substrate, followed by the subsequent step of pin insertion. In some cases, it is practical to employ a board which has a large number of regularly spaced perforations therein, and wherein pins are inserted in the desired locations. However, jigging or templating is necessary so that the pins are inserted in the desired holes, leaving the other holes vacant. If this cannot be easily accomplished, the pin inserter/operator wastes a considerable amount of time in searching out the correct holes into which pins should be inserted.

The prior art structures have not accomplished pin insertion into unperforated substrate insulation board because the previous equipment was neither sufficiently sturdy nor especially equipped for that kind of operation. The wire pins must be straight, and each pin must be fully supported during the insertion step so that the necessary driving force for such insertion through unperforate board does not cause bending of the terminal pin. Furthermore, the driving structure itself must be sufficiently rigidized to permit the application of the adequate driving force. A particular prior art patent is U.S. Pat. No. 3,134,982, granted on June 2, 1964, to G. A. Gagnon et al. This prior patent is an example of a pin-inserting machine which is useful for the insertion of pins in the holes into a mounting board, but is incapable of inserting a pin through an insulation substrate which is imperforate.

SUMMARY OF THE INVENTION

In order to aid in the understanding of this invention, it can be stated in essentially summary form that it is directed to a terminal pin-installing machine which is especially designed to be capable of inserting terminal pins into an imperforate insulative substrate. The machine has a frame upon which is movably mounted a power-driven ram. The ram carries a slide down with it to a predetermined position where the slide is locked to the frame. Continued downward ram movement swings a cutter through a cutting stroke and swings the driver into driving position. Downward motion of the ram causes the driver to drive the now cutoff terminal pin through the substrate insulation board, while the terminal is guided by a guide groove in the slide. In the preferred embodiment, the ram is slotted so that a new terminal pin can be driven closely adjacent a previously-driven terminal pin.

Accordingly, it is an object of this invention to provide a terminal pin installing machine which is capable of inserting electric terminal pins into and through imperforate insulative substrate board. It is still another object of this invention to cut a terminal pin off a length of terminal pin material and maintain it in guided control while it is driven through an imperforate substrate board. It is a further object to provide a terminal pin-inserting machine which has sufficient structural strength and adequate control over the terminal pin to drive electrical terminal pins through imperforate electrically insulative substrate board. It is another object to provide such a machine with a frame having a ram reciprocable thereon, and a slide which is selectively secured to the ram or to the frame so that it is movable into position and locked there. It is another object to employ such a machine which incorporates a cutter associated with the slide so that, when the ram further moves with respect to the slide beyond the slide locked position, a pin is cut off of a length of terminal pin material. It is a further object to maintain full support for a cutoff pin so that, upon driving of such a pin through imperforate material, it is fully supported. It is another object of this invention to provide a driver of adequate force to drive an electric terminal pin through an imperforate insulative substrate.

Other objects and advantages of this invention will become apparent from a study of the following portion of the specification, the claims and the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of an exemplary terminal board having terminal pins installed therein.

FIG. 2 is a top plan view of a terminal board of the prior art, showing the terminal pin spacing which can be accomplished thereby.

FIG. 3 is a fragmentary top plan view of two sections of the terminal board, showing the spacings of terminal pins which can be accomplished by the terminal pin installing machine of this invention.

FIG. 4 is a front elevational view of two terminal pin installing machines of this invention.

FIG. 5 is an isometric view of a guide block for employment with the terminal pin installing machine of this invention.

FIG. 6 is a section with parts broken away, taken generally along the line 6—6 of FIG. 5.

FIG. 7 is a front-elevational view of the terminal pin installing machine of this invention.

FIG. 8 is a rear elevational view thereof.

FIG. 9 is a right side elevational view thereof.

FIG. 10 is an enlarged front elevation view, with parts broken away and part in section, of some of the structural details of the terminal pin installing machine, in a first, raised, rest position.

FIG. 11 is a view similar to FIG. 10, showing the structure in an intermediate, second position.

FIG. 12 is a view similar to FIG. 10 showing the mechanism in a final, driving position.

FIG. 13 is a section taken generally along the line 13—13 of FIG. 10.

FIG. 14 is an enlarged, exploded, isometric view of the inter-engagement between the driver and the ram.

FIG. 15 is a section taken through the interlocking structure between the driver and the ram, when in the engaged position.

FIG. 16 is a section taken generally along the line 16—16 of FIG. 15.

FIG. 17 is an enlarged isometric view of the lock pin shown in FIGS. 15 and 16.

FIG. 18 is an enlarged fragmentary section taken generally along the line 18—18 of FIG. 16.

FIG. 19 is an isometric view of part of the feed mechanism.

FIG. 20 is an enlarged fragmentary front-elevational view of part of the structure of FIG. 19.

FIG. 21 is a section taken generally along the line 21—21 of FIG. 20.

FIG. 22 is a front-elevational view of another part of the feed mechanism.

FIG. 23 is a section taken generally along the line 23—23 of FIG. 22.

FIG. 24 is an isometric view of the driver.

FIG. 25 is a horizontal section through the driver, similar to FIG. 13, but fragmentary and enlarged with respect thereto.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. 1 and 3, a terminal board 10 is shown therein. Terminal board 10 comprises a substrate 12 having terminals 14 extending therethrough. In accordance with this invention, the most conveniently employed terminals are those which extend out of both sides of the substrate 12, but it is clear that, when carefully employed, the terminals can terminate substantially at one surface of the terminal boards. However, since it is clear that the terminals rely upon frictional engagement in an opening through the terminal board for their structural positioning, it is necessary for the terminals to extend fully through the terminal board for maximum terminal strength.

The substrate 12, for the purpose of this invention, is the conventional insulation board presently conveniently commercially available. It is normally a filled phenolic board of 3/32 inch thickness. The terminal pin installing machine of this invention is particularly suited for installation of pins in such substrates or boards, but it is clear that with suitable strengthening of structure, heavier pins can be driven through heavier boards. In the preferred embodiments described herein, the filled 3/32 inch phenolic insulation board is the preferred substrate, although filled phenolic board up to ⅛ inch thick can be employed, should the need arise.

FIG. 3 shows that rows of terminals 14 can be spaced as small as dimension *a*, while columns of terminals can be spaced as little as *b*. Furthermore, as the portion of the board 12 to the right end of FIG. 3 illustrates, the terminals can be spaced in columns as little as *b*/2, when the terminals are staggered in the rows.

As illustrated in the prior art in FIG. 2, the prior art board 16 has terminals spaced in rows by a distance *c* and in columns by a distance *d*, both of which are considerably larger than the dimensions *a* and *b*, which can be accomplished by the terminal pin installing machine of this invention. The manner in which this close spacing is accomplished is a function of the slide and driver design, and will be described in detail in the specification following.

FIG. 4 illustrates a workbench having a top 18 and having an upstanding backboard 20. Terminal pin installing machines 22 and 24 are mounted on backboard 20. They are identical machines, with machine 22 shown with its movable structure in the raised position, while machine 24 is illustrated with its movable structure in the lowered position, where a terminal pin is being installed. Since the machines 22 and 24 are identical, the machine 22 will be described in more detail hereinafter.

Since the terminal board is imperforate, and it is desired that terminals be inserted in predetermined positions through the terminal board, it is necessary to form a template 26 which has a plurality of holes 28 therein, each of which corresponds to the position where a terminal pin 14 is to be inserted through the substrate board 12. In FIG. 6, the substrate board 12 is shown as being clamped upon template 26, and it is to be noted that there is no hole in the substrate board 12 corresponding to the hole 28, where a terminal pin is to be inserted. The substrate board is secured to the template by any convenient means, such as edge guides and clamps. Guide blocks 30 and 32 are identical and, accordingly, only guide block 30 will be described. The guide blocks are mounted upon workbench top 18. The top 34 of guide block 30 is flat and serves as rest surface against which the template 26 can lie. Guide pin 36 extends upward from top surface 34 and is of such diameter as to be received by the hole 28. Thus, template 26 is moved across the top of guide pin 36 until a hole is found. Thereupon, the template is moved down over the guide pin 36 until it rests on the top surface of the guide block. In this position, the substrate board 12 is positioned to receive a pin. Preferably, the substrate board 12 rests upon the top of pin 36, to provide firm support, when the terminal pin is driven. Guide pin 36 has a central hole 38 therein which receives the punchout from the substrate board and receives the portion of the terminal pin which extends through substrate 12.

Switch actuator 40 is mounted upon spring 42 so that the switch actuator 40 extends above the top surface 34, when the template 26 is not positioned. However, when the template is moved down on guide pin 36, the template depresses switch actuator 40 and spring 42. Such depressing causes closure of electric switch 44, which is in series with the terminal pin installing machine main actuating switch. Switch 44 is a safety switch and requires that the template be in position. When its serially connected main actuating switch is manually actuated by the machine operator, the machine goes through an operating cycle to drive a terminal pin. If the terminal board 12 were in the incorrect position, by not having the template down with its holes 28 embracing the guide pin, the terminal pin would be wrongly in place, but this is prevented by switch 44. As will be clear from the following discussion, the slide comes down to substantially contact the

top of the terminal board, when it is in its correct position for terminal pin driving. Thus, if the template is on the top of guide pin **36**, damage would occur to the positively driven slide. Thus, electric switch **44** protects both against improper terminal placement and damage to the machine by having an improperly placed template.

The front, rear and right side elevational views of the terminal pin installing machine **22** are respectively shown in FIGS. **7**, **8** and **9**. Mounting bracket **46** is mounted on the backboard of the workbench and supports the machine **22**. Frame **48** is the main stationary part of the machine, and is carried upon mounting bracket **46** and carries the principal parts of the machine **22** thereon. Cylinder **50** is the actuating motor of the machine **22**. Cylinder **50** is a conventional type of cylinder, mounted on its lower end to frame **48**.

The upper end of cylinder **50** carries control valve **52** and exhaust muffler **54**. Control valve **52** is a conventional electro-pneumatic control valve connected to the cylinder **50** on both sides of the piston therein, to provide double acting control of piston rod **56**, which is driven by the piston. Piston rod **56** is shown in its extended, lower position in FIGS. **7** through **9**.

Control valve **52** has a control circuit connected thereto. The control circuit, as previously described, includes a serially connected switch **44** and the main actuating switch. The control circuit actuates valve **52** to drive the piston rod down to its extended position, shown, and in this position, limit switch **58** is actuated to signal completion of the terminal pin insertion portion of the cycle and to signal control valve **52** to return piston rod **56** and its associate structure to the raised position.

FIGS. **10**, **11**, **14** and **15** illustrate the connection of the lower end of piston rod **56**. The lower end of piston rod **56** carries threads **60** and upper jaw **62** is threadedly engaged thereon. The length of threads **60** permit the adjustment of upper jaw **60** upon the threads, to control the lower limits of travel of the ram and the structure carried thereon. The limit of travel is controlled by the piston on rod **56** bottoming in cylinder **50** so that piston rod **56** is at the bottom end of its stroke. Should the terminal board be absent, the nose of the ram, hereinafter described, does not come in contact with guide pin **36**. Thus, some adjustment is necessary between upper jaw **62** and the piston rod. This is accomplished by adjusting the thread engagement therebetween.

Clamping is accomplished by clamp plug **64**, which has a threaded end, see FIGS. **17** and **18**, which engages against the thread **60** on the lower end of piston rod **56**. Clamp plug **64** is prevented from turning in its recess by means of keyway **66**, which is engaged by pin key **68**. Additionally, clamp plug **64** is forced against the threaded end of piston rod **56** by means of set screw **70**. With the set screw tightened down, the piston rod **56** cannot rotate with respect to upper jaw **62**.

Lower jaw **72** is securely mounted to the top end of ram **74**. Upper jaw **62** is a recess **76** and tongue **78** which respectively engage with tongue **80** and recess **82** on lower jaw **72**. By this means, ram **74** is forced downward by means of its air cylinder motor **50** and is forcibly raised by the same motive means.

Ram **74** moves in guide **84**, see FIG. **13**, which is secured to frame **48**. Ram **74** is directly connected to be actuated by the piston rod **56**, as is previously described, and thus moves through its complete stroke as a function of piston rod movement. The lower terminus of ram movement is controlled by the stroke limit of the piston rod, as described above. Toward the lower end of ram **74**, it is formed with slot **86**, see FIG. **10**, in which is mounted driver **88**. Driver **88** is pivoted in slot **86** on pivot pin **90**, and driver **88** carries cam dog **92** on its back side. Cam dog **92** extends through an opening in the left side of ram **74**, at the bottom of slot **86**. Cam dog **92** rides in slot **94** in the left side of guide **84**, through most of its stroke. Toward the bottom of the stroke, cam dog **92** engages with cam face **96** to swing driver **88** to the right, from the position of FIGS. **10** and **11** to the position of FIG. **12**. The purpose of this motion will be described below. Slot **86**, in which driver **88** is located, extends all the way to the bottom of ram **74**, as is best seen in FIG. **12**. The purpose of this slot being open at the bottom end of the ram will be described hereinafter.

Slide **98** is movably mounted in a T-slot, see FIG. **13**, the base of the T-slot being in frame **48**. As is seen in FIG. **13**, slide **98** has a slot **100** therein in which is located lock roller **102**. In the position shown, the lock roller is engaged in a half-recess in ram **74** so that the ram and slide are locked together for vertical motion. However, at the desired bottom terminus of motion slide **98**, there is positioned a half-recess **104** in the frame **48**. When the slide moves down with the ram to this lower terminus position, which is the position wherein nose **106** of the slide is in contact with the substrate **112**, as shown at the bottom of FIG. **12**, lock roller **104** transfers from its half recess in ram **74** to its half recess **104** in the frame to lock the slide with respect to the frame. It should be noted, however, that ram **74** is now free to descend without the slide to its lower terminus position determined by the bottoming of the piston in cylinder **50**, and the adjustment of piston rod **56** in upper jaw **62**.

The terminal posts **14** are originally provided in long lengths of wire, wound on reels of a conventional nature. The preferred material, most usually used in the terminal ports of principal interest, is solder coated square steel wire. Other types of wire may be employed, but soft copper wire may not have sufficient strength to be driven through the substrate board, this depending on the nature of the substrate board, as well as the diameter, hardness and length of the particular wire terminal. The wire is furnished in the conventional reel, and the supply from the reel is indicated at **108** at the upper part of FIG. **7**. Wire **108** is fed to wire straightener **110**. Below straightener **110**, the terminal wire **108** extends downwardly to a terminal wire channel which extends through the mechanism. The terminal wire channel is illustrated at **112** in the lower part of FIG. **11**, where it extends out of the nose **106**.

Cover **114**, see particularly FIGS. **10** through **13**, engages over wire feeder **116**, which is shown in fragmentary detail in FIGS. **22** and **23**. FIG. **22** illustrates the wire feeder from the rear, and shows the terminal wire channel **112** with terminal wire **108** therein. Wire feeder **116** is reciprocable up and down in its channel and carries feeder stop **118** thereon. Feeder stop **118**

reciprocates between stop dog **120** and adjustable stop **122**. As is seen in FIG. **22**, pawl **124** is pivoted in the wire feeder **116** and engages against the terminal wire **108**. Spring **126** urges the pawl in the upward, wire-engaging direction to lock terminal wire **108** against the back of wire feed channel **112**. It is thus seen that terminal wire **108** is free to move downward past the pawl, but the pawl does not permit upward terminal wire movement with respect to wire feeder **116**. There is sufficient friction of pawl **124** against the terminal wire **108** to draw the wire feeder **116** down to engagement by feeder stop **118** onto stop dog **120**, when the wire **108** is moved downward. Upward movement of the wire causes upward movement of wire feeder **116** until feeder stop **118** engages with adjustable stop **122**, whereupon upward movement of wire **108** is positively stopped.

Pivotally mounted upon slide **98** is terminal cutter **128**, seen in detail in FIGS. **19**, **20** and **21**, and shown in FIGS. **10** and **13**. Terminal cutter **128** is carried on pivot pin **130**, which is mounted in slide **98**. Terminal cutter **128** has the terminal wire channel **112** extending therethrough. In the central part of the terminal cutter, facing rearwardly as viewed in FIGS. **10** through **12**, is a wire feeder. Roller **132** is positioned in cavity **134** and rests between the terminal wire **108**, and the cavity backwall **136**. The cavity backwall is slightly angularly related to the wire channel **112** in which terminal wire **108** lies, so that, as roller **132** moves upward, as seen in FIG. **20**, the roller engages therebetween to lock the wire **108** in its slot. Spring **138** urges the roller in its upward direction toward the locked position. Thus, wire **108** can move downwardly through the wire feeder portion of cutter **128**, but cannot move upwardly with respect thereo.

As is best seen in the lower part of FIGS. **11** and **12**, terminal wire channel **112** extends out of the bottom of terminal wire cutter **120**, adjacent cam face **140** which extends to the left. Dog **142** extends to the right and lies inside of guide **144** when the slide is above its lowermost position. Furthermore, when the slide reaches its lowermost position, dog **142** is released from the bottom of guide **144**, as shown in FIG. **12**. It is in this position that the slide is locked, with nose **106** in contact with substrate terminal board **12**.

In this position, the ram **74** can continue downwardly. This downward further motion of ram **74** causes the front end of the ram to engage cam face **140** to swing the lower end of terminal cutter **128** to the right, about its pivot, to cut off the terminal wire through shear action. At the same time, the terminal wire channel at the lower end of the terminal wire cutter is swung to the right to expose the top end of now cutoff terminal **14**.

With the top end of the terminal **14** now accessible, continued downward motion of the ram causes cam dog **92** on the driver to engage with cam face **96** to swing the driver from the upright position of FIGS. **10** and **11** to the active position of FIG. **12**. In this position, driver web **146** swings into the terminal wire channel and engages on the top of the cutoff terminal **14**. Downward motion of the ram causes the driver to thrust the cutoff terminal through the substrate terminal board **12**. It should be noted that the terminal wire **14**, after its cutoff, is supported on three sides in channel **112** and the angle of the driver **88** is such as to retain the cutoff terminal **14** in the back of the channel slot during the driving operation.

It must be particularly noted that driver **88** is of wider material than the terminal wire channel **112**, but the driver web **146** is sufficiently narrow to engage into the terminal wire channel. This permits a strong driver, of adequate strength to drive the terminal into unperforate substrate board **12**. Furthermore, it permits the employment of a terminal wire channel **112** which is of sufficiently narrow dimension to properly support the terminal wire on both sides of the channel as the terminal is being driven.

In operation, the operator secures a substrate board **12** on top of the template **26**. The operator next places the template so that a hole **28** therein engages over guide pin **36** on the guide block **30**. This actuates switch **44**, when the template is bottomed against the top of the guide block, and upon operator closure of the operating switch, the piston **50** is energized for the downstroke. Slide **98** is locked to ram **74**, and, as terminal cutter **128** moves downward, carrying feed lock roller **132**, it pulls the wire downward with it, so it moves down with the slide. The wire has previously been positioned so that the front end thereof extends substantially to nose **106**.

Wire feeder **116** moves downward, being pulled down by the wire, to the point where feeder stop **118** engages stop dog **120**. From this point on, the wire is drawn downward through the wire feeder **116** and the wire feeder remains stationary. The slide **98** continues its downward travel until nose **106** engages on substrate **12**. This was adjusted on setup by adjusting the height at the top **34** of guide block **30**. At this point, lock roller **102** transfers from a lock between ram **74** and slide **98** to a lock between slide **98** and frame **48**. Thus, the slide is locked in position and the ram is unlocked to move downward relatively to the slide.

Further downward motion causes the nose **148** of the ram to engage cam face **140** on terminal cutter **128**. The terminal cutter is now sufficiently low so that its dog **142** is not restrained by guide **144**. Thus, this right swinging of the terminal cutter **128** causes cutoff of the wire to form a cutoff terminal pin **14**. This pin is restrained between the side walls of the terminal wire channel **112** in the nose of the slide. Further downward motion of the ram causes right swinging of driver **88** so that its web **146** is inserted into terminal wire channel **112** above the now cutoff terminal **14**. Further downward motion drives the terminal through substrate board **12**.

In the final downward position, limit switch **58** is actuated to recycle the cylinder **50** to cause upward motion of ram **74**. The above-described operation is substantially reversed, with the ram moving upward to permit left swinging of driver **88**. Further upward motion of the ram causes transfer of lock roller **102** from the condition when it locks the slide to the frame to the condition where it locks the slide to the ram. In this condition, slide **98** moves upward with upward ram movement. The first thing that happens is that terminal cutter **128** is swung to the left, by means of dog **142** being engaged by guide **144**. This lines up the portion of the terminal wire channel **112** in the cutter with the portion of the channel in the nose of the slide. The en-

tire structure moves upward together, until feeder stop **118** engages with adjustable stop **122**. This stops wire feeder **116** to restrain the terminal wire **108**. Further upward motion of the slide causes relative downward movement of the terminal wire **108** with respect to the slide. The relative amount of motion is equal to the length of the desired terminal **14**, and is adjusted by adjustable stop **112**. This causes relative downward motion of the terminal wire **108** so that its new bottom end is below the end of terminal cutter **128** and is positioned in the terminal wire channel in the nose of the slide. The cylinder stops in its upward terminal position, and the terminal pin inserting machine **22** is in condition for its next terminal wire insertion.

As previously discussed, ram **74** has the slot **86** which extends out of the nose **148** of the ram. This makes the bottom end of the ram channel-shaped, and the flanges of the channel are the portions of nose **148** which are active against cam face **140**. However, this slot also provides a large clearance area into which a previously inserted terminal can extend. As is best seen in FIG. **12**, there is a considerable amount of space in the slot **86** at the nose **148** behind the driver, so that terminals can be driven closely adjacent each other. Nose **106** and slide **98** are narrow in the front to back direction, perpendicular to the drawing sheet in FIGS. **10–12** so that rows of terminals can be closely spaced.

Adjustment of wire terminal length is accomplished by adjustment of adjustable stop **122**. The adjustment of the nose **116** so that it stops directly against substrate **12** is accomplished by adjustment of the entire machine frame with respect to its guide block **30**. Thus, the guide block **30** may be adjusted up and down to accomplish the desired relationship. Since the slide is locked to the frame by means of lock roller **102** in its lowermost position, adjustment with respect to the nose of the slide, when the slide is in the locked position, must be made with respect to the frame. Finally, the amount that the cutoff terminal **14** is driven through the terminal board is adjusted by the terminal position of ram **74**, since the ram carries driver **88**. This adjustment is accomplished by the previously described thread engagement of piston rod **56** into upper jaw **62**. It is, thus, clear that all of the required adjustments can be accomplished. The spacing and positioning of the holes **28** in the template determine the position in which the terminals **14** are inserted into the substrate **412**.

This invention having been described in its preferred embodiment, it is clear that it is susceptible to numerous modifications and embodiments within the ability of those skilled in the art and without the exercise of the inventive faculty. Accordingly, the scope of this invention is defined by the scope of the following claims.

What is claimed is:

1. A terminal pin installing machine, said terminal pin installing machine comprising:

a frame, a guide block located with respect to said frame, said guide block having guide means thereon;

a ram movably mounted on said frame for reciprocable motion toward and away from said guide block, a driver means mounted on said ram for driving terminal pins;

a template having locating means thereon for cooperating with said guide means on said guide block for positioning an imperforate insulative material substrate with respect to said guide block, said driver means being for driving a terminal pin so that the terminal pin extends out of both sides of the substrate.

2. The terminal pin installing machine of claim **1** wherein said ram has an opening in the face thereof so that a previously driven terminal pin can be accepted within said opening while an additional terminal pin is driven through said substrate adjacent the previously driven terminal pin.

3. The terminal pin installing machine of claim **2** wherein said opening comprises a slot in said ram, said driver being pivotally mounted in said slot, said slot being open to the bottom end of said ram.

4. The terminal pin installing machine of claim **3** wherein said driver has a body and has a driver web narrower than said body extending from said body, said terminal pin being positioned in a terminal wire channel and said driver web being movable into said terminal pin channel to engage the top of said terminal pin.

5. A terminal pin installing machine, said terminal pin installing machine comprising:

a frame, a ram reciprocably mounted with respect to said frame, a terminal pin driver mounted on said ram for driving terminal pins through an insulative terminal board;

a cylinder mounted on said frame, said cylinder having a piston rod extending therefrom, screw threads on said piston rod;

an upper jaw having a threaded opening thereon, said threaded opening therein being threadedly engaged with said screw threads on said piston rod, a clamp plug mounted on said upper jaw and engaging said threads on said piston rod to clamp said piston rod with respect to said upper jaw to prevent relative rotation thereof so that the adjustment of said upper jaw with respect to said piston rod is retained.

6. The terminal pin installing machine of claim **5** wherein there is a transverse opening through said upper jaw intersecting with said threaded opening, said transverse opening containing said clamp plug.

7. The terminal pin installing machine of claim **6** wherein a set screw is engaged in said transverse opening and against said clamp plug to clamp said clamp plug against said piston rod threads.

8. The terminal pin installing machine of claim **7** wherein a keyway is formed in said clamp plug and a key is located in said upper jaw to prevent said clamp plug from turning in said transverse opening, said clamp plug having grooves across the clamping face thereof to engage said threads on said piston rod.

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