

Oct. 2, 1962

P. E. SCHMIDT ET AL
STAKING MACHINE

3,056,446

Filed June 29, 1959

3 Sheets-Sheet 1

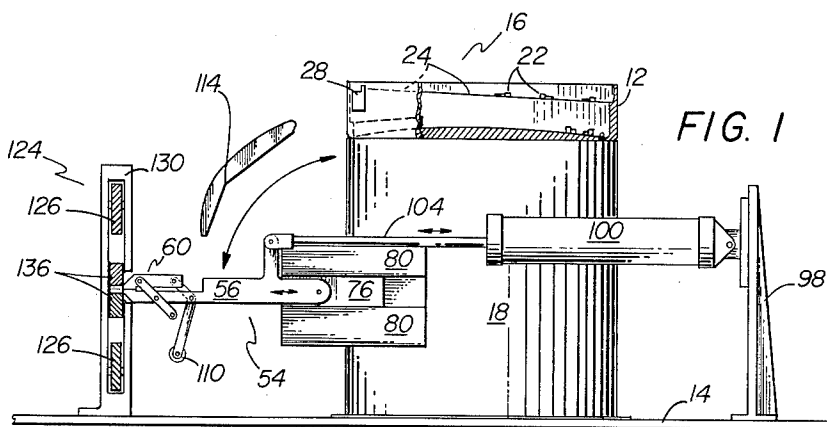


FIG. 1

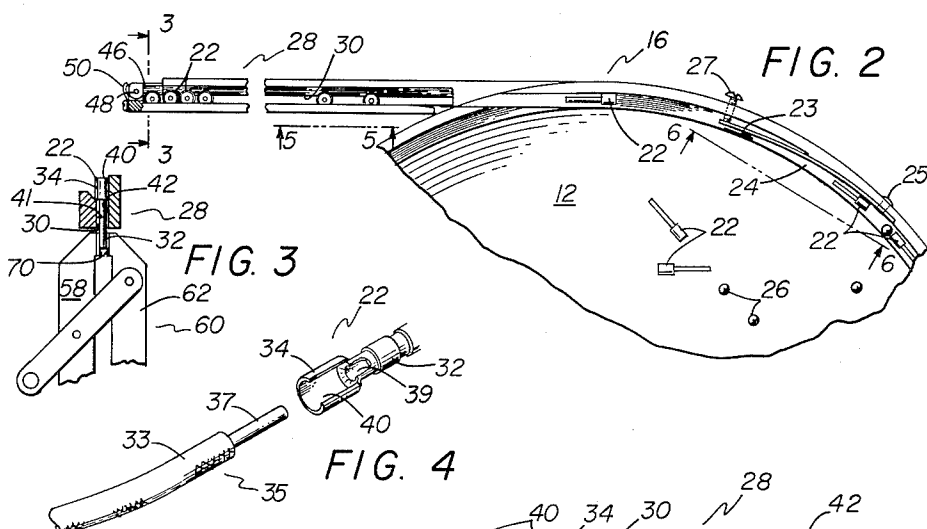


FIG. 2

FIG. 3

FIG. 4

FIG. 5

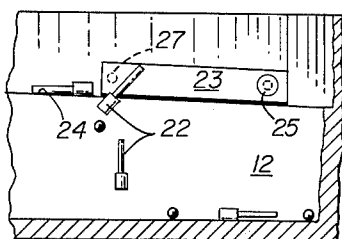


FIG. 6

INVENTORS
Paul E. Schmidt
James F. Waddell, Jr.
BY *Duane C. Bowen*
ATTORNEY

Oct. 2, 1962

P. E. SCHMIDT ET AL

3,056,446

STAKING MACHINE

Filed June 29, 1959

3 Sheets-Sheet 2

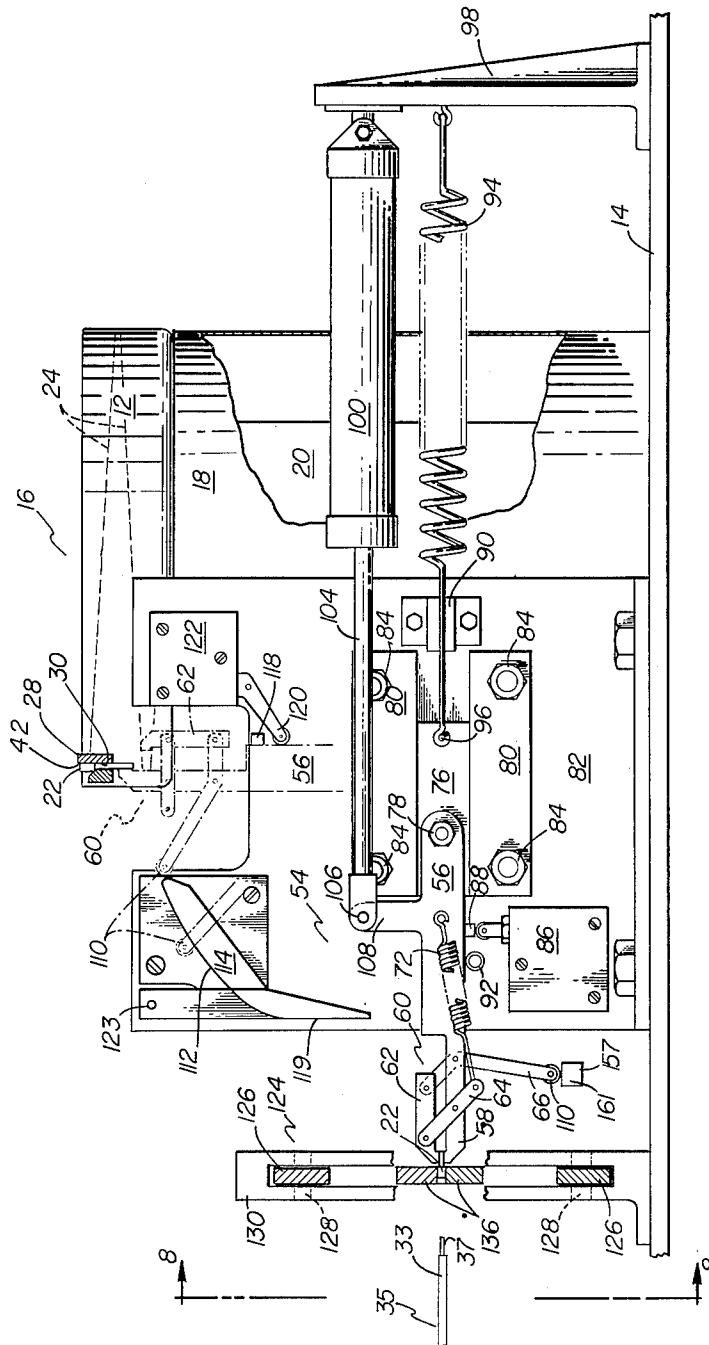


FIG. 7

INVENTORS
Paul E. Schmidt
James F. Waddell, Jr.
BY
Quane C. Bowen
ATTORNEY

3,056,446

3 Sheets-Sheet 3

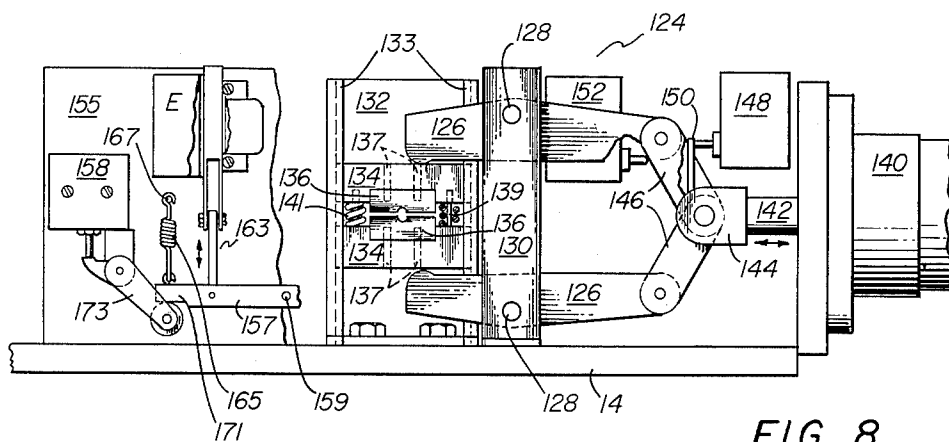


FIG. 8

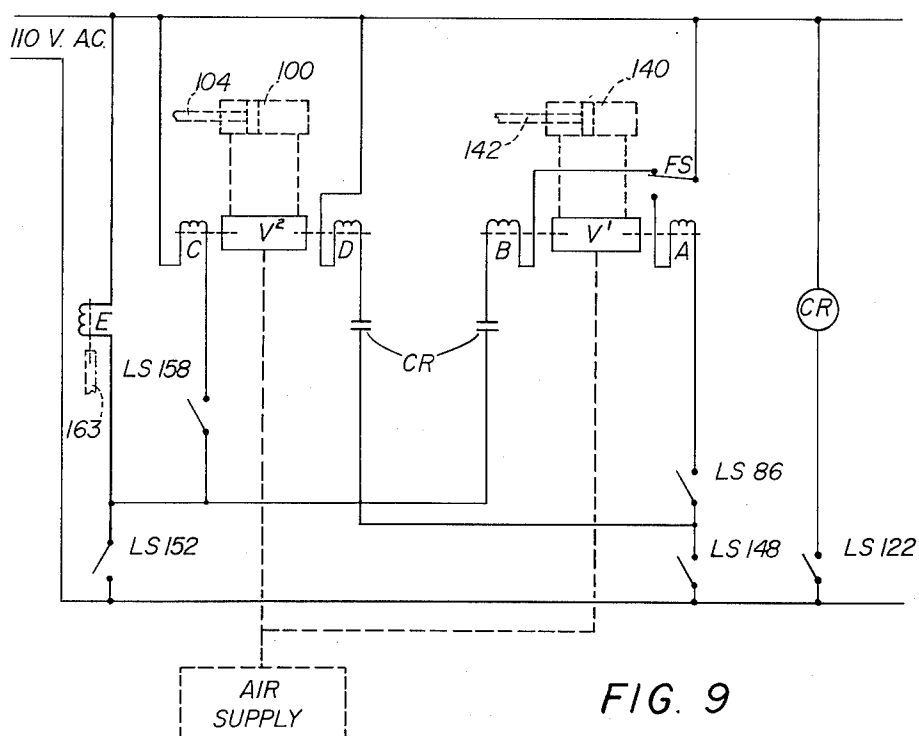


FIG. 9

INVENTORS
Paul E. Schmidt
James F. Waddell, Jr.
BY *Duane C. Bowen*
ATTORNEY

1

3,056,446

STAKING MACHINE

Paul E. Schmidt, Wichita, Kans., and James F. Waddell, Jr., Versailles, Mo., assignors to Boeing Airplane Company, Wichita, Kans., a corporation of Delaware

Filed June 29, 1959, Ser. No. 823,453

6 Claims. (Cl. 153-1)

Our invention relates to a semiautomatic machine to apply an electrical terminal or connector to an electrical conductor. The machine includes automatic orienting and feeding means for serially feeding terminals in oriented position, a pincers-type transfer device for transferring the terminals from the orienting and feeding means to staking means while maintaining terminal orientation, and control means for semiautomatically operating the transfer and staking means. The end of an electrical conductor is manually positioned in each terminal at the staking position and then the control means is actuated to initiate a cycle including the staking of the terminal on the conductor and the transfer of another terminal to the staking position.

Terminal staking has been accomplished in automatic production line machines in automotive, electrical appliance and radio factories in which measured lengths of insulated wire are automatically cut from a reel and stripped at both ends, and in which terminals from strips of metal have been formed about the stripped ends of the wire lengths. Other expensive machines have been devised for the forming of terminals from strips of metal and the staking thereof on wires which are manually fed. The machines above described are too expensive for use in small-lot production runs and some of these machines are restricted to use with a single type of terminal.

The present invention was conceived in connection with the manufacture of aircraft, where it is not feasible to automatically feed the wire for various reasons, i.e., the wire may be at the end of a bundle made up for installation on an aircraft, or production is relatively limited and can not justify an expensive machine and setup. In many aircraft plants, the wire is stripped by hand strippers and the terminals are staked by hand-held plier-like tools.

The objects of our invention include: to provide a semi-automatic terminal-applying machine; to devise a machine that is suitable for aircraft or like production conditions, that will meet quality requirements and that will save labor in terminal staking operations; to provide a machine to substitute for hand-staking operations, that is sufficiently lightweight to permit movement from place to place in a plant as need arises, and that does not require a large investment; to devise a machine into which the stripped ends of electrical conductors can be fed manually, in which terminals are fed from a bulk terminal supply chamber, and in which the staking operation is conducted merely by the operation of a manual control such as a foot switch; and to provide a machine adaptable for staking more than one design of terminals, including terminals that require axial and radial orientation in the staking position.

Our invention will be best understood, together with additional objectives and advantages thereof, from the following description, read with reference to the drawings, in which:

FIGURE 1 is an elevation view, partly in section, showing the major moving components of a specific embodiment of our terminal staking machine;

FIGURE 2 is a plan view showing a portion of the terminal supply chamber and the terminal orienting and feeding mechanism;

FIGURE 3 is a section view taken on line 3-3 of FIGURE 2 and showing the terminal pincers in gripping position;

2

FIGURE 4 is an enlarged, fragmentary perspective view of a specific terminal which the machine is adaptable to handle and the view shows the enlarged ferrule and radial slot of the terminal and the end of the electrical conductor to be staked in the terminal;

FIGURE 5 is an enlarged, fragmentary elevation view taken on line 5-5 of FIGURE 2;

FIGURE 6 is an enlarged, fragmentary view taken on line 6-6 of FIGURE 2;

FIGURE 7 is an enlarged, detailed view taken from the same viewpoint as FIGURE 1;

FIGURE 8 is an elevation view including the staking jaws and operating mechanism, viewing the structure in the manner indicated by line 8-8 of FIGURE 7; and

FIGURE 9 is a combined schematic drawing in which electrical circuitry is shown in full lines and pneumatic circuitry is shown in dashed lines.

Our machine was specifically designed to stake terminals of the separable, plug-in, pin type, such as the contacts of Cannon miniature electrical connectors. The machine is adaptable to process other terminals. For example, Bendix "Pygmy" miniature electrical connectors, which do not have radial slots, can be processed by simple modifications of the sorting and feeding track means of the terminal orienting and feeding mechanism 16 and by providing a four part jaw means in the staking mechanism 124. The Cannon product is generally as shown by terminal 22 in FIGURE 4. Terminal 22 has an enlarged end forming a wire insulation receiving ferrule 34 having a radial slot 40 therein. Ferrule 34 is crimped around the insulation of an electrical conductor, closing radial slot 40, such as the insulation at 33 on electrical conductor 35 in FIGURES 4 and 7. The stripped wire, as 37, on the conductor is positioned in the axial opening 39 of terminal 22 and is staked in place by deformation of the shank 32 of terminal 22 in the area of axial opening 39. The staking operation is conducted by the crimping dies 136 shown in FIGURES 1, 7, and 8. Terminals 22 are provided as male or female parts, not shown in detail, on the smaller shank ends 32 opposite enlarged ferrules 34.

In various industries it is desirable to apply some type of terminal to a wire-like body. The terminals and the wires may or may not be metal and if the wire is an electrical conductor, it may or may not be insulated. Although our invention is particularly adapted to process the terminals shown and described, its usefulness is not limited to those terminals. For purposes of the present specification and claims the word "terminal" is defined as including any small body, of whatever material, having a deformable portion to be applied to the end of a wire, of whatever material, by a crimping or staking operation or the like. Although the bodies to be staked are sometimes called by other names, such as "connectors" or "contacts," the word "terminal" was selected for use herein because it is descriptive of a member positioned at the end of a wire, e.g., where the wire terminates. The words "crimping" and "staking" are used interchangeably to describe the action in securing the terminal to the conductor but the words are defined, for the purposes of the present specification and claims, as including any securing system in which jaws, dies or the like, upon application of pressure, deform a terminal to clamp the end of a wire.

Briefly, the structure of our invention includes a supply chamber to receive bulk, separate, unoriented terminals; orienting and feeding means associated with the supply chamber including vibrating, ramp and guide means adapted to orient and present the terminals in sequence; pincer-like terminal gripping members supported on a pivotable arm to deliver the terminals from the orienting and feeding means to a staking position; and staking means

to stake terminals, in said staking position, on conductors or the like.

The structure will be described in the following order: (1) the terminal orienting and feeding means 16; (2) the transfer means 54; (3) the staking means 124; (4) the electrical and pneumatic circuitry and operation; and (5) the operation of the machine.

Terminal Orienting and Feeding Means

The terminal orienting and feeding means 16 includes a vibrator-supply chamber 12 supported on the upper surface of a table base 14 by a housing 18 that includes vibration producing means 20. The vibrator-supply chamber assembly 12 is a light-weight dish-shaped container resiliently supported by housing 18. The chamber is vibrated in a vertical and rotary motion by an electro-magnetic vibrator 20. The bottom of chamber 12 is slightly convex, e.g., raised in the center, whereby the terminals tend to vibrate to the periphery of the chamber. In the prototype machine, a commercial unit was used called "Syntron Vibratory Elevator" and manufactured by the Syntron Company, Homer City, Pa. The unit was modified as to details of the ramp 24 and a feeding track 28 was added so that the unit could perform the difficult orienting and feeding action necessary in the present machine.

The vertical and rotary action of vibrator 20 causes terminals 22, after they have reached the periphery of chamber 12, to ascend helical ramp 24. The upper surface of the ramp has a slight longitudinal groove to prevent the terminals, as they vibrate upwardly, from falling over the ramp edge back into the chamber. Because of the nature of the present orienting and feeding action needed, it is desired to have the terminals ascend the ramp small ends first. When subjected to the vertical and rotary vibratory movement, more of the terminals head up the ramp with their larger ends 34 first than with their smaller ends first. The addition of shot 26 facilitates the action in directing part of the terminals small ends first up ramp 24. A sufficient number go shank ends 32 first up the ramp so that the orienting problem resolves itself into eliminating the large end first oriented terminals from the procession.

A terminal sorting means 23 has been provided to divert all terminals ascending large ends first, over the edge of ramp 24 back into the chamber 12, as shown in FIGURES 2 and 6. Sorting means 23 consists of some means of narrowing the ramp and is shown as comprising a spring strip forming an abutment crowding the terminals to the outer edge of the ramp. Spring strip 23 is secured at one end by a rivet 25 and a screw 27 pressing on the other end is adjustable to vary the crowding action so that head-first oriented terminals will fall off the ramp and the shank-first oriented terminals will continue up the ramp. The head-first oriented terminals tend to fall off more easily apparently because the terminals are pointed off the ramp at the point of maximum unbalance, whereas when the small end is first the terminals are pointed onto the ramp at the point of maximum unbalance. In changing between sorting male and female terminals of the type above described, sorting spring strip 23 is adjusted to a different position (narrowing ramp 24 for the male terminal) by means of screw 27.

Feeding track 28 leads from the upper end of ramp 24 and receives terminals therefrom that are, as before related, advancing with the smaller, shank end 32 forward. Feeding track 28 has an elongated slot 30 of sufficient width whereby the smaller ends or shanks 32 of the terminals 22 advancing onto track 28 from the helical ramp 24 may easily fall through. This positions the enlarged or ferrule portions 34 of the terminals uppermost. One upper wall section 42 of the feeding track 28 is upright and coplanar with the underlying wall section of the slot 30, except for a transition section adjacent the ramp. The opposite wall 41 is beveled whereby the terminals are unstable until terminal radial slots 40 abut upright wall

42. The combined actions of walls 41 and 42 may be termed camming abutment means. Feeding track 28 is secured to chamber 12 and vibrates therewith and terminals 22, under the vibratory action, rotate until the edges of radial slot 40 abut wall section 42, whereby all of the terminals are oriented to face in the same direction. This radial orientation of the slots 40 is necessary to insure proper orientation of the terminals 22 for staking when they are later transferred to and disposed in the staking die.

The vibratory and rotary movement of chamber 12 also advances terminals 22 serially toward a feeding position at the end of track 28. At the outer end of feeding track 28 is a pivotal gate 46, hinged at 48 to permit removal of the terminals, one at a time, sideways, from the feeding position within slot 30, by the transfer means 54. A flat spring 50 urges gate 46 to a closed position.

Transfer Means

The transfer mechanism 54 operates in a vertical plane at right angles to feeding track 28 and at right angles to the orientation of the staking mechanism 124. A transfer arm 56 is provided to pivot about one end in that vertical plane. The terminal feeding and staking positions are within the vertical plane and, during transfer, the terminals do not change orientation relative to that plane.

The other end 58 of arm 56 forms, together with a movable jaw 62, a parallel-bar type pincers 60. Movable jaw 62 is pivotably connected to arm 56 by a link 64 and a dog-leg shaped lever link 66. Links 64, 66 allow movable jaw 62 to move away from jaw end 58 of arm 56 in an arcuate movement while remaining in parallel relationship thereto. The tips of the jaws on the inner or gripping surfaces are faced with a slightly resilient material 70, such as nylon. The terminals 22 are pinched by the jaws with sufficient force to hold them without marring their exterior surface. A tension spring 72 secured to an end of link 64 resiliently urges pincer jaws 58, 62 closed.

One end of transfer arm 56 is pivotably attached to a slide block 76 by a bolt 78. The pivotal support of arm 56 permits it to swing in a vertical plane, in the manner indicated in FIGURES 1 and 7, between an upper, upright position, picking up a terminal 22 in feeding position from feeding track 28 to a lower, horizontal position where it is disposed to insert the terminal in staking position in the staking means 124. This action will be described in more detail later.

Slide block 76, on which arm 56 is pivoted, is slidably supported to travel horizontally by gibs 80 which are secured to a back support plate 82 by bolts 84. This permits transfer arm 56 to be moved toward and away from staking means 124. A limit switch 86 is located to be actuated by an abutment 88 on transfer arm 56 during the horizontal travel of the arm. A stop 90 limits movement of the transfer arm 56 away from the staking mechanism, and a roller abutment 92 supports the outer end of transfer arm 56 while in the horizontal or down position. Slide block 76 is held in a retracted position abutting stop 90 during swinging movement of arm 56 by a tension spring 94 connecting spring post 96 and an upright support 98.

A two-way acting pneumatic cylinder 100, which actuates transfer arm 56, is pivotally secured to upright support 98 and its piston rod 104 is attached to transfer arm 56 by a pivot pin 106 secured to a lug 108 on arm 56. When pneumatic cylinder 100 is operated to withdraw arm 56, in its horizontal, down position, away from staking means 124, arm 56 is pivoted upwardly when slide block 76 strikes abutment 90. Spring 94 insures that block 76 is completely withdrawn when arm 56 is pivoted upwardly.

Dog-leg lever link 66 has a roller cam follower 110 that, during the upward pivoting of transfer arm 56, contacts an

5

arcuate camming surface 112 of a cam 114 secured to back support plate 82. This action opens pincer jaws 58, 62. In the fully open position, before cam follower leaves cam 114, pincer jaw 62 passes beneath the end terminal 22 in the feeding position in slot 30 of feeding track 28. As cam follower 110 rolls over the end of cam surface 112, three things happen substantially simultaneously: (1) transfer arm 56 contacts a stop 118 and the contact lever 120 of a limit switch 122; (2) fixed jaw 58 of arm 56 is positioned abutting the outermost terminal 22 in feeding track 28; and (3) tension spring 72 closes movable jaw 62 of pincers 60 pinching the terminal 22 in the feeding position between jaws 58, 62. This means that the end terminal 22 is grasped in an oriented position relative to pincers 60 that is maintained throughout the remainder of the transfer cycle.

Transfer arm 56 is now moved in a reverse, downward direction by pneumatic cylinder 100. Cam follower 110 passes beneath cam member 114. The lower portion 119 of cam member 114 is pivotally supported from back plate 82 by a pivot pin 123 so that portion 119 is pressed outwardly by cam follower 110 permitting it to pass in downward movement.

When the transfer arm 56, in its downward swing, contacts abutment 92, further extension of piston rod 104 moves arm 56 horizontally toward the staking means 124. At the limit of this horizontal travel, terminal 22 is disposed in a properly oriented staking position between crimping or staking dies 136 with the radial slot 40 of terminal 22 uppermost.

As will be explained later, limit switches 86 and 122, contacted in lower and upper positions of arm 56 respectively, function in the control circuitry of the machine. Referring to FIGURE 8, a further control device, relating to the transfer system, includes a solenoid E and a limit switch 158, mounted on a backing plate 155. A bar 157, pivotally supported at 159, has one end 161 disposed under cam follower 110 of the pincers mechanism and is in position to upwardly press follower 110 when transfer arm 56 is in its horizontal, extended position. A linkage 163 connects bar 157 to the moving core of solenoid E, which is operable by downward movement, to pivot the bar and thereby to raise cam follower 110. A tension spring 165, between a spring post 167 and bar 157, acts oppositely to solenoid E and normally urges bar end 161 away from cam follower 110. The other bar end 171 contacts the contact lever 173 of limit switch 158. As will be discussed again later, initiation of a cycle of operation starts when staking dies 136 are pressed to crimp a terminal on a conductor, solenoid E is then automatically operated pivoting bar 157 whereby bar end 161 raises cam follower 110 whereby pincers 60 release the terminal. At the same time, bar end 171 operates limit switch 158 to initiate the terminal transfer cycle.

Staking Means

The staking means 124 is secured to the base 14 and is generally aligned at right angles to transfer means 54 and parallel to feeding track 28. A pair of superposed clamping arms 126 are pivotally supported by pins 128 in a slot in an upright support 130. Split die-holders 134 are disposed between arcuate bosses at the end of arms 126. Die-holders 134 are guided in vertical movement by a supporting plate 132, bolted to base 14, which has flanges 133 acting on the edges of die-holders 134. Plate 132 has an opening, not shown, whereby pincers 60 may position a terminal 22 in a staking position between mating staking dies 136 secured between die-holders 134 by bolts 137. Staking dies that are now standard products for use in hand, plier-like terminal crimpers, may be used for staking dies 136 or special dies may be used. Die-holders 134 are guided in mating movement by pins 139 disposed in matching openings and the die holders are normally pressed apart by compression springs 141 encircling pins 139. The foregoing structure may be generally described

6

as jaw means, particularly for purposes of the claims, and the term is taken to mean any mechanism that will perform a staking or crimping operation as heretofore defined.

Staking means 124 is actuated by a two-way acting pneumatic cylinder 140 supported by table base 14 and having its piston rod 142 connected to the ends of arms 126 by a clevis 144 and a toggle linkage 146. A limit switch 148 is positioned so that its plunger will be depressed by a lug 150 extending from clevis 144 during retraction of piston rod 142. Another limit switch 152 is positioned so that its plunger is actuated by movement of toggle link 146 during extension of the piston rod 142. The purpose of these switches will be explained later.

Electrical and Pneumatic Circuitry and Operation

FIGURE 9 is a combined showing of the electrical circuitry in full lines and the pneumatic circuitry in dashed lines. The circuits and their operation will be described below and that description will be followed by a review of the operation of the mechanical elements.

Referring to FIGURE 9, a cycle of operation is initiated by depressing foot switch FS that moves the switch from a position connected to solenoid B to a second position closing the line to solenoid A. Solenoid A then moves a pneumatic control shuttle valve V¹ for cylinder 140 to direct air pressure in cylinder 140 in a direction applying pressure through piston rod 142 to close dies 136. When the dies start to close, limit switch 148 (which is contacted by the piston rod 142 in retracted position) is opened thereby deenergizing solenoid A. Valves V¹ and V² are shuttle valves alternately directing air from the air supply, such as plant air, to opposite ends of cylinders 140 and 100. Valve V¹, having been moved by solenoid A, will remain in its position until moved to the opposite position by solenoid B.

When dies 136 have closed, limit switch 152 is contacted and closed by the linkage 146 associated with piston rod 142 (see FIGURE 8) and solenoid E is energized thereby acting through linkage 163 and bar 157 to lift cam follower 110 whereby pincers 60 release the terminal 22 being gripped. Upon pivoting of bar 163, limit switch 158 is also operated (see FIGURE 8) and LS 158 closes energizing solenoid C which moves pneumatic control valve V² to admit air to cylinder 100 to move transfer arm 56 back and swing it upward. When transfer arm 56 moves backwards, limit switch 86 is released (see FIGURE 7) and moves to open position to prevent having dies 136 again close due to continued or renewed depression of foot switch FS prior to return of transfer arm 56.

When transfer arm 56 reaches its vertical, pickup position, limit switch 122 is contacted and moves from an open to a closed position and this actuates CR which is a control relay which operates two switches in the lines to solenoids B and D respectively. In effect, CR closes electrical contact in the lines to solenoids B and D. However, solenoid B is not energized until FS is released and solenoid D is not energized until LS 148 is closed. LS 148 is the limit switch that is contacted when the piston rod 142 is in retracted position. Provided that FS has been released, solenoid B is energized moving shuttle valve V¹ to an opposite position and air is supplied to cylinder 140 to withdraw the piston rod 142 permitting dies 136 to open. When piston rod 142 starts to retract, LS 152 is released and moves to an open position which deenergizes solenoids B, C, and E. When solenoid E is deenergized, LS 158 is released and moves to open position. When piston rod 142 reaches fully retracted position, LS 148 is actuated and moves to a closed position. As control relay CR has previously closed switches in the lines to solenoids B and D, solenoid D is energized and moves shuttle valve V² to an opposite position applying air to cylinder 100 moving piston rod 104 forward thereby swinging transfer arm 56 down and pushing it forward thereby inserting the next terminal 22 in dies 136. As

transfer arm 56 moves down, LS 122 is released and moves to open position thereby deenergizing control relay CR which deenergizes solenoid D. As arm 56 moves forward it actuates LS 86 and moves it to closed position. At this point, the cycle can be repeated. The transfer and staking cycle is automatic except for the operation of one manual control member, foot switch FS, whereby the machine is termed semiautomatic.

Operation

The operation in the electrical and pneumatic circuits has been described and the mechanical action will be reviewed briefly below.

Before operation is started, a supply of terminals 22 are placed in vibrating chamber 12 together with some shot 26. Vibrator producing means 20 is turned on and terminals 22 advance up ramp 24. The terminals that are headed up the ramp with their large ends first are discharged back into chamber 12 by the sorting means 23. When a supply of terminals 22 have reached position at the end of slot 30 of feeding track 28, staking may commence. Means, not shown, in the electrical circuitry may shut off vibrator 20 as dies 136 close and until pincers 60 on arm 56 has picked up the end terminal in feeding position from feeding track 28, so that vibration does not interfere with the pickup of terminals in properly oriented position.

After the first terminal 22 is positioned in the path of dies 136, a conductor 35 from a supply of conductors having stripped ends 37, is positioned in terminal 22. The foot switch FS is pressed and pneumatic cylinder 140 operates to close dies 136 to crimp ferrule 34 about the insulation 33 of conductor 35 and to stake the stripped end 37 of the conductor in axial opening 39 of the terminal.

The rest of the action is automatic until another terminal 22 is positioned in the dies. Cylinder 100 is operated to retract arm 56 and to swing it upwardly. Cam follower 110 of pincers 60 strikes cam 114 and opens the pincers until the position shown in dotted lines in FIGURE 7 is reached when cam follower 110 is freed from cam 114 and pincers 60 close to grasp the terminal in feeding position in feeding track 28. Cylinder 100 then moves piston rod 104 in an opposite direction swinging transfer arm 56 downwardly and forwardly, positioning the next terminal within dies 136.

It will be evident that terminals of different shapes may be processed by modification of the details of feeding track 28, sorting means 23 on ramp 24 and/or other modifications of the structure described. These modifications will be understood by those skilled in the art after becoming familiar with the present disclosure. Although the equipment is designed to process terminals in the more difficult situation where radial orientation is required, the apparatus may be used to process terminals not requiring radial orientation. Dies 136 may be interchanged according to which terminals are being processed and in at least some applications the dies presently used in hand staking tools may be used in the present machine.

In aircraft plants and other facilities now using hand tools for staking terminals, the present machine will make a large savings of labor and the machine is an economical and versatile tool for such plants having the production conditions before recited. The machine has proven to require little maintenance and to produce a product of at least the quality of products produced by hand staking.

Having thus specifically described our invention, we do not wish to be understood as limiting ourselves to the precise details of construction shown, but instead wish to cover those modifications thereof which will occur to those skilled in the art from our disclosure and which fall within the scope of our invention, as described in the following claims.

We claim:

1. The improvement in a terminal staking device operable to stake terminals to wires including terminal orient-

ing and feeding means operative to serially feed terminals to a feeding position and to give the terminals a desired orientation by the time the terminals reach said feeding position, and including staking means at a staking position having jaw means positioned to receive terminals and operative to stake the terminals when operated, comprising: transfer means including a bar pivotally mounted at one end to pivot in an upright plane and said bar having parallel-bar type pincers at its other end, said pincers being normally spring pressed to a closed position and a cam follower connected to said pincers operable to open said pincers, a cam located in the path of said cam follower when said bar is upwardly pivoted in said plane, said cam being disposed so that said pincers are opened by said cam follower before reaching said feeding position and close on the terminal when the feeding position is reached, the bar when downwardly pivoted moving the pincers to said staking position, said jaw means being operable to receive and stake terminals while they remain gripped by said pincers, and means operable to release the terminals from said pincers after staking is completed.

2. The improvement in a staking device for terminals having a larger end with a radial slot and having a smaller end, including staking means including a pair of superposed jaws at a staking position, and including a chamber having a helical ramp, and means operable to vibrate said chamber in a vertical and rotary motion causing terminals in said chamber to move serially up said ramp, and feeding means at the ramp upper end and vibrated with said chamber, said feeding means including a horizontal track having a slot receiving the smaller ends of terminals from said ramp, comprising: said track having a camming abutment bordering the slot and acting on said terminal larger ends to orient said radial slots to face in a desired direction, a gate at the track outer end permitting removal of terminals from a feeding position, said gate being a spring-closed, hinged portion of the track wall, transfer means including a vertically pivotable transfer arm having a parallel-bar type pincers at one end, said pincers having spring means urging said pincers closed, said pincers having a cam follower operable to open the pincers and a cam in the path of said follower whereby said pincers open during vertical pivoting of said arm because of the contact of said follower with said cam, said cam terminating at a location so that said pincers at the peak of upward pivoting will simultaneously close and grasp a terminal at said feeding position, and said arm pivoting downwardly in front of said jaws and moving horizontally toward said jaws whereby terminals grasped by said pincers are positioned between said jaws in said staking position while remaining gripped by said pincers.

3. The improvement in a semiautomatic machine for staking terminals to wires, including terminal feeding means feeding the terminals to a feeding position, comprising: staking means including jaw means operative to stake the terminals on the wires in a staking position within said jaw means; transfer means including an arm pivoting between a position picking up terminals at said feeding position and a position to insert the terminals in said staking position within said jaw means; semiautomatic control means for said staking and transfer means including a manually operable control member to be operated when a terminal is positioned in said staking position and a wire is positioned in the terminal; said control means having means operative automatically upon operation of said control member first operating said jaw means to close to stake a terminal and later operating said jaw means to open to release the terminal, and said control means having means operating said transfer means to release the terminal upon closure of said jaw means and operating said transfer arm to pivot to a position picking up a second terminal at said feeding position and to pivot back and to insert the second terminal

in said jaw means in said staking position, said transfer means gripping the second terminal until said control member is again operated and until said jaw means again close, said control means including limit switches sensing the closing and opening of said jaw means, sensing the release of the terminal by said transfer means, sensing the movement of said arm away from and toward said staking position, and sensing the arrival of said arm at said feeding position.

4. The improvement in a semiautomatic machine for staking terminals to wires, including terminal orienting and feeding means to receive unoriented, separate terminals and automatically operative to orient the terminals to a common orientation and to feed the terminals serially in a row to a feeding position, comprising: staking means including jaw means operative to stake the terminals on the wires in a staking position within said jaw means; transfer means operative to pick up terminals at said feeding position and to deliver the terminals to said staking means in said staking position, said transfer means maintaining orientation of the terminals during transfer and at said staking position so that said common orientation of the terminals at the feeding position results in proper common orientation of the terminals at the staking position; semiautomatic control means for said transfer means and said staking means including a manually operable control member to be operated when a terminal is positioned in said staking position and a wire is positioned in the terminal, said control means having means operating automatically upon operation of said control member first operating said jaw means to close to stake a terminal, then operating said transfer means to release the terminal, operating said jaw means to open releasing the terminal, and operating said transfer means to pick up a second terminal at said feeding position and to insert the second terminal in said jaw means in said staking position at the end of the cycle.

5. The improvement in a terminal staking device operable to stake elongated terminals to wires, including staking means operable to stake said terminals at a staking

position, and including terminal orienting and feeding means serially feeding said terminals to a feeding position and giving said terminals a desired orientation by the time they are delivered to said feeding position, comprising: a transfer means including pincers operable to grip said terminals at an end thereof at said feeding position, said transfer means being operable to transfer said terminals in a pivoting, swinging movement from said feeding position to said staking position while maintaining the position of said terminals being gripped relative to said pincers, said staking means being operable to stake said terminals at said staking position while said pincers are still gripping said end of said terminals, and means operable to release said terminals from said pincers after staking is completed.

6. The subject matter of claim 5 in which said pincers are of a parallel-bars type and include spring means normally pressing the pincers to closed position and a cam follower operable to open the pincers, a cam in the path of said cam follower opening said pincers during movement toward said feeding position and permitting said pincers to close at arrival of the pincers at said feeding position whereby the pincers are worked to grasp terminals at said feeding position.

References Cited in the file of this patent

UNITED STATES PATENTS

1,905,046	Nicolai et al.	Apr. 25, 1933
2,253,644	Naugler	Aug. 26, 1941
2,340,448	Andren	Feb. 1, 1944
2,415,997	Eldred	Feb. 18, 1947
2,477,859	Burge et al.	Aug. 2, 1949
2,545,756	Andren	Mar. 20, 1951
2,662,646	McCain	Dec. 15, 1953
2,794,563	Daines et al.	June 4, 1957
2,858,008	Dilts	Oct. 28, 1958
2,858,930	Aidlin	Nov. 4, 1958
2,872,019	Owen	Feb. 3, 1959
2,908,376	Sahagun	Oct. 13, 1959
2,939,505	Bucher et al.	June 7, 1960