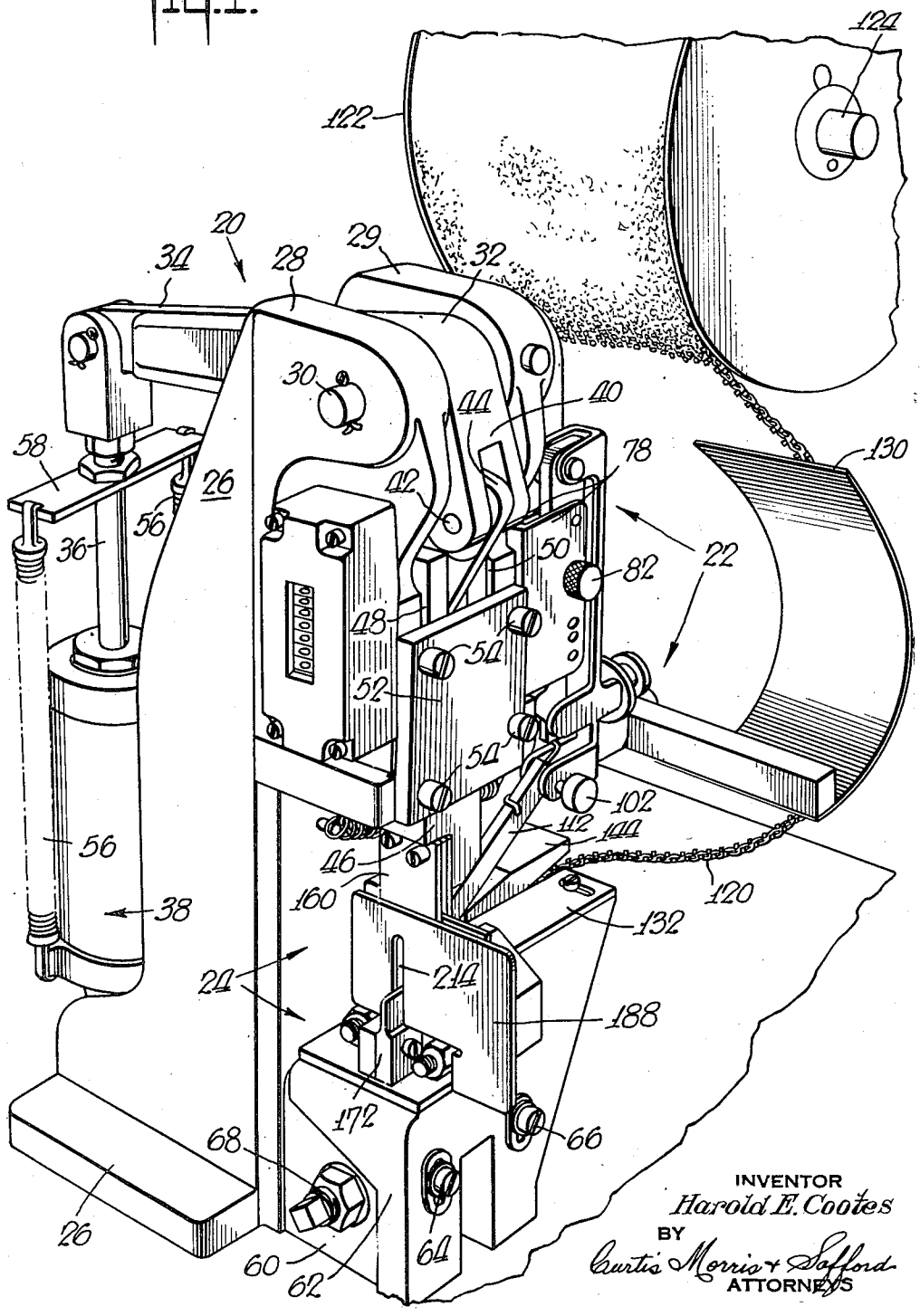
Oct. 5, 1954 H. E. COOTES 2,690,562

AUTOMATIC TERMINAL APPLYING MACHINE

Filed Dec. 16, 1948 6 Sheets-Sheet 1

Fig. 1.



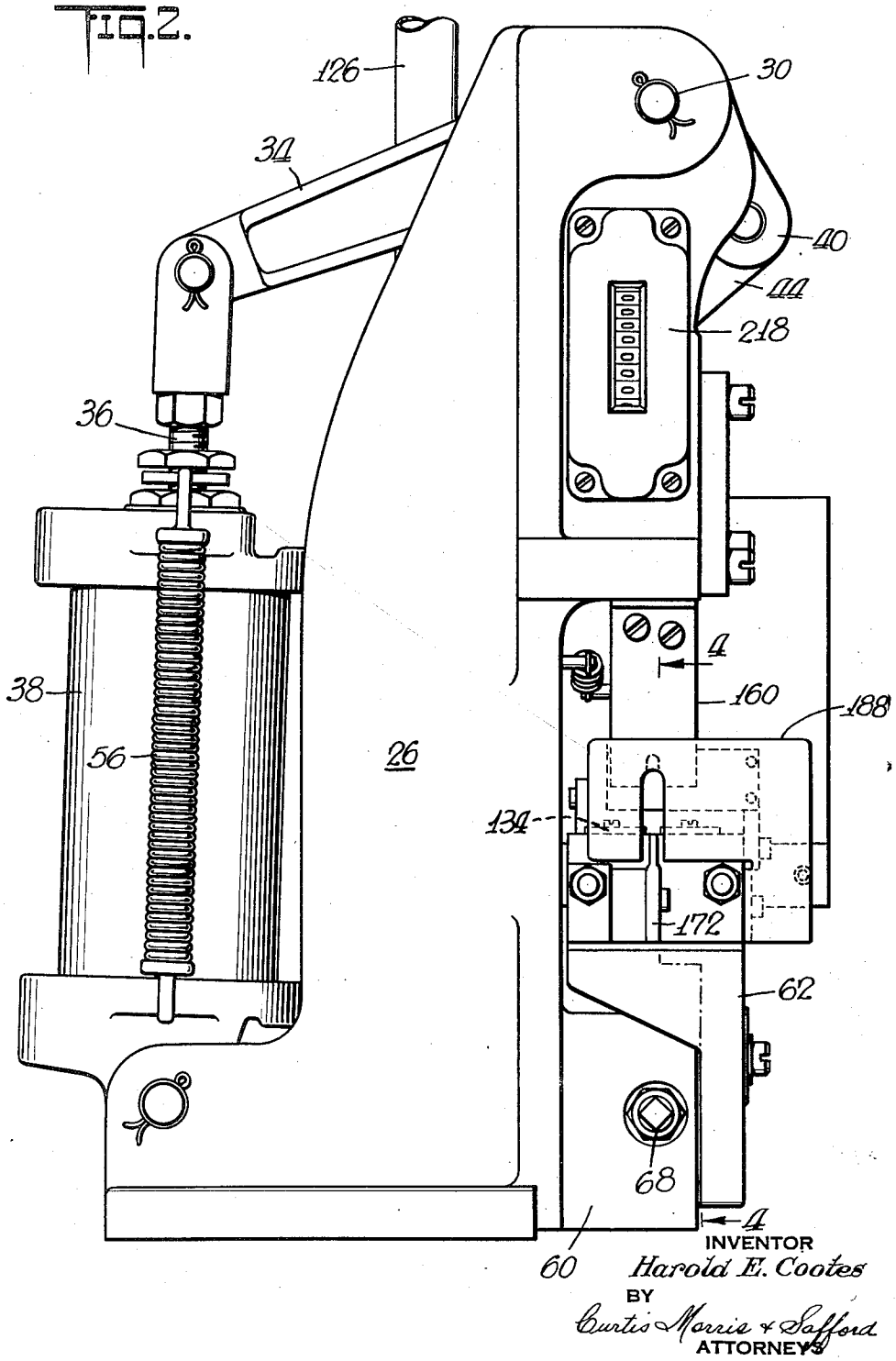
INVENTOR
Harold E. Cootes
BY
Curtis Morris & Safford
ATTORNEYS

Oct. 5, 1954 H. E. COOTES 2,690,562

AUTOMATIC TERMINAL APPLYING MACHINE

Filed Dec. 16, 1948 6 Sheets-Sheet 2

FIG. 2.



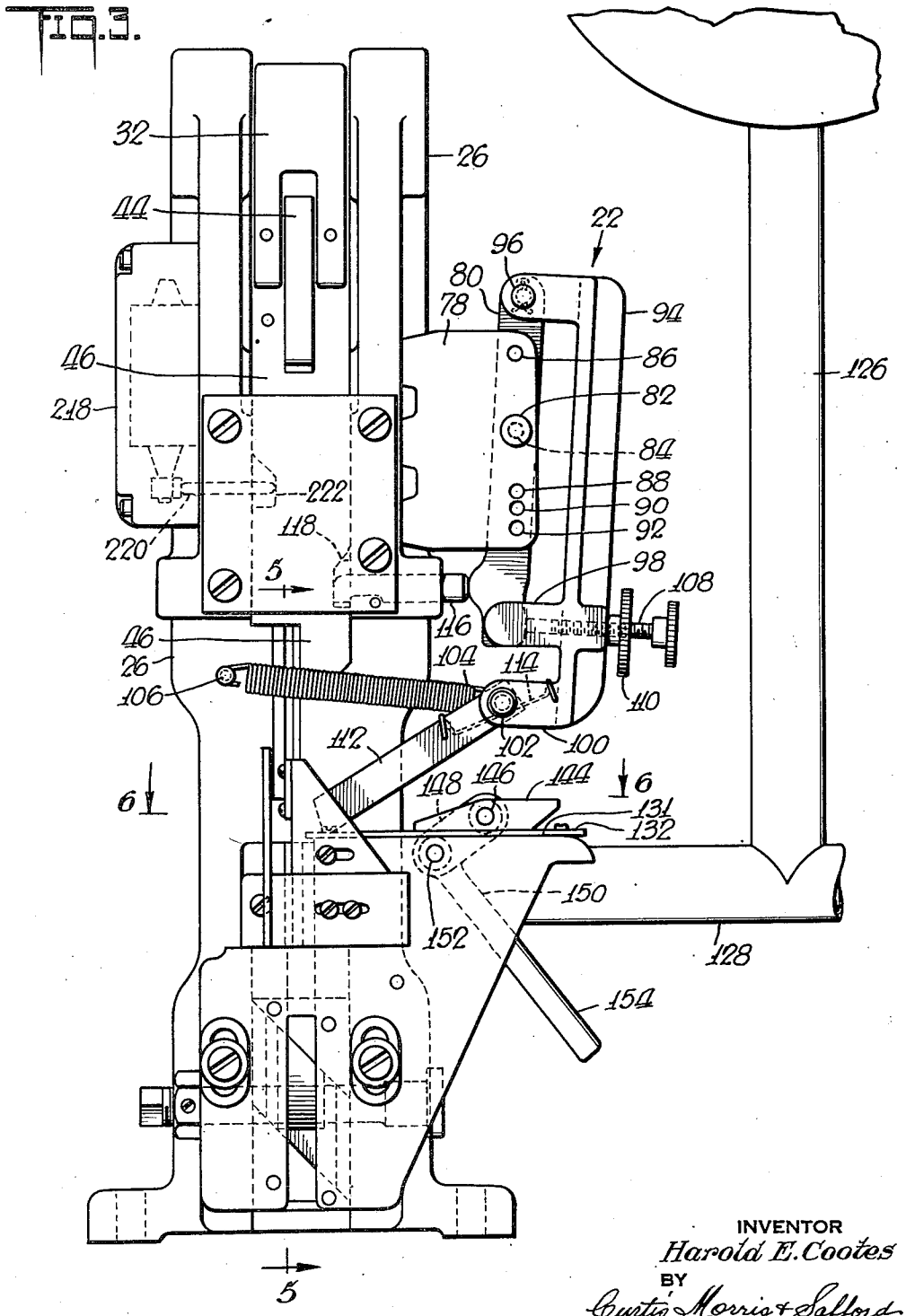
INVENTOR
Harold E. Cootes
BY
Curtis Morris & Safford
ATTORNEYS

Oct. 5, 1954 H. E. COOTES 2,690,562

AUTOMATIC TERMINAL APPLYING MACHINE

Filed Dec. 16, 1948 6 Sheets-Sheet 3

FIG. 3.



INVENTOR
Harold E. Cootes
BY
Curtis Morris & Safford
ATTORNEYS

Oct. 5, 1954 H. E. COOTES 2,690,562

AUTOMATIC TERMINAL APPLYING MACHINE

Filed Dec. 16, 1948 6 Sheets-Sheet 4

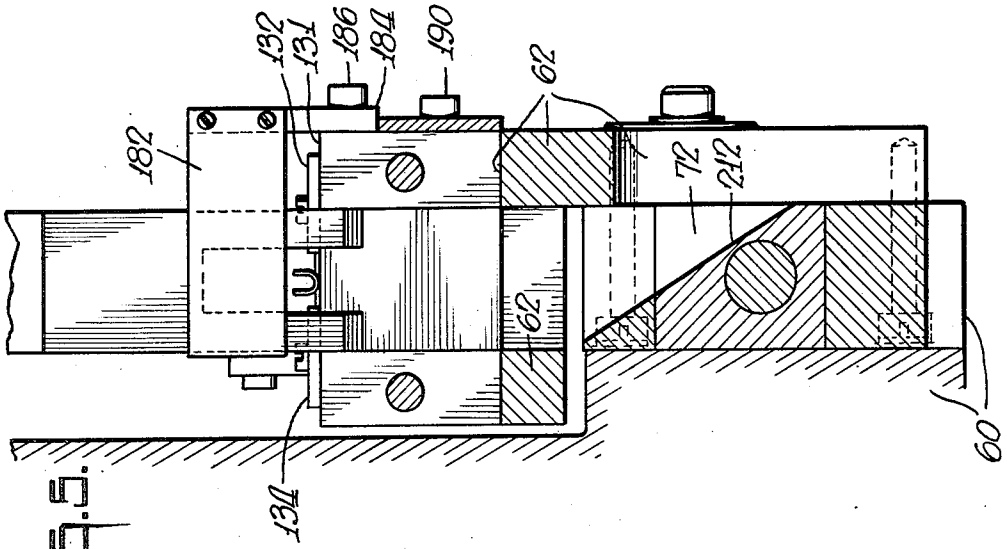


Fig. 5.

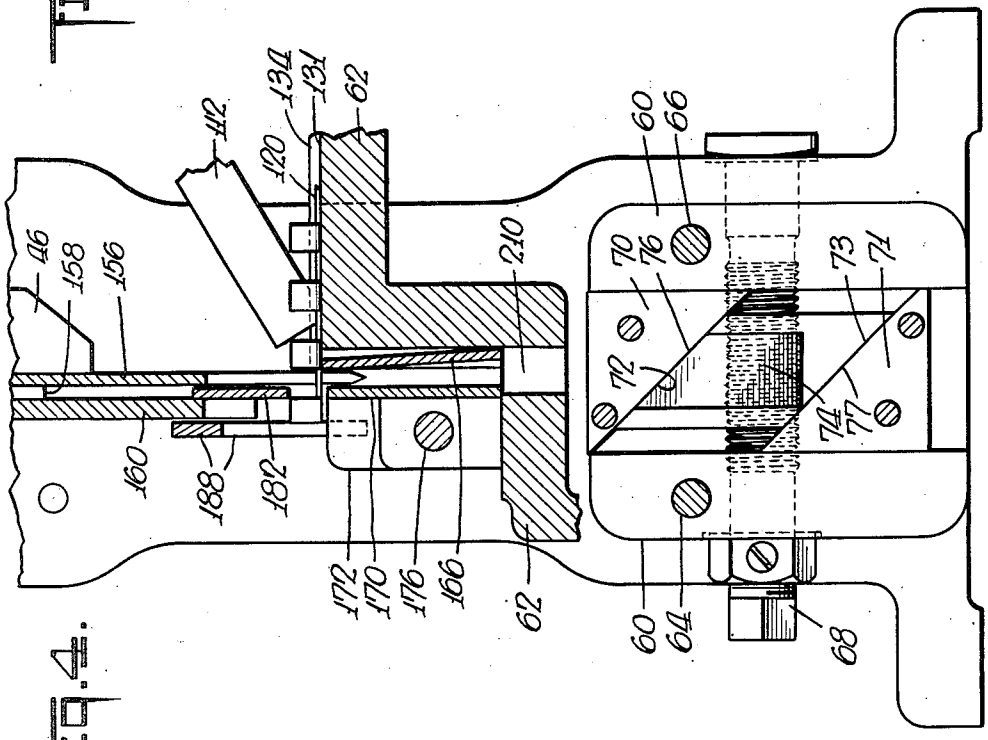


Fig. 4.

INVENTOR
Harold E. Cootes
BY
Curtis, Morris & Safford
ATTORNEYS

Oct. 5, 1954 H. E. COOTES 2,690,562

AUTOMATIC TERMINAL APPLYING MACHINE

Filed Dec. 16, 1948 6 Sheets-Sheet 5

FIG. 6.

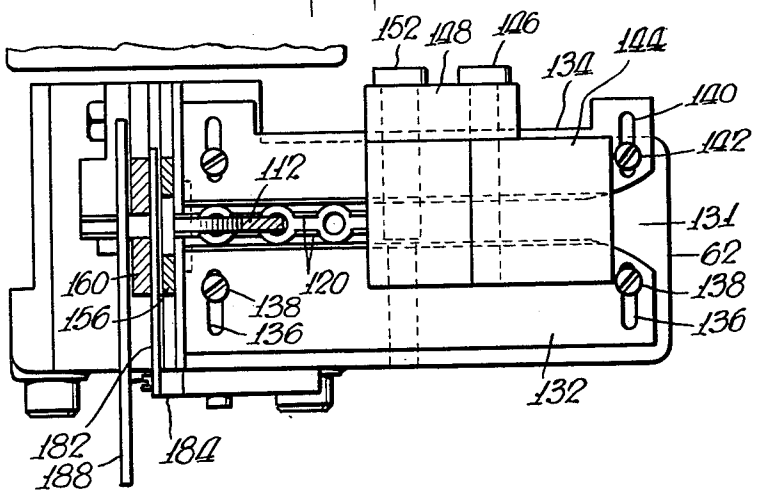


FIG. 7.

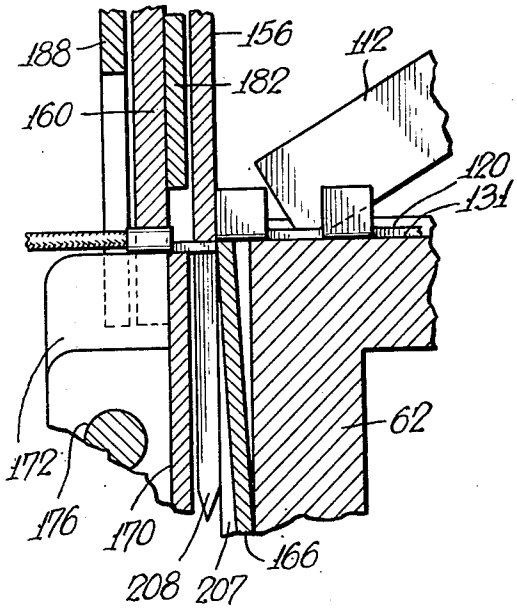
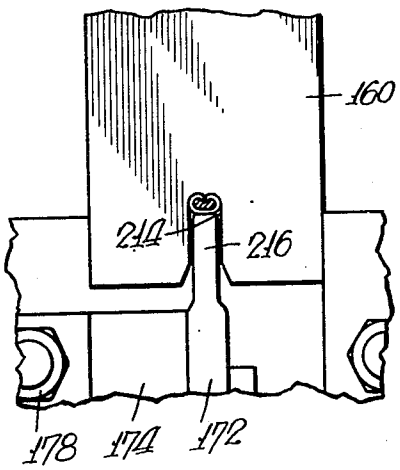


FIG. 8.



INVENTOR
Harold E. Cootes
BY
Curtis Morris & Safford
ATTORNEYS

Oct. 5, 1954 H. E. COOTES 2,690,562

AUTOMATIC TERMINAL APPLYING MACHINE

Filed Dec. 16, 1948 6 Sheets-Sheet 6

Fig. 9.

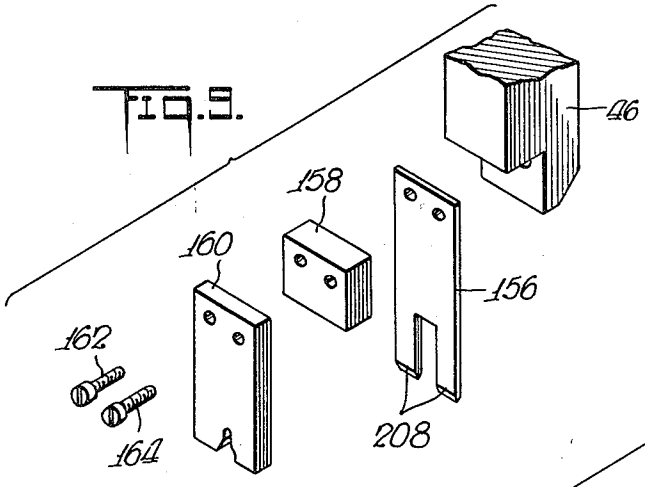


Fig. 10.

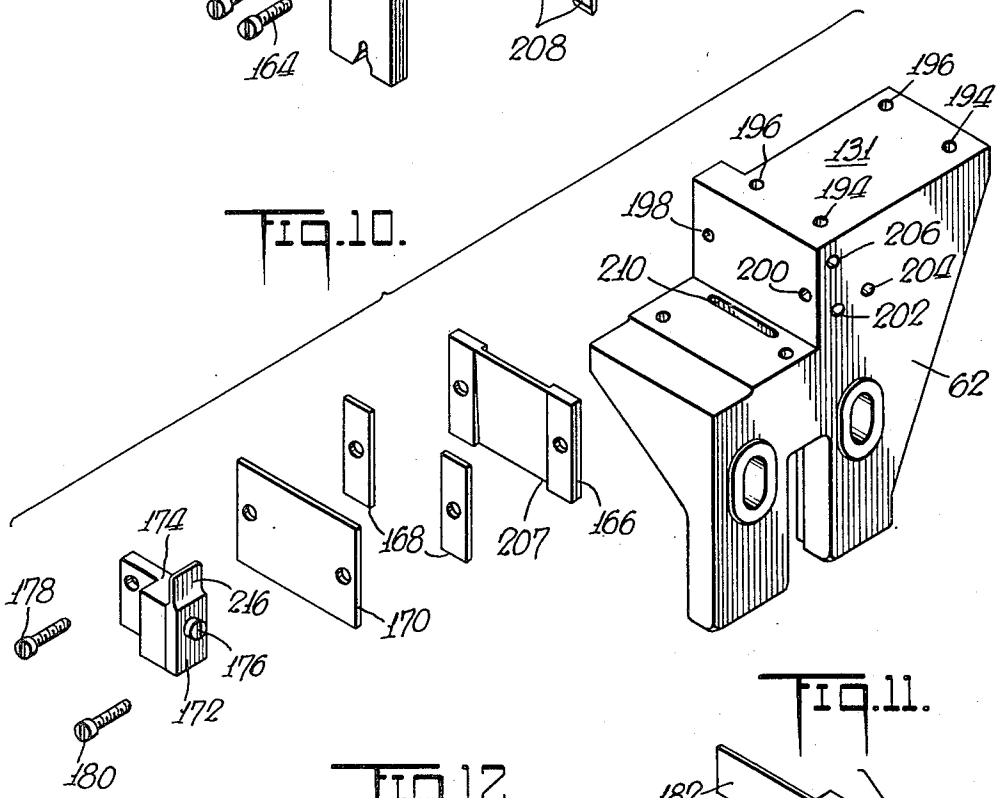


Fig. 11.

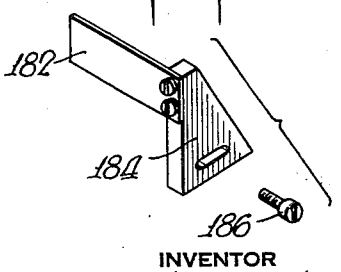
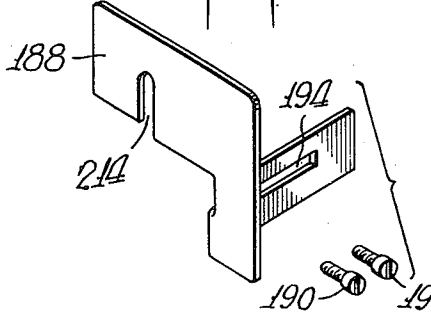


Fig. 12.



INVENTOR
Harold E. Cootes
BY
Curtis, Morris & Safford
ATTORNEYS

Patented Oct. 5, 1954

2,690,562

UNITED STATES PATENT OFFICE

2,690,562

AUTOMATIC TERMINAL APPLYING MACHINE

Harold E. Cootes, Harrisburg, Pa., assignor to Aircraft-Marine Products Inc., Harrisburg, Pa.

Application December 16, 1948, Serial No. 65,645

8 Claims. (Cl. 1—177)

1

This invention relates to a machine for automatically applying an electrical terminal or connector to a piece of wire. The machine includes a region of terminal application protected by a safety guard and is so constituted that when an operator inserts a wire through the guard into the region of terminal application and actuates a trigger, a preformed terminal blank from a supply of blanks carried in the machine is automatically and instantly applied to the wire to make a permanent and electrically efficient connection therewith.

In the illustrative form of invention to be described herein the machine incorporates a reel of preformed electrical terminals integrally attached in end-to-end fashion. Each terminal includes an ordinary ring tongue and a ferrule-forming portion. The ferrule-forming portion embodies a trough-like base which, upon application, will embrace a wire, and an ear projecting upwardly on each side of the base presenting with the base a U-shaped cross section perpendicular to the ferrule axis. Upon application these ears are crimped into intimate contact with the wire. The strip of terminals per se is not a part of my invention but is broadly described and claimed in an application of William S. Watts filed December 14, 1943, Serial No. 514,214. Other modifications of preformed terminals useful for automatic application and other machines and modifications thereof than the one specifically described hereinafter embodying my invention will readily occur to those skilled in the art.

Various mechanisms have been proposed heretofore for performing the same general functions as my machines. Most of these have embodied a press of general application modified to support crimping and feeding mechanisms. Some of these machines have been satisfactory, as where the demand of the user was for a huge number of identical terminals applied to an equally huge number of identical pieces of wire such that the machines could be elaborately set up and adjusted with full knowledge that the great number of terminals installed would reduce the cost per unit sufficiently to make the initial investment recoverable. In general, however, it has not been a simple matter to put these machines into operation or to change these machines to adapt them to applying a different kind of terminal to some other kind of wire. And there has long remained an unsupplied demand for a compact, relatively lightweight automatic machine which could easily be adapted to

2

apply automatically any one of a considerable variety of electrical terminals or connectors.

A machine incorporating my invention supplies this demand and at the same time is so constructed and arranged that most of the parts in the organization can be inexpensively produced without requirements for close machining operations. The result is that my machines can be maintained in optimum condition by an ordinary mechanic superficially familiar with lightweight production machinery and without the help of a tool maker or setup man. All of the parts are readily assembled or disassembled and the only pieces which are subject to appreciable wear may readily be obtained from stock and installed without delay. In addition, when changing a machine to enable it to install a different kind of terminal, the changes necessary can readily be accomplished simply by unbolting a few small parts, as will be described hereinafter, and by assembling from a stock of parts, in accordance with a simple set of instructions, a crimping and shearing assembly suitable for applying the terminals desired. These attributes are of particular importance when it is borne in mind that these machines find their primary utility in production rooms where electrical harnesses are being fabricated, electronic chassis wired, or the like, and where semi-skilled electrical assemblers are common but tool makers, setup men, and skilled machinists are, in effect, unvailable except upon special prearrangement and then only at considerable expense. To have a machine operable, convertible from one terminal to another, and requiring no precise setup or adjustment means the difference between efficient operation on the one hand and endless delay and annoyance to all concerned on the other.

It is an object of my invention to provide a machine of the character described having to a notable extent the capabilities and characteristics set forth. A further objective is to provide a machine which overcomes certain disadvantages inherent in previous machines intended for performing the same general functions as my machine. A further objective is to provide a lightweight, low cost press in which a terminal feeding assembly and a terminal applying assembly can be installed and maintained by an ordinary mechanic. Another object is the provision of a press for applying terminals in which any one of several terminal feeding relationships may be selected and into which any one of several terminal applying assemblies may be

installed all as a matter of mere rountine. A further objective is to provide a simple and low cost press which can be adapted by an ordinary maintenance worker to applying any one of a large variety of electrical terminals. Another objective is to provide a terminal applying machine wherein only a few wearing parts are present and in which all of the wearing parts may readily be replaced without requiring the services of a skilled mechanic. A still further object resides in the provision of a feeding assembly wherein the length of feed may readily and accurately be adjusted. A yet further object is to provide an automatic terminal applying machine which is sufficiently lightweight to permit movement from place to place in a plant as needs arise, which does not require a large initial capital investment, and which can be so easily converted to use with any one of a wide variety of terminals as to render its use feasible on what have heretofore been considered as small lot production runs. Another objective is to provide a press and feed assembly for obtaining optimum utility and efficiency in applying terminals by means of terminal applicators of the type described and claimed in the application of George J. Handel, Jr., Serial No. 65,646, filed December 16, 1948. Other objects will in part be pointed out as the description proceeds and will in part become apparent therefrom.

The invention accordingly consists in the features of construction, combinations of elements, methods of operation and arrangements of parts as will be exemplified in the structure and sequences and groups of related steps to be hereinafter described and the scope of the application of which will be set forth in the accompanying claims.

In this specification and the accompanying drawings I have shown and described a preferred embodiment of my invention and suggested various modifications thereof; but it is to be understood that these are not intended to be exhaustive nor limiting of the invention but, on the contrary, are given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in various forms, each as may be best suited to the conditions of a particular use.

In the drawings:

Figure 1 is a perspective view of an exemplary machine embodying my invention;

Figure 2 is a front elevation of the machine illustrated in Figure 1;

Figure 3 is a side elevation of the machine illustrated in Figure 1;

Figure 4 is a sectional view taken on an enlarged scale along the line 4—4 of Figure 2;

Figure 5 is a sectional view taken on an enlarged scale along the line 5—5 of Figure 3;

Figure 6 is an enlarged sectional view taken along the line 6—6 of Figure 3;

Figure 7 is an enlarged fragmentary perspective view of some of the parts illustrated in Figure 4 shown at the completion of a crimping stroke;

Figure 8 is a fragmentary perspective view of some of the parts illustrated in Figure 7 taken from the left as viewed in Figure 7;

Figure 9 is an exploded perspective view of those parts of the applicator assembly which are carried by the ram of the press;

Figure 10 is an exploded perspective view of some of the parts of the applicator assembly which are carried by the bed of the press;

Figure 11 is an exploded perspective view of the terminal stripper which forms a part of the applicator assembly; and

Figure 12 is an exploded perspective view of a guard which forms a part of the applicator assembly.

Figures 1, 2 and 3 illustrate one embodiment of the invention in a machine consisting essentially of a press generally indicated at 20, a terminal feeding assembly generally indicated at 22, and a terminal applicator generally indicated at 24. The press includes a relatively rugged casting 26, the upper portions of which form a pair of arbor mounts 28 and 29 in which is fixed an arbor 30. The arbor forms the pivot for a rocking bar 32, one end 34 of which is coupled to a piston rod 36 forming a part of a power unit; in the present embodiment the power unit takes the form of a pneumatically operated cylinder generally indicated at 38. The other arm 40 of the rocking bar carries a transversely disposed toggle pin 42 upon which is journaled a toggle link 44 (see Figure 3). The lower end of link 44 is pivotally pinned to the upper end of a ram 46. Ram 46 is constrained to vertical movement within the body of casting 26 with the aid of guide faces 48 and 50 and plate 52. For purposes of disassembly, inspection, or otherwise plate 52 may readily be removed by unscrewing machine screws 54.

In the illustrative form of press the parts normally occupy the relationship illustrated in Figure 1 wherein ram 46 is at the top of its stroke and the piston within cylinder 38 is at the bottom of the cylinder. The parts are returned to this position of rest by tension springs 56 which are spread between a yoke 58 retained on piston rod 36, and the bottom of the cylinder. When air under pressure is supplied to cylinder 38 its piston is forced upwardly carrying arm 34 with it and forcing arm 40 downwardly. The length of arm 34 compared with the length of arm 40, along with the toggle action of arm 40 and link 44, result in a great force multiplication which drives ram 46 downwardly with an even acceleration and deceleration. In addition, the power-advantage flowing from the toggle action makes itself felt principally through the final travel of the ram so that maximum power is available where it is most needed. Further, it will be observed that the toggle construction provides a definite downward limit beyond which the ram cannot travel. Thus the ram is driven to a point of lowermost travel and there stops smoothly and evenly without vibration or any jarring force which might be transmitted through the frame.

Casting 26 is provided with a pedestal 60 underlying the ram (see also Figures 2, 4 and 5). Pedestal 60 forms a support for an adjustable bed 62 upon which part of the applicator assembly is mounted, as will be set forth hereinafter. As pointed out above, the bottom limit of movement of ram 46 is fixed, and in order to facilitate easy adjustments to the height of the region of terminal application, between the bottom of the ram and the top of the bed, I have provided a mechanism for raising or lowering the surface of bed 62 with respect to pedestal 60. Ordinarily bed 62 is clamped solidly and rigidly to pedestal 60 by a pair of screws 64 and 66. In order to raise or lower bed 62 with respect to pedestal 60 it is necessary only to loosen

screws 64 and 66 and to apply adjustments to the height of the bed by turning an adjustment bolt 68. This is accomplished by mechanism now to be described.

As shown in Figures 4 and 5, bed 62 incorporates interiorly thereof a pair of triangularly shaped blocks 70 and 71. Block 70 presents a downwardly-facing, sloping surface 72; block 71 presents an upwardly-facing, sloping surface 73. Bolt 68 is threaded through openings in pedestal 60 and carries in threaded engagement upon its central portion a double-acting wedge member 74. Member 74 presents an upwardly-facing, sloping surface 76 in face-to-face contact with surface 72 and a downwardly-facing, sloping surface 77 in face-to-face contact with surface 73. As shown in Figure 4, if wedge member 74 is caused by bolt 68 to move to the right, the action of the sloping surfaces 76 and 72 will force bed 62 to move upwardly, where it can be clamped in place by screws 64 and 66. Or if bolt 68 is so turned as to move wedge member 74 to the left, as viewed in Figure 4, the action of the sloping surfaces 77 and 73 will force the height of bed 62 with respect to pedestal 60 to be lowered. Accordingly, when adjustments to the height of the region of terminal application between the surface of bed 62 and the bottom of ram 46 are desired, so as to accommodate the machine to a different size terminal applicator assembly, all that is necessary is to back off screws 64 and 66 and to cause the level of bed 62 positively to be raised or lowered by appropriate turning adjustments made to bolt 68. Thereafter the relationship between bed and pedestal may be fixed by tightening screws 64 and 66. These operations can be performed by an ordinary workman equipped with a screw driver and wrench.

Air is supplied to cylinder 38 by a conventional air supply system and with the use of any of several commercially available valve mechanisms which assures that the piston within the cylinder shall move its full stroke before the supply of air is shut off. By guarding against the possibility that the air supply may be shut off before the piston has moved through its full stroke, I thus make certain that the ram will be caused to move, upon every cycle, to the bottom of its stroke to complete a full crimping operation.

Ordinarily the cylinder and piston will cause the ram to make a rapid and complete downward stroke at the end of which the air supply is shut off and the springs 56 smoothly return the piston to the bottom of the cylinder as air is forced therefrom. In rare instances, as may occur if the applicator assembly should jam, the machine will stop abruptly in a cycle because the air supplied to the cylinder will not be able to drive the piston to the top of its stroke. Thus where, for any reason, the ram is prevented from reaching the bottom of its stroke the piston will simply stop moving at an intermediate point along its extent of travel and no serious damage will be done. An air supply pressure ranging in the order of 80 to 110 pounds per square inch will in general be adequate to cause the machine to perform all of its crimping and shearing operations, as will be developed more fully hereinafter, and yet will not be so great as to cause serious damage to the machine in those instances where something jams and the ram is not able to reach the bottom of its stroke. And at all times the operator will know that any regularly applied terminal has had the benefit of full crimping pressure. When the ram does not fully bottom, the machine will stop abruptly without completing its cycle and the operator will know that the terminal then in the machine has not had full crimping pressure. When the machine does jam, it can easily be cleared by manually shutting off the air supply to permit the parts to return to their normal position of rest. Thus the machine automatically precludes inadvertent or wilfully careless production of anything other than a fully crimped terminal. In the illustrative form and with an air supply of about 110 pounds pressure per square inch a ram action on the order of 8,000 pounds pressure may be achieved.

As will be developed more fully hereinafter my machine is so constituted that upon each downward stroke of the ram a terminal is separated from a strip of terminals and is crimped at the region of terminal application. In order to make sure that upon every stroke of the ram a terminal will be available at the region of terminal application and there so oriented as to be received and formed by the crimping dies, all as will be brought out later herein, I have provided a feeding assembly, heretofore indicated at 22, coordinated with the ram action in such fashion that upon every cycle it will present the end terminal of the series without fail in proper position for the next application. Feeding assembly 22 will now be described.

As shown in Figure 3 casting 26 carries a rearwardly extending bifurcated bracket 78. Between the two leaves of bracket 78 there is pivotally mounted a feed lever 80. In the illustrative form lever 80 is journaled upon a pin 82 extending through a pair of aligned openings 84 in the leaves of bracket 78. For reasons which will be amplified later in this description it is desirable that the length of the feeding operation performed by assembly 22 shall be readily adjustable and toward this end the leaves of bracket 78 are also provided with aligned pairs of openings 86, 88, 90 and 92; pin 82 may be inserted through any pair of the openings 84, 86, 88, 90 or 92. Lever 80 itself carries a series of five pivot openings, one for each of the five pairs of openings in the leaves of bracket 78. The result of this arrangement is that regardless of which set of openings pin 82 may extend through the general height of lever 80 with respect to bracket 78 does not change. The only change which flows from different settings of pin 82 is the location of the pivot point of lever 80 with respect to bracket 78.

Lever 80 at its top end forms a pivot support for a feed adjustment lever 94 pinned to the top of lever 80 by a pivot pin 96. Toward the bottom of adjustment lever 94 a pair of arms 98 extend inwardly, one on each side of the bottom of feed lever 80. The lowermost portion of feed adjustment lever 94 carries another pair of inwardly extending arms 100 with a pivot pin 102 extending therethrough. On the far end of pivot pin 102, as viewed in Figure 3, the right-hand end of a tension spring 104 is secured. The left-hand end of tension spring 104 is secured to a pin 106 set in casting 26. The action of spring 104 is always to urge the lower end of adjustment lever 94 to the left and in a clockwise direction with respect to pivot pin 96. The relationship of the lower end of lever 94 may be adjusted with respect to the lower end of lever 80 against the tension of spring 104 by the setting of an adjustment screw 108 threaded through lever 94 opposite arms 98 and extending therebetween to bear upon the lower end of feed lever 80. The

setting of adjustment screw 108 may be locked by means of a locking collar 110 threaded upon the shank of adjustment screw 108 in a position to impose a jamming action upon the threads of screw 108 within lever 94.

Pin 102 forms a swinging pivot support for the upper end of feed finger 112, the lower left-hand end of which, as viewed in Figure 3, is disposed to execute a pushing action with respect to a series of terminals associated with and directed into the applicator, as will be described later. Whenever the end terminal of the series of terminals is applied to a wire and removed, finger 112 functions automatically in coordination with other movements forming a part of one cycle of operation to feed the series of terminals to the left, as viewed in Figure 3, so as to bring the next terminal of the series to the region of terminal application. It is important, of course, in order that the crimping and shearing operations shall accomplish their intended results, that the end terminal be fed not too far and yet far enough.

With a machine embodying my invention it is a simple matter, when adjusting the mechanism to perform a series of operations automatically, to set the end terminal manually in its correct position while the machine is at rest. Each strip of terminals incorporating the invention of the afore-mentioned Watts application is so constituted that every terminal presents an abutment which serves to receive measured pushing operations imposed upon the strip. If each pushing operation is of the correct length and if the end of the feed stroke is correctly limited, once the strip of terminals has been properly oriented in relation to the shearing and crimping operations, thereafter each feeding operation will successively locate the end terminal in its correct position for another terminal applying operation. In the present embodiment finger 112 is constantly urged in a counterclockwise direction, as viewed in Figure 3, by a spring 114 centered upon pin 102 and bearing at one end upon a lower portion of adjustment lever 94 and at its other end upon an intermediate portion of feed finger 112. Thus when feed finger 112 is carried to the right, its lower end rides over the abutment of the next terminal and at once assumes a position to push the next terminal to the left. In my machine, the extent to which the end of feed finger 112 pushes the strip of terminals to the left can be accurately and easily set while the machine is at rest by adjustments made to screw 108 against the pressure of spring 104, varying the spacing between the lower ends of adjustment lever 94 and feed lever 96.

In order to perform a feeding operation each time that a terminal is applied, I have provided a push rod 116 slidably disposed in a horizontal guideway formed in casting 28 adjacent to the path followed by ram 46. Ram 46 includes a cam surface 118 cut into one of its vertical sides in such position (see Figure 3) as to cause push rod 116 to move to the right in simple harmonic motion each time that the ram is bottomed. Each time push rod 116 is moved to the right the lower end of feed lever 80 is caused to move to the right, counterclockwise with respect to pin 82, carrying with it adjustment lever 94. The result is that feed finger 112 is drawn to the right, the lower end of the finger riding over the next terminal of the series until it passes beyond the abutment of the next terminal.

The extent to which the lower end of feed

finger 112 is moved to the right is not so critical as the precise limit to which it is moved on the left. The finger must be moved to the right far enough to ride over the abutment of the next terminal in the series and it may travel slightly beyond that point. For even though it does travel a little beyond the next rearward terminal abutment, it will pick up the next terminal on the return feeding stroke when it reaches the abutment and the overtravel will simply be lost motion. The length of the feeding stroke desirable will depend, of course, upon the size and type of the individual terminals in the strip and the spacing between terminals. For a long feeding stroke pin 82 should be positioned in holes 92; for a short stroke it should be positioned in holes 86; and for a stroke of intermediate length it should be adjusted in some set of intermediate holes. I have found that for most cases the feed finger can be caused to ride over the abutment of the next terminal in the series of terminals and not too far beyond merely by selecting some one of the five sets of holes in the leaves of bracket 78 for pin 82. In special cases, certain of the parts of the assembly may be replaced by special parts.

As shown in Figure 1 the machine incorporates a strip of terminals indicated at 120 connected in end-to-end fashion and carried upon a reel 122. The reel is supported by a horizontal arm 124 projecting from a post 126 (see also Figure 3) carried by a bracket 128 extending from casting 26. The leading end of strip 120 is brought downwardly from reel 122, around a flexible guide 130, below feeding assembly 22, and toward the region of terminal application centered in applicator 24. Reel 122 contains a considerable mass and in order to isolate it from successive jerks applied on strip 120 by feeding finger 112 I provide the guide 130 in the form of a resilient leaf spring which flexes through its inherent resilience to absorb the jerks imposed upon the strip by the feeding mechanism. The result is that the feeding mechanism is enabled regularly to advance the leading end of the strip into the region of application with rapid acceleration and deceleration without interference caused by inertia effects which otherwise would be imposed by the relatively heavy mass carried upon reel 122. The flexing of guard 130 permits the leading end of the strip to advance suddenly and causes the trailing end of the strip to uncoil from the reel gradually and evenly as the strip is consumed.

The leading end of strip 120 advances to the region of application across the upper surface of platform 131 formed by the rearward portion of bed 62 (see also Figures 4, 6, 7 and 10). The leading end of strip 120 is supported from below by platform 131 and is prevented from moving sidewise on the surface of the platform, to the right or left as viewed in Figure 5, by a pair of guide plates 132 and 134. Guide plate 132 is provided with a pair of adjustment slots 136 and adjustment screws 138. Guide plate 134 similarly is provided with a pair of adjustment slots 140 and adjustment screws 142. By means of these pairs of slots and screws the positions of the guide plates upon the surface of platform 131 may be adjusted, laterally to the right or left as viewed in Figure 5, so as to form therebetween a guide channel of controllable width accurately fitted to the particular strip of terminals to be applied. For any given width of strip the guide plates are clamped upon the bed so as to present a channel

directed into the region of application and through which the leading end of the strip of terminals loosely but accurately slides.

It is desirable that the leading end of strip 120 be firmly held against platform 131. Accordingly, I have provided a floating drag block 144 (see Figures 1 and 3) which overlies the terminal guide channel. Block 144 is retained in place by a pin 146 passing transversely through the block and upon which the block is loosely journaled. Pin 146 is rigidly carried in the upper end 148 of a bell crank lever 150; this lever is pivotally mounted upon a stud 152 set in bed 62. The lower end 154 of the bell crank lever projects downwardly to form a lifting handle by which block 144 may be lifted. Ordinarily the weight of handle 154 acts by gravity to urge block 144 downwardly toward platform 131; for some types of strip it is well to reinforce this action with a spring. When the leading end of a strip of terminals is resting upon platform 131 between plates 132 and 134, the upwardly turned ferrule-forming ears of the strip will ordinarily extend above the surface of plates 132 and 134 so that the bottom surface of drag block 144 will rest upon the ends of the upwardly projecting portions of the strip. Thus drag block 144, with the aid of the downward force supplied by the weight of lever 154, plugs any spring force desirable, serves to maintain the advancing end of the strip firmly seated in the guide channel. The friction upon the strip presented by the drag block and its related parts is sufficient to prevent the strip from moving backwardly upon the return stroke of the feeding finger when it moves to the right, as viewed in Figure 4, to ride over the next abutment of the adjacent terminal to the rear.

The lowermost portion of feeding finger 112 is centered in the guide channel between plates 132 and 134 and acts between drag block 144 and the region of terminal application. As the feeding mechanism causes the feeding finger to travel forwardly and rearwardly, the lower end of the feeding finger slides to and fro within the guide channel between the region of application on its left (see Figure 4) and drag block 144. As pointed out above, when the correct feeding limit of finger 112 has been set by adjustment screw 136, and when a suitable length of feeding stroke has been selected with the aid of adjustment pin 82, the lowermost portion of the feeding finger will ride to and fro within the guiding channel and will push against a terminal feeding abutment on its forward stroke to advance the series of terminals with each cycle of the machine by an amount exactly equal to the distance between terminal abutments. And during the feeding operations plates 132 and 134, with the aid of platform 131 and drag block 144, will continue to guide the advancing end of the strip into its correct position in the region of application.

In the illustrative form the applicator contains die members of the general type described and claimed in the applications of James C. Macy, Serial No. 679,630, filed June 27, 1946, U. S. Patent No. 2,557,126, granted June 19, 1951, and Serial No. 717,842, filed Oecember 23, 1946. The inventions embodied in the applicator per se described in the present specification are more fully set forth and are claimed in the application of George J. Handel, Jr., Serial No. 65,646, filed concurrently herewith. Essentially the applicator embodies a series of elements selected from a stock of elements so as to build an assembly suited to the particular configurations of the illustrated strip 120. Some of these elements are clamped to the lower end of ram 46 and others of them are supported upon bed 62. Figure 9 illustrates the subassembly carried by ram 46. It includes a shear blade 156, a spacer 158 and a crimper 160. The parts are fastened into the ram by means of screws 162 and 164 passing through aligned holes and threaded into the base of the ram.

As shown in Figure 10 the parts of the subassembly carried by bed 62 include a shear plate 166, spacers 168, a slug plate 170, an anvil 172, and an anvil bracket 174. Anvil 172 is screwed to bracket 174 by a screw 176. The parts of the subassembly are clamped in position in bed 62 by screws 178 and 180.

The applicator assembly further includes (see Figure 11) a stripper plate 182 carried upon a stripper bracket 184 secured upon bed 62 by a screw 186. In addition, the assembly includes a guard plate 188 adjustably secured upon bed 62 by screws 190 and 192 passing through a slot 194 in the plate.

In the embodiment illustrated in Figure 10 screws 138 (see Figure 6) thread into openings 194 in bed 62. Screws 142 are threaded into openings 196. Screw 178 threads into opening 198 and screw 180 threads into opening 200. Screws 190 and 192 thread into openings 202 and 204 and screw 186 threads into opening 206.

It will be appreciated that upon each cycle of the machine a shearing and a crimping operation are performed. The end terminal is sheared from the series of terminals and it is crimped onto a wire oriented within the region of application. In some instances, depending upon the character of the terminal to be fabricated, it is convenient to shear a slug from between the end terminal and the next terminal and where a slug is to be removed from the strip, slug plate 170 may also function as a shearing plate along with shear plate 166. In this instance shear blade 156 completes a severing operation against each of the members 166 and 170. The width of the slug so removed will depend upon the width of blade 156 and the corresponding spacers 168.

As illustrated in Figure 7, the central portion of shear plate 166, below its shearing edge, is obliquely relieved, as indicated at 207, so that in those instances where plate 166 is used in removing a slug a clearance space will be presented through which the slug may be ejected. As also illustrated in Figure 7, blade 156 is provided with a pair of heels 208 which at all times remain in sliding relationship within the subassembly clamped upon bed 62 and between spacers 168. Bed 62 is provided with a slot 210 into which the lower ends of heels 208 may pass when the ram bottoms and through which a slug may fall in those instances when a slug is sheared from between adjacent terminals. As shown in Figure 5 a sloping surface 212 is provided below slot 210 for diverting slugs outwardly from the machine where they may be collected as scrap material. The purpose of stripper plate 182 is to dislodge those terminals which, after the ram bottoms, tend to stick in the female crimper. The purpose of guard plate 188 is to assure that the operator shall not inadvertently have a finger in the region of application when the ram bottoms. The slot plate 214 in plate 188 straddles the die portion 216 of anvil 172 and together slot 214 and the die surface aid in funneling the ends of the wires correctly into the region of application.

Figure 4 illustrates that when the parts are at rest the leading terminal is in crimping position on the die surface of anvil 172.

As best shown in Figure 3, casting 26 is fitted with a counter 218 operated by a push rod 220 cooperating with a cam surface 222 cut in ram 46. Thus, each time the cam bottoms the counter registers the next higher number. Such counters are generally well known in the art.

From the foregoing it will be seen that an automatic terminal applying machine made in accordance with the present invention is well adapted to attain the ends and objects hereinbefore set forth and to be economically installed and operated since both the machine and its methods of operation and use are suited to common production practices and are susceptible to a wide latitude of variations as may be desirable in adapting the invention to different applications.

Although I have described the invention above as embodied in a particular pneumatic press it will be apparent to those skilled in the art that it is applicable also in other types; and altho the invention is described particularly in its application to machines for applying electrical connectors onto wires, it is not limited thereto, but obviously has other practical uses wherever adjustable small presses are required and especially where step by step feeding of work to the press is required.

I claim:

1. A press construction including a ram constrained to reciprocatory movement along a path, a unitary supporting structure in which said ram is constrained and providing a supporting portion for a feeding mechanism adapted to feed work pieces to said ram, a feed lever pivoted on said supporting portion, a feed limit adjustment lever pivoted at one end to one end of said feed lever, an adjustment screw threaded through the other end of one of said levers and bearing on the other end of the other lever whereby the pivot angle between said levers may be adjusted, at least one spring biasing said other ends of said levers toward each other and, together, in the work-feeding direction, and an interponent mechanism between said feed lever and a moving part of said ram with which said feed lever is maintained in cooperative relation by said spring to transfer motion from said ram to said feed lever.

2. A press construction including a ram constrained to reciprocatory movement along a path, a unitary supporting structure in which said ram is constrained and providing a series of pivot fulcrums for an adjustable-stroke feeding mechanism adapted to feed work pieces to said ram, a feed lever having a series of pivot bearings, a removable pivot pin whereby the pivot axis of said feed lever with respect to said supporting structure may be selectively determined and said feed lever being pivotally mounted at selected bearing on one of said pivot fulcrums, and an interponent mechanism between said feed lever and a moving part of said press whereby to transfer swinging motion about the selected axis of said feed lever.

3. A press construction including a reciprocatory ram, a unitary supporting structure provided with a guide for said ram and providing a support for a feeding mechanism adapted to feed work pieces to said ram, a feed lever pivoted on said support, means actuated by the ram and engaging an arm of the feed lever for effecting the idle swing thereof, said feed lever and said support being each provided with a series of corresponding pivot receiving openings to permit varying the relative lengths of the power and load arms of the lever, whereby the feed stroke may be varied without changing the lengthwise relation of the lever to the support or to its ram-actuated operating means, a feed limit adjustment lever pivoted at one end to said feed lever and having a feed finger pivotally connected to its free end, means carried by one lever and bearing on the other for varying the pivot angle between said levers and a spring biasing said levers toward each other and, together, in a direction to feed the work.

4. A press construction according to claim 3 in which the feed limit adjustment lever extends at least to the end of the feed lever and in which an adjustment screw is threaded through one of said levers and bears on the other lever, whereby the pivot angle between said levers may be adjusted, a spring biasing the relatively adjustable ends of said levers toward each other and, together, in a direction to feed the work.

5. A press construction including a reciprocatory ram, a support provided with a guide for said ram and mechanism adapted to feed work pieces to said ram, said mechanism comprising a feed lever pivoted on said support and spring-biased in one direction of swing, means actuated by the ram and engaging an arm of the feed lever for effecting the swing thereof against said spring, a feed limit adjustment lever pivoted at one end to said feed lever, carrying a feed finger at its free end and biased by the feed lever actuating spring toward the feed lever and an adjustment screw threaded in one of said levers and bearing on the other to keep the free ends of said levers adjustably spaced against the action of the feed lever spring.

6. In a self-feeding press for applying electrical connectors, the combination of a ram, a unitary supporting structure in which said ram is constrained to reciprocatory movement along a path and providing a supporting portion for a feeding mechanism adapted to feed work pieces to the path of said ram, a feed lever pivoted on said supporting portion, a feed limit adjustment means for determining the final position of each feeding step relative to said path, spring means biasing said feed lever in the work-feeding direction, and means interposed between and abutted against said feed lever and a moving part of said press for transferring motion in the feed direction to said feed lever but free from coupling to said part in the opposite direction.

7. A press construction as defined in claim 6 which further includes means for adjusting the throw of the feed lever and in which a feed pawl is pivoted on the feed lever and the adjusting means is interposed between the pawl and the part of the feed lever which abuts said moving part of the press, whereby the position of the pawl at any given position of said lever may be accurately adjusted.

8. A press construction including a reciprocatory ram, a unitary supporting structure provided with a guide for said ram and providing a support for a feeding mechanism adapted to feed work pieces to said ram, a feed lever pivoted on said support, means actuated by the ram and engaging an arm of the feed lever for effecting the idle swing thereof, at least one of said lever and support having spaced alternative openings, means for varying the relative lengths of the power and load arms of the lever by shifting the pivot to different ones of said openings, whereby the feed stroke may be varied without changing

the lengthwise relation of the lever to the support or to its ram-actuated operating means, a feed limit adjustably mounted at one end on said feed lever and a feed finger pivotally connected to the free end of said feed lever and a spring biasing said feed lever toward the direction of feeding the work.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
242,772	Halkyard	June 14, 1881
259,597	Smith	June 13, 1882
260,250	Smith	June 27, 1882
272,787	Smith	Feb. 20, 1883
274,741	Dull	Mar. 27, 1883
630,449	Corscaden	Aug. 8, 1899
738,103	Devine	Sept. 1, 1903
900,335	Williams	Oct. 6, 1908
1,124,577	Allen	Jan. 12, 1915
1,373,522	Nickel	Apr. 5, 1921
1,836,497	Phelps	Dec. 15, 1931
1,836,500	Poole	Dec. 15, 1931
1,836,503	Poole	Dec. 15, 1931
2,024,416	Allison	Dec. 17, 1935
2,059,010	Melin	Oct. 27, 1936
2,333,120	Parker	Nov. 2, 1943
2,339,410	Keller	Jan. 18, 1944
2,353,471	Johndrew	July 11, 1944
2,414,178	Sprinkle	Jan. 14, 1947
2,418,761	Dasher	Apr. 8, 1947
2,422,042	Roberts	June 10, 1947
2,426,446	Funk	Aug. 26, 1947
2,436,806	Hunt	Mar. 2, 1948
2,473,623	Voity	June 21, 1949