Sept. 12, 1944. E. L. MALHIOT 2,357,902

ARTICLE FORMING APPARATUS

Filed Aug. 29, 1942 4 Sheets-Sheet 1

FIG. 1

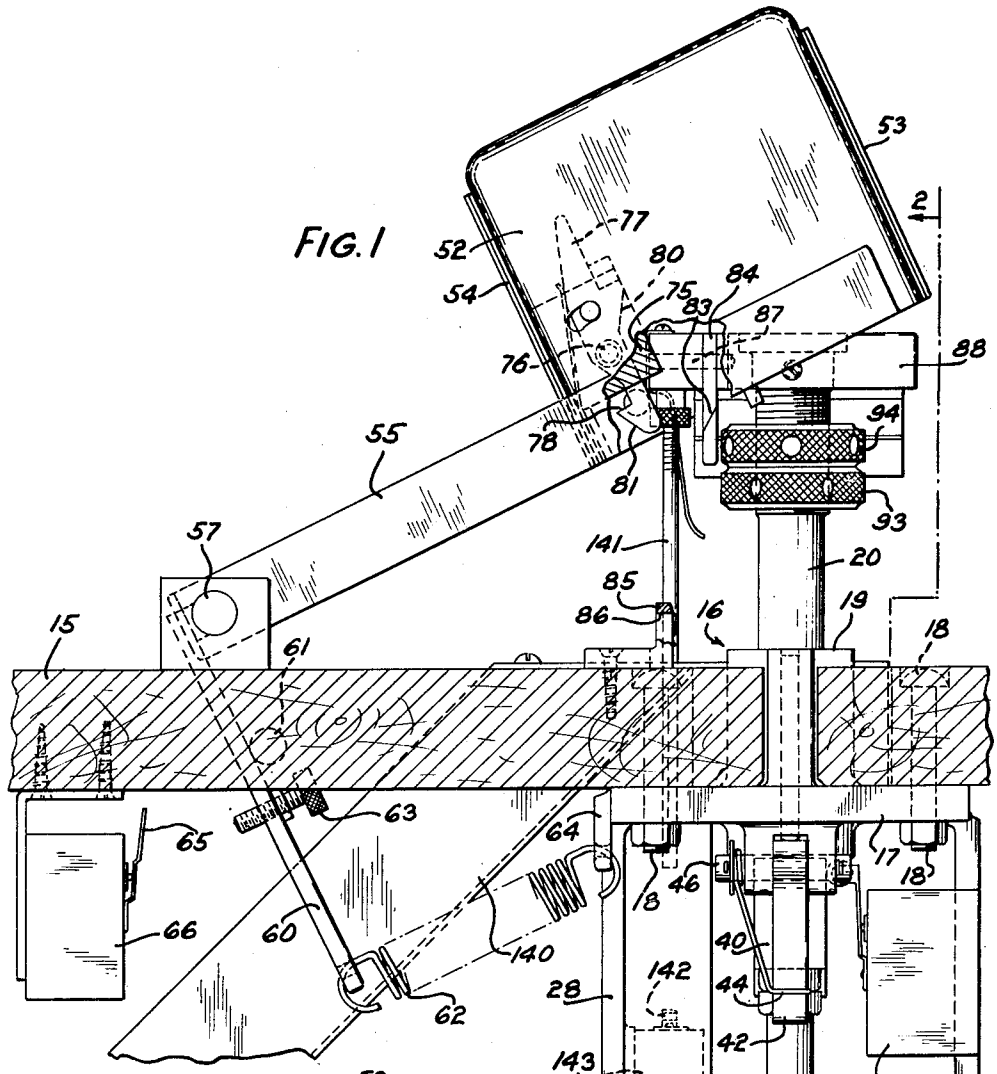


FIG. 8

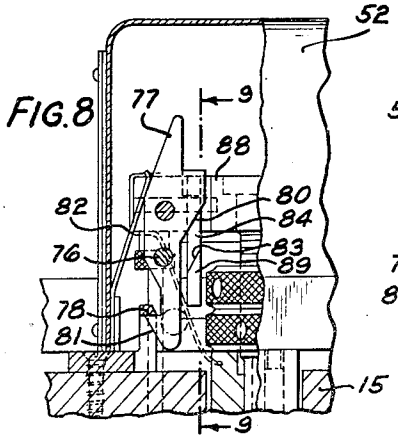
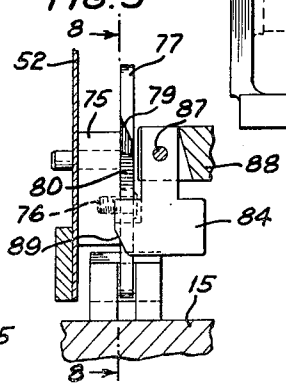


FIG. 9



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ARTICLE FORMING APPARATUS

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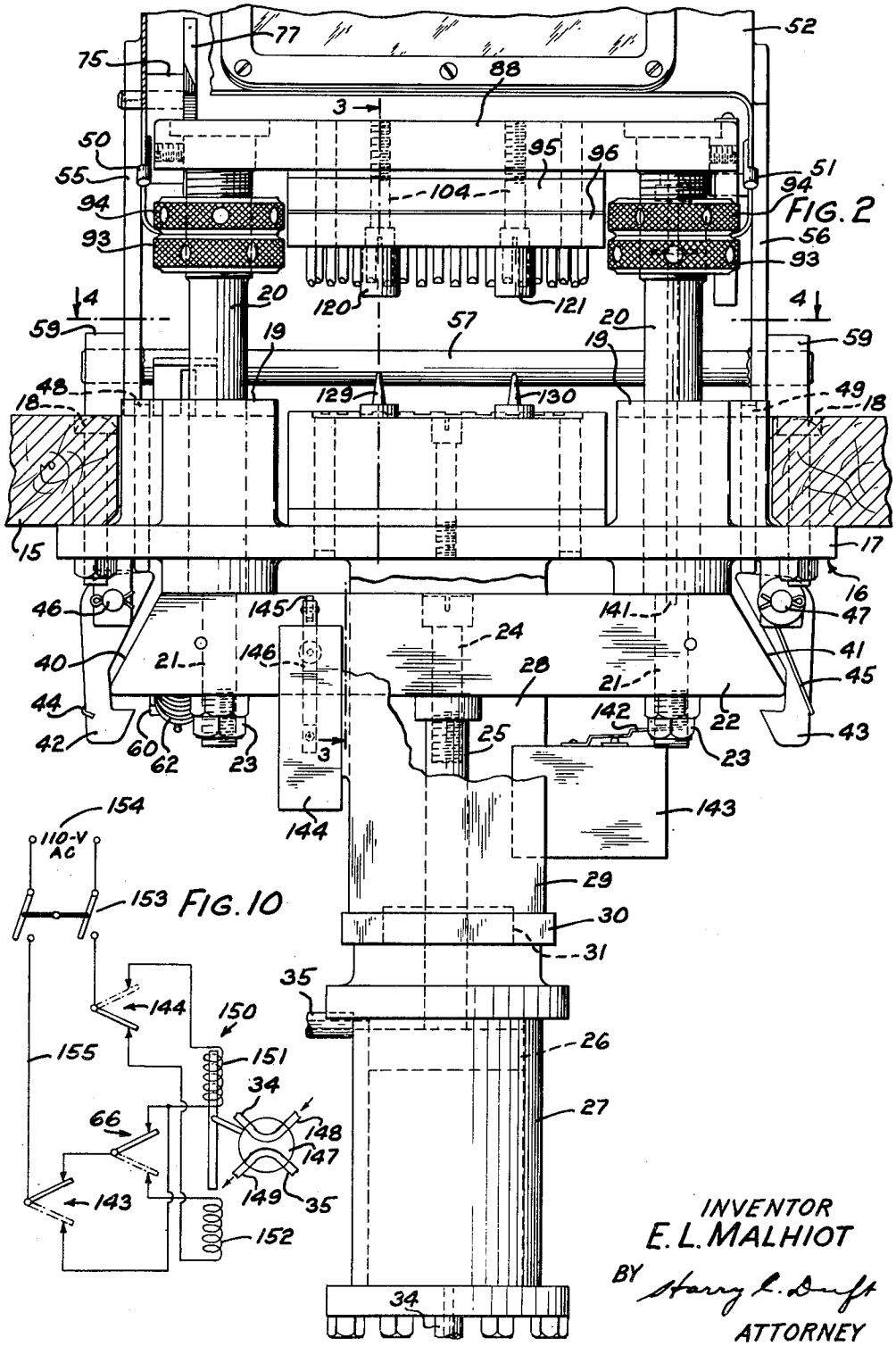

FIG. 2

FIG. 10

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ARTICLE FORMING APPARATUS

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FIG. 3

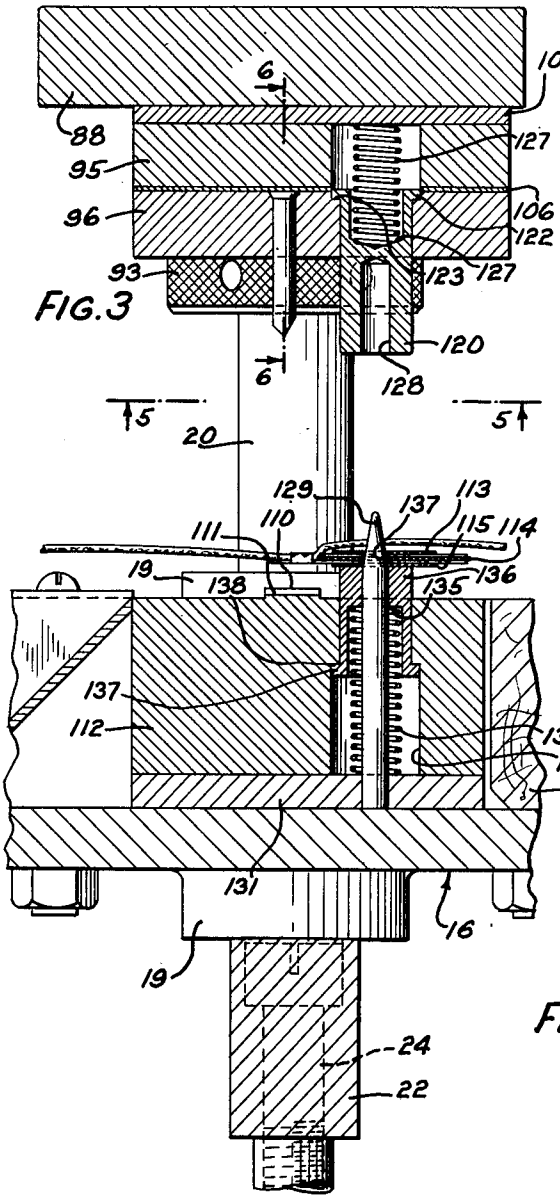


FIG. 5

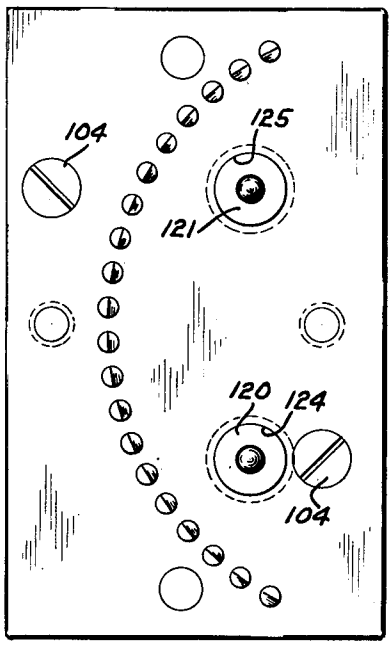


FIG. 6

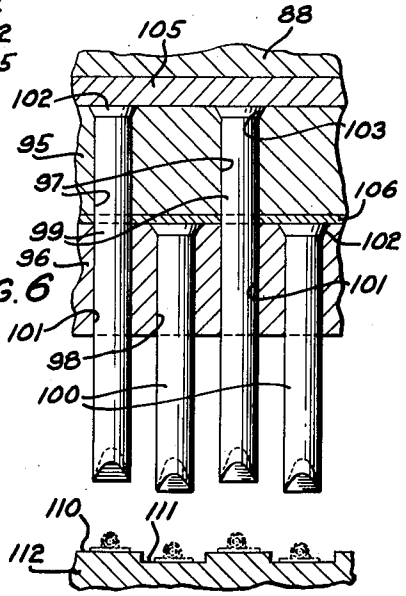
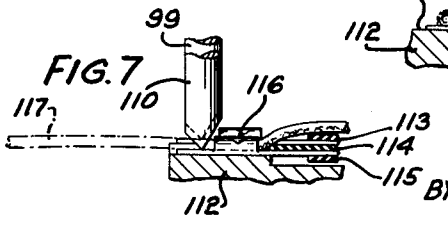


FIG. 7



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ARTICLE FORMING APPARATUS

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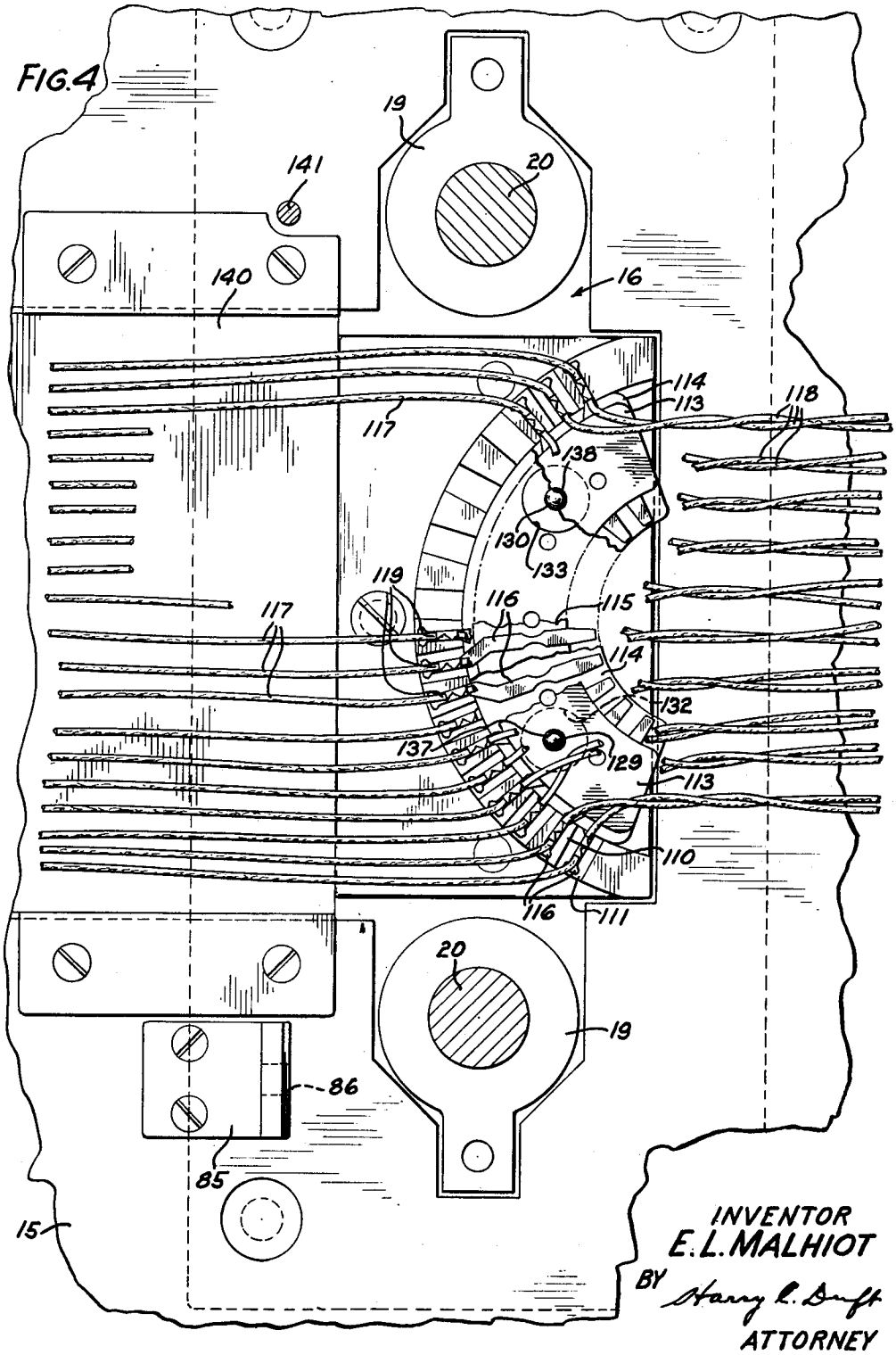
FIG. 4



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Patented Sept. 12, 1944 2,357,902

UNITED STATES PATENT OFFICE

2,357,902

ARTICLE FORMING APPARATUS

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Application August 29, 1942, Serial No. 456,656

6 Claims. (Cl. 140—145)

This invention relates to article forming apparatus and more particularly to a wire trimming apparatus for wired articles.

In the manufacture of wired apparatus, for example, telephone exchange equipment, it is frequently desirable to form sub-assemblies of parts wired together for later assembly with other pieces of apparatus and automatic machines have been designed for forming these wired assemblies or articles. However, in most of these machines, it has proven uneconomical to trim the ends of the wires closest to the terminals to which the wires are attached, but has proven more satisfactory to leave relatively long ends extending from the terminals so that it is necessary to trim the end in a later operation.

It is an object of the present invention to provide a simple and effective apparatus for forming articles such as wired sub-assemblies.

In accordance with one embodiment of the invention as applied to telephone step-by-step wired assemblies, an apparatus has been provided for trimming the free ends of wires which have been previously attached to terminals by cutting off a group of wires simultaneously, utilizing a portion of each terminal as an anvil toward which a cutting tool is pressed to trim the wire ends from the assemblies. In the apparatus, a wired assembly is suitably positioned beneath a movable guard and the guard is then moved downwardly to initiate operation of an electrical circuit after the guard is in position surrounding a substantial portion of the article. When the guard reaches the position where it encloses the article, the electrical circuit becomes effective to cause a piston to be reciprocated and the guard is latched in place mechanically while the piston reciprocates to carry a shearing head downwardly and upwardly. As the shearing head moves downwardly, a latch thereon is tripped to position to become effective to release the guard and permit it to return to normal inoperative position after the head starts up. In addition to this feature, various safety devices are provided in the apparatus whereby the piston will be rendered ineffective to move the shearing head downwardly until the guard is in place surrounding the article to be sheared and the shearing head is provided with a plurality of cutting members staggered to cut the various wires which are attached to terminals arranged in staggered formation.

A better understanding of the invention will be had by reference to the accompanying drawings, wherein

Fig. 1 is a side elevational view of apparatus embodying the present invention, parts being broken away to show more clearly portions of the apparatus located behind them;

Fig. 2 is a fragmentary sectional view taken substantially along the line 2—2 of Fig. 1 in the direction of the arrows showing details of the means for locating an article in the apparatus and the means for preventing complete operation of the shearing mechanism until the guard member is in guarding position;

Fig. 3 is an enlarged fragmentary vertical sectional view taken substantially along the line 3—3 of Fig. 2 in the direction of the arrows;

Fig. 4 is a horizontal sectional view taken substantially along the line 4—4 of Fig. 2 in the direction of the arrows showing a step-by-step wired assembly in position in the apparatus to have the free ends of its wires trimmed adjacent the terminals thereof;

Fig. 5 is a detail view of the under side of the shearing head looking in the direction of the arrows along the line 5—5 of Fig. 3;

Fig. 6 is a fragmentary sectional view on an enlarged scale, taken substantially along the line 6—6 of Fig. 3 in the direction of the arrows showing the staggered relation of the cutting members in their inoperative position;

Fig. 7 is a fragmentary detail sectional view showing the cutting members in their operative position;

Fig. 8 is a fragmentary sectional view of the latching means for holding the guard member in its downward position during the shearing operation taken along the line 8—8 of Fig. 9;

Fig. 9 is a fragmentary detail sectional view taken on the line 9—9 of Fig. 8 in the direction of the arrows; and

Fig. 10 is a circuit schematic showing the control circuit for the apparatus.

Referring to the drawings, wherein like reference characters designate the same parts throughout the several views, particular reference being had to Figs. 1 and 2, the apparatus is designed to be mounted upon a bench or table 15, which is cut out to receive a main support member 16 on which substantially all of the apparatus except the pivot support for the guard is mounted. The main support member 16 comprises a plate portion 17, which extends outwardly beyond the body of the main support member to provide flanges whereby the main support member 16 may be secured to the bench or table 15 by means of bolts 18. In addition to the plate 17, the main support member 16 includes bearing bosses 19—19, which extend above and below the

plate portion 17 and slidable support actuator rods 20—20. The actuator rods 20 are provided with reduced portions 21—21, which extend through a cross head 22 and are threaded on their lower ends to receive lock nut assemblies 23. Thus, the cross head 22 is fixed to the actuator rods 20 and is movable with them to either raise or lower them.

Attached to the middle of the cross head 22, by means of a screw 24, is a piston rod 25, carrying a piston 26 on its lower end for movement in a cylinder 27. The cylinder 27 is suspended from the under side of the main support member 16 by a box-like support bracket comprised of plates 28 and 29 welded or otherwise suitably secured to the portion 17 of the main support member 16 and extending downwardly therefrom to a cylinder supporting plate 30, which is suitably secured to the lower ends of the plates 28 and 29. A reduced portion 31 of the cylinder extends up into an aperture 32 in the cylinder supporting plate 30 and is attached thereto by means of a set screw 33. The cylinder 27 may have fluid supplied to or exhausted therefrom through pipe connections 34 and 35 connected adjacent the lower and upper ends of the cylinder, respectively.

At its left and right sides (Fig. 2) the cross head 22 is provided with cam surfaces 40 and 41 having cooperating therewith latch members 42 and 43, which are normally urged to the position shown in Fig. 2 by springs 44 and 45, respectively, which are coiled around pivot pins 46 and 47, suitably supported from the under side of the portion 17 of main support member 16. These latch members 42 and 43 will prevent the cross head 22 from moving downwardly until the latch members are rocked clockwise and counterclockwise, respectively, by push rods 48 and 49, respectively, associated with them. The push rods 48 and 49 are slidable in the main support member 16 and are adapted to be actuated by pins 50 and 51, respectively, mounted upon opposite sides of a guard member 52. The guard member 52 is an inverted box-like structure provided with front and rear windows 53 and 54, respectively, and is carried upon a pair of levers 55 and 56 fixed to a rock shaft 57 which extends across the guard member and is rotatable in a pair of mounting lugs 58 and 59, respectively, suitably secured to the bench or table 15.

Adjacent the left end (Fig. 2) of the rock shaft 57, there is suitably secured thereto a lever 60, which is normally urged up against a stop member 61 by a contractile spring 62 attached to the lower end of the lever 60 and to a hook 64 fixed to the portion 17 of the main support member 16. Thus, the guard 52 is normally held in its upper inoperative position, as shown in Fig. 1, by the spring 62, being limited in its movement by engagement of the lever 60 with stop member 61. The lever 60 is provided with an adjustable thumb nut 63, adapted to engage an actuator spring 65 of a switch 66 to actuate the switch 66 when the guard member is moved to its lowermost position, as shown in Figs. 8 and 9.

Mounted inside the guard member 52 and fixed to the left wall thereof (Fig. 2) is a support block 75, into which is threaded a pivot screw 76 (Figs. 8 and 9). The pivot screw 76 pivotally supports a latching lever 77 provided with a latching shoulder 78 and cam faces 79, 80 and 81 (Figs. 1, 8 and 9). A leaf spring 82, fixed to the side of the guard member 52, normally urges the lever 77 to the position shown in Figs. 1 and 8. When the guard member 52 is moved down against the action of the spring 62, the cam face 80 will strike against a cam face 83 on a trip lever 84 and the lever 77 will be rocked a short distance counter-clockwise (Figs. 1 and 8) to permit the lever 77 to move past the trip lever 84. As the guard member 52 is moved down to its lowermost position, the cam face 81 thereon will engage a locking bracket 85 and the lever 77 will be again cammed to rock in a counter-clockwise direction to permit the shoulder 78 thereon to move into position to engage in an aperture 86 formed in the locking bracket 85. As soon as the cam face 81 moves to the position shown in Figs. 8 and 9, the shoulder 78 will engage in the aperture 86, thereby to hold the guard member in its lowermost position. The lever 84 is pivoted at 87 on a cross head 88, which is, in turn, mounted upon the upper ends of the actuator rods 20, being fixed to the actuator rods for movement therewith.

When the actuator rods 20 are drawn downwardly due to the admission of fluid under pressure to the upper end of the cylinder 27, they will carry the cross head 88 downwardly with them and when the cross head 88 moves downwardly, a camming surface 89 on the trip lever 84 will engage with the cam faces 79 on the lever 77 and the lever 84 (now in its lowermost position) will be rocked counter-clockwise about its pivot point at 87. After the cross head 88 has moved downwardly to complete its cycle of operation, the weight of the lever 84 will cause it to move under the cam face 80 on the lever 77 so that when the actuator rods 20 are moved upwardly to carry the cross head 88 with them, the lever 84, in moving upwardly, will cam the lever 77 counter-clockwise to release the shoulder 78 from the wall of the aperture 86, thereby to release the guard member 52 and permit the spring 62 to rock it to the position shown in Fig. 1.

Each of the actuator rods 20 is provided with a knurled collar 93, threaded onto it for limiting the downward movement of the actuator rods 20 and, consequently, the collars 93 will limit the amount of downward movement of the cross head 88. Cooperating with each of the knurled collars 93 are knurled lock nuts 94, which, like the collars 93, are provided with sockets for receiving a spanner wrench whereby they may be suitably locked together. When the piston 26 moves downwardly to carry the cross head with it, the length of the stroke thereof will be limited by the collars 93, striking the bearing bosses 19. Thus, the amount of travel of the cross head 88 may be micrometrically adjusted.

Secured to the under side of the cross head 88 are a pair of knife supporting plates 95 and 96, which, as most clearly shown in Fig. 6, have apertures 97—97 and 98—98 formed in them for receiving wire cutting knives 99—99 and 100—100. The plate 96 is also provided with a series of apertures 101—101 in alignment with the apertures 97 in the plate 95, whereby the wire cutting knives 99 extend through the plate 96. The wire cutting knives 99 and 100 are all of substantially the same construction except that the knives 99 are long enough to extend through the plate 96 and to extend into the position shown in Fig. 6. Each of the wire cutting knives is provided with upset heads 102, which rest against cooperating tapered shoulders 103 formed in the plates 105 and 106. The plates 95 and 96 are held on the cross head 88 by means of screws 104—104, which extend through both of the plates 95 and 96 and through a spacer 105 interposed between the plate 95 and

the cross head 88 and through a spacer 106 interposed between the plates 95 and 96.

It will be noted, by reference to Fig. 6, that the lower cutting ends of the knives 99 and 100 are staggered. This construction is provided in order to trim wires placed at different levels and attached to terminals which are disposed at different levels in the sub-assembly being trimmed by the apparatus. In sharpening or forming the knives, the spacer 106 is removed from the assembly and the plates 95 and 96 are positioned in abutting relation while the knife edges at the bottom ends of the knives are formed or sharpened so that this sharpening operation will cut all of the knife edges along exactly the same line and then when the apparatus is assembled for use, the spacer 106 is replaced in the assembly, thereby providing the proper displacement of the knives to correspond with article backing portions 110 and 111 on an anvil 112, which is designed to support the step-by-step sub-assembly.

The step-by-step sub-assembly, as shown most clearly in Fig. 4, and which is to have wire ends trimmed from it, comprises three arcuately shaped insulators 113, 114 and 115, to which terminals 116 have been suitably attached. The terminals 116 are placed on the inner surfaces of the insulators 113 and 115 and are separated from each other by the insulator 114, which is loosely mounted between them. Thus, the terminals 116 on the insulator 113 will be spaced from the terminals 116 on the insulator 115 by the thickness of the insulator 114. Accordingly, the anvil 112 has its article backing portions 110 and 111 at different levels and it is the purpose of the present apparatus to shear the ends 117 of the wires 118 at the line 119, which is to the left (Fig. 4) of the place where the terminals 116 grip the wires 118. This operation is performed by cutting the wires against the terminal and thus the travel of the cross head 88, which actuates the knives 99 and 100, must be accurately regulated by means of the threaded collars 93 and the knives must have their shearing edges staggered to correspond with the location of the terminals.

The cross head 88 has mounted thereon a pair of article gripping sleeves 120 and 121 (Figs. 2, 3 and 5) which are provided, as shown most clearly in Fig. 3, with an annular shoulder 122, which rests upon a cooperating shoulder 123 formed in the plate 96. The sleeves 121 and 122 are of exactly the same construction and are each slidably mounted in apertures 124 and 125 in the plate 96, being urged downwardly by compression springs 127, which bear against the spacer 105 and nest in sockets 127 formed in each of the sleeves 120 and 121. The sleeves 120 and 121 are each provided with a central bore 128, which is adapted to receive a locating pin 129 or 130, which are fixed in a bolster plate 131 mounted upon the main support member 16 and supporting the anvil 112. The pins 129 and 130 extend up through apertures 132 and 133, formed in the anvil 112 and are surrounded by a coiled compression spring 134 which rests on the bolster plate 131 and has its upper end bearing against a shoulder 135 formed internally of a locating sleeve 136. Each of the sleeves 136 is provided with an annular shoulder 137, which engages with a shoulder 138 formed in the apertures 132 and 133 to prevent movement of the sleeve 136 upwardly beyond the position shown in Fig. 3. Thus, when the sub-assembly to be trimmed is inserted in the apparatus, it may be positioned by placing it in such a manner in the apparatus that aligned apertures 137 and 138 in the insulators 113, 114 and 115 will receive the pins 129 and 130. Then, when the guard member 52 is rocked downwardly, the sub-assembly will be held loosely on the pins 129 and 130 until the sleeves 120 and 121 engage with the upper surface of the insulator 113, whereupon the pins 129 and 130 will enter the central bore 128 in the sleeves 120 and 121 and the article will be clamped between the resilient sleeves 120, 121 and 136, which will clamp the sub-assembly in position prior to the engagement of the wires 118 by the knives 99 and 100.

A discharge chute 140 is provided for receiving the ends 117 of the wires 118 when the ends are sheared from the body of the wires to discharge them from the apparatus.

Fixed to the cross head 88 is a switch actuating plunger 141 (Figs. 1, 2 and 4), which, when the cross head 88 approaches the end of its downward stroke, will engage the actuator spring 142 of a highly sensitive electrical switch 143 to operate this switch. In addition to the switch 143, which is actuated when the cross head 88 reaches its lowermost position, there is a switch 144 provided which carries a roller 145 on its actuator spring 146 in the path of movement of the cross head 22. This switch 144 will be held in the position shown in Fig. 10 when the cross head 22 is in its upper position, the switch assuming the position shown just before the cross head 22 reaches its uppermost position on its travel upward. The purpose of these switches will be described more clearly in connection with the following description of the mode of operation of the apparatus.

Referring to Fig. 10, it will be seen that the pipe connections 34 and 35 extend to a reversing valve 147 to which fluid under pressure may be supplied through a pipe connection 148 and from which the spent fluid may be passed from a pipe connection 149, suitable ports being provided in the valve for interconnecting either the pipe connection 34 or the pipe connection 35 with the pipe connections 148 or 149 when the valve is operated. The valve is adapted for operation by a solenoid 150 having coils 151 and 152. The circuit, as shown in Fig. 10, illustrates the condition of the apparatus when the guard member 52 is in its uppermost position preparatory to initiating a trimming operation of the apparatus. With the apparatus in this condition, an article to have the wire ends 117 trimmed from it may be placed upon the locating pins 129 and 130 and the guard member 52 may then be moved downwardly. As soon as the guard member 52 reaches its lowermost position, the thumb screw 63 will strike actuator spring 65 to shift switch 66 from the position shown in full lines in Fig. 10 into engagement with its lower contact. If a switch 153 has been closed to connect the 110 volt source 154 in the circuit, the reversal of switch 66 from the position shown will connect the side 155 of the now energized 110 volt circuit through switch 143 in the position shown, switch 66 in the dotted line position to energize the coil 152.

When coil 152 is energized, the reversing valve 147 will be reversed to interconnect pipe connection 148 and pipe connection 35 and to interconnect pipe connections 34 and 149. Thus, fluid under pressure will be admitted to the upper end of cylinder 27 and the cross head 88 will be drawn downwardly through the action of the

actuator rods 20 and cross head 22. The cross head 22 will be permitted to move downwardly as soon as the push rods 48 and 49 have rocked the latch members 42 and 43 out of the path of the cross head 22. This action occurs just before the guard member 52 reaches its lowermost position, and when the guard member reaches its lowermost position, the lever 77 will have its shoulder 78 engaged in the aperture 86 of the locking bracket 85 and thus the guard member 52 will be held in its lower position until the cross heads 22 and 88 have moved downwardly to cause the wire cutting knives 99 and 100 to cut through the wires 118 and have started back up. The knives 99 and 100, however, will not engage the terminals 116 since the collar 93 and lock nut 94 will have been adjusted so that they will only permit the cross head 88 to travel down a distance such that it will carry the knives substantially all the way through the wire ends, but will not engage the terminals 116. When the cross head 22 carries the cross head 88 to its lowermost position, the plunger 141 will engage and actuate the actuator spring 142 of switch 143 to connect the side 155 of the 110 volt line to the coil 151. Since switch 144 shifted from its full line to its dotted line position as soon as the cross head 22 moved out of engagement with the roller 145, the reversal of switch 143 from position shown in Fig. 10 to its dotted line position will cause the energization of the coil 151 to switch the valve 147 to the position shown in Fig. 10 and fluid under pressure will then be admitted through pipe connection 48, valve 147 and pipe connection 34 to the lower end of cylinder 27 to force the piston 26 upwardly, the fluid under pressure being exhausted from the upper end of the cylinder through pipe connection 35, valve 147 and pipe connection 149. In this manner, the apparatus will be restored to normal position and the switches 143, 144 and 66 will assume their solid line positions preparatory to the next movement of the guard member 52 downwardly. As the cross head 88 moved upwardly, it carried the trip lever 84 with it and the lever 84, in moving upwardly with the cross head, will engage its cam surface 83 with cam face 80 of the lever 77 to rock the lever 77 counter-clockwise (Figs. 1 and 8), thereby to release the guard member 52 and permit the spring 62 to return it to its normal position, as shown in Fig. 1. As soon as the guard member 52 moves upwardly, switch 66 assumes the full line position, as shown in Fig. 10, and, therefore, when the plunger 141 moves out of engagement with the switch actuating spring 142, the circuit to the coil 151 will be shifted from control of the switch 143 in its dotted position to the switch 143 in its full position and through the switch 66 in its full line position.

What is claimed is:

1. In an apparatus for trimming wire ends from terminals of wired articles, wire cutting knives, a guard member movable to enclose a substantial portion of an article and said knives, means for locking the guard member in enclosing position, means operated by the guard member for initiating operation of the knives, a reciprocable head for supporting said knives, means controlled by the means operated by the guard member for supplying fluid pressure to actuate the head, and means releasable by the guard member for normally holding the head against actuation by the fluid under pressure, said last mentioned means comprising spring pressed latches and plungers actuated by the guard member for moving the latches to inoperative position.

2. In an apparatus for trimming wire ends from the terminals of wired articles, locating pins for locating the article in the apparatus, clamping means cooperating with said locating pins to clamp the article in the apparatus, a reciprocable head for supporting part of said clamping means, an anvil for supporting the rest of said clamping means, knives mounted in said head, terminal supporting means on said anvil, means for moving said head toward the anvil to cut wire ends from the terminals on the terminal supporting means, and means for stopping movement of said head before the knives strike the terminals.

3. In an apparatus for trimming wire ends from terminals of wired articles, a plurality of knives for trimming the wire ends, fluid actuated means for moving the knives toward the terminals to cut the wires against the terminals, and means for limiting the movement of said knives to prevent them from cutting the terminals, including micrometrically adjustable collars fixed to said fluid actuated means, and fixed abutments for engagement by said collars to block movement of said fluid actuated means in a predetermined position.

4. In an article forming apparatus, a reciprocable cross head, a fixed anvil cooperating with said cross head, means on said anvil for supporting an article in a predetermined position, a pair of knife holding plates mounted on said cross head, a plurality of knives mounted on one of said knife holding plates, a plurality of knives mounted on the other plate and extending through said one plate, and a spacer between said knife holding plates to hold the plates spaced a predetermined distance apart and thereby determine the relative amount the knives extend beyond the said one plate.

5. In an article forming apparatus, a reciprocable cross head, a fixed anvil cooperating with said cross head, means on said anvil for supporting an article in a predetermined position, article backing portions formed at different levels on said anvil, a pair of knife holding plates mounted on said cross head, a plurality of knives mounted on one of said knife holding plates, a plurality of knives mounted on the other plate and extending through said one plate, and a spacer between said knife holding plates to hold the plates spaced a predetermined distance apart and position the extending ends of the knives to correspond to the different levels of the article backing portions of the anvil.

6. In an article forming apparatus, a reciprocable cross head, a fixed anvil cooperating with said cross head, means on said anvil for supporting an article in a predetermined position, a pair of knife holding plates mounted on said cross head, a plurality of knives mounted on one of said knife holding plates, a plurality of knives mounted on the other plate and extending through said one plate, a spacer between said knife holding plates to hold the plates spaced a predetermined distance apart and thereby determine the relative amount the knives extend beyond the said one plate, and micrometrically adjustable means for limiting the movement of the cross head to prevent the knives from contacting with a part of the article.

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