

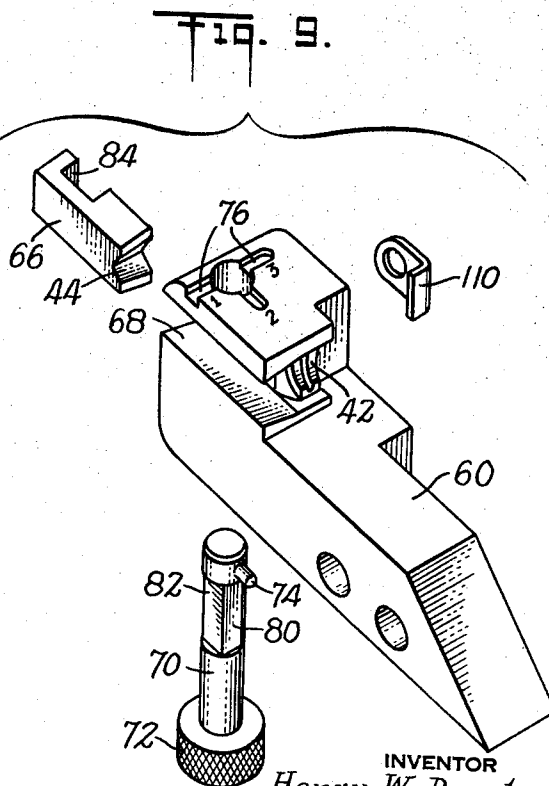
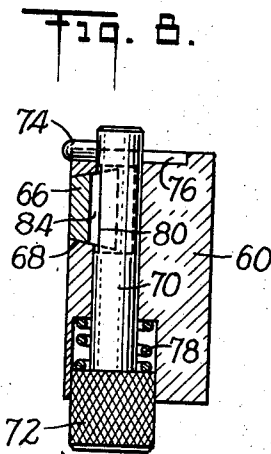
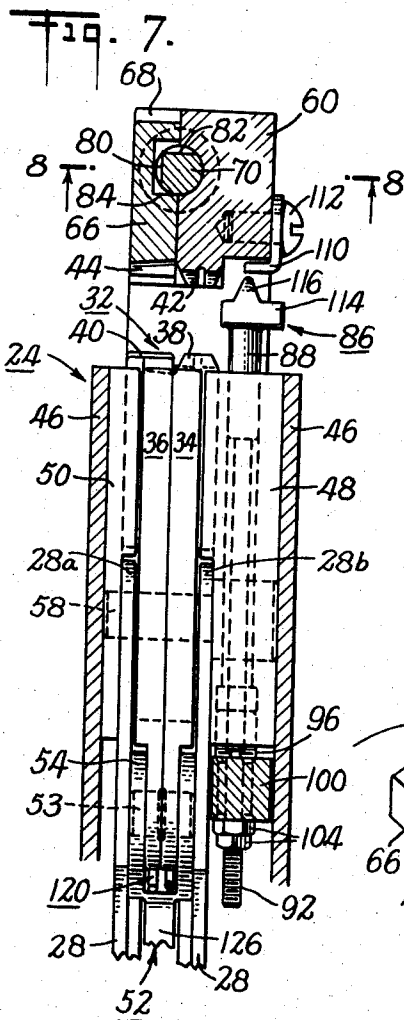
Aug. 2, 1960

H. W. DEMLER
HAND CRIMPING TOOL

2,947,207

Filed Nov. 23, 1956

6 Sheets-Sheet 1



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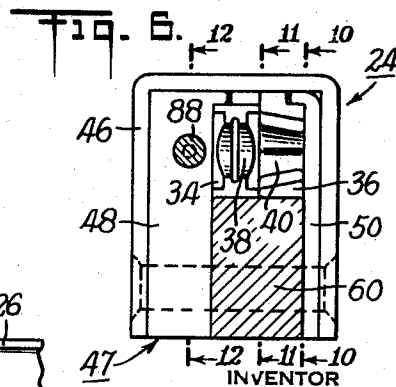
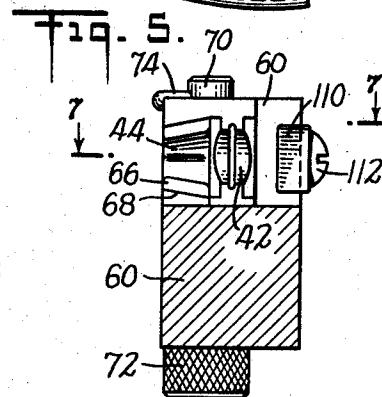
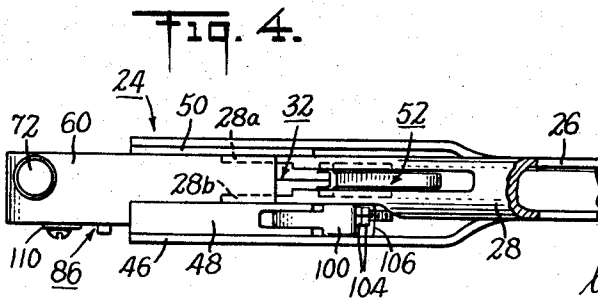
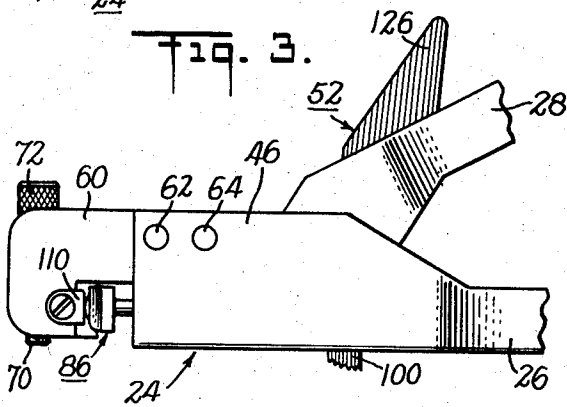
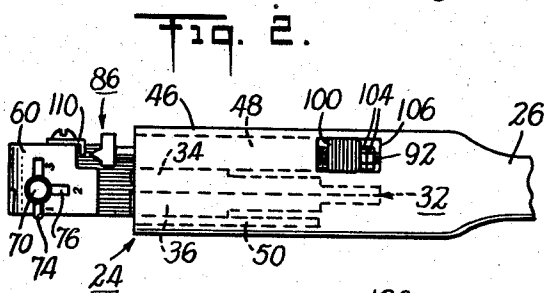
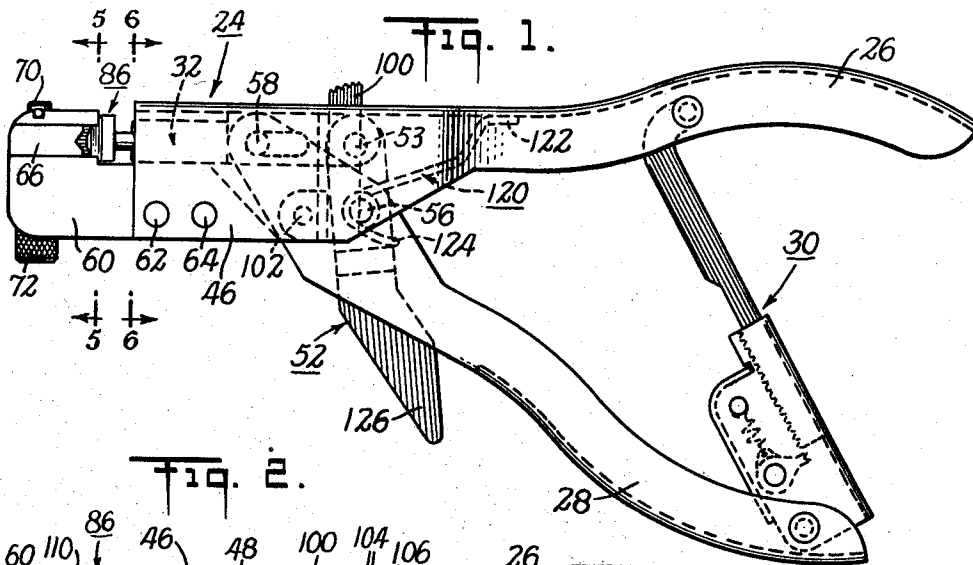
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6 Sheets-Sheet 2



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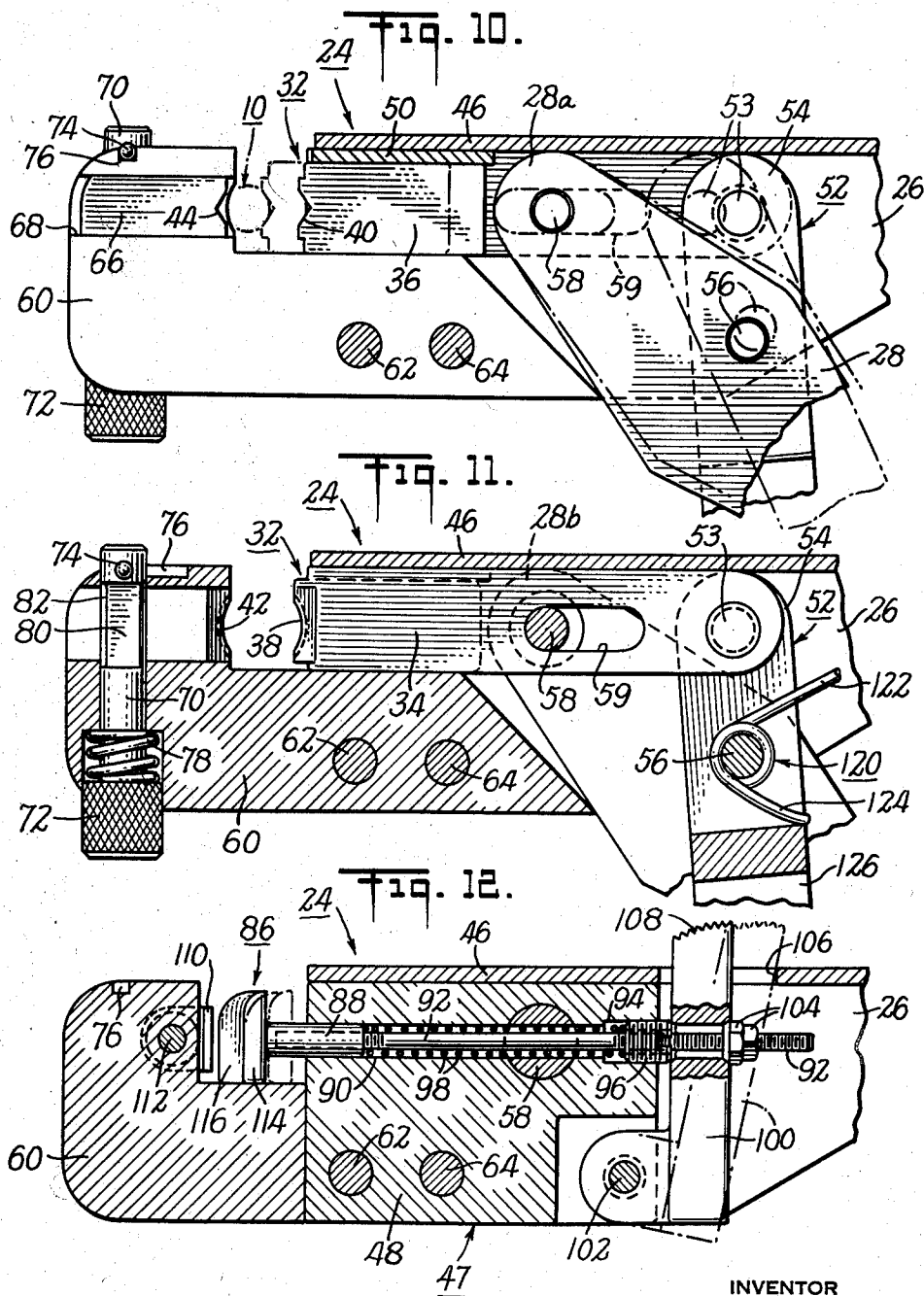
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6 Sheets-Sheet 3



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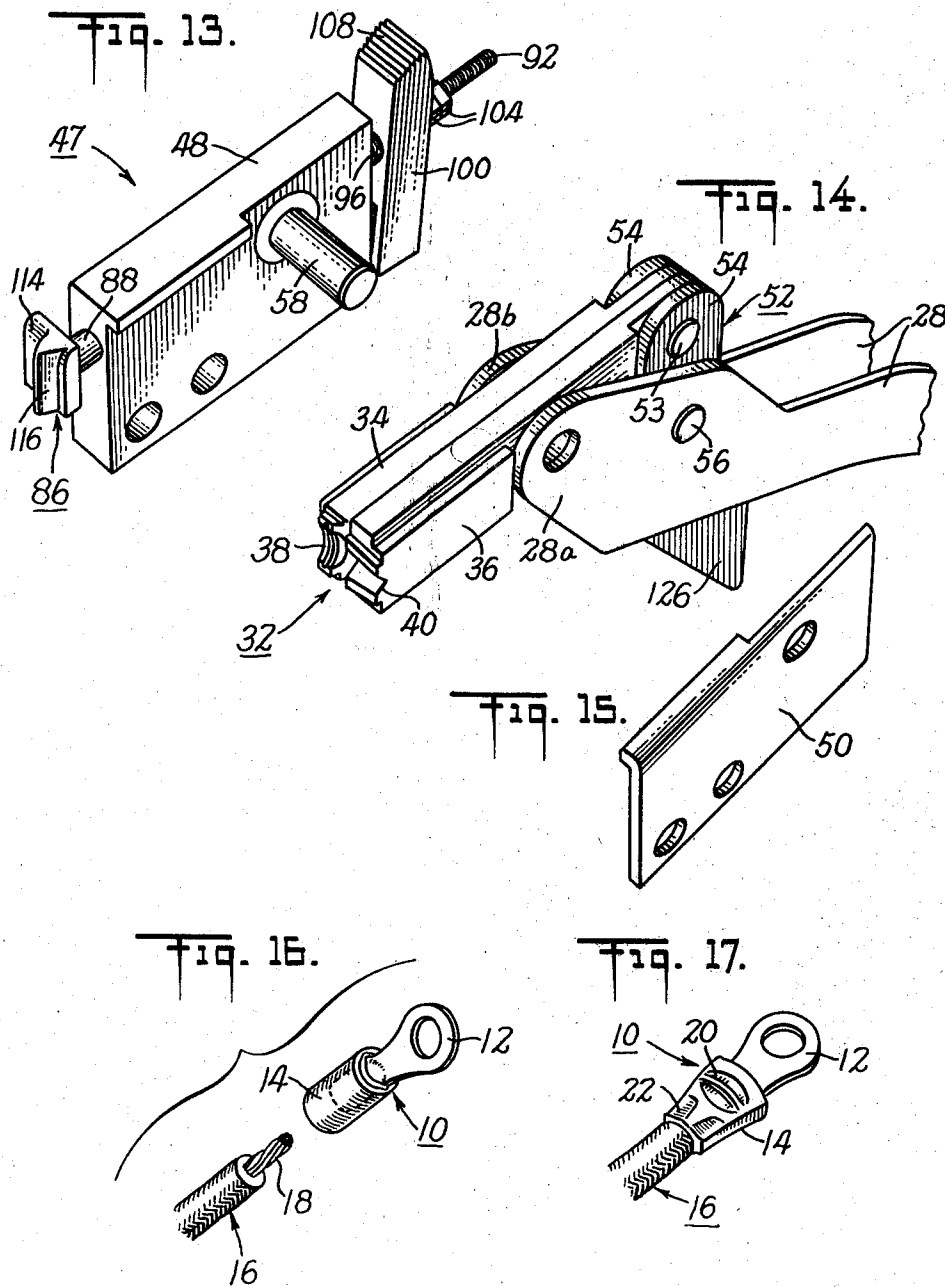
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6 Sheets-Sheet 4



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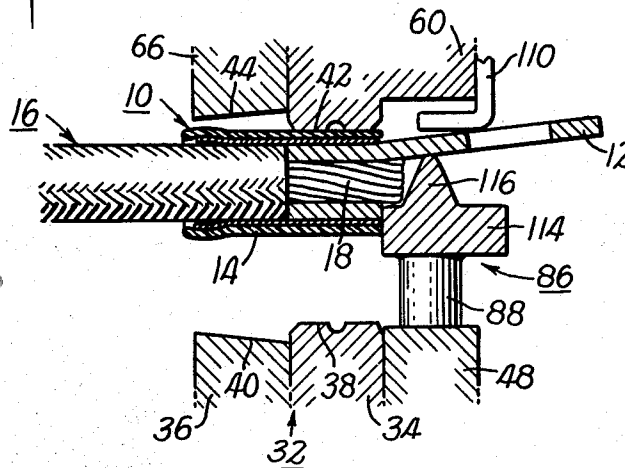
H. W. DEMLER
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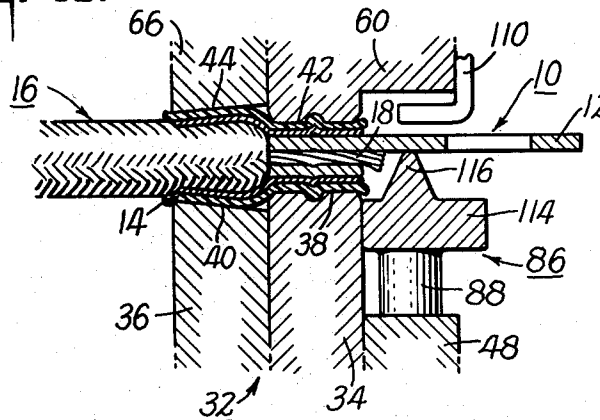
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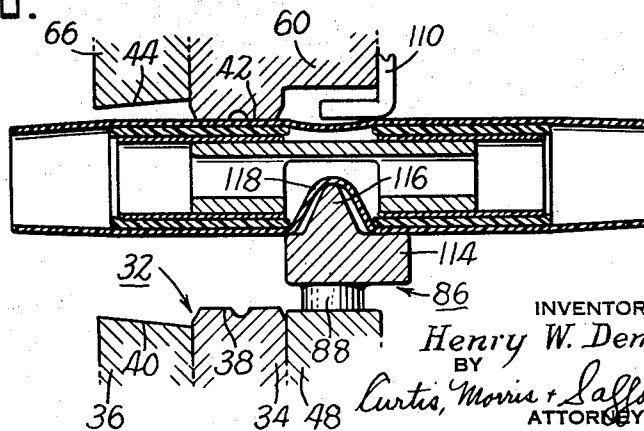
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2,947,207

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6 Sheets-Sheet 6

Fig. 21.

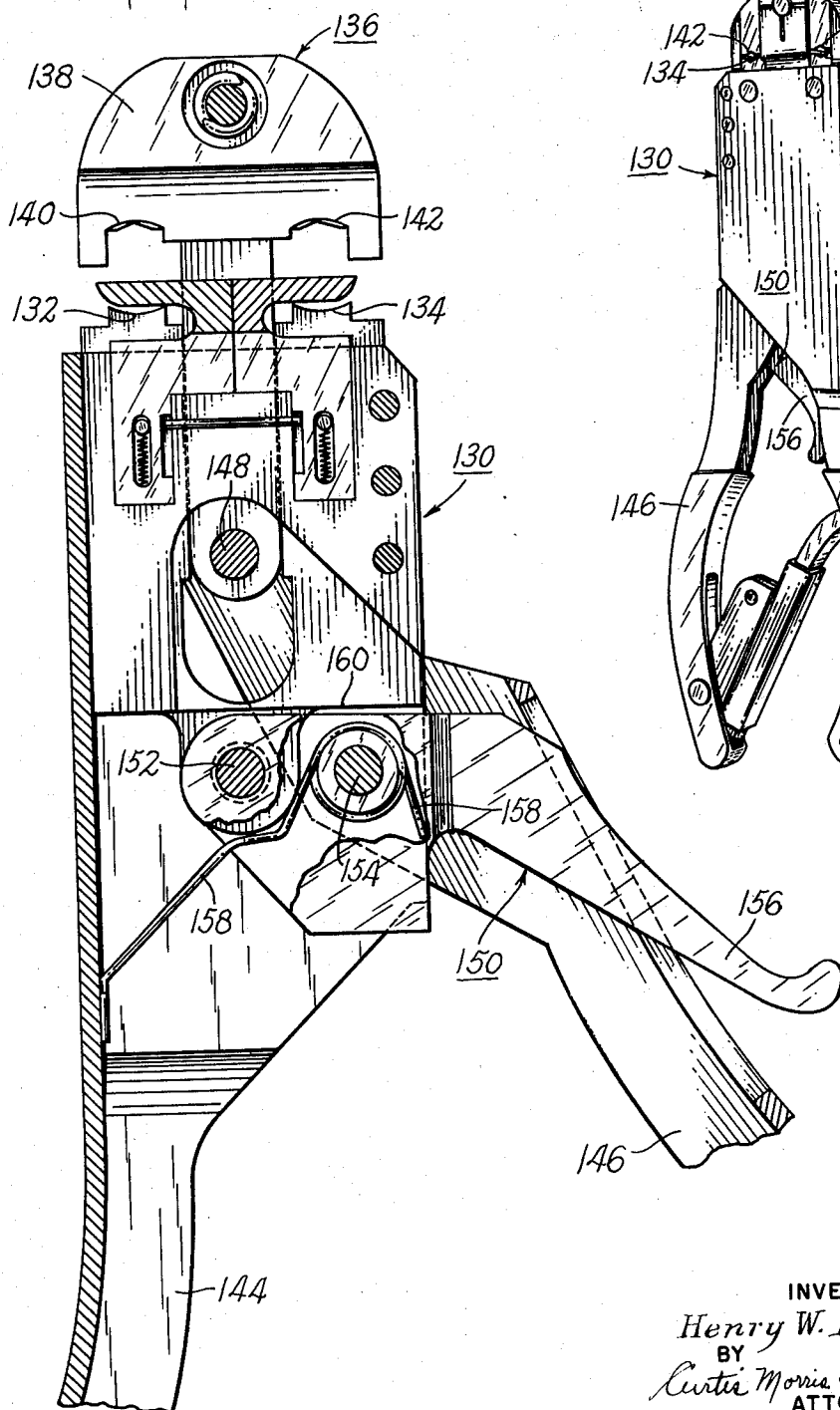
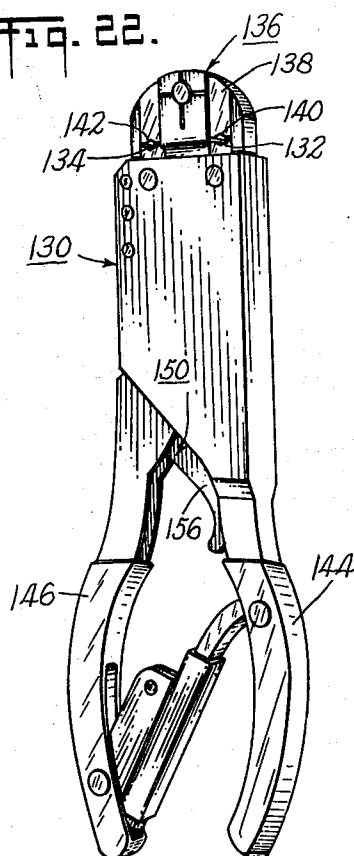


Fig. 22.



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HAND CRIMPING TOOL

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6 Claims. (Cl. 81-15)

This invention relates to hand-operated crimping tools for crimping electrical connectors onto electrical conductors. Hand tools embodying the present invention can be used to apply a variety of different types of crimp to a variety of different types of connectors. However, the utility of the present tool can be most conveniently pointed out with reference to a typical application of the tool and will be so described in the present specification.

Such a typical application is illustrated in Figures 16 and 17 of the accompanying drawings wherein the numeral 10 designates a connector comprising a tongue portion 12 adapted to be secured to a binding post or the like and a barrel portion 14. The numeral 16 generally designates an insulated conductor with the insulation stripped from an end portion 18 thereof. The bare end 18 and adjacent insulated portion of conductor 16 are inserted in the barrel 14, after which the barrel is crimped to secure the connector 10 to the end of conductor 16. As shown in Figure 17 the barrel 14 of the connector is crimped at two points 20 and 22. The crimp 20 provides a connection between the connector and the bare end 18 of conductor 16 and the crimp 22 seals the barrel 14 to the insulation of conductor 16.

The crimping of such a connector to a conductor can be effected by either a power-operated or a hand-operated tool and tools of both types have been previously proposed. For fixed installations power-operated tools are generally preferred since they do not have the power limitations of hand-operated tools. On the other hand, there are many cases where ready portability and/or economy are of paramount importance and in these situations a manually operated tool is preferred. The general requirements of such a hand-operated tool are: (1) that it be light in weight and small in size; (2) that it be sufficiently strong structurally to withstand the usual crimping pressures; (3) that it be capable of delivering the desired relatively high crimping pressures by a simple mechanical movement, e.g. the closure of a pair of handles and; (4) that it have a mechanical advantage such that the necessary high crimping pressure can be delivered by application of relatively little manual force, e.g. the force that can be conveniently applied by a woman operator.

It is evident that the simplest way of increasing the mechanical advantage of a crimping tool is to increase the length of the handles and in a number of previously proposed tools this has been done. However, an increase in the length of the handles also increases the weight of the tool which is undesirable.

It is accordingly a principal object of the present invention to provide a hand tool which in relation to its weight has a substantially higher mechanical advantage than the tools that have previously been proposed. It is another object of the invention to provide a hand tool that is capable of developing desired high crimping pressures and that is of sufficiently small size and light

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weight so that it can be held in and operated by one hand.

It is evident that the force required to effect a crimp varies as a function of the extent to which the crimping operation has proceeded. For example, in the initial stages of the crimping operation only a relatively light force need be applied to deform the barrel 14. On the other hand, in the final stages of the crimping operation a relatively large force is required to insure a good electrical contact between the barrel portion of the connector and the conductor. The ideal crimping tool from this standpoint would be one wherein the application of a continuous uniform manually applied input force would produce at the crimping die a force that varies in precise correspondence with the force requirements of the crimping operation. If, for example, the nature of the linkage used in the tool is such that it develops a maximum force at the die when it is only partially closed, then a larger and heavier tool must be used to effect a given crimp. In like manner, if the nature of the tool linkage is such that when it is, for example, half-closed it develops at the die a force that is low in relation to the force required for the crimping operation, then a larger and heavier tool must be used to effect a given crimp. It is accordingly a further object of the present invention to provide a tool having an actuating linkage of such a character that the application of a constant input force produces at the crimping die a force-displacement relationship which closely approaches the force-displacement requirements for crimping a connector. Other objects of the invention will be in part obvious and in part pointed out hereafter.

The many objects and advantages of the present invention can best be understood by reference to the accompanying drawings which illustrate hand tools incorporating two different embodiments of the invention and wherein:

Figure 1 is a side elevation of a hand tool showing the general arrangement of the handles and crimping head as well as the ratchet mechanism interconnecting the handles;

Figure 2 is a top plan view of the tool of Figure 1 particularly showing the locating head of the connector locating mechanism and portions of the crimping mold adjusting mechanism;

Figure 3 is a side elevation of the tool showing the reverse side from that illustrated in Figure 1;

Figure 4 is a bottom view of the tool of Figure 1;

Figure 5 is a vertical section taken on the line 5-5 of Figure 1 and particularly showing the crimping molds;

Figure 6 is a vertical section taken on the line 6-6 of Figure 1 and particularly showing the configuration of the crimping dies that are located at the forward end of the reciprocating plunger;

Figure 7 is a horizontal section taken on the line 7-7 of Figure 5 showing the reciprocating plunger in retracted position and the locating head of the locator mechanism in fully advanced position;

Figure 8 is a section on line 8-8 of Figure 7 showing details of the crimping mold adjusting mechanism;

Figure 9 is a perspective view of a portion of the crimping head showing the crimping mold and disassembled components of the crimping mold adjusting mechanism;

Figures 10, 11 and 12 are vertical sections taken on the lines 10-10, 11-11, and 12-12 of Figure 6 respectively;

Figure 10 particularly includes a side view of the reciprocating plunger and the crimping molds and dies;

Figure 11 particularly illustrates the crimping mold adjusting mechanism;

Figure 12 particularly illustrates the details of the connector locating mechanism;

Figures 13, 14 and 15 comprise an exploded perspective view of the central portion of the crimping head;

Figure 13 shows the connector locator mechanism supporting block;

Figure 14 shows the reciprocatory plunger with the crimping dies at its front end;

Figure 15 shows the plunger guide plate of the crimping head;

Figures 16 and 17, as previously indicated, illustrate an uncrimped and crimped connector respectively;

Figure 18 is a horizontal section taken through the crimping molds and dies and showing a connector and conductor in crimping position and also the manner in which the locator mechanism locates the connector for crimping;

Figure 19 is a view similar to Figure 18 but with the parts in the position they occupy after a connector has been crimped;

Figure 20 is a view generally similar to Figure 18 but showing a tubular connector having a positioning indentation in the center thereof which cooperates with the locating head of the locator mechanism to insure proper positioning of the connector for crimping;

Figure 21 is a section through a modified form of the tool, particularly showing the operating linkage of the tool; and

Figure 22 is a general exterior view of the tool of Figure 21.

Before proceeding to a detailed description of the structure shown in the drawings, it seems desirable to point out that in achieving the objectives of the present invention as outlined above two features of the present hand tool are particularly important. One of these is a manually operable quick-takeup link which moves the crimping die into engagement with the connector before the handles are closed to perform the crimping operation proper, so that nearly the full movement of the handles is available for performing the crimping operation itself. A second important feature of this hand tool is the use of a special linkage mechanism which although somewhat similar to a toggle mechanism is modified in such manner that the manually applied force required to close the handles to crimp the connector is more nearly uniform than it would be with a toggle linkage. The result is that the maximum manually applied force required to crimp a given connector is substantially less using the present linkage than it would be using a comparable toggle linkage. Also the linkage mechanism of the present tool permits a much more compact structure to be used than could be achieved with a conventional toggle mechanism.

Referring to the drawings and more particularly to Figure 1, the tool there shown comprises a crimping head generally designated 24, a handle 26 effectively integral with head 24 and a handle 28 pivotally secured to the head 24. The handles 26 and 28 are interconnected by a ratchet mechanism 30 which operates in such manner that once crimping of a connector has started the handles 26 and 28 cannot again be opened until the crimping operation has been completed. Such ratchet mechanisms are known in the art and hence need not be described in detail herein.

Referring now particularly to Figures 7 and 14 of the drawings, longitudinally slidable in the crimping head 24 there is a reciprocable plunger 32 made up of the two plates 34 and 36 which are secured together and are provided at their forward ends with the wire crimping die 38 and insulation crimping die 40, respectively. The die 38 is positioned to cooperate with a mold 42 formed in the crimping head (see also Fig. 9) to crimp a portion of the connector onto the uninsulated end of the conductor. The die 40 is positioned to cooperate with a crimping mold 44 formed in the crimping head 24 to crimp a portion of the connector onto the insulation of

the conductor. As best shown in Figures 18 and 19, the connector with the end of the conductor inserted therein is positioned between the crimping dies and crimping mold and the plunger is advanced toward the crimping molds to cause the dies 38 and 40 to cooperate with the crimping molds 42 and 44 to crimp the barrel portion 14 of the connector at two points as previously described in connection with Figures 16 and 17. Reciprocating movement of plunger 32 is effected by relative manual movement of handles 26 and 28 in a manner described in detail below.

Referring now to Figures 1 and 6 of the drawings, the handle 26 at its left-hand end merges into a U-shaped housing 46 that effectively forms part of the crimping head. Referring to Figure 6, nested within the housing 46 there is a sub-assembly 47 that is particularly shown in exploded perspective view in Figures 13-15. The sub-assembly 47 comprises in general a locator mechanism supporting block 48 (Figure 13), the plunger 32 (Figure 14) and the plunger guide plate 50 (Figure 15).

Portions of the plunger-actuating mechanism are also shown in Figure 14. Pivotally connected to the rear end of plunger 32 there is a quick-takeup link 52 that has a bifurcated upper end 54 which embraces the rear end of the plunger and is pivotally secured thereto by a pin 53. The handle 28, which is of generally U-shaped cross-section, terminates at its left end in a pair of ears 28a and 28b that embrace both the link 52 and the central portion of plunger 32. The ears 28a and 28b are pivotally connected to the link 52 by a pin 56.

It has been previously pointed out that handle 28 at its left-end is pivoted to the crimping head. This pivotal connection is established by means of a pin 58 (see Figure 13) which is mounted in the block 48 and passes through ear 28b of handle 28, the plunger 32, ear 28a of handle 28 and plate 50. The plunger 32 (see Figure 11) has a slot 59 formed therein to permit reciprocating movement of the plunger with respect to pin 58. The assembled arrangement of the parts just described is shown in Figures 6 and 7 of the drawings.

Referring to Figures 6 and 9-11 of the drawings and more particularly to Figures 10 and 11, the crimping molds 42 and 44 are formed in a crimping mold supporting block 60 that extends into the housing 46. More specifically and as best shown in Figure 6 the inner end of the crimping mold block fits between the lower portions of the locator mechanism support block 48 and the side plate 50 and is secured to these parts, as well as to the housing 46, by a pair of rivets 62 and 64 (shown in Figures 10-12).

Referring now to Figure 9, the wire-crimping mold 42 is formed in the main portion of block 60 whereas the insulation-crimping mold 44 is formed on one end of a slidable member 66 constructed and arranged to slide in a recess or track 68 formed in the block 60. As best shown in Figure 8 both the member 66 and track 68 have upper and lower walls that diverge inwardly in such manner as to prevent movement of member 66 other than the desired sliding movement along the track. The member 66 is positioned along track 68 to provide a desired clearance between the insulation-crimping die and insulation-crimping mold in a manner that will now be described.

Referring to Figure 8 as well as to Figure 9, positioned within the block 60 there is a mold position adjusting pin 70 having a knurled knob 72 at its lower end. At its upper end the pin 70 is provided with a laterally extending arm 74 adapted to engage one of a series of slots 76 formed in the top of block 60 in such manner that the pin is latched against rotation. A spring 78 interposed between the knob 72 and block 60 is biased to urge the pin 70 downwardly and thereby urge the arm 74 into one of the slots 76.

Near its upper end pin 70 is provided with two flat surfaces 80 and 82 located at different distances from the center of the pin. As best shown in Figure 7 the pin is

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partially located within a recess 84 formed in the member 66. The construction is such that the pin 70 acts as a stop to limit outward movement of member 66 and thus of mold 44. When the pin is in the position shown in Figure 7 the periphery of the pin is adapted to engage the inner edge of recess 84 and limit outward movement of member 66 when a connector is crimped. In this position of pin 70 there is minimum clearance between die 40 and mold 44. If it is desired to increase the clearance between the insulation die and mold, the pin is moved manually upward by means of knob 72 to release arm 74 from one of the slots 76 and then rotated 90° counterclockwise and released to cause the arm 74 to fall into another slot 76. When the pin has been thus rotated, flat 80 is in a position to engage the inner edge of recess 84 and thus provide a greater clearance between die 40 and mold 44 during crimping. By rotating pin 70 another 90° flat 82 can be positioned to engage the inner edge of recess 84 and thus still further increase the crimping clearance between the insulation die and mold.

Referring now particularly to Figure 12 of the drawings, the connector locator mechanism is mounted in the block 48 as previously described. The locator mechanism comprises a head 86 having a neck 88 that extends into a bore formed in the block 48 and is secured therein to a shaft 92 which extends through the remaining portion of bore 90 to and beyond the right-hand end of the block 48. Near its right-hand end the bore 90 opens into a larger bore 94 that is internally threaded to receive a nut 96. The nut 96 has a central hole therein of sufficient diameter to permit free movement therethrough of the shaft 92. The bore 90 and shaft 92 define an annular space within which there is a spring 98 that bears at its left and against the neck 88 of locating head 86 and at its right end against the nut 96, the spring being under compression to urge the locating head 86 to the left as viewed in Figure 12.

The portion of shaft 92 to the right of block 48 extends through a hole in an operating lever 100 that is pivotally secured to block 48 near its lower end by a pin 102. The right-hand end of shaft 92 is threaded to receive a pair of lock-nuts 104 that are threaded onto the shaft in such manner as to secure it loosely to lever 100. Clockwise rotation of lever 100 about pin 102 causes the shaft 92 and with it the locating head 86 to be drawn to the right as viewed in Figure 12. The upper end of shaft 100 extends through an opening 106 formed in the housing 46 and is provided at its upper end with the serrations 108 to facilitate pivoting of lever 100 to retract the locating head 86.

The configuration and operation of the locating head 86 are best shown in Figures 18-20 of the drawings. Referring to these figures, the crimping mold block 60 is provided with a stop or positioning member 100 which is secured to the block by a screw 112 (see Figure 7). The operating face of stop 110 is approximately flush with mold 42. The locating head 86 comprises a flange portion 114 and a positioning projection 116 which extends toward the stop 110 but is spaced therefrom a predetermined distance that is slightly greater than the thickness of the tongue of a tongue-type connector. The distance between projection 116 and stop 110 can be adjusted by means of the lock nuts 104 previously described.

The location of the parts with a connector in crimping position is shown in Figures 18-20. Referring to Figure 18, this figure shows a tongue-type connector such as illustrated in Figure 16 in crimping position within the tool. It will be noted that the connector is guided into proper position for crimping by the cooperative action of the stop 110 and the projection 116 of the locating head 86. Projection 116 also limits movement of the uninsulated conductor end 18 into the connector. Figure 19 illustrates the locations of the parts after crimping has occurred.

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In Figure 20 there is illustrated a common type of tubular connector which has an indentation 118 formed therein for positioning purposes. In this case the projection 116 fits into the indentation 118 and the flange 114 bears against the wall of the connector to hold it against the stop 110 and thus insure proper positioning of the connector for crimping. Insertion of such a connector in the tool requires retraction of the locating head 86 by means of lever 100 as previously described.

Reverting now to Figure 1 of the drawing, it has been previously pointed out that the lever 52 is pivotally secured to the plunger 32 by a pin 53 and to the handle 28 by a pin 56, and that handle 28 is effectively and pivotally secured to the crimping head by a pin 58. The lever 52 is urged in a clockwise direction around its pivot 56 by a spring 120 shown in dotted lines in Figure 1. The spring 120 is loosely mounted on pin 56 and has two extending arms 122 and 124 that bear respectively against the interior of handle 26 and the lever 52, the spring being biased to urge lever 52 clockwise and thereby retract plunger 32. Lever 52 extends through and beyond handle 28 when the parts are in the position shown in Figure 1 to form a finger piece 126, by means of which link 52 can be manually rotated to advance the plunger.

The operation of the above-described tool is as follows: A conductor is inserted in a connector as described in connection with Figure 16 of the drawings and the connector and conductor are inserted in the tool as shown in Figure 18. If the connector is of the type illustrated in Figure 20, the lever 100 of the hand tool is pivoted to withdraw the locator mechanism and permit insertion of the connector and conductor into the tool. Thereafter the lever 100 is released to cause spring 98 to advance the locator mechanism and position the connector for crimping as shown in Figure 20.

When the connector has been properly positioned for crimping, link 52 is rotated counterclockwise by manual pressure on the finger piece 126 to advance the plunger until the crimping dies are in contact with the connector. The rotation of link 52 is essentially independent of the closing movement of the handles. However, referring to Figures 1 and 10, it will be apparent from a consideration of the locations of pivots 53, 56 and 58 that as link 52 is rotated counterclockwise, pivot 56 will be drawn a short distance toward the axis of the plunger and a slight closing movement of the handles will occur. The tool illustrated is so constructed that this slight closing movement of the handles causes the ratchet 30 to become engaged. Thus when the link 52 has been manually rotated to a position in which finger-piece 126 is flush with handle 28, it cannot be rotated clockwise by spring 120 until after the handles have been fully closed and the ratchet 30 has become disengaged. This action ensures proper crimping of the connector as the handles are forced together.

Referring now to Figures 21 and 22, these figures illustrate a modified form of tool wherein crimping is effected by a retractive rather than an advancing movement of a plunger. The tool shown in these figures comprises a crimping head 130 provided at its upper end with crimping dies 132 and 134, and a plunger 136 that is reciprocably slidable in the head 130 and includes a cross-member 138 having the dies 140 and 142 which are aligned respectively with dies 132 and 134 of the head 130.

As in the case of the tool of Figure 1, sliding movement of plunger 136 within head 130 is effected by means of opening and closing movement of a pair of relatively pivoted handles. More particularly, head 130 has secured in fixed relation thereto a handle 144, and a second and movable handle 146 is connected at its upper end to the lower end of plunger 136 by a pivot pin 148. Interconnecting head 130 and movable handle 146 there is a quick-take-up link 150 that is pivoted to head 130 at

152 and to movable handle 146 at 154. Link 150 has a manual extension 156 similar to the manual extension 126 of the tool of Figure 1.

Link 150 is urged in a counter-clockwise direction about pivot 152 by a spring 158 that bears at one end against the inside of fixed handle 144, passes around the pivot pin 154 and is connected to link 150. Counter-clockwise movement of lever 150 is limited by an abutment 160 of head 130 against which lever 150 rests when the handles 144 and 146 are fully open. The tool of Figures 21 and 22 is more fully described in my co-pending application Serial No. 581,936, filed May 1, 1956, now Patent No. 2,892,368.

It should be noted that in both the tool of Figure 1 and that of Figure 21, the quick take-up link is effectively perpendicular to the path of motion of the plunger when the handles are open. More particularly, with the handles open, the line connecting pivots 53 and 56 forms approximately a right angle with the line connecting pivots 53 and 58; and the line connecting pivots 152 and 154 forms approximately a right angle with the line connecting pivots 152 and 148.

This arrangement of the quick-takeup link provides several advantages. In the first place it permits a relatively wide angle between the handles in the open position to be used, since the tendency of the tool to lock or bind when such a wide angle is used is overcome by manual rotation of the quick-takeup link. Also because of the perpendicular relationship referred to above the tool is positively locked in open position until the link is manually rotated, and hence inadvertent closure of the handles is avoided. Moreover, rotation of the quick-takeup link advances the plunger into contact with the connector to be crimped with only a slight closing movement of the handles, and therefore almost the entire closing movement of the handles is available for the crimping operation proper.

The particular type of linkage used in the present tool also contributes to the attainment of the objectives set forth at the beginning of the specification. It should be noted that the pivots 56 and 154 move away from both crimping dies during closing movement of the handles and that pivots 53 and 58, as well as pivots 148 and 152, approach one another as the handles are closed. This action is quite different from that of a conventional toggle and as previously pointed out above provides a tool wherein the peak manual force required to crimp a given type of connector is substantially less than it would be if a conventional toggle linkage were used. Moreover, the present linkage provides a more compact structure than a toggle mechanism would provide. As a practical matter this means that the present linkage can be used to build an exceptionally small tool which will develop the necessary high crimping pressures with the application of only a moderate manual force.

A further feature of the present structure is that the pivots 53 and 58 are aligned with the central axis of reciprocation of plunger 32. Similarly pivots 148 and 152 are aligned with the central axis of motion of plunger 136. This central location of the pivots provides a balanced and more effective conversion of manual pressure on the handles into crimping force at the crimping dies and increases the mechanical advantage of the tool.

From the foregoing description it should be apparent that hand tools incorporating the present invention are capable of achieving the several objects set forth at the beginning of the present specification. By using the combination of quick-takeup link and special linkage described above a small light-weight hand tool can be constructed which develops a surprisingly high maximum crimping force. The quick-takeup links 52 and 150 permit the use of a relatively wide handle opening since they provide a means whereby the pivots 53 and 152 can be shifted toward the crimping dies in the head of

the tool before an effort is made to close the handles. Also they permit the lost motion of the plungers to be taken up before significant starting movement of the handles occurs, and hence a relatively large angular movement of the handles is available for a given displacement of the plunger. It has been found that by using the structure of the present invention hand tools can be made no more than 6" long which develop surprisingly high and quite satisfactory crimping pressures.

It is of course to be understood that the foregoing description is illustrative only and that numerous changes can be made in the preferred embodiment described above without departing from the spirit of the invention. For example, the quick-take-up link can be used in conjunction with a linkage other than the specific modified toggle linkage described and shown in the drawings. In like manner, by shifting the pivots 53 and 56, an operative tool can be made without using the quick-take-up link. The pivot 58 can be spaced somewhat from the axis of plunger 32, although preferred results have been obtained by locating pivot 58 at or close to the plunger axis, i.e. in substantial alignment with pivot 52 in the direction of movement of the plunger. Other modifications within the scope of the invention will be apparent to those skilled in the art.

This application is a continuation-in-part of my co-pending application Serial No. 391,269, filed November 10, 1953, now Patent 2,800,042.

I claim:

1. In a hand tool for crimping electrical connectors in combination, a crimping head having a first crimping die therein, a plunger mounted for reciprocating motion in said head and having a second crimping die positioned to cooperate with said first die to crimp a connector placed in the path of said plunger, a pair of handles connected to said head and plunger to reciprocate said plunger, one of said handles being fixed to said head and the other handle having a first pivot near one end thereof, and a link connected to said other handle by a second pivot spaced from said first pivot, said link having a third pivot near one end thereof, one of said first and third pivots being connected to said head and the other of said first and third pivots being connected to said plunger, whereby relative movement of said handles reciprocates said plunger, said link, when said handles are open, being substantially perpendicular to the path of movement of said plunger and having a manually operable extension by which it can be rotated about said second pivot, whereby said handles are locked in open position and can be closed only after said link has been manually rotated to move said plunger toward its crimping position.

2. In a hand tool for crimping electrical connectors in combination, a crimping head having a first crimping die therein, a plunger mounted for reciprocating motion in said head and having a second crimping die positioned to cooperate with said first die to crimp a connector placed in the path of said plunger, a pair of handles connected to said head and plunger to reciprocate said plunger, one of said handles being fixed to said head and the other handle having a first pivot near one end thereof, a link connected to said other handle by a second pivot spaced from said first pivot, said link having a third pivot near one end thereof, one of said first and third pivots being connected to said head and the other of said first and third pivots being connected to said plunger, whereby relative movement of said handles reciprocates said plunger, said link, when said handles are open, being substantially perpendicular to the path of movement of said plunger and having a manually operable extension by which it can be rotated about said second pivot, whereby said handles are locked in open position and can be closed only after said link has been manually rotated to move said plunger toward its crimping position, and spring means interconnecting said link and said

fixed handle and biased to maintain said handles in open position with said link in said perpendicular position.

3. The device of claim 1 wherein the first pivot is connected to the plunger, and the third pivot is connected to the head, and the plunger and head are coaxial, whereby closing movement of the handles causes the plunger to move in a direction toward the handles.

4. In a tool for crimping electrical connectors, in combination, a crimping head, a crimping ram longitudinally slidable therein, connector crimping means on said head and said ram, a first handle fixed to the head, a second handle pivoted to the ram at a first pivot, a link pivoted at one end to the second handle at a second pivot, and at the other end to the head at a third pivot, said pivots so disposed that a line joining said second and third pivots forms an angle of not more than 90° with respect to another line adjoining the first and third pivots when the handles are open and said pivots substantially are aligned when the handles are closed, and means for rotating said link with respect to said head.

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5. The device of claim 4 wherein the means for rotating the link comprises an extension of the link which operates as a lever.

6. The device of claim 4 wherein the ram is coaxial with the head.

References Cited in the file of this patent

UNITED STATES PATENTS

495,793	Fletcher	Apr. 18, 1893
1,058,625	Pepper	Apr. 8, 1913
1,195,065	Morrow	Aug. 15, 1916
2,605,663	Aden	Aug. 5, 1952

FOREIGN PATENTS

138,347	Great Britain	June 17, 1920
953,249	France	May 16, 1949
493,112	Belgium	Jan. 31, 1950
1,092,422	France	Nov. 10, 1954