

April 12, 1966

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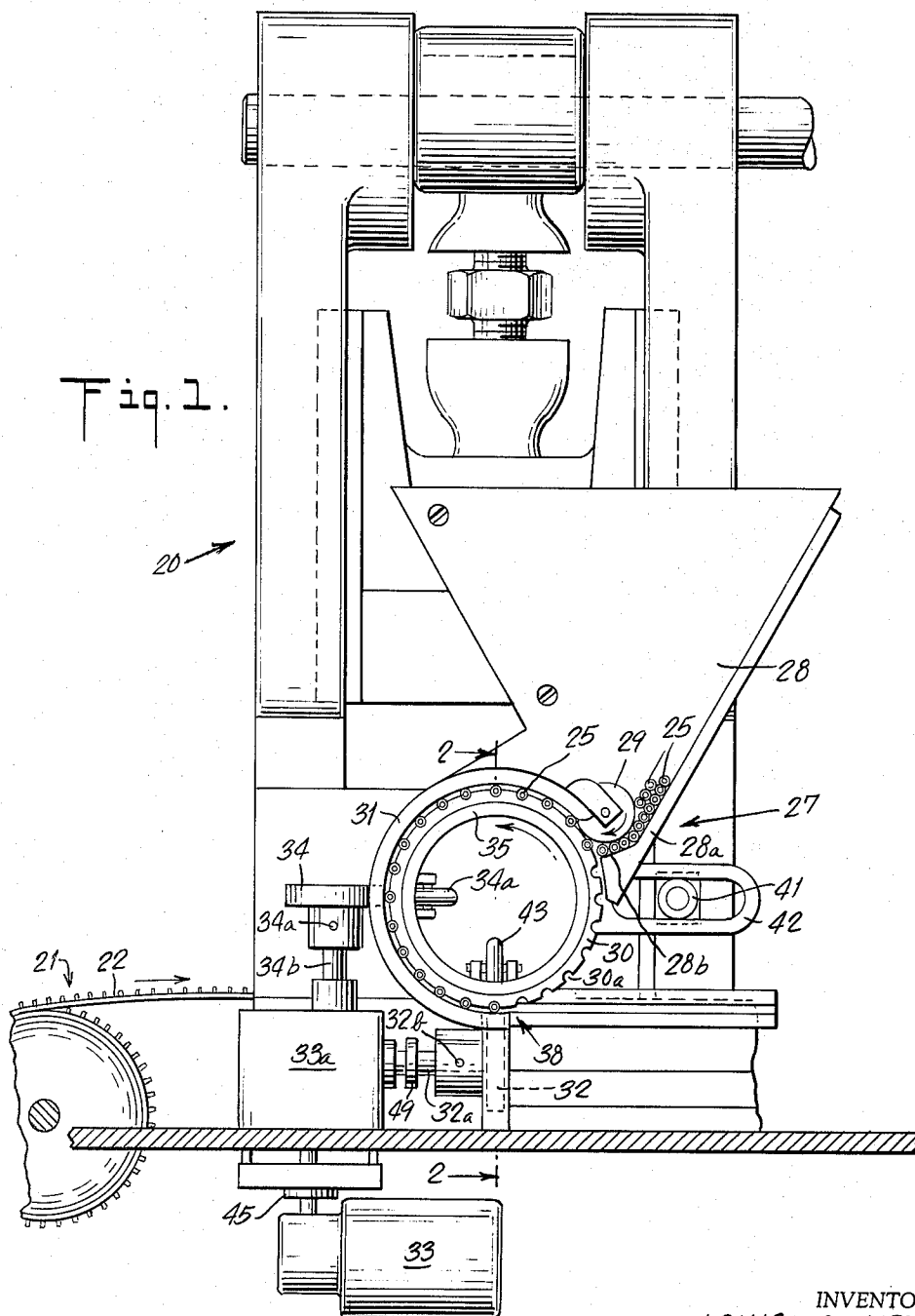
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AUTOMATIC WIRE HANDLING DEVICE

Filed June 14, 1963

5 Sheets-Sheet 1

Fig. 1.

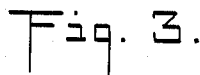


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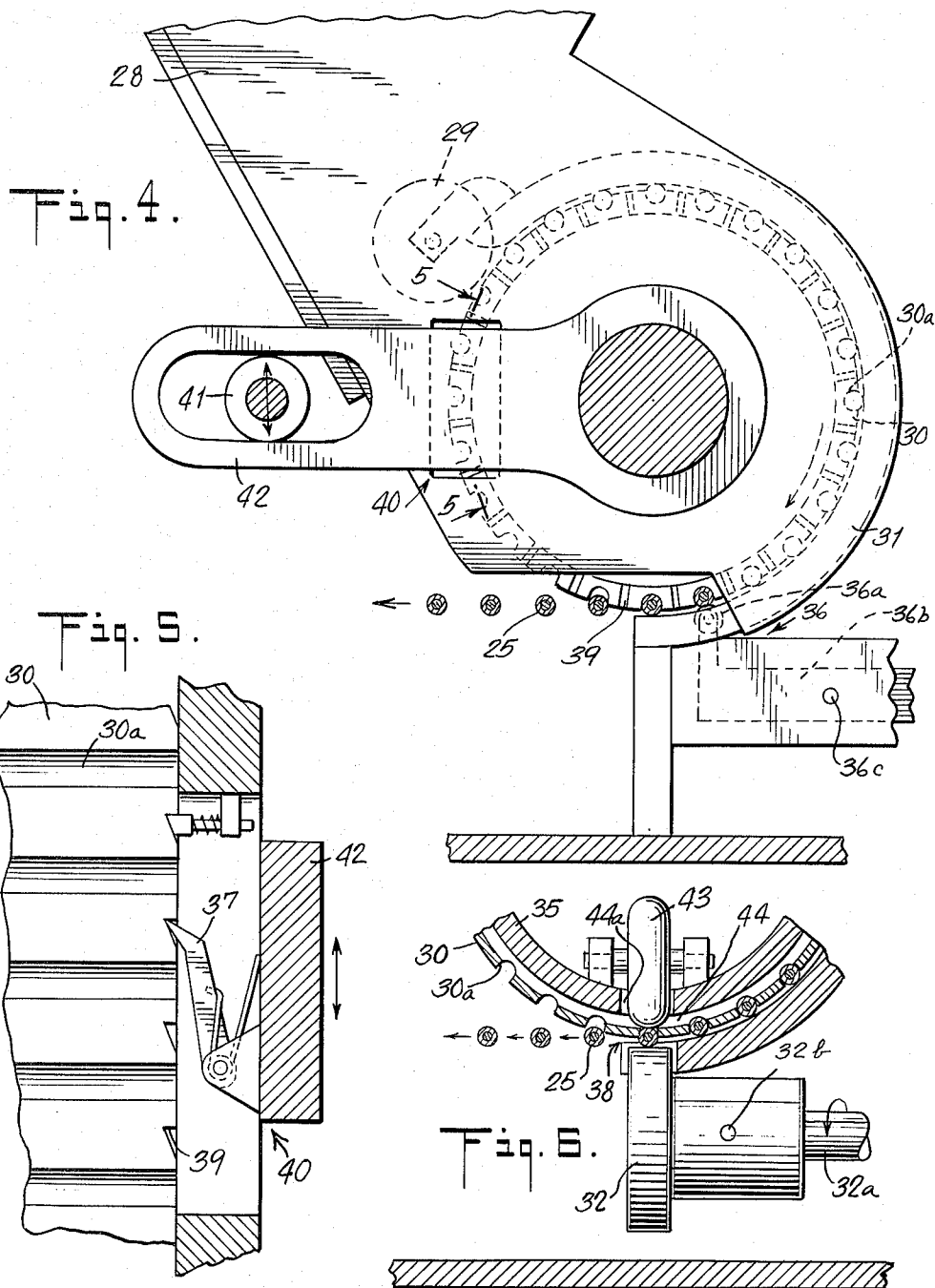
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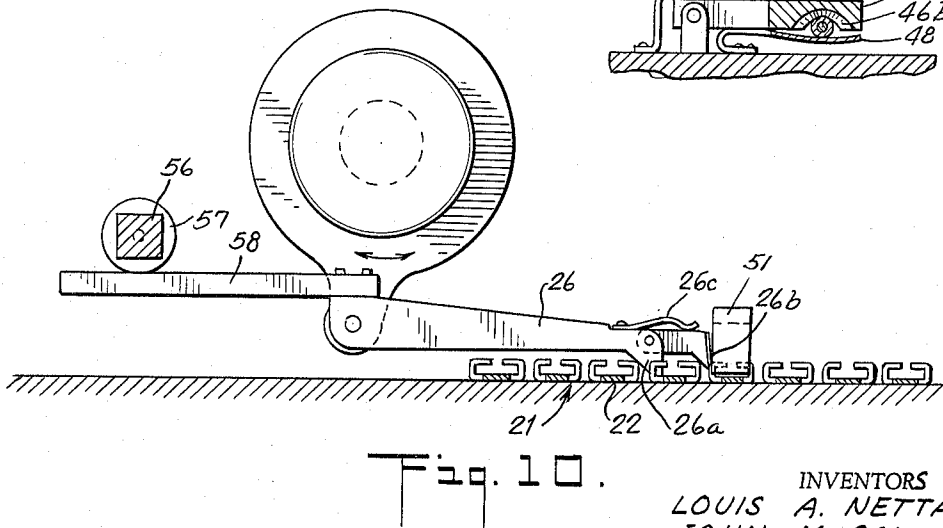
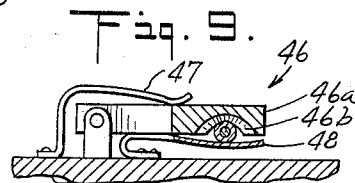
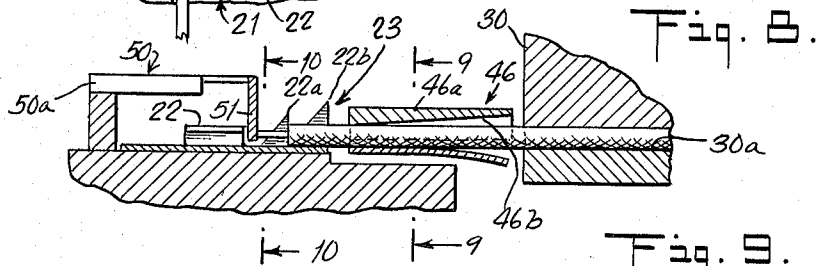
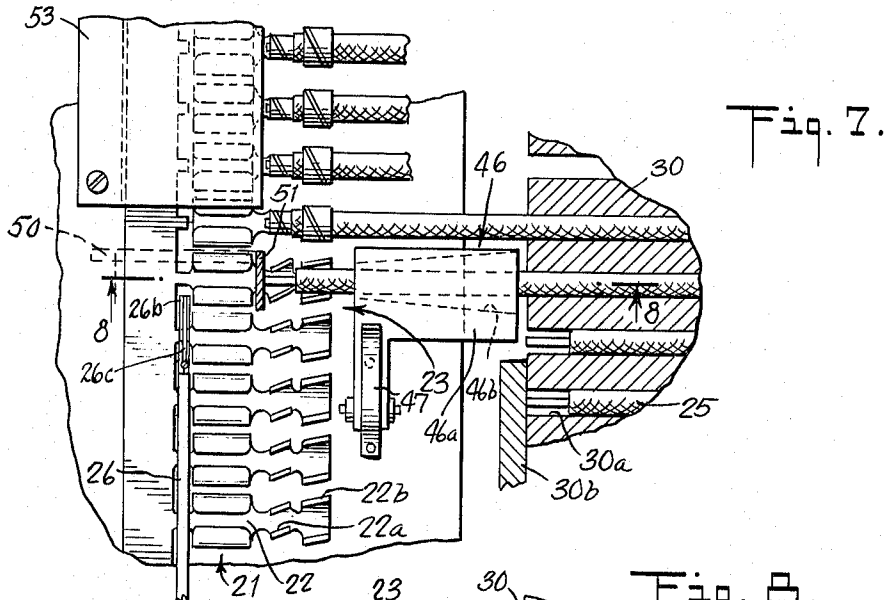
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AUTOMATIC WIRE HANDLING DEVICE

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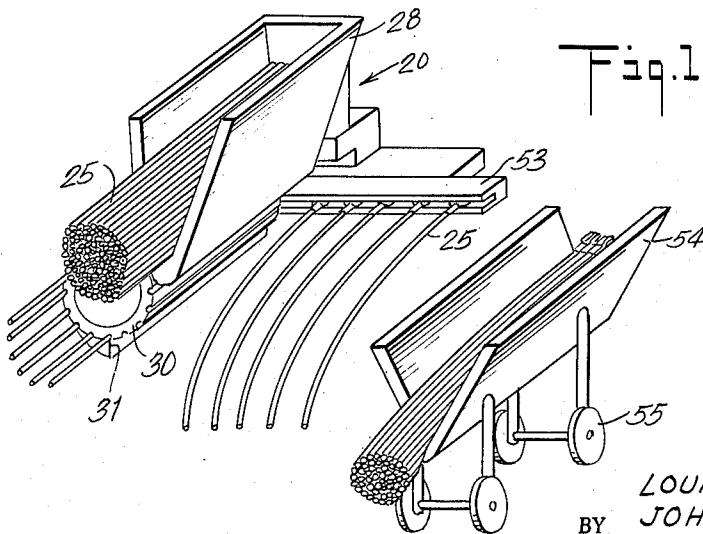
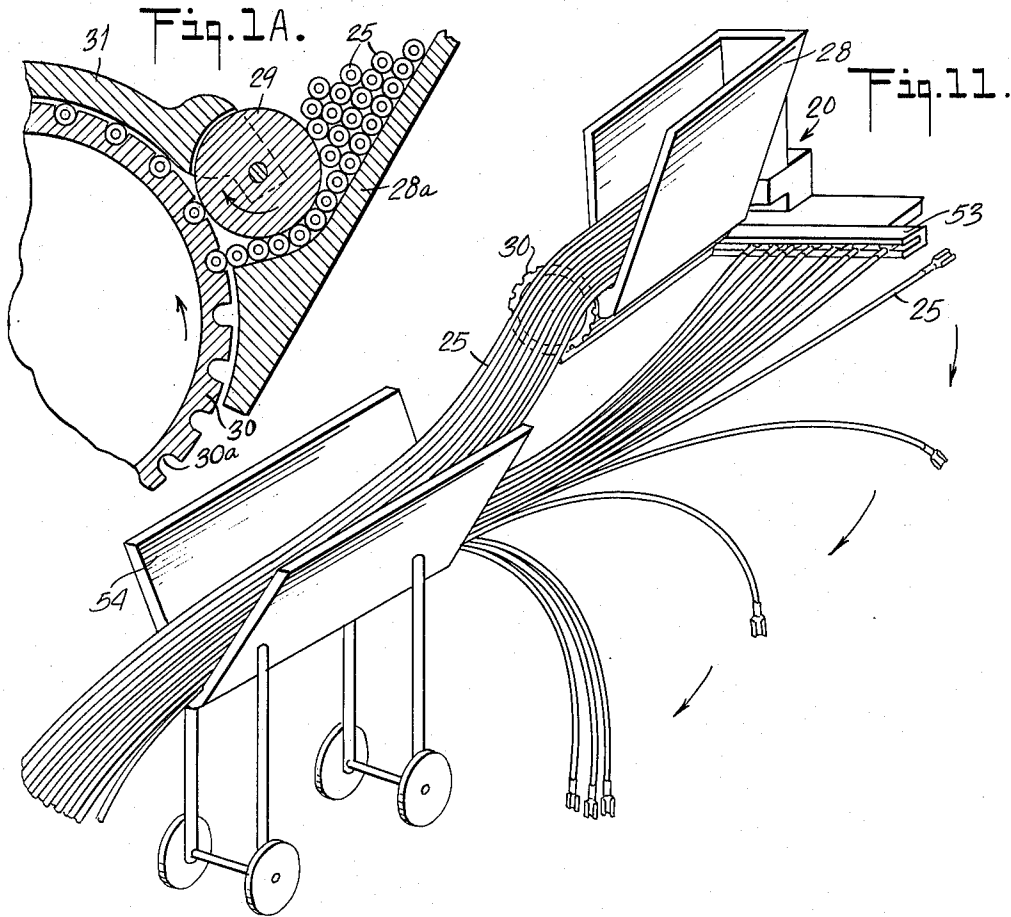
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AUTOMATIC WIRE HANDLING DEVICE

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AUTOMATIC WIRE HANDLING DEVICE

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19 Claims. (Cl. 29—155.55)

The present invention relates to an automatic wire handling device and more particularly to a device for automatically feeding pre-cut prepared lengths of wire into a terminal attaching machine.

At the present time terminals are attached to pre-cut and prepared lengths of wire by an operator who hand feeds the exposed end of the wire into a terminal attaching machine. Once the wire has been properly positioned, the operator depresses a foot control which causes the terminal attaching machine to complete one cycle, during which a connector is attached to the end portion of the wire, either to both the exposed conductor and the insulation covering or to the exposed conductor alone. The attached terminal is then severed from a strip of such terminals. The previously operated-on wire with its attached terminal is ejected and the strip of terminals is fed forward so as to be in position to receive the next wire.

The equipment which is currently in use is capable of applying 20,000 to 21,000 terminals per hour. However, due to the time needed to feed the wires to the attaching machine by hand, skilled operators can only produce in the neighborhood of 2,000 to 2,500 assemblies per hour. Thus, the equipment is operating at substantially 10 percent of its capacity.

There have been previous suggestions in the art for automatically handling wires in a terminal attaching operation. Such equipment, however, is extremely complex and much too expensive for the normal manufacturer to operate economically.

In addition to the human limitations involved in the operations as they are carried out insofar as total production is concerned, there is also some waste because of the operator's failure to correctly position the wire with respect to the terminal attaching device. In other words, if the stripped end of the wire is inserted too far into the terminal attaching machine, the terminal may not be electrically connected to the wire at all, since both the wire gripping portion and the insulation gripping portion may be attached to the insulation. On the other hand, if the stripped portion of the wire is not inserted far enough into the terminal attaching machine, both gripping portions may be attached only to the wire, resulting in a very weak attachment of the terminal member.

Accordingly, it is the object of this invention to provide an improved device for attachment to a standard terminal attaching machine which makes possible the automatic feeding of wires to the terminal attaching machine at a rate commensurate with its cycling rate.

A further object is to insure the automatic feeding and positioning of wires with respect to a continuously operating terminal attaching machine so as to insure a correct attachment of the terminal to the wire.

It is a further object to provide as an attachment for a standard terminal attaching machine an automatic device for feeding wires thereto which has means for sensing the presence or absence of a wire in position to be fed to the attaching position and means for controlling the terminal to prevent the feeding of a terminal to the attaching position in the event no wire is present at the time the attaching portion of the cycle takes place.

With these and other objects and advantages described

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below in mind, the device of this invention is described generally here and in detail below.

The operation of prior art machines which feed wire from a coil, sever a length therefrom, strip its ends and attach a terminal to the stripped wire is quite inflexible. The device of this invention retains the complete flexibility of operation of standard terminal attaching machines without the problems of complexity and expense associated with other units which automatically feed wires for terminal attaching purposes. A standard terminal attaching device which is currently in widespread use is a one-cycle, foot-controlled device. As mentioned above, because of manual feeding and positioning of the wires, it operates at much less than its capacity. Furthermore, even under ideal conditions involving a highly skilled operator, there may be a number of incorrectly attached terminals which result from simple human error of positioning the wire with respect to the terminal attaching machine. The device of this invention eliminates these difficulties while taking advantage of the reliability and capacity of standard terminal attaching machines.

Generally, it can be said that the device of this invention must effectively accomplish three functions in order to replace the operator. The first of these functions is to separate the wires from a bundle of wires so that they are individually presented to the terminal attaching machine. The second function is to provide a means for correctly positioning each wire with respect to the terminal attaching machine so that as the terminal machine goes through its cycle, a terminal will be correctly attached to each wire. The third function is to remove the terminated wire from the attaching position and collect them in a neat manner.

In order to accomplish the first of the above-mentioned functions, means are provided for separating individual wires from a bundle of wires. The bundle of wires, or a portion of one end of a bundle of wires, is placed in a hopper, the lower end of which converges into a narrow channel. A wire segregating and positioning wheel, either independently driven or driven by a geared or frictional connection to a feeding drum, wipes individual wires or a portion thereof into a narrow channel at the base of the hopper. The feed drum is essentially an elongated cylinder having a plurality of slots milled in its exterior which are parallel with its axis of rotation.

As the feed drum indexes, the wire segregating and positioning wheel turns and forces a single wire into one of the aforementioned slots. Because of previous operations and because of the nature of the material, the wires may be bent, and in most cases, do not lie in a single plane. However, for proper attaching conditions, they must be fed into the terminal attaching machines along a substantially straight line which corresponds with their longitudinal axes. Therefore, once a wire is positioned by the wire segregating and positioning wheel within a slot on the feed drum, it must be flattened. This is accomplished by providing a shroud which comes to a point at the location of the wire segregating and positioning wheel with respect to the feed drum. The shroud is made from a sheet of material substantially in the form of a triangle with its apex positioned at the point of the wire segregating and positioning wheel's location and its base extending beyond the station on the feed drum at which the wire is fed to the terminal attaching machine. This "triangle" or shroud is bent around the feed drum and has a radius of curvature which is parallel to the curvature of the feed drum. The shroud is positioned adjacent the feed drum in order to wipe each wire into the desired length of the slot on the feed drum.

In other words, as the feed drum indexes, each wire, or at least a portion thereof, is gradually flattened within

the slot so that by the time the wire or the portion thereof carried by the feed drum reaches the feeding position, it will be substantially supported throughout the length of the feed drum between the shroud and the slot.

In order to align the ends of the wires, pre-positioning means are provided which insure that all the ends of the wires to be terminated are in substantially the same position. The slots of the rotary drum are provided with an opening extending along a portion thereof. After receiving a wire and advancing with respect to the adjacent shroud, each slot approaches a position at which is located a pre-positioning wheel adjacent to the outside portion of the drum. As each slot containing a wire passes adjacent to the pre-positioning wheel, the wheel engages the wire which is urged outwardly by a crowned idler wheel mounted within the drum and engaging the wire through the opening therein. The engagement of the wire by the pre-positioning wheel urges the wire toward the end of the drum adjacent to the terminal attaching machine with the result that, after passing beyond the location of the pre-positioning wheel, all of the wires are arranged with one of the end portions adjacent to one end of the drum.

The rotation of the turret portion of the feed drum is accomplished by mechanically linking, through a spring pawl, the ram of the terminal attaching machine to the drum itself. This insures that for each stroke of the terminal attaching machine's ram, the turret will, on the upward portion of the terminal attaching machine's cycle, be rotated one station.

The device of this invention itself is mechanically located with respect to the terminal attaching machine by a pin arrangement which matches a slot in a plate attached to the terminal attaching machine. This physical attachment of the device of this invention to the terminal attaching machine controls its position. Since the indexing of the feed drum is mechanically linked to the ram of the terminal attaching machine, its synchronous operation therewith is insured.

At the time of the rotation of the feed drum, at which a slot on the feed drum coincides with the correct position of the wire with respect to the terminal attaching machine, the first function of the device of this invention is substantially complete.

At this point the second function of the machine comes into operation. In other words, the segregated wire in proper alignment with the terminal attaching machine is now in position to be fed. The feeding operation is accomplished by the device of this invention as follows. A feed wheel is positioned at the bottom dead center position of the feed drum. The feed wheel is driven by an independent motor. The vertical position of the feed wheel is adjustable for the purposes pointed out below. The surface of the feed wheel is such that it will frictionally engage the wire, and the direction of the rotation of the feed wheel is such as to cause the wire to be fed into the terminal attaching machine. Because the feed drum rotates, it is necessary to mill a slot in the base of the shroud so as to accommodate the rotation of the feed wheel and to insure that its upper surface will be in close proximity to the slots in the feed drum. A crowned idler wheel, mounted on the non-rotating bearing around which the feed drum rotates, is positioned so that as the wire reaches the feed position, a portion of the wire is forced outwardly from the slot far enough so that the surface of the wire comes into contact with the feed wheel. When this occurs, the frictional engagement of the wire now being held between the idler wheel and the feed wheel is such as to cause the wire to be fed along its longitudinal axis and the longitudinal axis in the feed drum into the terminal attaching machine.

A wire guide which has a flared open end facing towards the feed drum receives the end of the wire to which the terminal is to be attached and guides it cor-

rectly into the attaching position in the terminal attaching machine.

Means are provided for controlling the distance into the terminal attaching machine through which the wire is fed so as to prevent either overfeeding or underfeeding. Such controlling means may be electrical sensing means which change the frictional contact of the feed wheel on the wire when it has traveled sufficiently far into the terminal attaching machine. In addition, such means may be pneumatically, mechanically or electrically operated. In many instances it will be sufficient to permit a rubber-faced wire stop at the rear of the attaching portion to halt the inward movement of the stripped end of the wire being terminated. In any case, the function of the controlling means is to insure that the wire is in its optimum position at the time the terminal attaching machine begins its attaching operation.

Once the terminal has been attached to the correctly positioned wire and the terminal attaching machine's ram begins its upward stroke, as pointed out above, the feed drum is indexed to the next position and again presents a wire in the slot of the feed drum ready for feeding to the terminal attaching position. At the same time the third function of the device of this invention is carried out. The ejection procedure takes place with respect to a wire which has just had a terminal attached to it. This insures continued operation and a positive ejection of the wire, with its terminal attached, away from the attaching position. Once the turret has indexed beyond the station next following the attaching station, the wire is no longer supported in the slot on the feed drum by the shroud.

The terminal attachment then occurs in the normal manner. As the terminal is ejected, it may be guided by a slot and then fall into a hopper or other means to insure its being carried away from the terminal attaching machine and the device of this invention.

It may be desirable to insure that no terminal is placed in position ready to be attached whenever there is no wire present within a slot at the time a particular slot on the feeding drum reaches the attaching position. To accomplish this, a mechanical connection may be effected between a modified feed pawl of the terminal attaching machine and a sensing member. The sensing member has a spring-biased finger which will fall into a slot on the feed drum if there is no wire present. The normal feed pawl of the terminal attaching machines currently in use is replaced by the feed pawl which has its ejection portion pivotally attached to its terminal feeding portion. This modified feed pawl itself is pivotally mounted, as is presently the case. A rearwardly extending lever arm is rigidly attached to the feed pawl. Riding on this attached lever arm there is provided a linkage between a spring-biased member which bears against the feed drum of the device of this invention.

If no wire is present, the spring-biased member falls into a slot, thus causing rotation of the mechanical linkage and causing the portion of the linkage bearing on the feed pawl extension lever to cause counterclockwise rotation of the feed pawl which raises its feeding lip sufficiently far so as to clear the terminal strip and thus avoid feeding a terminal into the terminal attaching position. However, since the ejection portion is pivotally attached and is spring-biased downwardly, it will remain down and will eject the terminal with its wire attached away from the terminal attaching position. If a wire is present, the spring-biased member cannot fall into the slot, and the feed pawl remains in its normal position so as to feed a terminal for every cycle of operation.

It will be seen that by accomplishing the three functions above-described, the device of this invention replaces the need for manual segregating, feeding and removal by an operator; permits the terminal attaching machine to operate up to its full capacity; correctly positions a wire with respect to the terminal attaching machine; insures positive ejection of a wire with a terminal attached; and

if desired, prevents feeding of a terminal in the event no wire is in the position to be fed to the terminal attaching machine.

With these objects, features and advantages in mind, the device of this invention will be better understood by consideration of the detailed description of elements set forth below, along with the drawings, in which:

FIG. 1 is a front elevational view of a terminal attaching machine with the wire feeding and positioning device of the invention connected thereto;

FIG. 1A is a fragmentary section view taken along the line 1A—1A in FIG. 2 and showing details of the wire segregating elements of the device of this invention;

FIG. 2 is a fragmentary vertical section view taken along the line 2—2 in FIG. 1 and showing a wire being fed from the rotary feed drum;

FIG. 3 is a fragmentary horizontal section view taken along the line 3—3 in FIG. 2 and showing the wires disposed in the slots of the rotary drum adjacent to its shroud;

FIG. 4 is an enlarged fragmentary vertical section view taken along the line 4—4 in FIG. 2 and showing a portion of the linkage connecting the ram to the rotary drum;

FIG. 5 is an enlarged fragmentary section view taken along the line 5—5 in FIG. 4 and showing a pawl and teeth arrangement for engaging the ram to the rotary drum;

FIG. 6 is an enlarged fragmentary vertical section view taken along the line 6—6 in FIG. 2 and showing the wheel arrangement for feeding the wires;

FIG. 7 is an enlarged fragmentary horizontal section view taken along the line 7—7 in FIG. 2 and showing the strip of terminals before and after attachment to the wires;

FIG. 8 is a fragmentary vertical section view taken along the line 8—8 in FIG. 7 and showing a wire positioned with respect to a terminal prior to being attached thereto;

FIG. 9 is a fragmentary vertical section view taken along the line 9—9 in FIG. 8 and showing the guide for directing the wire toward the terminal;

FIG. 10 is a fragmentary vertical section view taken along the line 10—10 in FIG. 8 and showing the feed pawl arrangement for the strip of terminals;

FIG. 11 is a perspective view showing the wires supported in a hopper mounted on wheels both during and after attachment of the terminals;

FIG. 12 is a perspective view showing the wires with terminals attached thereto being delivered to a hopper mounted upon wheels.

The device illustrated in FIG. 1 constitutes two major elements. The first of these is a terminal attaching machine illustrated generally at 20. This element is of the standard variety. It is a single cycle machine which feeds strip 21 of connected terminals 22 (FIG. 7) past an anvil and die station, which will be referred to hereafter as the terminal attaching station 23. A reciprocating ram 24 on the downward stroke crimps a terminal onto wire 25 which is positioned at terminal attaching station 23 (FIG. 2). On the upward stroke, the terminal attached to the wire is ejected from terminal attaching station 23 and terminal strip 21 is fed forward so that the next terminal is in position to be crimped onto a wire inserted into the terminal attaching station. The feeding operation is controlled by a feed pawl 26, which will be more fully described hereinbelow. Feed pawl 26 translates forwardly during the upward stroke of ram 24 while during the beginning of the ram's downward movement, it moves backwardly (FIG. 10).

The second major element is the wire feeding and positioning attachment illustrated generally at 27 (FIG. 1). The wire feeding attachment 27 is composed of the following elements: hopper 28, segregating and positioning wheel 29, rotary feeding drum 30, cover or shroud 31, pre-positioning wheel 34, feed wheel 32 and driving motor

33 bearing mount 35 which supports feeding drum 30 (FIG. 1), wire guide 46 (FIGS. 7-9), wire presence sensor 36 (FIG. 4), and for use in connection with the latter, special feed pawl 26 (FIG. 10).

For the sake of convenience, the above-listed elements of the wire feeding attachment are described in the order in which each becomes operative during the normal cycle of operation and the elements of wire presence sensor 36 are described last.

In general, wires 25 which are to be fed by the device of this invention are made up in loose bundles and loaded into hopper 28. Because of prior operations and the nature of the wire, considerable warpage or bending of the wires may be present. Additionally, without an expensive sorting and aligning operation, the ends of the wires will not be aligned evenly. Therefore, prior to being fed to terminal attaching machine 20, individual wires 25 must be segregated and must then be fed so that they enter into the terminal attaching machine the required amount and at the proper time.

The segregating and positioning function is accomplished by segregating and positioning wheel 29 in conjunction with guide element 28b attached to or forming a part of hopper wall 28a. The space between the periphery of segregating and positioning wheel 29 and wire guiding element 28b is such that it constantly decreases until at their closest point or the point at which the wire 25 is removed from the wire guide 28b by the segregating wheel 29, the space is only equal to or slightly less than one diameter of the wire 25 being fed.

The segregating wheel 29 may be frictionally driven by the rotation of feed drum 30 or may be driven from a separate motor by a flexible shaft or the like. As shown in FIG. 1, the means for rotating the segregating wheel 29 in order that the wires 25 be properly presented to the feed drum 30 comprises the frictional engagement of the periphery of wheel 29 to the periphery of drum 30. A flexible shaft may be provided, actuated by driving motor 33, to drive wheel 29 at a peripheral speed in excess of the peripheral speed of feed drum 30. This insures positive segregation of an individual wire 25 from the bundle in hopper 28 while guide element 28b and the periphery of wheel 29 insure an axial positive feed of wire 25 into slot 30a.

Segregating wheel 29 is illustrated as being pivotally mounted on the pointed end of shroud 31. Since there is very little clearance between the segregating wheel and the feed drum, the effect of the segregating action is to wipe one wire into one of slots 30a formed in the surface of feed drum 30. Slots 30a are formed in the outer surface of the feed drum 30 and are so constructed as to support a length of wire 25 to be fed. Because of varying wire sizes, a plurality of drums may be provided which are interchangeable, thus permitting the same unit to accommodate a variety of wire sizes.

As has been pointed out above, the wires 25 themselves may be warped or bent. Shroud 31 is a substantially right triangular piece bent around drum 30 in order to present an under surface which is parallel to more than half of the periphery of the feed drum. The shroud 31 is closely spaced adjacent to the outer surface of the feed drum 30 and as the drum 30 is indexed around to feeding station 38, wire 25 is constantly being flattened into slot 30a throughout a greater and greater portion of its length until at the time of feeding, it is supported throughout almost the full extent of the length of the slot 30a.

Feeding drum 30 is provided with teeth 39 into which falls a spring-pressed pawl 37 which forms a part of mechanical linkage 40 (FIG. 5) connecting wire feeding device 27 to terminal attaching machine 20. Mechanical connection 40 itself is formed by stud 41 attached to ram 24 of terminal attaching machine 20 (FIG. 3). Stud 41 in turn has attached to its other end connecting rod 42. The connecting rod in turn is engaged with ratchet teeth 39 by pawl 37. As indicated above, spring-pressed pawl

37 fits into the teeth 39 on feed drum 30. As can be seen from the figures, on each upward stroke of ram 24, drum 30 is caused to rotate one position. The relative position of stud 41 along the slot in rod 42 determines the relationship of the movement of the ram to that of the feed drum so that when adjustments in the stroke of the ram are made, the movement of the feed drum remains the same.

As feed drum 30 is indexed and wire 25 is fully supported in slot 30a and adjacent shroud 31, the drum arrives at feeding station 38 (FIG. 6). At this point idler wheel 43, which has a crowned outer surface, forces the portion of wire 25 adjacent it in slot 30a outwardly, and into contact with feed roll 32. Idler wheel 43 is pivotally attached with respect to mount 35 as illustrated in FIG. 6, and extends into peripheral groove 44 milled on the inner surface of feed drum 30 a sufficient distance so that open slot 44a is formed through which idler wheel 43 may protrude. At the point at which wire 25 is gripped between feed roll 32 and the idler roll 43, it will be thrust forward into terminal attaching station 23 (FIG. 8).

As shown in FIG. 1, an arrangement similar to that of feed roll 32 and idler wheel 43 is employed to urge the wires disposed in the slots of rotary drum 30 in the direction of terminal attaching machine 20 prior to the feeding operation in the terminals. Thus, pre-positioning wheel 34 engages each of the wires with respect to crowned idler wheel 34a and urges the wires toward end portion 30b of the drum (FIG. 3). In this way it is insured that each of the wires is placed in a predetermined position, namely, against or closely adjacent to the end portion 30b of the drum prior to being fed toward the terminals by feed wheel 32. As shown in FIG. 1 pre-positioning wheel 34 is actuated by motor 33 through gear box 33a which also drives feed wheel 32. The vertical position of wheel 34 is made variable by set screw 34a which attaches wheel 34 to its shaft 34b.

Feed wheel 32 is driven by independent motor 33 which may be adjustable both as to speed and as to position relative to feed drum 30. The speed at which wire 25 is fed will be governed by the time during which the wire 25 must be fed prior to the downward stroke of ram 24. The relative position of the surface of the feed wheel 32 with respect to the drum 30 will to a large extent govern the amount of frictional contact between the wire 25 and the feed wheel 32 and again be variable depending upon the required amount of frictional force necessary to feed the wire into terminal attaching station 23.

Adjustments in speed of operation are made by applying a speed control to motor 33. The vertical position of feed wheel 32 is adjusted by means of adjusting screw 45 (FIG. 1) which adjusts the vertical position of gear box 33a. The longitudinal position of feed wheel 32 is controlled by set screw 32b which attaches feed wheel 32 to its shaft 32a.

As wire 25 is fed forwardly, it first passes through wire guide 46 (FIG. 7). Wire guide 46 is made up of a plate 46a which has converging slot 46b milled in its underside. Plate 46a itself is pivotally mounted and is held in its normal position by leaf spring 47 above and leaf spring 48 below. Spring 48 tends to close converging slot 46b formed in plate 46a. Normally, bottom spring 48 is slightly stronger than the top spring 47 so that the tendency will be to feed wires 25 into terminal attaching station 23 in a higher position, since the descending crimping tool 24a (FIG. 1) will have a tendency to gather loose strands of wire. If, however, the wire is fed in too low a position, its strands will become engaged in the terminal so that less than all of its strands will be gathered and the crimping of the wire gripping portion 22a of terminal 22 will not include all of the strands of wire 25 (FIG. 7).

The normal rubber stop means 51 may be relied on to halt the inward movement of wire 25. If necessary, a

sensing means 50 (FIG. 8) may be provided in conjunction with stop 51 so that when wire 25 has been fed far enough into terminal attaching station 23, the feed will be interrupted either by clutching arrangement 49 (FIG. 1) in conjunction with feed wheel 32 operated pneumatically, electrically or mechanically. The sensing means may be a microswitch 50a actuated by stop plate 51 of terminal attaching machine 20 so as to have the same effect.

The wire 25 is thus properly positioned during the upward stroke of ram 24. Next, ram 24 descends and causes wire gripping portion 22a and insulation gripping portion 22b to be crimped onto the wire. At the same time, severing tool 52 cuts the terminal from the strip (FIG. 2). As pointed out above, as ram 24 moves upwardly, feed pawl 26 is operative to eject the crimped-on terminal and wire and to feed the next succeeding terminal 22 into position. Likewise, the feed drum 30 is indexed one position and another wire is fed into the terminal attaching position.

This rotation of feed drum 30 carries wire 25 with its attached terminal 22 beyond terminal attaching station 23, at which point shroud 31 ends and permits the wire to pass into exit guide 53 (FIGS. 11 and 12). The portion of wire 25 in guide 46 is pulled therefrom by the combined action of the ejection lip 26b of feed pawl 26 and the indexing of feed drum 30. Beyond the end of the exit guide 53, the wire 25 can drop into hopper 54 or, if desired, be carried away. Hopper 54 can be mounted on wheels 55 to facilitate its movement.

In order to make this device more flexible and to safeguard against waste of terminals 22, wire presence sensor 36 is provided. The wire presence sensor is composed of a spring-loaded follower 36a carried on shroud 31. Follower 36a is biased towards slots 30a and if no wire is present, the follower falls into the slot. This causes lever 36b, on which the spring-loaded follower is attached, to rotate about its pivot point 36c. This in turn causes arm 56 attached to lever 36b to urge roller 57 down on feed pawl attachment arm 58 and causes counterclockwise rotation of feed pawl 26 (FIG. 10). This elevates feed pawl 26 and prevents its terminal advancing lip 26a from contacting terminal strip 21 and thus prevents positioning terminal 22 in terminal attaching station 23.

At the same time, the previously crimped terminal and its wire must be ejected from the terminal attaching position 23. This is accomplished, since terminal ejection lip 26b of the feed pawl 26 is pivotally attached and is spring-biased downwardly by leaf spring 26c. Thus, as arm 58 is rotated counterclockwise and the terminal advancing lip 26a is removed from its operative position, terminal ejecting lip 26b is rotated clockwise by spring 26c so as to still be in a position to eject the previously crimped-on terminal. Thus, the device of the invention eliminates the wasting of terminals when no wires are present on which terminals can be attached.

As will be seen from the above discussion, the device of this invention can be easily attached to standard terminal attaching machine 20. Its accurate location is insured by means of locating pin 59 (FIGS. 2 and 3) which fits into bracket 60 bolted to terminal attaching machine 20. Synchronism between the terminal attaching machine and wire feeding and positioning device is insured by mechanical linkage 40 between ram 24 and feed drum 30. Segregation of individual wires is assured by segregating and positioning wheel 29 in conjunction with wire guide 28b. Accurate positioning of the wire 25 in terminal attaching station 23 is insured by pre-positioning wheel 34, feed wheel 32 and guide 46 guiding the wire during the feeding operation and by means 51 which control the distance into terminal attaching station 23 through which the wire is fed.

The device of this invention will handle leads on wires 25 of almost any normal length. For long wires 25 a

wheeled cart 54 (FIG. 11) may be employed to support the major portion of the length of wires 25. The bundle of wires 25 is lifted up into hopper 28 and are individually segregated, fed, terminated, guided away from the attaching position by guide 53 and then the terminated ends fall free. A cart 54 which can carry a great number of wires 25 thus permits an adequate supply of wires 25 without making it necessary to be constantly reloading hopper 28.

When the wires 25 are of substantially the same length as feed drum 30, the entire bundle may be placed in and supported by the hopper 28. In this case, the cart 54 may be positioned at the exit end of guide 53 to receive the terminated leads and collect them in a neat manner.

The device of this invention therefore permits a single operator to tend a number of machines easily and, therefore, results in a great cost and labor savings by replacing the need for an operator for each machine.

Thus, the device of this invention operates at a rate which is equal to the capacity of the terminal attaching machine. Accuracy of the position of the wire is insured and a substantially fewer number of rejections result. The device of this invention is extremely simple and is readily attached to standard machines. Its reliability is such that production can be very materially increased with more accurate results and at a substantial saving.

The terminals 22 and the terminal attaching machine 20, illustrated in the drawings and described above, are of a particular type. Thus, the terminals 22 are carried into the unit as a strip 21. However, the device of this invention will operate on other types of terminal attaching machines where the terminals are all separately formed prior to being fed to the attaching position.

While the device illustrated and described represents a preferred embodiment, it will be appreciated that mechanical equivalents can be employed without departing from the scope of the appended claims.

What is claimed:

1. In a machine having means for attaching a terminal to the end portion of a wire adjacent thereto, the combination comprising means for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, said receiving means having an opening therein, a drum disposed adjacent to said opening having at least one slot extending along the length thereof, said slot being adapted to receive one of said end portions from said opening, means for rotating said drum to move said slot from adjacent said opening to a predetermined position, and means for feeding said end portion in a direction extending along the length of said slot when at said predetermined position to the means for attaching the terminal thereto.

2. In a machine having means for attaching a terminal to the end portion of a wire adjacent thereto, the combination comprising means for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, said receiving means having an opening therein, a drum disposed adjacent to said opening having at least one slot extending along the length thereof, said slot being adapted to receive one of said end portions from said opening, means for advancing said end portion toward the end of said slot in a predetermined direction to place said end portion at a predetermined location therein, means for rotating said drum to move said slot from adjacent said opening to a predetermined position, and means for feeding said end portion in substantially said predetermined direction when at said predetermined position to the means for attaching the terminal thereto.

3. In a machine having means for attaching a terminal to the end portion of a wire adjacent thereto, the combination comprising means for receiving an end portion of each of a plurality of wires to which a terminal is

to be attached, said receiving means having an opening therein, a drum disposed adjacent to said opening having at least one slot extending along the length thereof, said slot being adapted to receive one of said end portions from said opening, a wheel member disposed adjacent to said slot and adapted to engage said end portion disposed therein to advance said one end portion toward the end of said slot, means for rotating said wheel member to advance said end portion with respect to the end of said slot in a predetermined direction, means for rotating said drum to move said slot from adjacent said opening to a predetermined location, and means for feeding said end portion in substantially said predetermined direction when at said predetermined location to the means for attaching the terminal thereto.

4. In a machine having means for attaching a terminal to the end portion of a wire adjacent thereto, the combination comprising means for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, said receiving means having an opening therein, a drum disposed adjacent to said opening having at least one slot extending along the length thereof, said slot being adapted to receive one of said end portions from said opening, means for rotating said drum to move said slot from adjacent said opening to a predetermined location, means adjacent to said drum in rolling engagement with said one end portion for urging said one end portion into said slot, and means for feeding said end portion when at said predetermined location to the means for attaching the terminal thereto.

5. In a machine having means for attaching a terminal to the end portion of a wire adjacent thereto, the combination comprising means for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, said receiving means having an opening for releasing individual wires of said plurality therefrom, a drum member disposed adjacent to said opening, the outer surface of said drum having at least one slot adapted to receive one of said end portions, means for rotating said drum to move said slot from a location adjacent to said opening in said receiving means to a feeding location in response to the operation of the means for attaching a terminal, means enclosing at least a portion of said drum for directing and retaining said end portion into said slot, and means for feeding said end portion from said slot at said feeding location to the means for attaching the terminal thereto.

6. In a machine having means for attaching a terminal to the end portion of a wire adjacent thereto, the combination comprising means for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, said receiving means having an opening therein, a drum disposed adjacent to said opening having at least one slot extending along the length thereof, said slot being adapted to receive one of said end portions from said opening, means for rotating said drum to move said slot from adjacent said opening to a predetermined location, a shroud member disposed adjacent to said drum and extending from adjacent said opening to adjacent said predetermined location, and means for feeding said end portion in a direction extending along the length of said slot when at said predetermined location to the means for attaching the terminal thereto.

7. In a machine having means for attaching a terminal to the end portion of a wire adjacent thereto, the combination comprising means for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, said receiving means having an opening therein, a drum disposed adjacent to said opening having at least one slot extending along the length thereof, said slot being adapted to receive one of said end portions from said opening, means for rotating said drum to move said slot from adjacent said opening to a predetermined location, a shroud member disposed adjacent to said drum and extending from adjacent said opening to adjacent said

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predetermined location, the length of said shroud along the length of said drum increasing in a direction extending from adjacent said opening, the increasing length of said shroud progressively urging said one end portion into said slot, and means for feeding said end portion when at said predetermined position to the means for attaching the terminal thereto.

8. In a machine having means for attaching a terminal to the end portion of a wire adjacent thereto, the combination comprising means for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, said receiving means having an opening therein, a drum disposed adjacent to said opening, the outer surface of said drum having at least one slot extending along the length thereof, said slot being adapted to receive one of said end portions from said opening, means for rotating said drum to move said drum slot from a location adjacent to said opening in said receiving means to a feeding location in response to the operation of said means for attaching a terminal, means enclosing at least a portion of said drum for directing and retaining at least said end portion of said individual wires into said slots, means for urging said end portion from said receiving means toward said opening, said urging means being disposed adjacent to the opening in said receiving means and the outer surface of said drum, and means for feeding said end portion from said slot at said feeding location to the means for attaching a terminal thereto.

9. In a machine having means for attaching a terminal to the end portion of a wire adjacent thereto, the combination comprising means for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, said receiving means having an opening therein, a drum disposed adjacent to said opening, the outer surface of said drum having at least one slot extending along the length thereof, said slot being adapted to receive one of said end portions from said opening, means for rotating said drum to move said drum slot from a location adjacent to said opening in said receiving means to a feeding location in response to the operation of means for attaching a terminal, means enclosing at least a portion of said drum for directing and retaining at least said end portion of said individual wires into said slots, a wheel member disposed adjacent to the opening in said receiving means and the outer surface of said drum and having its axis of rotation substantially parallel to that of said drum, said wheel member urging said end portion from said receiving means towards said opening, and means for feeding said end portion from said slot at said feeding location to the means for attaching the terminal thereto.

10. In a machine having means for attaching a terminal to the end portion of a wire adjacent thereto, the combination comprising means for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, said receiving means having an opening therein, a drum disposed adjacent to said opening, the outer surface of said drum having at least one slot extending along the length thereof, said slot being adapted to receive one of said end portions from said opening, means for rotating said drum to move said drum slot from a location adjacent to said opening in said receiving means to a feeding location in response to the operation of said means for attaching a terminal, means enclosing at least a portion of said drum for directing and retaining at least said end portion of said individual wires into said slots, a wheel member disposed adjacent to the opening in said receiving means and the outer surface of said drum and having its axis of rotation substantially parallel to that of said drum, means for rotating said wheel member to urge said end portion from said receiving means towards said opening, and means for feeding said end portion from said drum slot at said feeding location to the means for attaching the terminal thereto.

11. In a machine having means for attaching a terminal to the end portion of a wire adjacent thereto, the

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combination comprising means for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, means for segregating one of said end portions from said receiving means, ratchet means responsive to the actuation of the attaching means for moving said segregating means from adjacent said receiving means to a predetermined location, and means for feeding said segregated end portion to the means for attaching the terminal thereto.

12. In a machine having means for attaching a terminal to the end portion of a wire adjacent thereto and means for delivering the terminals to the attaching means, the combination comprising means for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, means for segregating one of said end portions from said receiving means, means for feeding said segregated end portion to the means for attaching the terminal thereto, and means for interrupting operation of the means for delivering the terminals in response to the failure of said segregating means to segregate one of said end portions from said receiving means.

13. In a machine having means for attaching a terminal to the end portion of a wire adjacent thereto and means for delivering the terminals to the attaching means, the combination comprising a hopper for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, said hopper having an opening therein, a drum disposed adjacent to said opening having at least one slot extending along the length thereof, said slot being adapted to receive one of said end portions from said opening, means for rotating said drum to move said slot from adjacent said opening to a predetermined location, means for feeding said end portion when at said predetermined position to the means for attaching the terminal thereto, and means for interrupting operation of the means for delivering the terminals in response to the absence of said end portion from said slot after said drum has been rotated from adjacent said opening.

14. In a machine having means for attaching a terminal to the end portion of a wire adjacent thereto and means for delivering the terminals to the attaching means, the combination comprising a hopper for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, said hopper having an opening therein, a drum disposed adjacent to said opening having at least one slot extending along the length thereof, said slot being adapted to receive one of said end portions from said opening, means for rotating said drum to move said slot from adjacent said opening to a predetermined location, means for feeding said end portion when at said predetermined location to the means for attaching the terminal thereto, means for interrupting operation of the means for delivering the terminals, and a follower for actuating said interrupting means in response to the absence of said end portion from said slot after said drum has rotated from adjacent said opening.

15. In a machine having means for attaching a terminal to the end portion of a wire adjacent thereto, the combination comprising means for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, means for segregating one of said end portions from said receiving means, means for feeding said end portion segregated thereby to the means for attaching the terminal thereto, and abutment means for engaging said end portion of the wire and terminating the feeding of said segregated end portion when said segregated end portion is at a predetermined position with respect to the means for attaching the terminal.

16. A device for the handling of the end portion of a wire to a machine for attaching a terminal thereto, said device being adapted to be connected to said machine and comprising means for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, said receiving means having an opening, a drum disposed adjacent to said opening, the outer surface of

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said drum containing at least one slot adapted to receive one of said end portions from said opening, means for rotating said drum to move said slot from a location adjacent to said opening in said receiving means to a feeding location in response to the operation of the machine for attaching a terminal, a wheel member disposed adjacent to said feeding location for engaging said end portion disposed in said slot of the drum, and means for rotating said wheel member to urge said end portion engaged thereto toward the machine for attaching the terminal thereto.

17. A device for the handling of the end portion of a wire to a machine for attaching a terminal thereto, said device being adapted to be connected to said machine and comprising a hopper for receiving an end portion of each of a plurality of wires to which a terminal is to be attached, said hopper having an opening therein, a drum disposed adjacent to said opening having at least one slot extending along the length thereof, said slot being adapted to receive one of said end portions from said opening, means for rotating said drum to move said slot from adjacent said opening to a predetermined location in response to the actuation of the machine for attaching a terminal, means for moving said end portion with respect to said slot toward an end of said drum, means for feeding said end portion when at said predetermined position to the machine for attaching a terminal thereto, and means for interrupting operation of the means for delivering the terminals in response to the absence of said end portion from said slot after said drum has been rotated from adjacent said opening.

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18. A method of delivering an end portion of a wire to means for attaching a terminal thereto comprising the steps of receiving an end portion of each of a plurality of wires to which a terminal is to be attached, segregating one of said end portions from said plurality of wires, moving said end portion being segregated to a predetermined location, straightening said end portion being moved, and feeding said straightened end portion from said predetermined location to the means for attaching the terminal thereto.

19. A method of delivering an end portion of a wire to means for attaching a terminal thereto, said attaching means having means for delivering terminals thereto, said method comprising the steps of receiving an end portion of each of a plurality of wires to which a terminal is to be attached, segregating one of said end portions from said plurality of wires, feeding said end portion to the means for attaching the terminal thereto, and interrupting the operation of the terminal delivering means in response to the failure to feed said end portion to the terminal attaching means.

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