Nov. 6, 1962 G. H. SCHWALM ETAL 3,062,390

WIRE HANDLING APPARATUS

Filed April 3, 1961 7 Sheets-Sheet 1

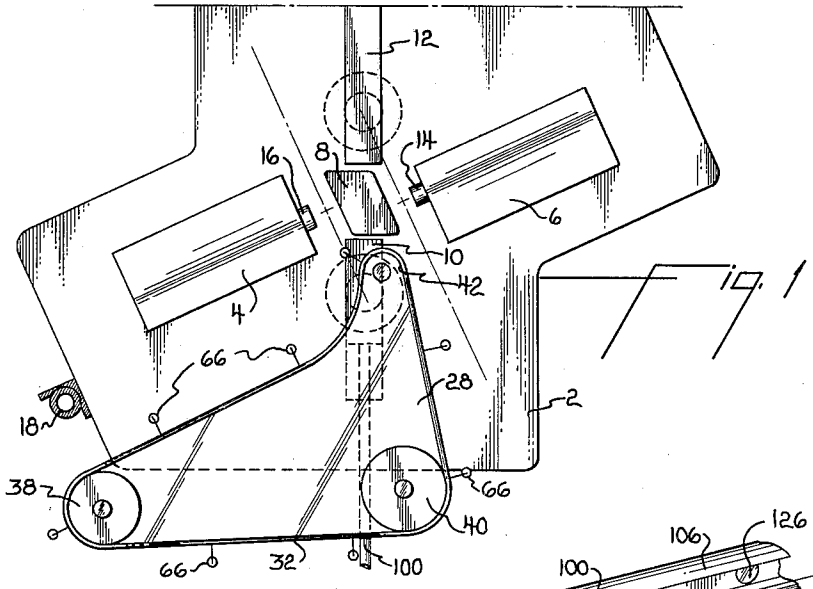


Fig. 1

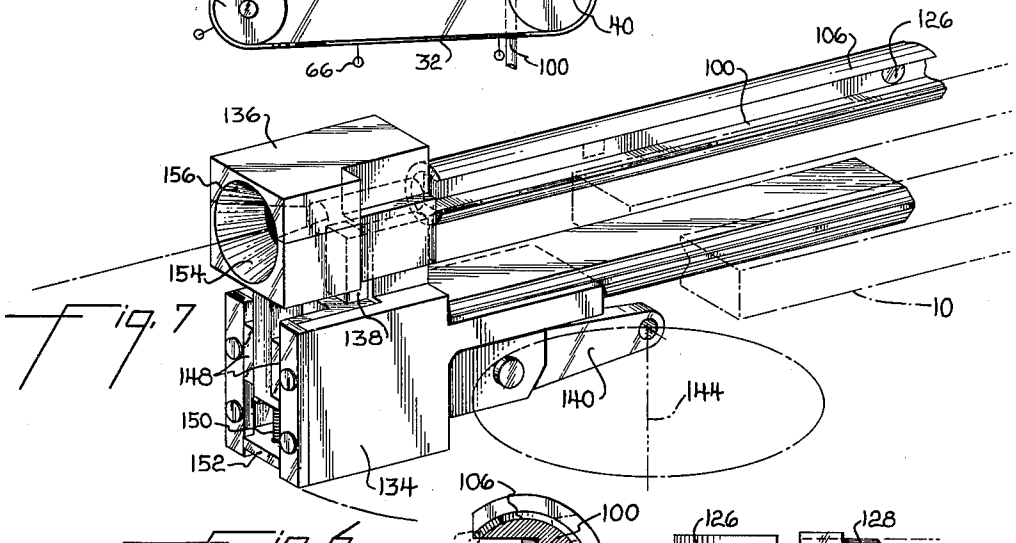


Fig. 7

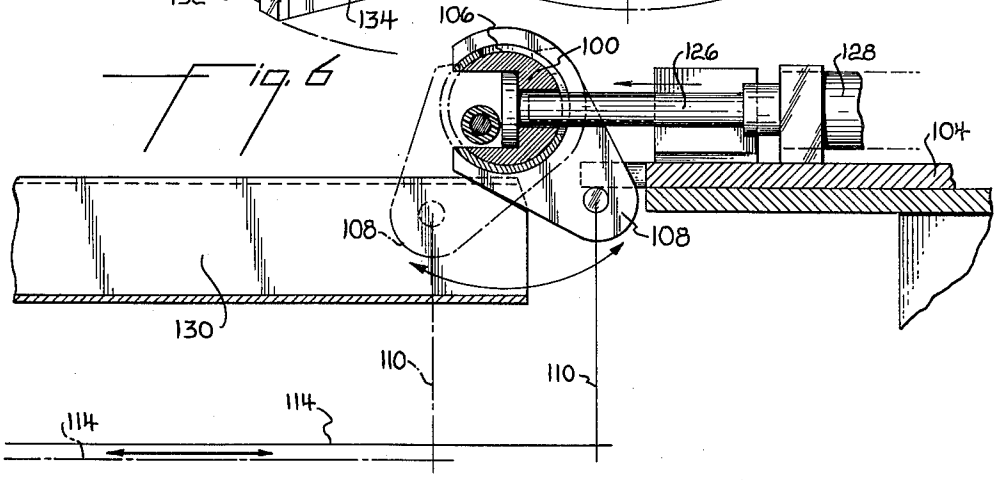


Fig. 6

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WIRE HANDLING APPARATUS

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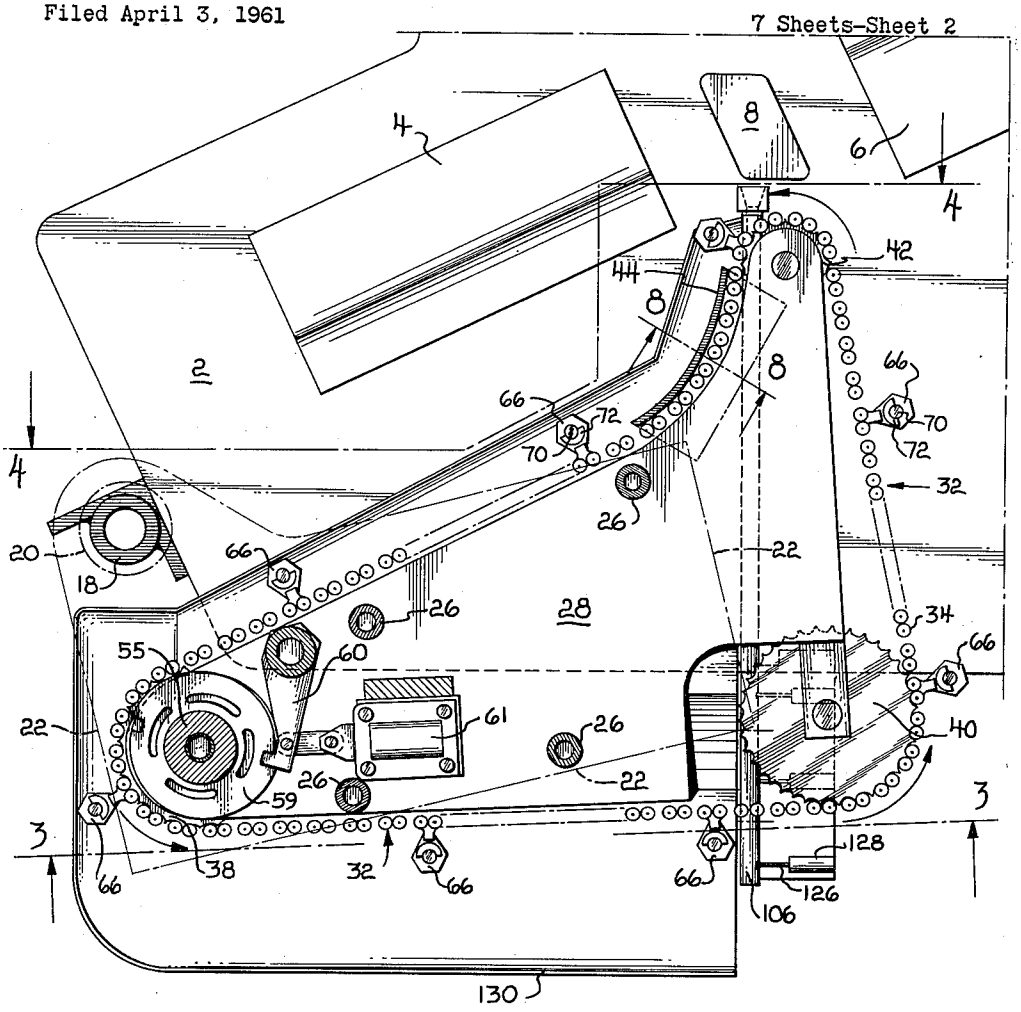


Fig. 2

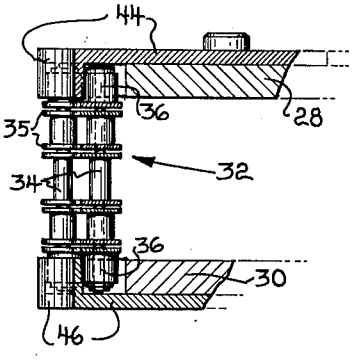


Fig. 8

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WIRE HANDLING APPARATUS

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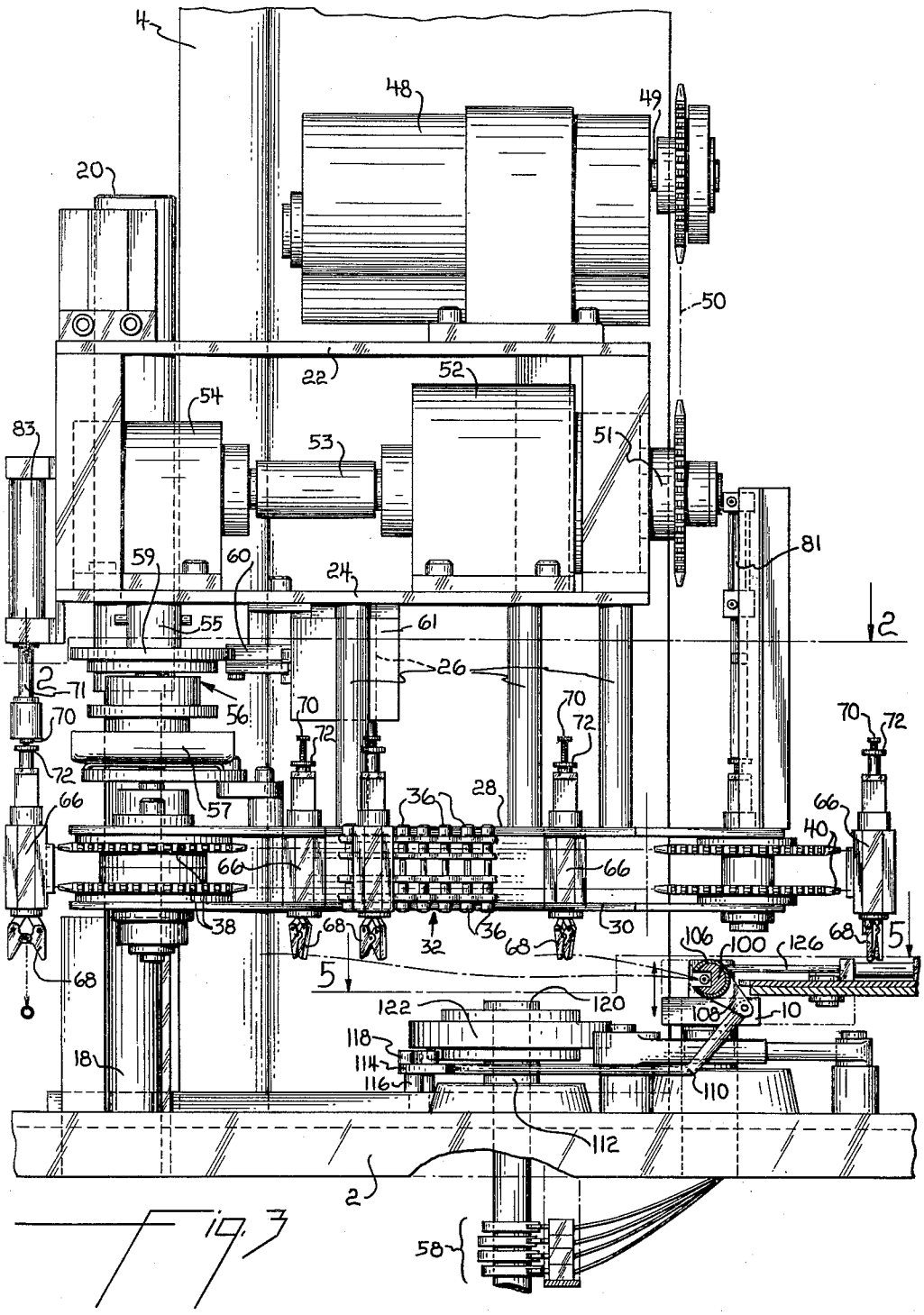


Fig. 3

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WIRE HANDLING APPARATUS

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Fig. 4

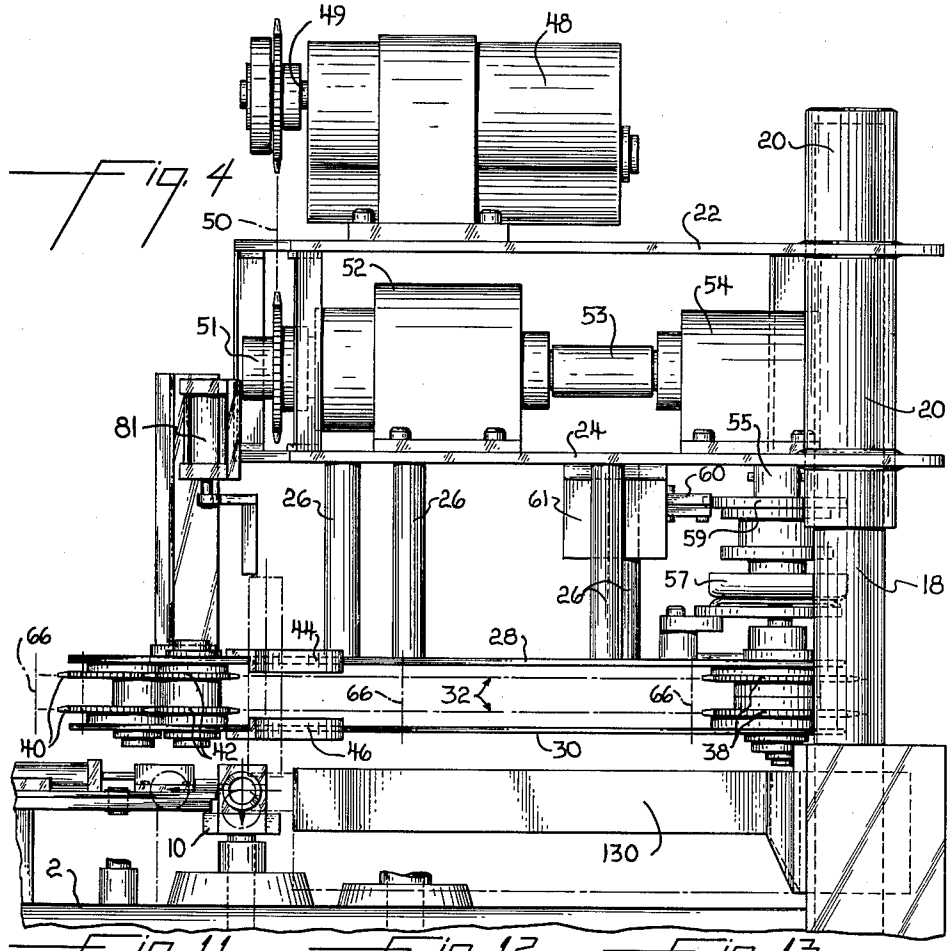


Fig. 11

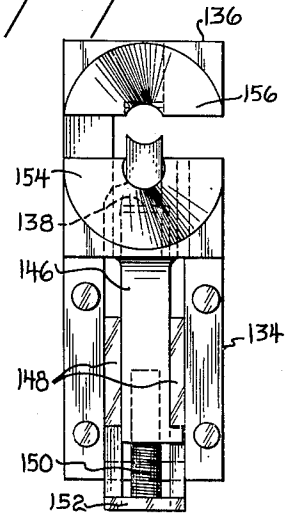


Fig. 12

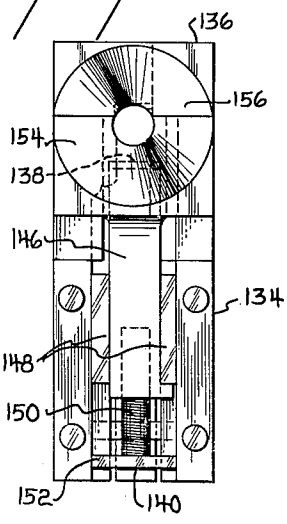
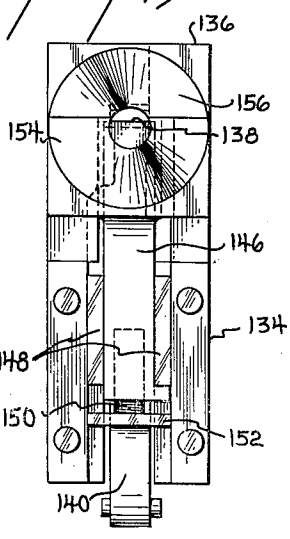


Fig. 13



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WIRE HANDLING APPARATUS

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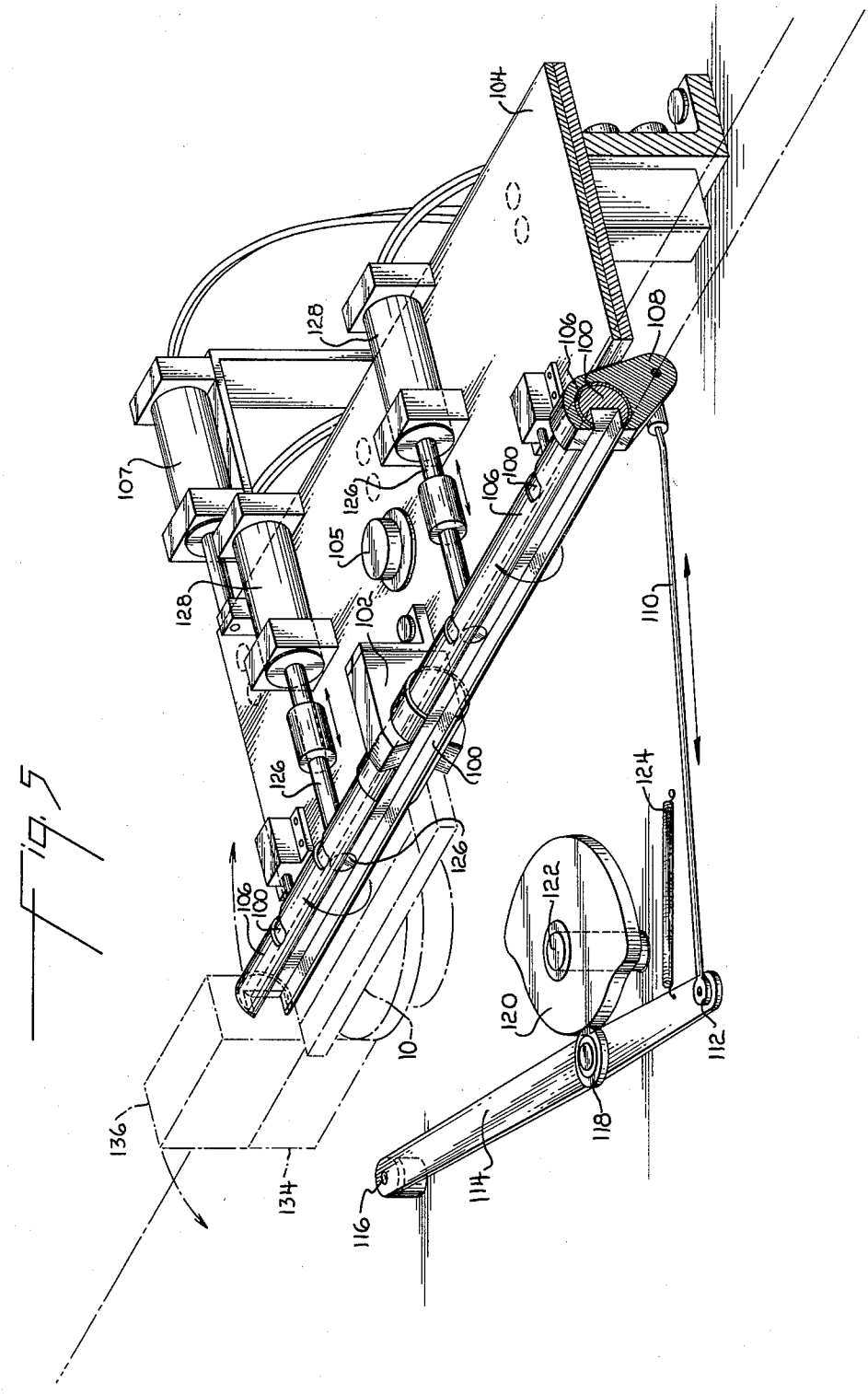


Fig. 5

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Fig. 9

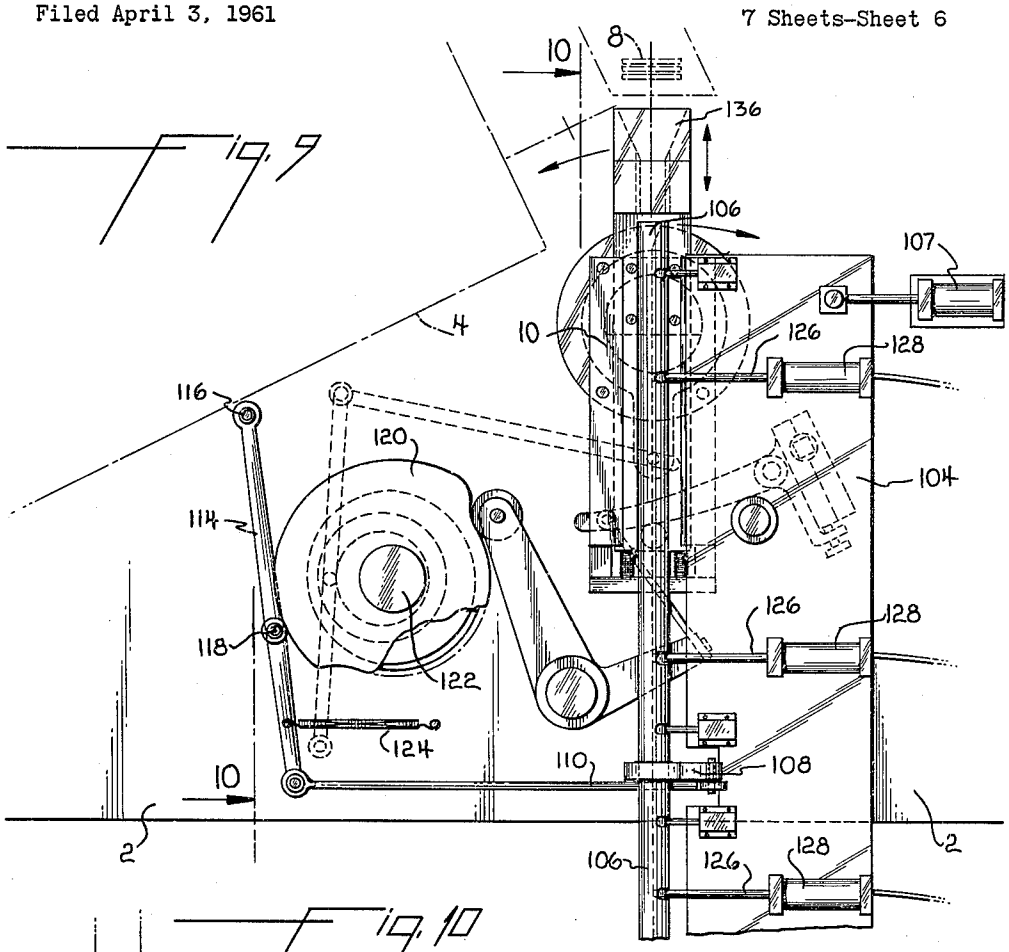
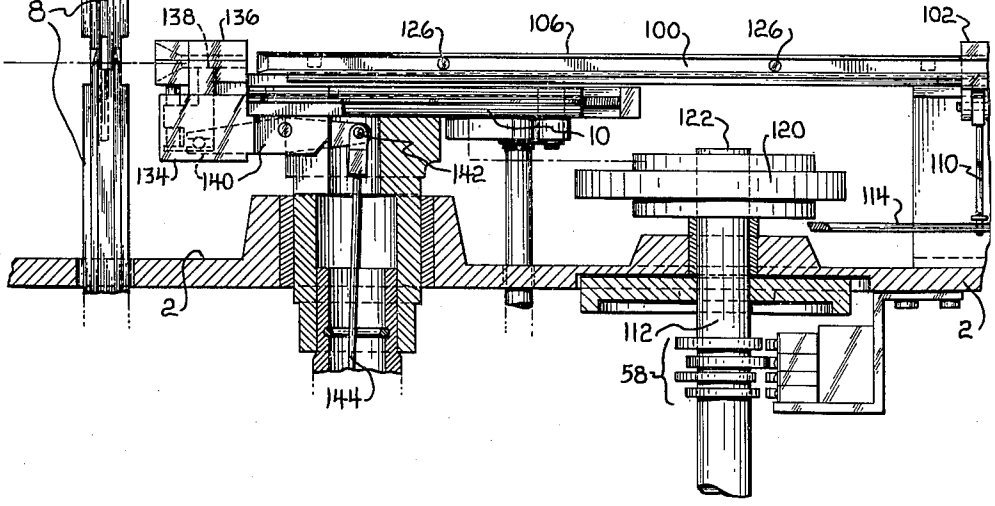


Fig. 10



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Fig. 14

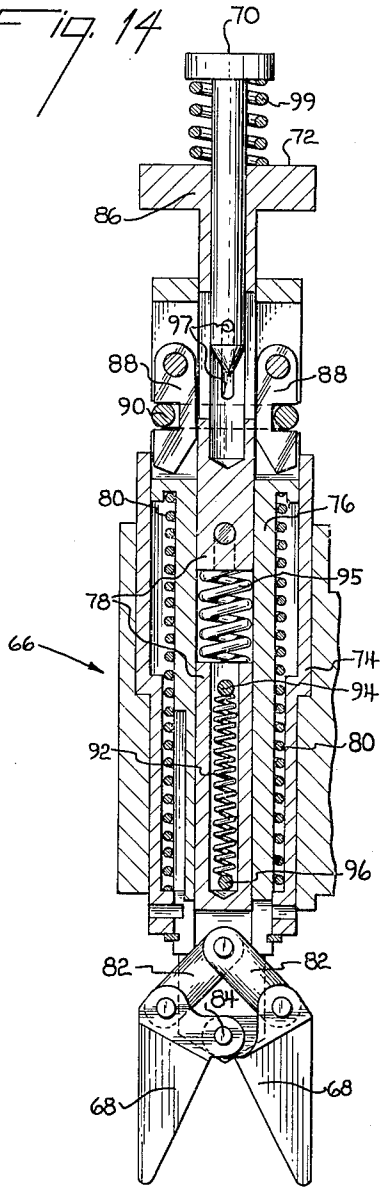
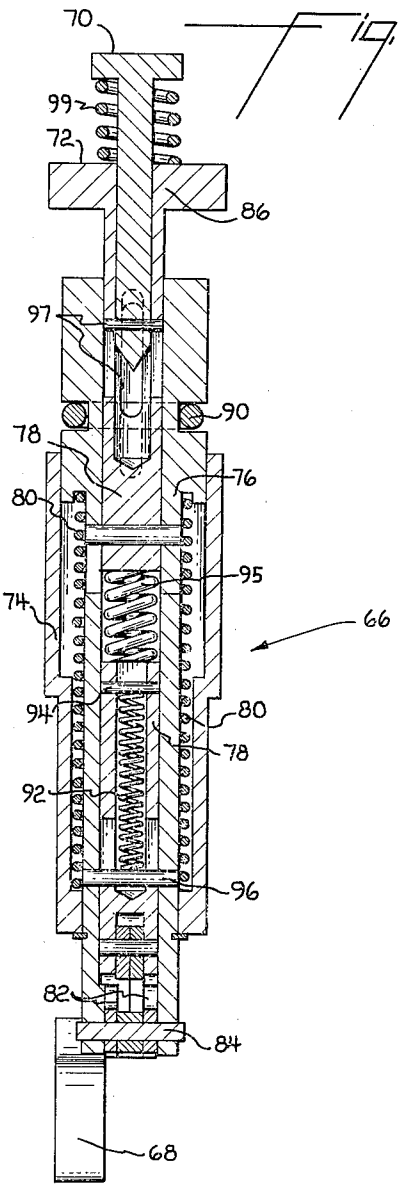


Fig. 15



United States Patent Office

3,062,390
Patented Nov. 6, 1962

3,062,390

WIRE HANDLING APPARATUS

Glendon H. Schwalm and Robert Ullman, Harrisburg, and Earl W. Wagner, Lebanon, Pa., assignors to AMP Incorporated, Harrisburg, Pa.

Filed Apr. 3, 1961, Ser. No. 100,340
5 Claims. (Cl. 214—6)

This invention relates to apparatus for handling and stacking pliable filamentary materials, particularly wires, and is particularly intended for usage in conjunction with an automatic lead making machine.

The copending application of Glendon H. Schwalm et al., Serial No. 748,722, filed July 15, 1958, now Patent Number 3,019,679 discloses and claims a fully automatic lead making machine which axially and intermittently feeds wire, cuts a lead from the end of the fed wires, strips insulation from the cut ends of the wire and lead, and crimps terminals unto these stripped ends. This apparatus has received a favorable reception and is in general usage on a commercial scale. Its principal advantages are that it is capable of relatively high speed operation, in the range of 3,000 to 6,000 leads per hour, and is capable of producing relatively long leads, up to 15 feet in length.

It has been found that when this apparatus is operated, and particularly when relatively long leads are being manufactured, the limiting factor of its operation is not within the apparatus itself but rather the removal and handling the finished leads. In the embodiment of this apparatus shown in the above-mentioned application, the finished leads are removed by pneumatic ejection from an ejection tube and must then be manually picked up and placed in a suitable container. This manual operation is highly undesirable in an otherwise fully automatic operation and limits the speed of the machine itself. Furthermore, where extremely long leads are being produced, it has been found that the relatively simple pneumatic ejection system of the Schwam et al. application is not adequate to move the leads out of the operating zone of the apparatus.

It is accordingly an object of the instant invention to provide an improved handling device for handling and transporting wire leads or the like. It is a further object to provide a device capable of extremely high speed operation so that the removal of the finished leads from the automatic lead making machine does not impose a speed limitation upon the operation of the machine itself. A still further object is to provide a machine which, while operating at relatively high speeds, will remove and neatly stack the finished leads so that they can periodically be manually removed. A still further object is to provide a device which is not limited with respect to the length of the leads handled and stacked.

These and other objects are achieved in a preferred embodiment of the invention intended for usage with a lead making machine and comprising a conveyor which is intermittently moved along a path extending laterally of the direction of feeding of the wire. A plurality of wire gripping and holding devices are mounted on this conveyor at evenly spaced intervals, these devices being of a type such that upon reception of an actuating stroke from an external source they are operative to grasp a finished lead and, upon a second actuating stroke from

an external source, will release the finished lead. The conveyor is indexed in timed relationship with operation of the lead making machine so that substantially concurrently with the finishing or the completion of the crimping operation on the lead, its end is gripped by the wire-holding device on the conveyor which is adjacent to the crimping station. The conveyor is then indexed and the finished lead is moved laterally and out of the crimping zone. Since the lead itself may be quite long, there is also provided in the preferred embodiment an elongated tube into which the wire is initially fed. When the conveyor is indexed, the finished lead is pulled laterally from this tube which is thus cleared for the subsequent wire feeding operation. The removal of the lead from the tube is assisted by a plurality of pushing devices which push the lead laterally from the tube as the conveyor is indexed. Upon arrival of the lead gripping device at the eject or release station, the lead gripper is again engaged by an external actuator and releases the lead above a tray provided for its reception. Since every lead produced by the machine is released at precisely the same spot, the leads produced are neatly stacked in a pile with their ends in alignment with each other. The finished stack of leads can be manually removed and when so removed will be in the form of a neat bundle so that tedious and time-consuming aligning and untangling operations on the part of the operator are unnecessary.

In the drawing:

FIGURE 1 is a diagrammatic plan view showing a lead making machine having a wire handling and stacking device in accordance with the invention.

FIGURE 2 is a sectional plan view showing a lead handling and stacking device in accordance with the invention taken aling the lines 2—2 of FIGURE 3.

FIGURE 3 is a front elevation view taken along the lines 3—3 of FIGURE 2.

FIGURE 4 is a rear elevation view taken along the lines 4—4 of FIGURE 2.

FIGURE 5 is a perspective view showing a guide tube which forms a part of the preferred embodiment.

FIGURE 6 is a sectional end view of the guide tube.

FIGURE 7 is a perspective view showing a wire clamp used in conjunction with the invention.

FIGURE 8 is a fragmentary sectional view showing a conveyor which forms part of the preferred embodiment.

FIGURE 9 is a plan view showing the guide tube and the mechanism for controlling the opening thereof.

FIGURE 10 is a sectional view taken along the lines 10—10 of FIGURE 9.

FIGURES 11, 12 and 13 are frontal views of the wire clamp and illustrating its operation; and

FIGURES 14 and 15 are sectional views of a wire holder used in conjunction with the invention.

The instant invention is herein disclosed in conjunction with a fully automatic lead making machine of the type disclosed in the above-mentioned Patent 3,019,679 of Glendon H. Schwalm et al. Since the specific details of this lead making machine itself do not form part of the instant invention, it is shown in the attached drawings and described in the following specification in general terms and only insofar as is essential for a clear understanding of the present invention.

Referring now to FIGURE 1, reference numeral 2 denotes a platform upon which are mounted a pair of crimp-

ing presses 4, 6 in face-to-face relationship. A wire cutting and insulation cutting device 8 is mounted between these presses and a lead carrier 10 and a wire carrier 12 are mounted in normal axial alignment with each other on each side of the wire cutting and insulation cutting apparatus 8. A wire feeding device, not specifically shown, is provided adjacent to the wire carrier 12 so that wire from a substantially endless source, such as a coil, can be fed axially through the wire carrier, through the cutting apparatus 8, and through the lead carrier 10 until the desired length of lead has been fed past the cutting apparatus 8. The lead carrier and wire carrier both incorporate clamping devices which are axially movable with respect to the wire so that upon actuation of the cutting device and upon axial movement of the wire and lead, the cut ends of the lead and wire are pulled axially and stripped of their insulation. The wire carrier and lead carrier are then oscillated in a manner described in the Schwalm et al. application to present the stripped ends to the crimping presses at which electrical terminals are crimped onto the stripped ends. At the conclusion of a crimping operation it becomes necessary to remove the finished lead from the operating zone of the apparatus to permit the next feeding step and the next operating cycle of the machine. The wire handling and stacking device in accordance with the instant invention which performs this function will now be described.

A post 18 (FIGURES 2 and 4) is secured to, and extends above, the platform 2. A sleeve 20 is rotatably mounted on the upper end of this post and has laterally extending parallel plates 22, 24 secured thereto which extend generally towards the path of wire feed. The lower plate 24 has a plurality of suspending rods 26 depending therefrom and a second pair of parallel plates 28, 30 are mounted on the ends of these rods in spaced apart relationship to each other. As will subsequently be described, the stacking mechanism and the drive mechanism therefor are mounted on the plates 22, 24, 28 and 30 and the entire assembly can thus be swung clockwise as viewed in FIGURE 2 for servicing and repair.

Extending around the periphery of the lower set of plates 28, 30 is a conveyor 32 comprising a chain composed of a plurality of pins 34 secured in spaced apart parallel relationship by links 35 (FIGURES 3 and 8). The extremities of these pins have rollers 36 mounted thereon to permit movement of the conveyor along an arcuate path as will be explained below. The conveyor is driven by a pair of drive sprockets 38 and moves along a path defined by idler sprockets 40, and 42 mounted on axes standing between the plates 28, 30. This path is generally triangular, however, the portion extending between the sprocket 42 and the drive sprockets 38 is inwardly curved in order to clear the edge of press 4. The arcuate movement of the conveyor in this area is achieved by means of a pair of curved guide flanges 44, 46 which are secured to the plates 28, 30 and which serve as a bearing surface for the rollers 36. This expedient eliminates the necessity of an additional sprocket to guide the conveyor along this same path.

The drive unit for driving the sprockets 38 comprises a motor 48 mounted on plate 22 having a shaft 49 which in turn is connected by a chain 50 to an input shaft 51 of a speed reducer 52 on plate 24. The output shaft 53 of the speed reducer extends to a right angle drive 54 comprising bevel gears which transmit power to a shaft 55. This shaft is coupled to the drive sprockets 38 through a clutch generally indicated at 56 and a brake 57. The clutch is of conventional design and is actuated by means of microswitches 58, described more fully below. The brake comprises a wheel 59 having notches in its periphery which are adapted to be entered by a pawl 60 to abruptly stop rotation of the drive sprockets at the proper time. This pawl is normally engaged with the wheel 59 and is disengaged therefrom while the sprockets are rotated by means of a solenoid 61 which is also controlled by the switches 58.

A plurality of wire-holders 66 are mounted on the conveyor at evenly spaced intervals and located such that whenever the conveyor is not in motion, one of these holders will be positioned adjacent to the crimping press for the trailing end of the finished lead. These conveyors are more fully described and claimed in the copending application of Glendon H. Schwalm, Serial No. 100,314, filed April 3, 1961, for Handling Device. In general, these holders are constructed in a manner such that upon receiving an actuating downward force on their surface 72, their jaws 68 are lowered and closed about a finished lead. When the actuating force or stroke is removed, the holder rises to the position shown in the drawing and upon indexing of the conveyor the finished lead is dragged leftwardly towards the discharge station described below. Upon arrival at this discharge station, a second actuating stroke is applied to the holders and particularly to the ejector rod 70 thereof by means of the pneumatic piston cylinder 71. Upon reception of this actuating stroke, the jaws are open and the end of the lead is dropped.

The structure of one of the wire holders is shown in FIGURES 14 and 15 to comprise an outer cylindrical housing 74, an inner sleeve 76, and a rod 78 mounted within the sleeve. Sleeve 76 is biased upwardly by means of a spring 80 which acts between a shoulder on the housing 74 and a shoulder on the sleeve. The rod 78 has a pair of links 82 pivotally mounted on its lower end which links are in turn pivotally connected to the jaws 68. These jaws are also pivotally mounted at 84 on the lower end of the sleeve 76 so that upon downward movement of the rod the jaws are closed. Such downward movement of the rod is effected by means of a depressor, described below, which engages the enlarged head 86 of the rod. The jaws are locked in the closed condition by means of a pair of pawls 88 which are pivotally mounted in slots in the upper portion of the sleeve 76 and are inwardly biased by means of a circular spring 90. These pawls are adapted to move into slots in the rod to hold it in its lowered condition thereby to hold the jaws closed. The rod is normally biased upwardly by a spring 92 which acts between pins 94 and 96 in the rod and sleeve respectively, the pin 96 extending through an elongated slot in the rod.

Opening of the jaws is accomplished by moving the jaw release rod 70 relatively downwardly to disengage the pawls. This rod is slidably mounted in rod 78 and normally biased upwardly by a spring 99 to the limit of its travel permitted by the pin-slot connection 97. Advantageously, the rod 78 is formed in two parts with a spring 95 interposed between the two parts. This spring functions as a shock absorber for the jaws 68 so that they do not pinch a wire severely when it is picked up.

Actuation of the wire holder is brought about by means of pneumatic pistons 81, 83, the cylinder 81 being secured to the plate 28 at a location adjacent to the end of the lead carrier 10 and the cylinder 83 being secured to the plate at a location adjacent to the sprocket 38. The piston rod of the latter cylinder engages the release rod 70 to release the transported lead as shown in FIGURE 3 while the piston rod of the cylinder 81 engages the upper surface of sleeve 76 to lower the wire holder and pick up a lead. Both cylinders are actuated by suitable solenoid valves which are controlled by one of the microswitches 58.

When the leads being produced are extremely short, say six inches or so, the wire holders 66 will be sufficient to handle them without other assistance, however, where extremely long leads are being produced, say ten or fifteen feet, it is necessary to provide an additional means to push the wires leftwardly. In the disclosed embodiment, there is accordingly provided a guide tube 100 which is mounted by means of a bracket 102 on a plate 104 secured to the platform 2. This guide tube is open along its lefthand side as viewed in the drawing

and is surrounded by a second tube **106** which is rotatably mounted with respect to the tube **100**. Tube **106** also is open along one side thereof so that when the open sides of the two tubes coincide with each other, an axially extending gap or opening is formed through which the lead can be moved laterally out of the tube assembly but such movement is not permitted when the tube openings are not aligned. In accordance with the invention then, the tube **106** is positioned rotatably with respect to the tube **100** such that the slot is closed during the feeding portion of the cycle but is opened during the ejection portion of the operating cycle to permit lateral movement of the end of the finished lead. Such opening of the guide tube assembly is achieved by means of a collar and ear **108** on tube **106** which is connected by means of a link **110**, to a ball and socket joint **112** on the end of a lever **114** which is pivoted at its opposite end **116**. Intermediate its ends this lever has a cam follower **118** thereon which engages against a cam **120** on a shaft **122**. A spring **124** normally biases lever **114** in a clockwise direction so that the cam follower **118** is held against the cam **120**. It should be mentioned at this point that the shaft **122** upon which cam **120** is mounted forms a part of the lead making machine referred to above and continuously rotates during operation. For purposes of the instant disclosure, however, it is sufficient to point out that the two tubes **100**, **106** are maintained in the position shown in the drawing so that the side openings coincide during about one half of the cycle. During the feeding cycle, however, the cam **120** permits the tube **106** to be rotated by link **110** and spring **124** to close this side opening. The enclosed tube thus constitutes a guide for the wire during feeding.

It is desirable to provide means to push the portion of the lead disposed in the tube laterally as the conveyor is indexed thereby to remove the lead from the guide tube preparatory to the feeding of the wire during the ensuing cycle of operation. In the disclosed embodiment, there is accordingly provided push rods **126** extending transversely of the tube axis and through openings in the tubes **100**, **106**. These push rods are actuated by pneumatic cylinders **128** mounted on plate **104** and are energized, by one of the microswitches **58**, in timed sequence with the operation of the lead making apparatus and the wire handling apparatus to remove the finished lead during movement of the conveyor.

In the disclosed embodiment, the entire plate **104** is adapted to be moved about a pivotal axis **105** by means of a pneumatic piston cylinder **107** which is actuated by one of the microswitches **58**. This motion of the plate permits it to follow the swinging motion of the carrier **10** when the stripped end of the lead is shifted from the insulation stripping device **8** to the crimping press **4**.

The wire clamping assembly for clamping the fed length of wire is shown in FIGURES 7 and 11–13. This assembly comprises a frame **134** having a head portion **136**. A clamping member **138** is slidably mounted on the frame for movement towards and away from the head portion to clamp a wire extending into the tubes. The lower portion of this clamping member is pivotally connected to a lever **140** which is pivoted intermediate its ends on the lower side of the slide frame and which is pivotally connected at its opposite end **142** to a rod **144**. The rod **144** is vertically reciprocable.

Clamping member **138** slidably supports a slide member **146** between a pair of arms **148**. A spring **150** acts between a toe portion **152** of the clamping member and the underside of the slide member. The upper end of the slide member has a conical mouth portion **154** which moves into engagement with a complementary portion **156** of the head **136** to define an enclosed opening for the fed wire.

In use, upon clockwise movement of lever **140**, the slide **146** and the clamping member **138** move upwardly as a unit from the position of FIGURE 11 to the position of FIGURE 12. Thereafter, spring **150** is compressed and the clamping member **138** moves upwardly independently to clamp the wire. After stripping of the wire and crimping of a terminal onto the stripped end, the clamping assembly is opened by downward movement of the rod **144** thereby to permit lateral movement of the lead. The rod **144** is moved upwardly and downwardly in timed sequence with the operation of the wire stripping mechanism as disclosed in the above-mentioned U.S. Patent 3,019,679.

The entire assembly including the plates **22**, **24**, **28**, **30** is mounted above a tray **130** which has a generally L-shaped depression extending beneath the eject station and towards the guide tubes. By virtue of this arrangement, the finished leads are deposited and neatly stacked in the tray with their trailing ends in substantial alignment with each other.

As noted previously, the microswitches **58** control solenoid valves which, in turn, supply compressed air to the several pneumatic cylinders at the proper times. These switches are actuated by means of cams or the shaft **112** which rotates a complete revolution during each cycle of operation of the machine as explained in U.S. Patent 3,019,679.

The operation of the disclosed embodiment will be apparent from the foregoing description. The wire holder **66** which is located adjacent to the crimping press **4** is depressed and clamps the finished lead after the crimping operation has been completed. Thereafter the conveyor is indexed, the lead is pulled laterally and pushed out of the guide tubes and finally is dropped at the discharge station. After the finished lead has been ejected from the guide tubes, these tubes are realigned with the wire cutting apparatus for the next feeding cycle. The proper sequence of events during the cycle such as the actuation of the piston cylinders and the indexing of the conveyor can be achieved by means of the settings of the cams for the microswitches **58**.

Changes in construction will occur to those skilled in the art and various apparently different modifications and embodiments may be made without departing from the scope of the invention. The matter set forth in the foregoing description and accompanying drawings is offered by way of illustration only. The actual scope of the invention is intended to be defined in the following claims when viewed in their proper perspective against the prior art.

We claim:

1. Apparatus for handling relatively elongated sections of pliable material such as wire comprising, a pair of concentric tubes each having an axial opening extending for its entire length, said openings normally being out of alignment with each other to form a closed tubular supporting means, means for intermittently and axially feeding elongated sections of filamentary material into said tubes, means for rotating at least one of said tubes after feeding each of said sections to align said openings, a support disposed laterally of, and beneath, said tubes, and means for grasping one end of a fed section adjacent to one end of said tubes and moving said one end laterally to a position over said support and simultaneously moving remaining portions of said fed section from said tubes to said support, and means for releasing said one end at a location over said support whereby, said fed sections are stacked on said second support.

2. Apparatus for handling relatively elongated sections of pliable wire comprising, means for intermittently and axially feeding elongated sections of said wire along a predetermined path, guide tube means in surrounding relationship to said path for supporting and guiding said wire against lateral movement with respect to said path, a normally closed axially extending gap on one side of said guide tube means, means for opening said gap after feeding of said wire, a support disposed laterally of, and

beneath, said guide tube means, transfer means for grasping one end of said wire adjacent to one end of said guide tube means and moving said end laterally through said gap to a position over said support and simultaneously moving remaining portions of said wire from said guide tube means through said gap to said support, and means for releasing said one end from said transfer means at said position.

3. Apparatus as set forth in claim 2 wherein said guide tube means comprises a pair of concentric elongated cylindrical tubes having axially extending slots, and said means for opening said gap in said guide tube means comprises means for rotating one of said tubes until said slots are aligned with each other.

4. Apparatus as set forth in claim 2 wherein said transfer means comprises a conveyer movable from a position adjacent to said one end of said guide tube means to said position over said support.

5. Apparatus as set forth in claim 2 including push rod means for pushing said wire from said guide tube means.

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