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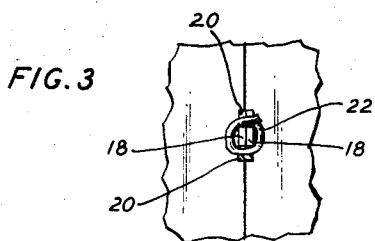
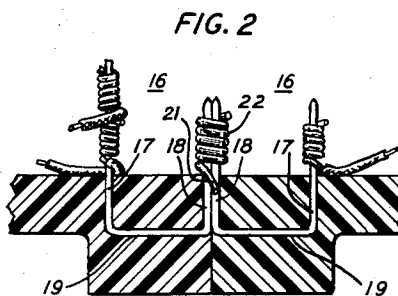
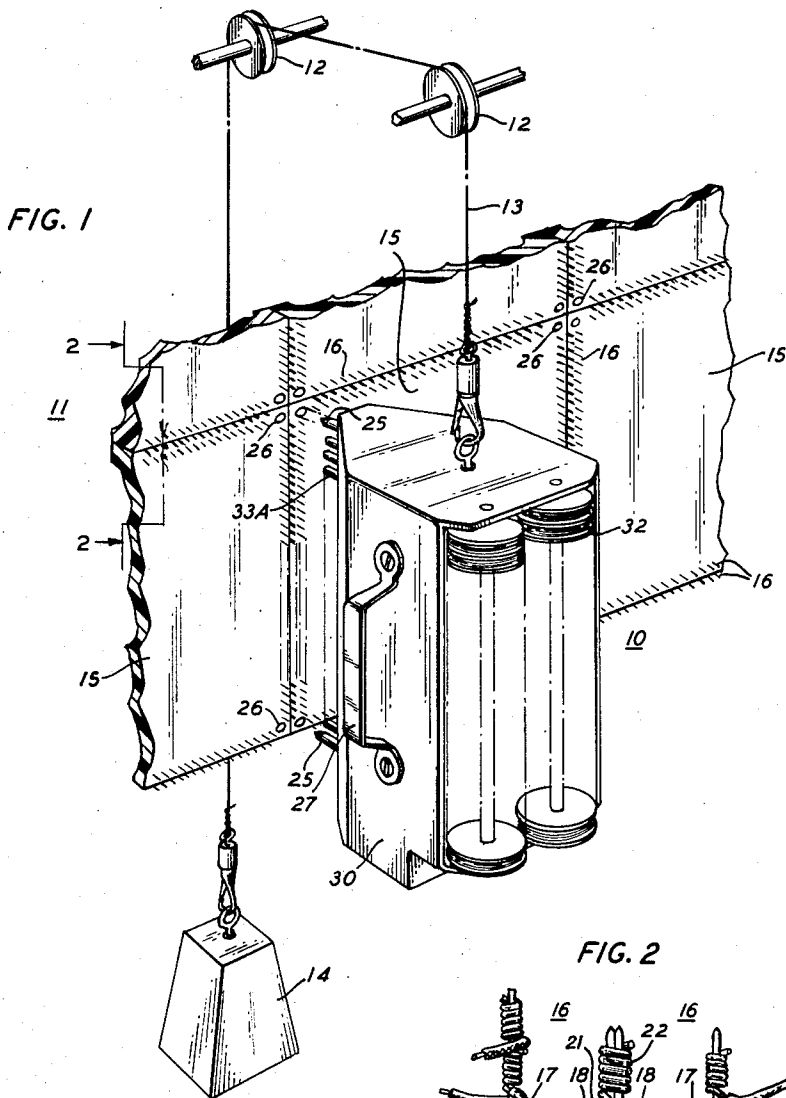
R. F. MALLINA

2,855,159

MULTIPLE SPINDLE WIRE WRAPPING TOOL

Filed Nov. 29, 1954

4 Sheets-Sheet 1



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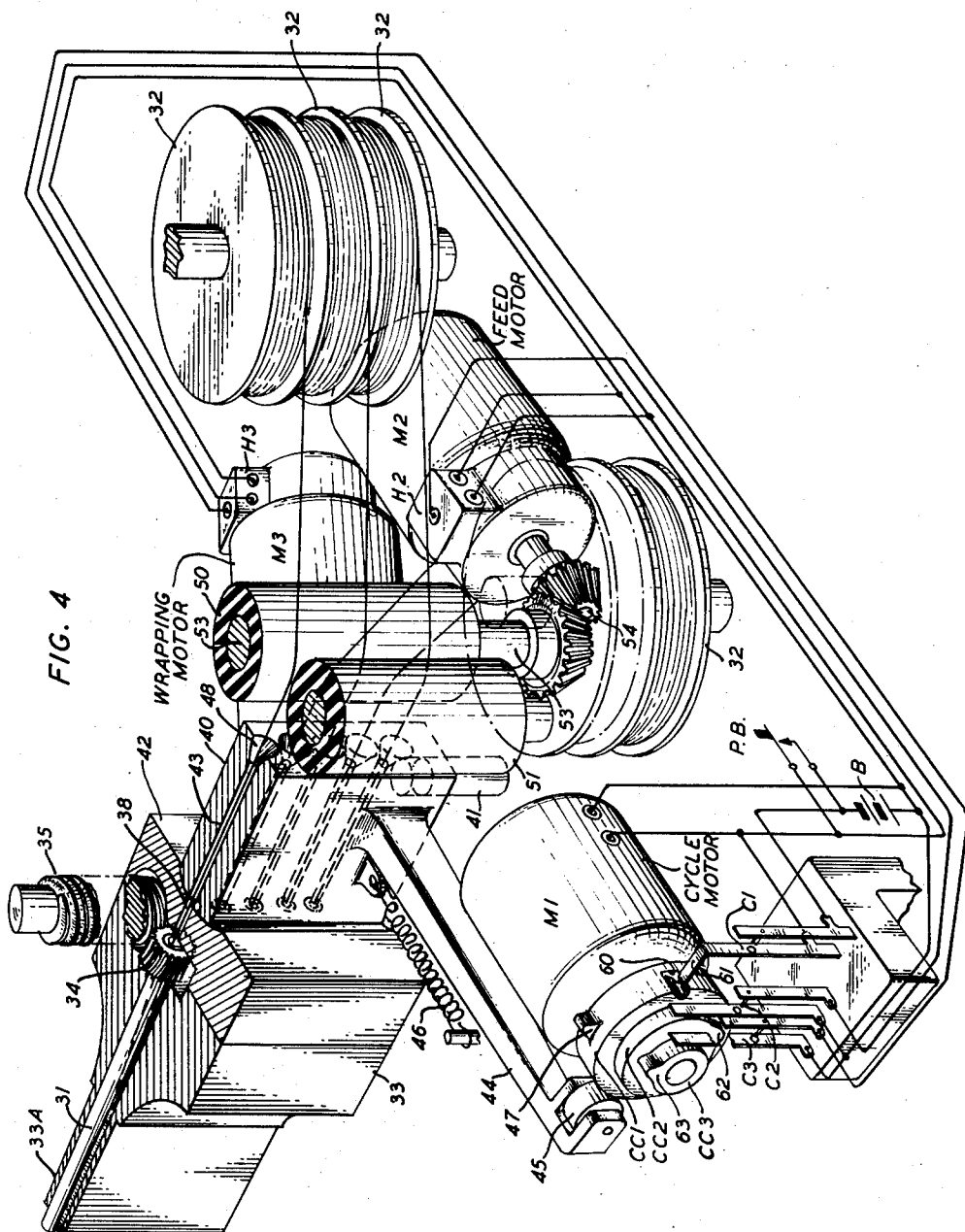
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FIG. 6

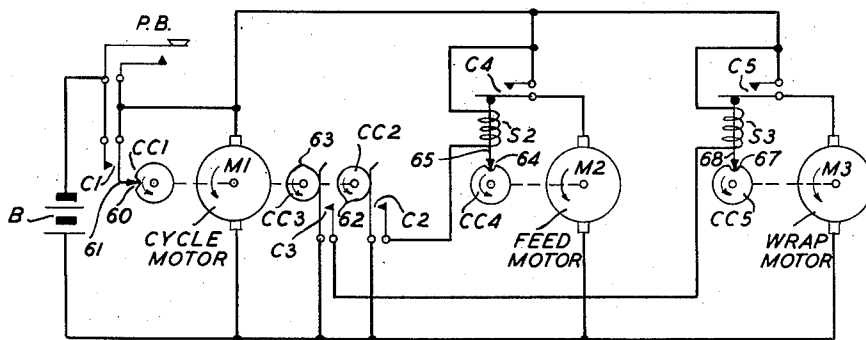
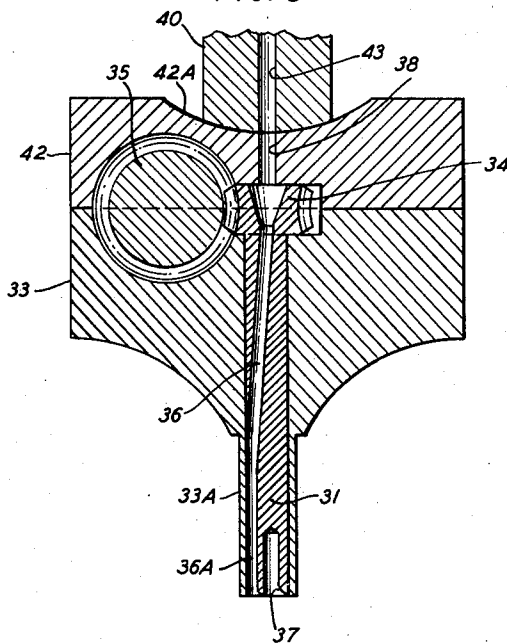


FIG. 5



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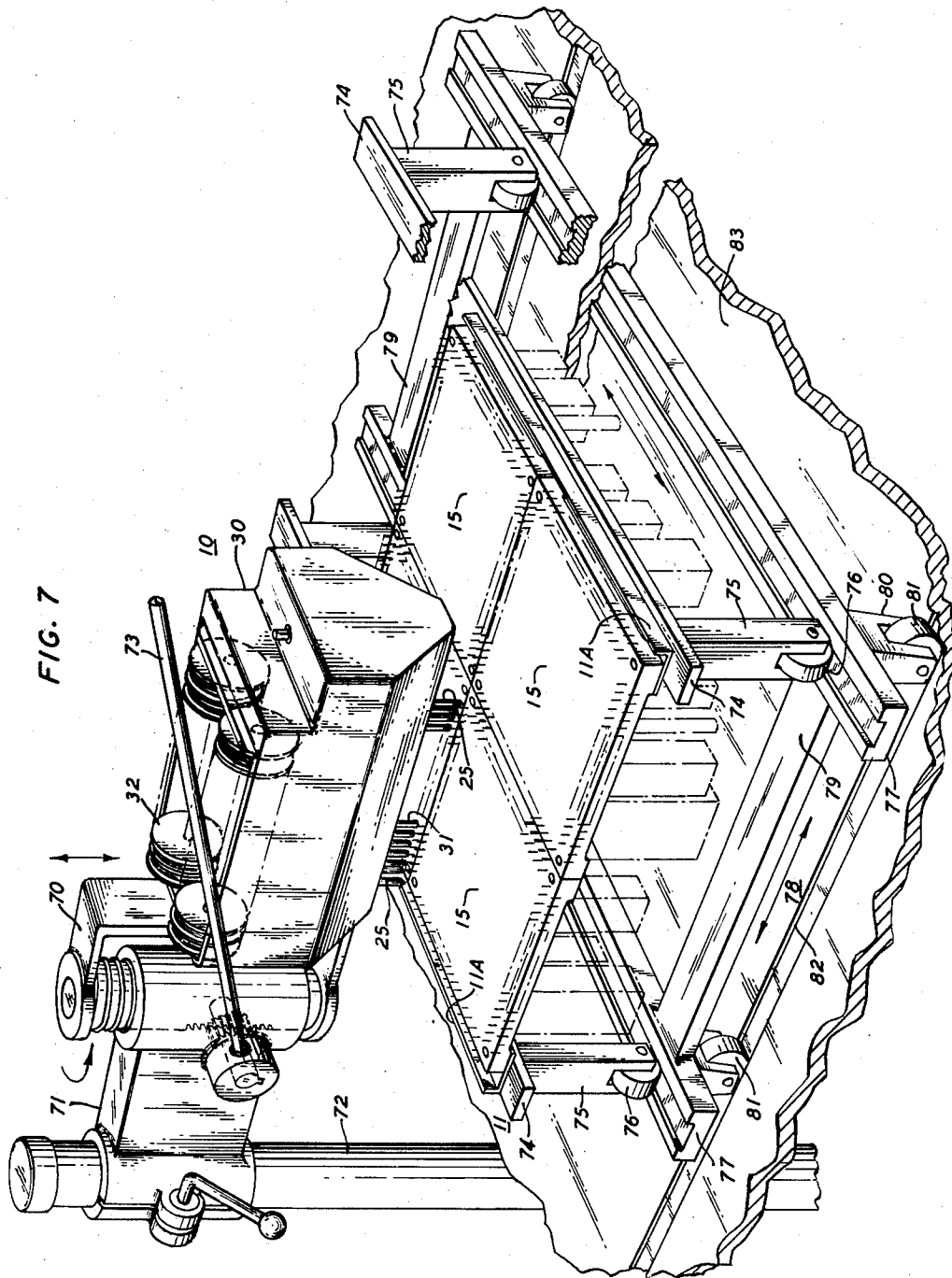
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4 Sheets-Sheet 4



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MULTIPLE SPINDLE WIRE WRAPPING TOOL

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6 Claims. (Cl. 242—7)

This invention relates to wire wrapping tools and more particularly to a multiple spindle wire wrapping tool for simultaneously making a plurality of wrapped connections.

In a system of machine wiring employing unit panels of moderate or small size mounted together on a rack or the like, some means of interconnecting the wiring of the unit panels is required. A machine wiring system for wiring such unit panels is disclosed in application Serial No. 370,147 of R. F. Mallina, filed July 24, 1953. As will be more fully explained, the unit panels of such a system are provided with rows of dual terminals along their margins, whereby panel-to-panel connections may be made. The whole wiring scheme is arranged so that wires which are to make connections external to a particular unit panel are connected at their outgoing ends to an appropriate dual terminal in the marginal row. Thus, after the wired unit panels are suitably mounted, connections are made to adjacent panels by interconnecting, juxtaposed terminals of the marginal rows.

An object of this invention is to facilitate the assembly of an array of circuit instrumentalities comprising wired unit panels or the like.

A more specific object is to expedite the electrical interconnection of electrical apparatus elements distributed among a plurality of unit panels.

One feature of the invention resides in a multiple spindle wire wrapping tool capable of simultaneously making all of the necessary connections between a unit panel and an adjacent unit panel.

More particularly, a feature of this invention is embodied in a wire wrapping tool having a plurality of aligned wire wrapping spindles constructed and arranged to respectively apply a wrapped connection to each juxtaposed pair of terminals of two mating rows of marginal dual terminals on adjacent unit panels.

Other and further objects and features of this invention will appear more fully and clearly from the following description of an exemplary embodiment thereof taken in connection with the appended drawing in which:

Fig. 1 is a view in perspective of one embodiment of the wiring tool of this invention oriented for making connections between two unit panels;

Fig. 2 is an enlarged section on the line 2—2 of Fig. 1 showing two juxtaposed dual terminals connected together;

Fig. 3 is a plan view of a portion of two adjacent unit panels in the vicinity of two juxtaposed terminals;

Fig. 4 is a partially sectioned, fractional perspective view of the mechanism of the wiring tool and includes a schematic representation of the control circuit;

Fig. 5 is a partial section showing details of the machine with the spindle rotated 90° from the normal starting position in order to better show the configuration of certain parts;

Fig. 6 is a schematic representation of the control circuit; and

Fig. 7 is a perspective view of another embodiment of this invention.

As shown in Fig. 1, the wiring tool 10 may be suspended in front of the panel 11 from overhead pulleys 12 by a cord or cable 13 having a counterweight 14 attached to its opposite end. The tool could be hand held by means of the handle 27 without further support, but the counterweighted support is desirable to relieve the operator of the weight of the tool. This tool as oriented in Fig. 1 is capable of making connections only between vertical rows of terminals. The remaining connections may be made by rotating the tool 90° and suspending it from an eye (not shown) on the right side of its housing. The panel 11 may, on the other hand, be rotated 90° leaving the tool in the position shown in Fig. 1. Either the tool or the panel may be moved horizontally or vertically to bring successive terminal rows into position.

The panel 11, a portion only of which is shown, is made up of a plurality of unit panels 15 mounted on a rack or the like (not shown in Fig. 1 but similar to the frame 11A of Fig. 7). This may be done by means of screws or bolts passing through suitable orifices adjacent each corner of the unit panel. Each unit panel is provided with a plurality of aligned U-shaped dual terminals 16 along its margin. As shown in Fig. 2 and partially in Fig. 3, each terminal 16 comprises a leg 17 and a leg 18 connected by a cross member 19. The parts 17, 18, and 19 are advantageously made integral. The leg 17 and the cross member 19 may be molded into or otherwise secured in the unit panel 15 so that the leg 18 lies in a notch 20 at the edge of the unit panel. The depth of the notch 20 is such that the outer face of the leg 18 is flush with the edge surface of the unit panel. Thus, when the unit panels are mounted in edge-to-edge relation, the respective terminal legs 18 of adjacent terminals are in contact. The notches 20 are wider than the terminals so as to leave a space or orifice for receiving the end 21 of a wrapped wire connection, as will be subsequently explained. Instead of having individual notches 20 for each dual terminal as shown in Fig. 3, each unit panel may have a continuous, marginal notch for the whole row of terminals. Such a notch will allow the outer legs of the dual terminals to be juxtaposed and will provide space for the wire ends 21 at each terminal pair. When reference is made to notch 20, either form is intended.

To aid in applying the wiring tool to the terminals, registering or guide pins, two of which are shown at 25 in Fig. 1, may be used. The guide pins may be tapered to more easily enter the panel orifices 26. The orifices 26 may be those at the corners of the panels for receiving the mounting screws, or other guide pin orifices may be provided. If the mounting screw holes are used, the screws should be sufficiently countersunk to allow space for the guide pins. Also, if the screw holes are used, the guide pins 25 would advantageously be in pairs at each end of the spindle row and offset respectively to the left or right of said row. The corners of the unit panels may be slightly relieved so as to define an orifice at the juncture of four panels or a notch at the juncture of two panels. In this case single guide pins in line with the spindles may be used.

The wiring tool 10, as shown in Figs. 1, 4, and 5, comprises a housing 30 in which are mounted a plurality of wrapping spindles 31 and a plurality of wire storage spools 32, one for each spindle. The spindles 31 are journaled in parallel spaced bores in the header 33 and its extension 33A, as shown for one spindle in Fig. 4. Each spindle has a worm gear 34 attached to its inner end. The gears 34 are driven by a worm 35 also mounted in the header and driven by a wrapping motor M3 by means such as beveled gearing (not shown). Each

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spindle has a wire guiding channel 36 therethrough. The channels 36, as may best be seen in Fig. 5, extend from the center of each spindle at its inner end to a peripheral groove portion 36A parallel to the terminal receiving opening 37 on the spindle axis. The shear plate portion 42 of the header 33 has a plurality of orifices 38 in line with the inner ends of the channels 36.

A cutter member 40 is mounted on a pivot 41 to cooperate with the surface 42A of the shear plate 42 which comprises the rear portion of the header 33. The cutter member 40 has a plurality of wire guiding orifices 43 corresponding respectively to the channels 36. The shear plate 42 and the cutter member 40 have arcuate mating surfaces having a radius of curvature around the pivot 41. The orifices 43 may be flared as at 48 to aid in the initial threading of wire into the tool.

The normal position of the cutter member 40 is as shown in Figs. 4 and 5, with the orifices 43 and channels 36 in alignment. Deflection of the cutter from this position, when a wire is threaded through 43 and 36, will shear the wire at the juncture of the mating arcuate surfaces. The cutter member 40 has an arm 44 extending from one side and mounting a cam follower 45 at its end. A biasing spring 46 maintains the follower 45 in contact with a cam CC1 driven by the cycle motor M1. The cam CC1 is circular except for a rise 47 sufficient to deflect the cutter member 40 to shear the wire at the appropriate time. The cam CC1 also includes a contact operating portion to be described later.

Adjacent the end of the cutter member opposite to the header 33 are a pair of cooperating feed rollers 50 and 51 which may be of resilient material, for feeding wire from the spools 32 to the wrapping spindles 31. The roller 50, which is the drive roller, is mounted on the shaft 53 and is driven by the feed motor M2 through gearing 54.

To prepare the machine for wire wrapping, wires from the spools 32 are threaded between the rollers 50 and 51, the wire guiding orifices 43 via their flared entrances 48, and up to the surface 42A of shear plate 42. In practice this may be done by feeding sufficient wire through the guide orifices 43 to enter the guide channels 38 of the shear plate 42 and then working the cutter manually so that all of the wires will be sheared at the surface 42A of the shear plate.

When the machine is put into operation with a pair of terminal legs 18 in the terminal openings 37 of each spindle, sufficient wire is fed through the spindle channels 36 and 36A to extend a portion 21 (Fig. 2) into the slot formed by the mating notches 20 of the panel edges. The wire is retained in the groove portion 36A of the wire channel by the extension 33A of the housing. Thus, when the spindles are rotated, the end 21 of the wire is constrained and the remainder is wrapped on the terminal pair as at 22 of Fig. 3. It may be noted that the spindle is so oriented in its initial position that the groove 36A is in register with a slot formed by notches 20 of the panel, i. e., 90° from the position shown in Fig. 5.

The distance between the shear plate surface 42A and the outer end of the spindle 31 is such that a sufficient length of wire for the required connection is available. Since different lengths of wire may be required for terminals of different cross section, spindles of different length may be made available. This could be done in one way by making the wrapping tip detachable and providing different length tips. In order that sufficient wire may be fed through the spindle to reach into the slots formed by notches 20, different size feed motor cams CC4 may be provided. Thus, the proper cam and spindle tip may be inserted when the machine is set up for a particular terminal size.

The wiring tool is operated by the three motors M1, M2, and M3, controlled by a starting pushbutton PB and a plurality of contactors, cams, and solenoids.

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The cycle motor M1 has on its shaft three cams CC1, CC2, and CC3, respectively. The cam CC1, as previously noted, is circular except for a short rise 47 for mechanically operating the cutter member 40. This cam CC1 also has a depression or notch 60 in its surface. An extension 61 of a contactor C1 rests in the notch 60 when the motor M1 is in the starting position, leaving the contactor C1 open.

The cam CC2, which cooperates with the contactor C2, is circular with a rise 62 at a proper position to momentarily close the normally open contactor C2 at an appropriate time.

The cam CC3 is also circular with a rise 63 for momentarily closing the normally open contactor C3 at the proper time.

Within the housing H2 of the feed motor M2 is a cam CC4 connected to the motor shaft, which cam has a detent notch 64 in its periphery. As shown in Fig. 6, the end of a plunger 65 rests in the notch 64 and its opposite end is connected to the contactor C4. The plunger 65 may be withdrawn from the notch 64 by energization of the solenoid S2. This operation of the plunger 65 also closes the contactor C4, which is kept closed during one rotation of the cam CC4 until the plunger 65 drops into the detent notch 64. The cam CC5 having a notch 67, the solenoid S3 having a plunger 68, and the contactor C5 of Fig. 6 are in the housing H3 of the wrapping motor M3 and are operated in a like manner to the equivalent means on the motor M2.

It is believed obvious that the foregoing arrangement for starting and controlling the feed motor M2 and wrap motor M3 by means of solenoids controlled by cycle motor operated contactors, may be replaced by other equivalent means. For example, the cams CC2 and CC3 may be mechanically linked with the detent plungers 65 and 68 of the motors M2 and M3 to lift them and close the appropriate contactors C4 and C5.

Assuming that the machine is threaded and otherwise ready for operation, the spindles are applied to a row of juxtaposed terminal pairs and the pushbutton PB is pressed. The cycle motor M1 is started and the contactor C1 is closed, due to rotation of the cam CC1, to maintain M1 in operation after pressure on the pushbutton is released and to continue this operation for one cycle. Presently the contactor C2 is momentarily closed by rise 62 on the cam CC2 energizing the solenoid S2 and starting the feed motor M2 via its contactor C4 operated by said solenoid. After the required length of wire has been fed to each spindle the feeding operation is stopped by the plunger 65 dropping into the notch 64 of the cam CC4 and opening the contactor C4. The rise 47 on the cam CC1 then operates the cutter to shear the wires. The contactor C3 is then momentarily closed by the rise 63 of the cam CC3 to energize the wrapping motor M3 via the solenoid S3 and the contactor C5 to rotate the spindles and simultaneously wrap all of the connections. After the wrapping is completed, the wrap motor is stopped by the plunger 68 dropping into the notch 67 and opening the contactor C5. The cam CC1 has now moved to a position such that the extension 61 of the contactor C1 enters the notch 60 to open the contactor C1 and deenergize the cycle motor M1. The extension 61 and the notch 60 act as a detent to retain the motor M1 in this position ready for the next cycle.

The various motors are connected to the parts which they operate, e. g., spindles, feed rollers, and cams, with gearing of appropriate ratios to perform the various functions in a suitable manner. For example, the spindles must rotate several turns (five or six) to make a suitable wrapped connection; and the feed rollers must project sufficient wire to extend into the notches 20.

The wiring tool, instead of being suspended as in Fig. 1, may be mounted as shown in Fig. 7. The panel units to be interconnected may be supported on cross slide

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means as shown. The wire wrapping tool of Fig. 7 is substantially the same as that of Fig. 1. No handle 27 is required, and guide pins, such as the pins 25 of Fig. 1, may be omitted or retained as desired. The tool is shown in Fig. 7 with guide pins. In this modification the tool 10 is provided with a bracket 70 by means of which it is pivotally attached to an adjustable arm 71 clamped to a post 72. A means for lowering and raising the tool in a manner employed in drill presses and the like, is controlled by the lever 73. The tool is pivotally attached to the arm 71 so that it may be oriented for making interconnections in the positions shown or with the tool at 90° to said position.

The panel 11 comprising several unit panels 15 suitably connected together by the frame 11A portions of which are shown in Fig. 7 is supported on the parallel members 74 having legs 75. Rollers 76 on each leg 75 ride in guide rails 77 of a carriage 78. The carriage 78 includes the parallel rails 77 and cross members 79 for tying the rails together. The carriage 78 has legs 80 and rollers 81, the latter riding in guide slots 82 of the base 83. Other conventional cross slide means may be used if desired.

Since the supports for both the tool and the panel are connected to a common base, indexing means (not shown) may be used to orient the panel with respect to the tool, thus allowing the previously noted omission of guide pins if desired.

Ordinarily the tool will have all of its spindles supplied with wire so as to make all possible interconnections between marginal terminals whether required circuitwise or not. This will aid in holding the unit panels together, the otherwise unconnected terminals being electrically inactive. In assembly line use where corresponding, like pairs of unit panels are successively interconnected at a given station, wires not required for electrical interconnection may be omitted if not required to aid in the mechanical joining of the unit panels.

What is claimed is:

1. A tool for simultaneously making a plurality of wrapped electrical connections comprising a housing, a plurality of aligned wire wrapping spindles mounted in said housing, each spindle including a wire wrapping head and a wire guiding channel extending from said wrapping head to the opposite end of the spindle, wire storage means for a plurality of wires, wire guiding means for each spindle, each guiding means including a wire guiding orifice normally in alignment with a corresponding wire guiding channel of a spindle, wire feeding means for feeding wires from the storage means via the wire guiding means to each of the wrapping spindles, means intermediate the feeding means and the spindles and including a portion of the wire guiding means for severing the wires, and means for driving the spindles.

2. A wiring tool for simultaneously making a plurality of wrapped electrical connections on a plurality of terminals comprising a housing, a plurality of wire wrapping spindles mounted in said housing, each spindle having a terminal receiving opening and a wire guiding channel, wire storage means, wire guiding means for each spindle including said channels, means for feeding wires

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from the storage means via the wire guiding means to each spindle, means intermediate the feeding means and the spindles and including a portion of the wire guiding means for cutting the wires, cycling means, motor means for driving the spindles, motor means for driving the feeding means, motor means for operating both the wire cutting means and the cycling means; and means for initiating operation of the cycling means to control the other means, to feed, to cut, and to wrap wires simultaneously on a plurality of terminals.

3. A wiring tool as in claim 2 in which the wire guiding channel extends from the axis of the spindle at the inner end thereof to the periphery of the spindle at the outer end thereof.

4. A wiring tool as in claim 2 in which the wire cutting means comprises a rotatable cutter member and a cooperating shear plate each provided with a set of registering wire orifices of the wire guiding means, and means for rotating the cutter member sufficiently to offset one set of orifices thereby cutting each wire.

5. A wiring tool for simultaneously interconnecting a plurality of juxtaposed terminals, comprising a plurality of aligned wire wrapping spindles, wire storage means, wire feeding means and wire guiding means for conducting wires from the storage means to the wire wrapping spindles, wire cutting means intermediate the storage means and the spindles and comprising a deflectable portion of the guiding means, cycling means for controlling the time and sequence of wire feeding, cutting, and wrapping; a wrap motor connected to simultaneously drive said spindles, a feed motor connected to operate said wire feeding means, a cycle motor connected to operate the wire cutting means and the cycling means, circuit means interconnecting the cycling means and the motors, and a housing for supporting all of said means.

6. A wiring tool for simultaneously making a plurality of wrapped wire connections on a plurality of aligned terminals, said tool comprising a housing, a row of wire wrapping spindles on said housing, each spindle including a terminal receiving opening and a wire guiding channel at its outer end, each channel extending to the inner end of its spindle, wire storage means, wire feeding means, wire cutting means intermediate said feeding means and said spindles, said cutting means comprising a deflectable member mating with a part of said housing adjacent the inner ends of said spindles, said deflectable member and said part of the housing including normally aligned orifices for guiding wires to the inner ends of said spindles and motive means for operating the spindles, the feeding means and the cutting means.

References Cited in the file of this patent

UNITED STATES PATENTS

1,796,906	Zimmer	Mar. 17, 1931
2,290,626	Bosomworth	July 21, 1942
2,474,285	Smith	June 28, 1949
2,550,281	Martin	Apr. 24, 1951
2,551,358	Andren	May 1, 1951
2,682,063	Miloché	June 29, 1954
2,696,656	Madden	Dec. 14, 1954