Oct. 24, 1950 S. M. WEISBERG 2,526,717

MACHINE FOR MAKING SOLDERLESS ELECTRICAL CONNECTIONS

Filed June 22, 1946 4 Sheets-Sheet 1

Fig. 1

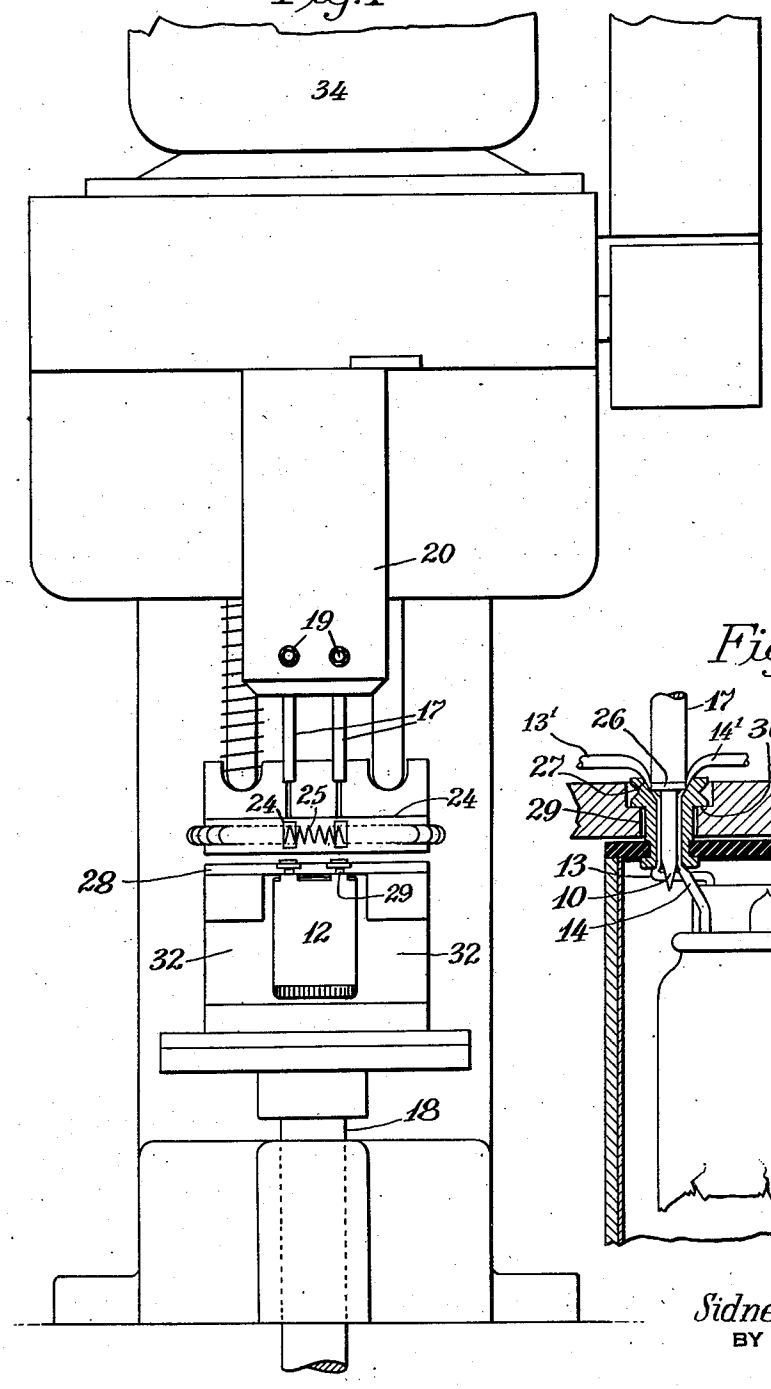


Fig. 2

INVENTOR
Sidney M. Weisberg
BY Philip S. McLean
ATTORNEY

Oct. 24, 1950 S. M. WEISBERG 2,526,717

MACHINE FOR MAKING SOLDERLESS ELECTRICAL CONNECTIONS

Filed June 22, 1946 4 Sheets-Sheet 2

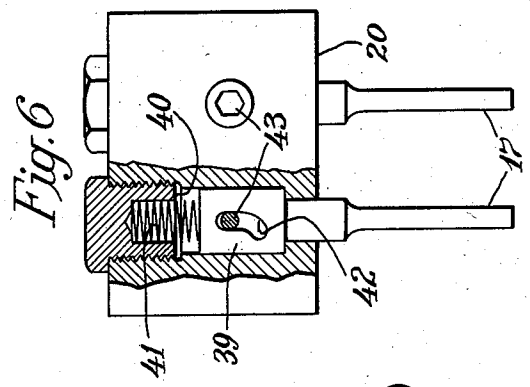


Fig. 6

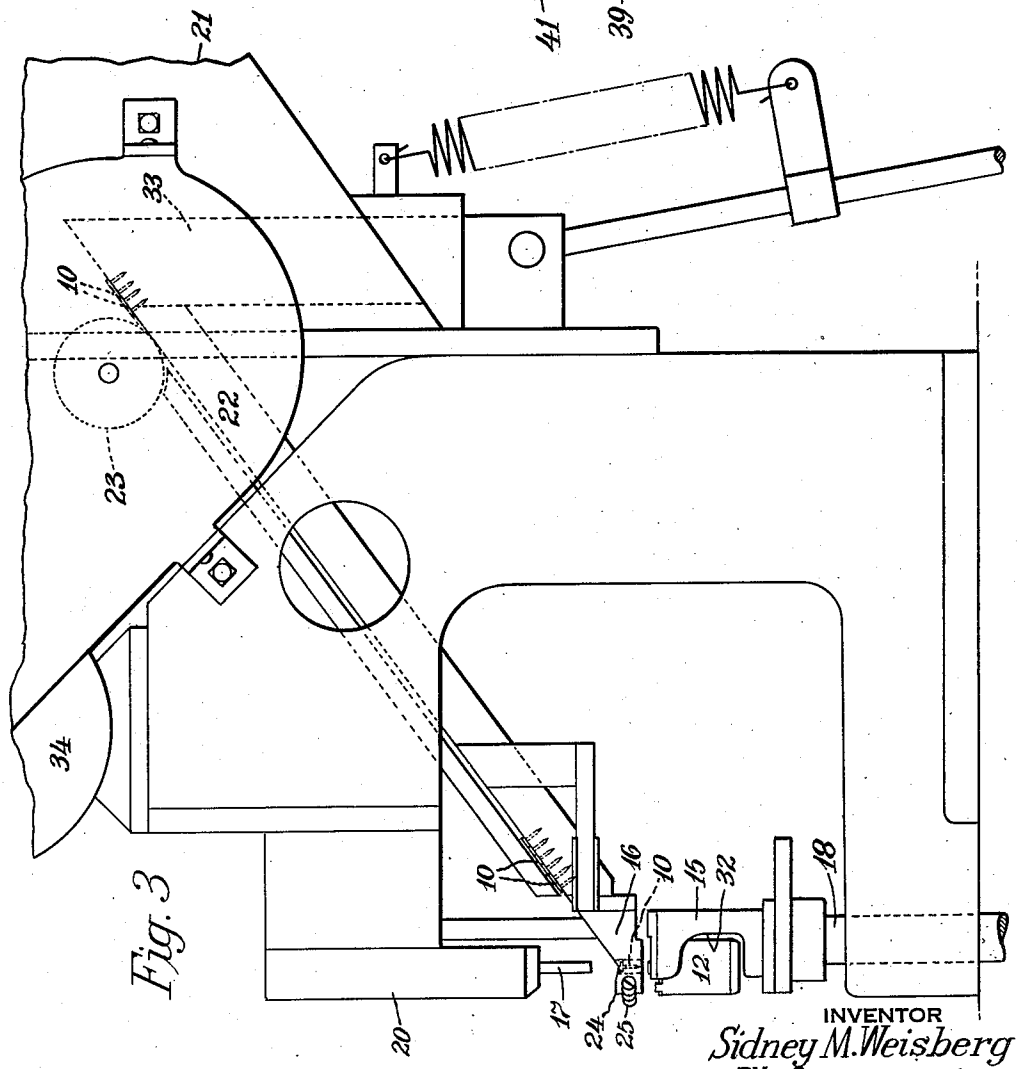


Fig. 3

INVENTOR
Sidney M. Weisberg
BY
Philip S. McGraw
ATTORNEY

Oct. 24, 1950 S. M. WEISBERG 2,526,717

MACHINE FOR MAKING SOLDERLESS ELECTRICAL CONNECTIONS

Filed June 22, 1946 4 Sheets-Sheet 3

Fig. 5

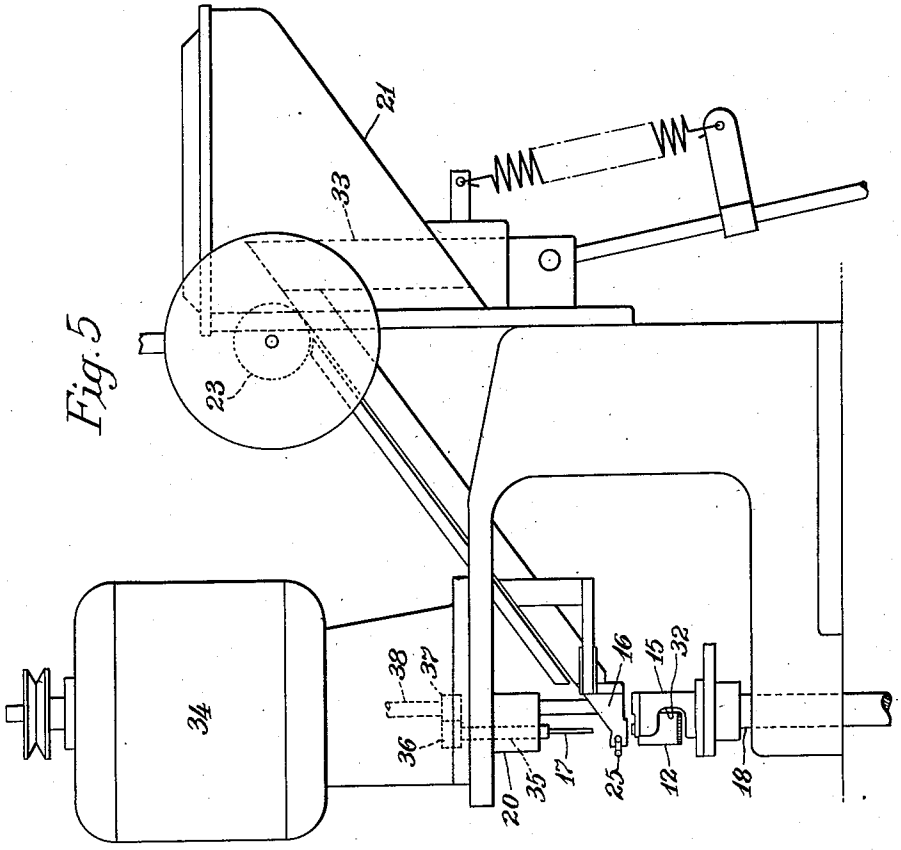
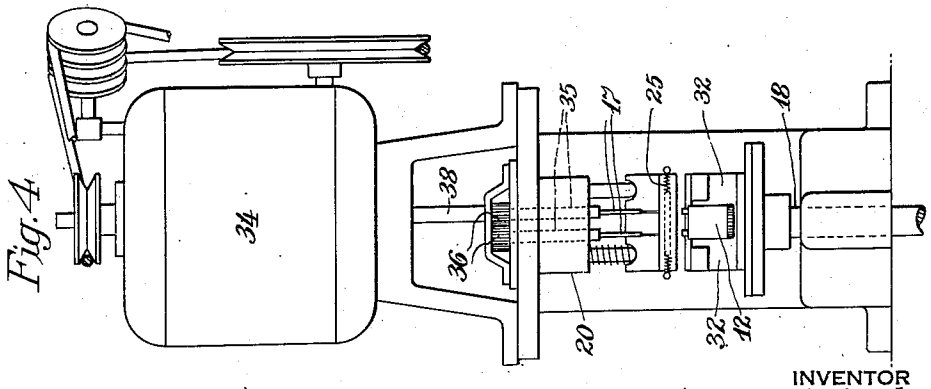


Fig. 4



INVENTOR
Sidney M. Weisberg
BY
Philip S. McLean
ATTORNEY

Oct. 24, 1950 S. M. WEISBERG 2,526,717

MACHINE FOR MAKING SOLDERLESS ELECTRICAL CONNECTIONS

Filed June 22, 1946 4 Sheets-Sheet 4

Fig. 9

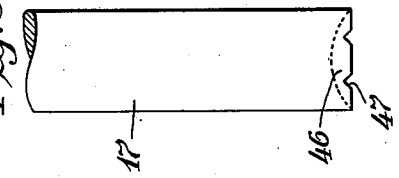


Fig. 8

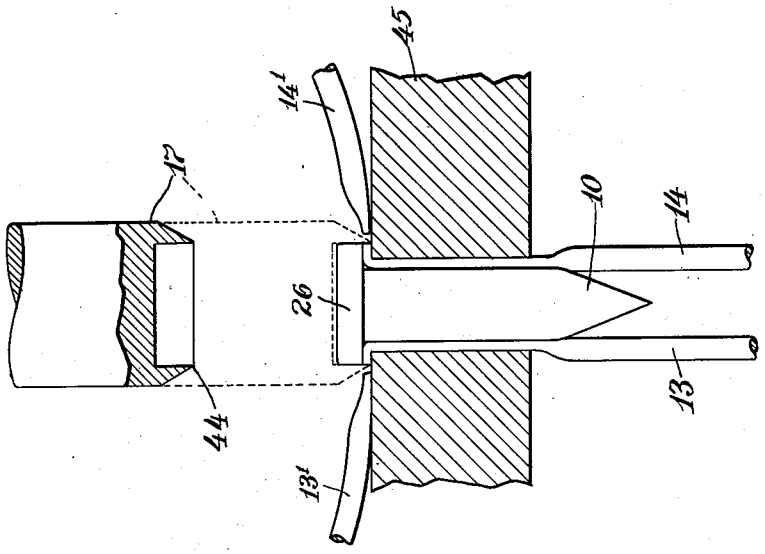
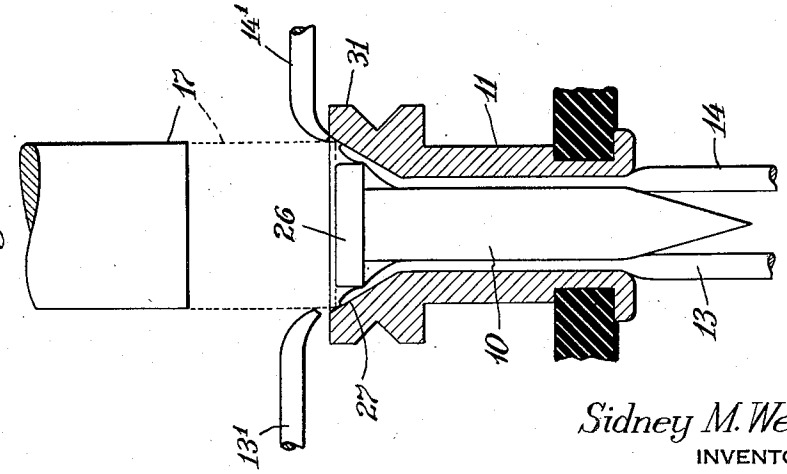


Fig. 7



Sidney M. Weisberg
INVENTOR

BY Philip S. McLean
ATTORNEY

Patented Oct. 24, 1950 2,526,717

UNITED STATES PATENT OFFICE

2,526,717

MACHINE FOR MAKING SOLDERLESS ELECTRICAL CONNECTIONS

Sidney M. Weisberg, Newark, N. J., assignor to Allied Electric Products, Inc., Irvington, N. J., a corporation of New Jersey

Application June 22, 1946, Serial No. 678,557

7 Claims. (Cl. 29—203)

1

The invention here disclosed relates to the manufacture of solderless wire terminals and connectors of the type disposed in copending patent application Serial No. 634,704, filed December 13, 1945, now Patent 2,456,601, issued Dec. 14, 1948.

In the type of connector referred to, the wire is mechanically and electrically secured without the use of solder, by entering it in a larger size opening in a terminal or connector member and then driving a wedging fastener in the nature of a pin or tack, into the opening alongside the wire, to bind and interlock the wire in positive, fixed engagement with the wall of the opening.

The main purposes of the present invention are to accomplish the practical and efficient production of such connections on a commercial scale, at a rapid rate and at low cost.

Special objects are to provide simple, inexpensive, easily operated mechanism for accomplishing the assembling and fastening functions peculiar to this particular form of connection.

Other objects attained by the invention and the novel features of construction through which all purposes of the invention are attained are set forth or will appear in the course of the following specification.

The drawings accompanying and forming part of the specification illustrate certain present preferred embodiments of the invention. Structure and arrangement, however, may be modified and changed as regards the present illustration, all within the true intent and broad scope of the invention as hereinafter defined and claimed.

Fig. 1 in the drawings is a broken front elevation of a machine for assembling the connectors and showing a fluorescent starter switch in position for having the wires affixed to the terminals of the same;

Fig. 2 is an enlarged broken sectional view illustrating the completion of the operation on the starter switch shown in Fig. 1;

Fig. 3 is a broken side elevation of the machine illustrated in Fig. 1;

Figs. 4 and 5 are broken front and side views, respectively, of a modified type of machine in which the punches are rotated to effect a twisting-off or shearing of the excess wire ends;

Fig. 6 is a broken, part sectional detail of a modification in which only partial rotation is imparted to the driving punches;

Fig. 7 is a broken sectional detail illustrating use of a punch arranged to cooperate with the terminal to shear off the loose wire ends;

Fig. 8 is a similar view illustrating further modifications in the form of the terminal or connector member and in the form of a punch;

2

Fig. 9 is a broken detail of another form of wire severing punch.

The machine shown in Fig. 1 is designed for driving headed, tack-like fastenings 10, Fig. 2, into the tubular terminals 11 of fluorescent starter switches 12 for securing in each terminal two wires 13 and 14.

Accordingly, the machine is provided with a holder 15 for the starter switch, which will line up the terminals 11 with two of the pins 10 supported in a vertically movable holder 16, directly beneath a pair of punches 17.

The holder 15 for the starter switch is shown carried by a vertically movable rod 18 actuated from a foot pedal, air cylinder, motor crank mechanism or the like.

The pin driving punches 17 in this first illustrated embodiment of the invention are adjustably and rigidly secured as by set screws 19 in a rigid head 20.

The fastenings 10 are fed to the holder 16 from an elevated hopper 21, down inclined guides 22. A motor driven hopper wheel 23 lines the pins up in the upper ends of the guides 22 and the vertically movable pin holder 16 at the bottom of the guides operates as a cut-off to release only two pins at a time into position in the holder.

The front portion of the pin holder 16 is made in relatively separable sections to provide pin holding fingers 24 yieldably closed by a spring 25 so as to open up to permit passage of the pins into the terminals under the driving action of the punches 17.

The enlarged view, Fig. 2, shows how in addition to effecting the driving of the pins and the securing of the wires, the machine accomplishes the trimming off or removal of excess wire 13', 14', by forcing the pins far enough in the terminals to cause the heads 26 of the pins to bite or pinch the wire against the convergently inclined or beveled surrounding walls 27 provided in the ends of the terminals.

This pinching-off action effected by the heads of the fasteners is generally sufficient because even if the wires are not cut entirely through, they will be so weakened as to drop off in the further handling of the switch.

While the construction of the nest or holder for the starter may vary, the one shown is entirely practical and desirable, embodying in general a rigid, horizontally disposed plate 28 having slots 29 in the forward edge of the same positioned to receive the reduced neck portions of the terminals, and shouldered at the top at 30 to provide seats or rests for the enlarged or head portions 31 of the terminals.

The body of the holder **15** below the locating plate is shown as recessed at **32**, at opposite sides to provide clearance for the fingers in placing the switch in and removing it from the holder.

A vertically operable feed slide **33** is shown for lifting the pins up to the hopper wheel at the upper end of the inclined guides. This feed slide may be connected to operate automatically with each operation of the starter switch holder **15**.

In use it is only necessary to insert a starter **12** in the holder **15** and to step on the pedal or otherwise operate the control or actuating means for the machine. Such mechanism is of the single stroke type to lift the holder to the punches and lower the holder back into the position of rest, ready for removal of the finished work and insertion of a new piece. In removing, the part may be inspected to see whether the loose wire ends have been fully removed and if not, they may be shaken or broken loose with a light brushing movement.

The assembly may be effected with a quick drive stroke, since the displacement of metal in the wires by the wedging and binding action of the pins may be relatively slight. While the force required in fastening different terminals may vary depending on relative location of the wires in the terminal passages, variations in size of the pins, etc., such variations are minor in character and are readily overcome by the action of the pins in wedging the wires more or less apart and into generally longitudinally aligned relation as the pins are driven.

Figs. 4 and 5 illustrate how the structure may be modified to accomplish a more certain separation and removal of loose wire ends, by causing the driving punches to rotate and thus act to sever or shear the excess wire.

In the illustration, the motor **34** for operating the hopper wheel is shown utilized for rotating the punches **17** by rotatably supporting them at **35** in the head **20** and providing them at the upper ends with intermeshing gears **36** driven by gear **37** on the lower end of the motor shaft extension **38**, the motor in this instance being mounted with its shaft vertical and coupled to the vertical shaft extension **38**.

In the last described construction the punches may rotate continuously and both in the same or in different directions. These punches may be of enough larger diameter at their driving ends to extend beyond the heads **26** of the pins to engage and exert a shearing or tearing action on projecting end portions of the wires. The time of engagement of the punches with the heads of the pins may be substantially instantaneous so that any twisting effect of the punches on the pins need not be disadvantageous, and this twisting moment may be an actual advantage in setting the pins more firmly in the terminals and into interlocking engagement with the wires in the terminal passages.

Fig. 6 illustrates another embodiment of the machine in which the punches **17** have only a partial rotation, and that only at the end of the driving stroke.

For such purposes the punches are rotatably mounted in the supporting head at **39** and have slight longitudinal movement in their bearings, limited by stop shoulders **40**. Springs **41** thrust the punches to their projected position. Cam grooves **42** in the inner body portions of the punches, engaged by stationary pins **43**, impart a slight final twist to the punches as they are

forced back in the driving operation, this rotary movement being determined by the cam slope and sufficient to normally effect the desired severance and separation of the loose wire ends.

Fig. 7 is an enlarged view illustrating the feature of making the punch diameter sufficient for the corner edge of the punch to engage the conical socket **27** in the terminal head, substantially at the instant of fully setting the pin in the terminal, thus to act in a cut-off capacity to fully sever the surplus wire.

Fig. 8 illustrates another form of punch formed with a chisel edge **44** to go down over the head **26** of the pin and cooperate with the end face of the terminal **45** about the head to sever any protruding portions of wire.

The terminal **45** in the last illustration is shown as a flat piece of metal to illustrate the point that the invention is applicable to various kinds of terminals other than those of the generally tubular form first illustrated.

Fig. 9 illustrates another form of punch having a concave end **46** which may be toothed as indicated at **47** to operate as a cutter when used in the rotating type of machine shown in Figs. 4 and 5.

The machine and the method disclosed afford practical, high speed production of particularly strong and durable solderless connections. As shown in Fig. 2, the severance of excess wire in the conical cup or cavity in the end of the terminal leaves the end surface of the terminal flush and smooth so that it will make good contact in the receptacle or other device with which it may be intended to cooperate.

The severance of the excess wire may be either partial or complete, that is, the wire may be entirely cut off or only partially severed, in the latter instance to be removed by breaking off at the weakened section as by a simple brushing movement.

While desirable, as illustrated in the present instance, to make two solderless connections at a time, the machine may be constructed to make one or any number of these connections at a time.

The form of the electric terminal with which the wire is connected may vary, the invention being applicable to make these solderless connections with any forms of electrical parts or devices. The word "terminal," therefore, has been used in the sense of any kind of connector or part with which a wire is to be connected.

While two wires are shown secured in each terminal, it will be realized that one or a number of wires may be secured in a terminal, after the manner of this invention.

While ordinarily the pin may be in the form of a metal tack, it should be understood that this pin need not be a headed member, and also that it need not be of metal, since the wire in being crushed against the side of the passage will be firmly bound in electrical and mechanical connection with the terminal member.

While the passage in which the wire is secured is shown as an opening extending entirely through the terminal, it will be realized that this wire opening or passage need not extend entirely through the member with which the wire is connected.

The members at the end of the punch which effect the complete or partial severance of the wire or wires, as shown, may be companion shearing elements as between the end of the punch and the terminal member, or as between

the end of the punch and the head of the fastener or between the head of the fastener and the end of the terminal, or the like.

Generally speaking, the invention is of broad scope and the claims therefore are to be construed in a broad sense and on the order as indicated above.

What is claimed is:

1. A machine for making solderless connections for electric terminals having wire receiving openings and comprising cooperating punch and holder members having relative movement toward and away from each other, said holder member having means for positioning a terminal with a wire receiving opening therein in line with said punch, a holder for a pin of a size which may be driven into binding engagement with a wire in said passage, said pin holder being arranged to temporarily support a pin between said punch and terminal holder members and in line with the wire passage of the supported terminal, means for effecting relative movement of said punch and terminal holder members to accomplish the driving of a temporarily supported pin into binding engagement with a wire in said wire passage and means for effecting relative rotation of said punch and terminal holder members for accomplishing severance of excess wire at the end of the wire opening in a supported terminal.

2. A machine for making solderless connections for electric terminals having wire receiving openings and comprising cooperating punch and holder members having relative movement toward and away from each other, said holder member having means for positioning a terminal with a wire receiving opening therein in line with said punch, a holder for a pin of a size which may be driven into binding engagement with a wire in said passage, said pin holder being arranged to temporarily support a pin between said punch and terminal holder members and in line with the wire passage of the supported terminal, means for effecting relative movement of said punch and terminal holder members to accomplish the driving of a temporarily supported pin into binding engagement with a wire in said wire passage and means for imparting rotary motion to the punch member to apply a severing action on wire projecting from the end of the wire passage in a supported terminal.

3. A machine for making solderless connections for electric terminals having wire receiving openings and comprising cooperating punch and holder members having relative movement toward and away from each other, said holder member having means for positioning a terminal with a wire receiving opening therein in line with said punch, a holder for a pin of a size which may be driven into binding engagement with a wire in said passage, said pin holder being arranged to temporarily support a pin between said punch and terminal holder members and in line with the wire passage of the supported terminal and means for effecting relative movement of said punch and terminal holder members to accomplish the driving of a temporarily supported pin into binding engagement with a wire in said wire passage, said punch member having a wire severing edge and means for imparting rotation to said member for effecting severance of excess wire at the end of the wire opening in a supported terminal.

4. A machine for making solderless connections for electric terminals having wire receiving openings and comprising cooperating punch and holder members having relative movement toward and away from each other, said holder member having means for positioning a terminal with a wire receiving opening therein in line with said punch, a holder for a pin of a size which may be driven into binding engagement with a wire in said passage, said pin holder being arranged to temporarily support a pin between said punch and terminal holder members and in line with the wire passage of the supported terminal and means for effecting relative movement of said punch and terminal holder members to accomplish the driving of a temporarily supported pin into binding engagement with a wire in said wire passage, said punch member having a wire severing edge and means for effecting relative rotation of said punch and terminal holder members for accomplishing severance of excess wire at the end of the wire receiving opening in a supported terminal.

5. A machine for forming a solderless connection comprising means for supporting a terminal having a wire receiving passage with a wire loosely located therein, a punch in line with said passage, means for loosely supporting a pin in line with said passage and loosely supported wire, means for effecting approach of said supporting means and punch to thereby accomplish the driving of the fastening pin interposed between said members into the wire receiving passage over the wire disposed therein and means for effecting relative rotation of said supporting means and punch for exerting a twisting-off action on any wire that may project beyond the end of the wire receiving passage.

6. A machine for making solderless connections for electric terminals having contact making end faces, seats countersunk in said contact making end faces and wire receiving passages extending from said seats and comprising cooperating punch and holder members having relative movement toward and away from each other, said holder member having means for positioning a terminal with the wire receiving passage and end seat therein in line with said punch, a holder for a headed pin of a size which may be driven into binding engagement with a wire in said passage, said pin holder being arranged to temporarily support a pin between said punch and terminal holder members in line with the wire passage of a terminal supported in said terminal holder member, means for effecting relative movement of said punch and terminal holder members toward each other to effect driving of a pin temporarily supported in said pin holder into binding engagement with a wire in said wire passage and to an extent sufficient to force the head of the pin below the contact face of the supported terminal and means operable by said punch at the end of said driving stroke for effecting pinching of excess wire projecting from said wire passage into said seat in the terminal, for removal of excess wire that might interfere with the contact face of the terminal.

7. A machine for making solderless connections for electric terminals having contact making end faces, seats countersunk in said contact making end faces and wire receiving passages extending from said seats and comprising cooperating punch and holder members having relative movement toward and away from each other, said holder member having means for positioning a terminal with the wire receiving passage and end seat therein in line with said punch, a holder for a headed pin of a size which may be

driven into binding engagement with a wire in said passage, said pin holder being arranged to temporarily support a pin between said punch and terminal holder members in line with the wire passage of a terminal supported in said terminal holder member, means for effecting relative movement of said punch and terminal holder members toward each other to effect driving of a pin temporarily supported in said pin holder into binding engagement with a wire in said wire passage and to an extent sufficient to force the head of the pin below the contact face of the supported terminal, said punch having an end diameter less than the diameter of the seat in the end of the terminal whereby to enter said seat in driving the head of the pin below the contact face to accomplish pinching off of excess wire projecting from beneath the head of the driven pin.

SIDNEY M. WEISBERG.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
378,341	Snee	Feb. 21, 1888
459,820	Short	Sept. 22, 1891
556,046	Daniels	Mar. 10, 1896
721,042	Holland	Feb. 17, 1903
985,915	Marchand	Mar. 7, 1911
1,200,593	Currie	Oct. 10, 1916
1,488,563	Stappler	Apr. 1, 1924
1,596,673	McLaughlin	Aug. 17, 1926
1,709,393	Fitch	Apr. 16, 1929
1,817,462	Phelps et al.	Aug. 4, 1931
1,856,018	Barth	Apr. 26, 1932
1,950,156	Swoboda	Mar. 6, 1934
1,982,212	Hagist	Nov. 27, 1934
2,146,923	Wahlstrom	Feb. 14, 1939
2,183,641	Double	Dec. 19, 1939
2,285,380	De Bella et al.	June 2, 1942
2,383,330	Michael	Aug. 21, 1945