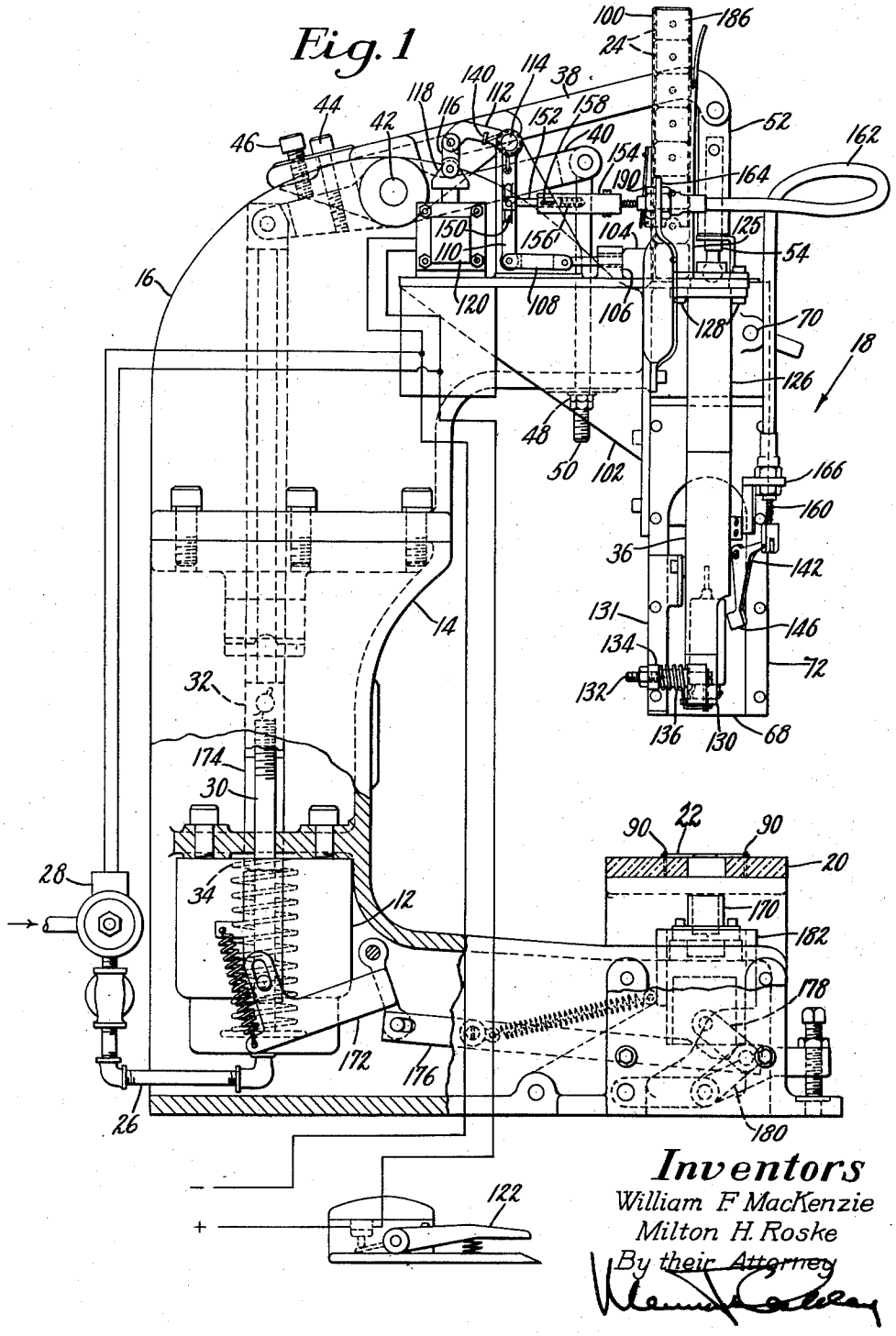
July 22, 1958 W. F. MacKENZIE ET AL 2,843,923

ASSEMBLING MACHINES

Filed Sept. 23, 1955 4 Sheets-Sheet 1

Fig. 1



Inventors

William F. MacKenzie

Milton H. Roske

By their Attorney

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Fig. 2

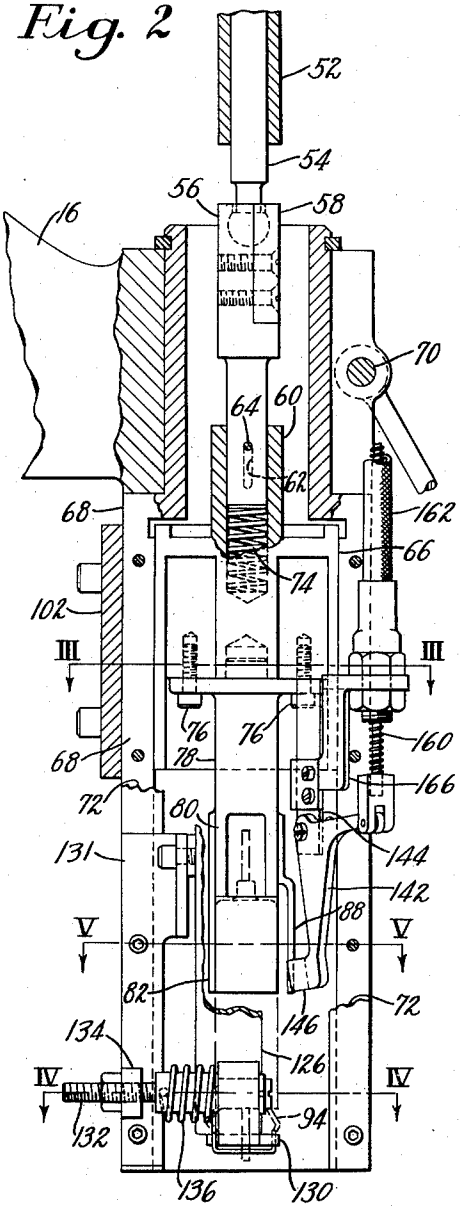


Fig. 3

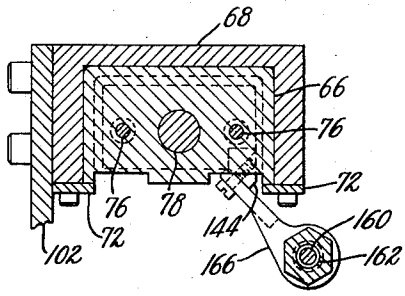


Fig. 4

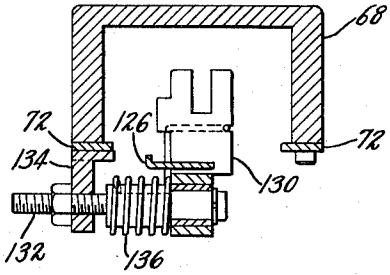
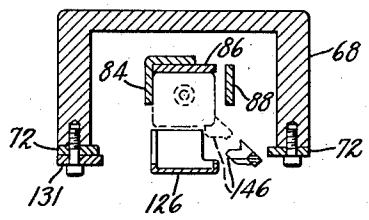


Fig. 5



Inventors
William F MacKenzie
Milton H. Roske
By their Attorney

July 22, 1958 W. F. MacKENZIE ET AL 2,843,923

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Fig. 6

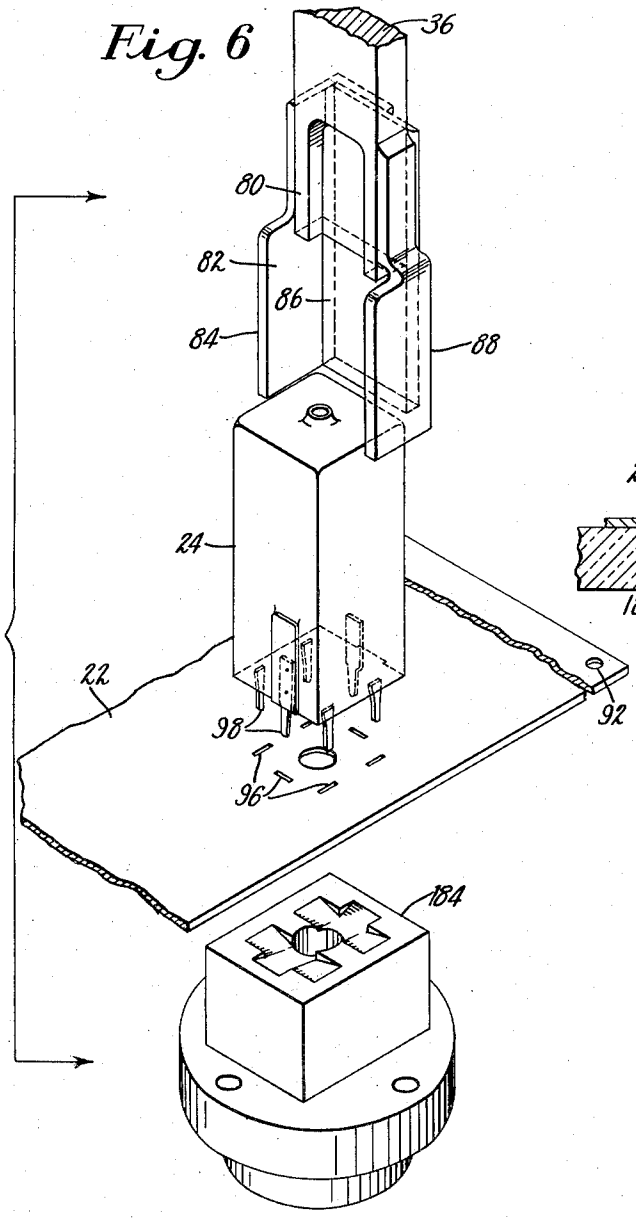
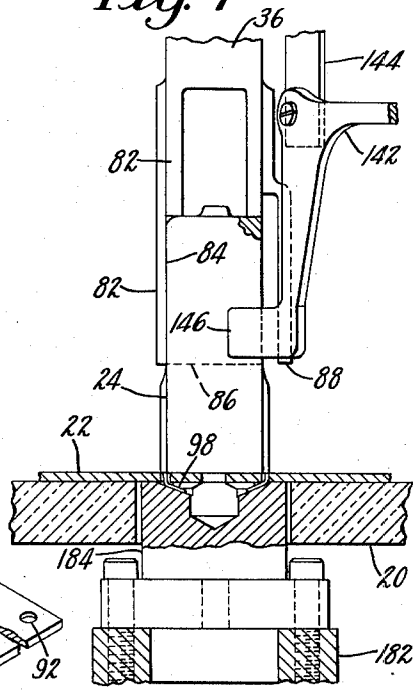


Fig. 7



Inventors

William F. MacKenzie

Milton H. Roske

By their Attorney

July 22, 1958 W. F. MacKENZIE ET AL 2,843,923

ASSEMBLING MACHINES

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Fig. 8

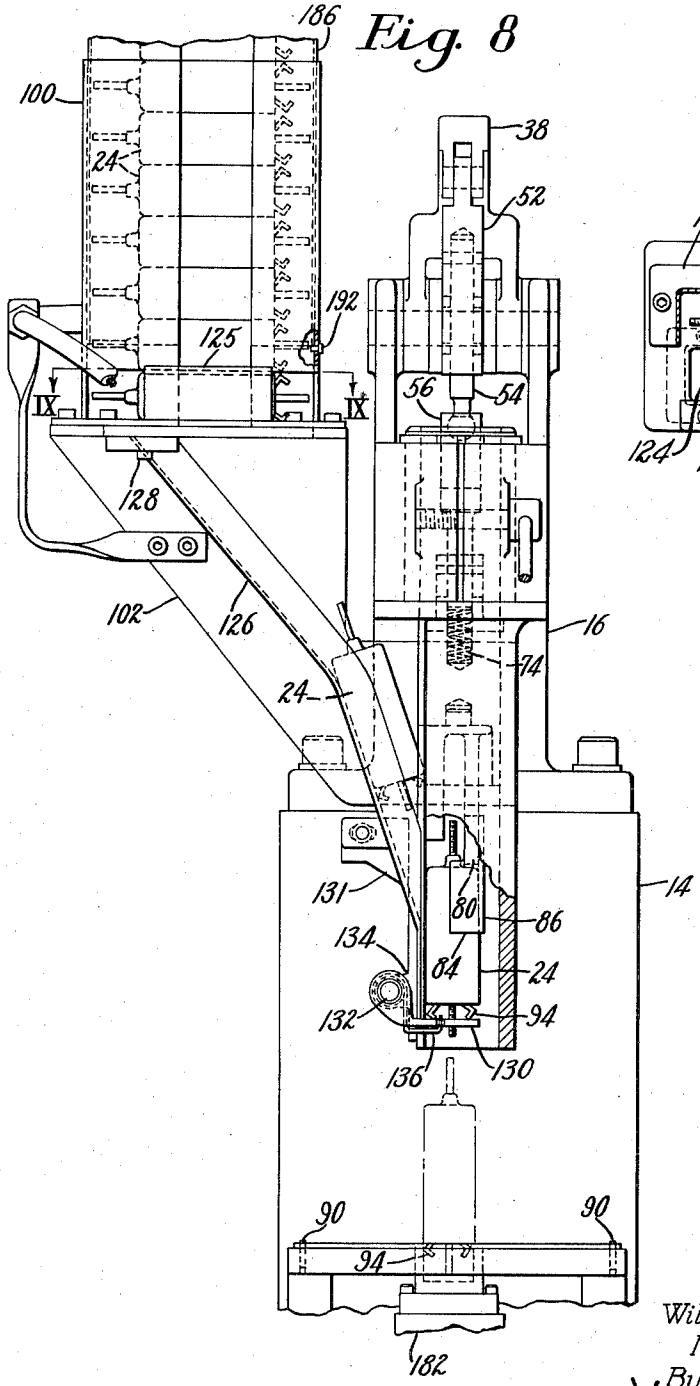


Fig. 9

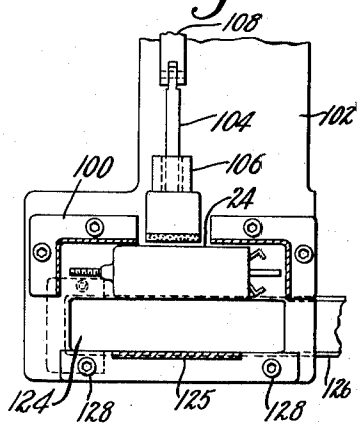
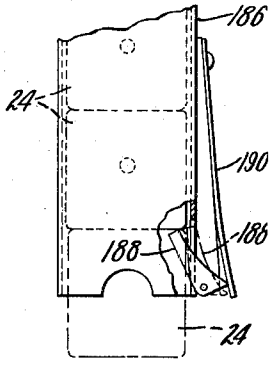


Fig. 10



Inventor
William F MacKenzie
Milton H. Roske
By their Attorney

United States Patent Office 2,843,923 Patented July 22, 1958

2,843,923

ASSEMBLING MACHINES

William F. MacKenzie, Hamilton, and Milton H. Roske, Malden, Mass., assignors to United Shoe Machinery Corporation, Flemington, N. J., a corporation of New Jersey

Application September 23, 1955, Serial No. 536,184

4 Claims. (Cl. 29—203)

This invention relates to machines for assembling articles with work pieces, and more particularly to machines for successively pressing into assembled and definite relation on chassis, parts respectively having a plurality of projections formed and arranged to make effective connection with preformed portions of the chassis. The invention is herein illustrated as embodied in a machine for assembling electronic components, for example I. F. transformers of the so-called can type, on printed wiring boards. It will be appreciated that application of the invention is not limited to insertion of components, electrical or otherwise, of any particular type or shape, and that the invention has utility whether the terminal connections of the articles to be installed are characterized as tabs, prongs, snap fasteners or other registering elements.

The so-called can type of transformer is in one respect typical of many components being installed in electronic assemblages in large quantities: the main body or shield of the component is provided with fastening means comprising a group of slender connectors which may be of different configuration and adapted to be thrust into a socket consisting of several individual holes or one large chassis hole. Frequently these projecting connectors are resilient and deflected upon being urged into engagement with an edge of a chassis to hold the component in upstanding relation. Also, the connectors of a component and the chassis hole or holes which are to receive them will usually be so disposed that only the intended component may be received in proper register. Having selected and oriented a component so that its connectors are directed accurately to their socket, it normally is not an arduous task manually to complete the single installation. In view of the tediousness of the task, the tremondous quantities of such components to be inserted, and the importance of consistently obtaining proper installations, the work is of a nature to be dealt with advantageously by machine.

In view of the foregoing it is an object of this invention to provide an improved machine, capable of independent use or as part of automatic apparatus, for assembling articles successively in definite relation on work pieces, the latter being preformed to cooperate with connectors associated with said articles.

In keeping with this object a feature of this invention resides in the provision of an assembling machine comprising a support for chassis having socket means for receiving the connectors of an article to be mounted, a machine head fixed with respect to said support, a driver bar reciprocably mounted in said head for movement toward and from the chassis support and having an open portion formed to receive each article to be mounted, a raceway in communication with said open portion when the driver bar is retracted, means for feeding an article into said raceway when the driver bar is being advanced to eject and mount a preceding article from the machine head, and means mounted for movement with the driver bar and controlled by said feeding means for engaging

and positioning each article in the article receiving portion of the driver bar for register of its connectors with said socket means.

The above and other features of the invention, including novel work replenishing means, together with various novel details and construction of parts, will now be more particularly described in connection with an illustrative machine in which the invention is embodied and with reference to the accompanying drawings thereof, in which:

Fig. 1 is a view in side elevation, with frame portions broken away, of an illustrative machine for assembling components such as can type transformers or the like in printed wiring boards, certain electrical connections being indicated schematically and the machine being shown in rest position;

Fig. 2 is a view in side elevation and on a larger scale of the head of the machine shown in Fig. 1, portions being broken away to reveal construction details;

Figs. 3, 4, and 5 are sections taken on the lines III—III, IV—IV, and V—V of Fig. 2 and looking in the direction of the arrows;

Fig. 6 is an enlarged and exploded perspective view of a can type component, a wiring board formed to receive it, and inserting instrumentalities of the machine comprising the lower end of a driver bar, and an upsetting anvil;

Fig. 7 is a view in side elevation and partly in section of the parts shown in Fig. 6 and at the stage when assembling is completed;

Fig. 8 is a view in front elevation of head portions of the machine shown in Fig. 1 and indicating work feeding means;

Fig. 9 is a section taken on the line IX—IX of Fig. 8; and

Fig. 10 is an end elevation of a portion of a can holding clip.

Although the illustrative machine hereinafter described is adapted to be mounted on a bench and controlled by a manually operated switch it will be appreciated that the design of the machine is such that it may, with very minor modifications, occupy an automatically operated station, for example in an automatic assembly line of the type disclosed in the copending application, Serial No. 458,328, filed September 27, 1954, in the names of Adolph Dorosz and Thomas W. Snow, now Patent No. 2,772,416, granted December 4, 1956.

The machine includes actuating mechanism similar to that disclosed in a copending application Serial No. 458,312, relating to a component inserting machine and filed September 27, 1954, in the names of Leon D. Alderman, Charles P. Cardani, Edward S. Kant, and Henry B. Kimball. Thus, an air motor **12** is mounted in a base **14** of a composite, hollow C-frame having an upper portion **16** for supporting a head **18** of the machine. Beneath the head **18** and at the front of the base **14** a Plexiglas table **20** is arranged to support the work, in this instance a printed wiring board **22** (Fig. 6), which is to be assembled with its component, for example a can type transformer **24** hereinafter referred to simply as a can. The motor **12** is connected by a pipe **26** (Fig. 1) to a source of air under pressure, a solenoid operated valve **28** governing the admission of air to the motor as will later be described. The arrangement is such that upon admission of air pressure a vertical piston rod **30** threaded into the lower end of a link **32** forces the latter upward against the resistance of a return spring **34** to actuate linkage operating a driver bar, generally designated **36**, in the head for installing the can **24** in the wiring board. The linkage just referred to includes a composite lever consisting of levers **38** and **40** mounted on a fulcrum rod **42** journaled in the

frame 16, the upper end of the link 32 being pivotally connected to the rearward end of the lever 40. The levers 38 and 40 are adjustably coupled by means of a bolt 44 threaded into the lever 40 and extending through a bore formed in the lever 38, a bolt 46 threaded into the latter abutting the lever 40 endwise. The initial position of the composite lever and hence the heightwise position of the driver bar 36 may be determined by means of a nut 48 threaded on a rod 50 depending from the front end of the lever 40 and normally abutting the frame 16.

The driver bar 36 is operatively suspended from the front end of the lever 38 as will next be described. Pivotally connected to the latter is a hollow link 52 (Figs. 1 and 2) in which is secured a ball-ended link 54. A spherically recessed intermediate link 56 (Fig. 2) is adjustably coupled to the ball end of the link 54 by means of a spherically recessed plate 58 which is screwed to the link 56. For a purpose later explained a sleeve 60 is provided with opposite vertical slots 62 through which extends a pin 64 (Fig. 2) that is carried by the link 56, the sleeve being integral with a block portion 66 of the driver bar 36. The front of the frame 16 is formed with confronting jaws to provide a vertical cylindrical bearing in which the upper end of a head casing 68 is adjustably secured, the casing being clamped in selected position about a vertical axis by means of a bolt 70 extending through the confronting jaws and oppositely threaded therein. Lower portions of the casing 68 are open on one side and rectangular in configuration, as indicated in Figs. 3, 4, and 5. Vertical guide bars 72, 72 secured to the casing serve to retain the driver bar 36 in its operative path therein, the bars acting as ways for the block portion 66. A compression spring 74 seated in the sleeve 64 and abutting the intermediate link 56 endwise normally urges the pin 64 against the upper end of the slots 62.

Demountably secured to the underside of the driver bar block portion 66 by bolts 76, 76 is a driver bar stem 78 (Figs. 2, 6, and 7) having a recessed driving end 80, U-shaped in horizontal section, and formed to bear upon the upper end surface of the component to be installed. Integral with the driver bar stem 78, as best indicated in Fig. 6, and constituting its lower extremity is an article receiving and positioning portion 82 which also, in this instance, is U-shaped in horizontal section and formed with flat vertical positioning sides 84, 86 and a retainer side 88. It will be appreciated that the configuration of both the driving end 80 and the portion 82 may be modified in interchangeable driver bar stems suitably to engage an upper bearing surface and side surfaces, respectively, of components having contours differing from the rectangular can herein shown. The driving end 80 and positioning portion 82 illustrated, it should be noted, may also be employed without change for installing cylindrical components. The sides 84, 86 extend in continuation of the exterior of the driving end 80 and intersect at substantially right angles for article positioning purposes whereas the side 88 is somewhat offset from the driving end 80 to afford adequate clearance for initially accommodating the receipt of each component to be installed.

A wiring board 22 may be located in appropriate position for the assembling operation by any suitable means, a pair of jig pins 90, 90 (Figs. 1, 6, and 7) being herein shown by way of illustration as mounted in the table 20 and disposed to be received in a pair of corresponding wiring board holes 92, 92 respectively. Accordingly, socket means formed in the wiring board and constituting, for example, a single hole for cooperating with snap-in terminal prongs of the type shown at 94 in Fig. 8, or a group of several small holes 96 (Fig. 6) for respectively receiving terminal tabs as shown at 98, may be registered accurately with the driver bar 36, and more especially with the component positioned in the

portion 82 and delivered endwise thereto by feeding means next to be explained.

For holding in vertically stacked formation a supply of cans 24 to be installed successively by the machine a hopper 100 (Figs. 1, 8, and 9) essentially rectangular in configuration and open at the top is affixed to a bracket 102 secured to the head casing 68. One side of the hopper is cut away near its bottom to provide an exit for the bottom-most can 24 when it is thrust sidewise by a horizontally reciprocable pusher 104 (Figs. 1 and 9). The latter is slidable in a bearing 106 on the bracket 102 and has a front end adapted to be extended through an opening in the hopper for effecting the can displacement, the rearward end of the pusher being connected by a link 108 (Fig. 1) to the lower end of one arm 110 of a bell crank lever 112. The latter is pivotally mounted on a pin 114 affixed in the bracket. The other arm of the lever 112 is connected by a link 116 to a plunger 118 of a solenoid 120 mounted on the bracket. Thus, the construction is such that when a circuit connected to the solenoid is energized by depression of a spring-backed switch 122 (Fig. 1), the bell crank lever 112 will be urged counterclockwise, as viewed in Fig. 1, to cause the pusher 104 to move the bottommost can from the hopper and over an opening 124 (Fig. 9) in the bracket through which the can is allowed to fall by gravity into a chute or raceway 126. An upturned lip 125 (Figs. 8 and 9) of the bracket 102 acts as a stop to aline the can with the opening 124. The upper end of the raceway is secured by bolts 128 (Figs. 8 and 9) to the underside of the bracket and normally is in communication with the article receiving and positioning portion 82 when the latter is in its normal or upper position to allow a can in the raceway to enter, with terminals down, into the lower part of the casing 68 where, for example, the snap-in prongs 94 of a can engage and are supported by a forked stop gate or work rest 130 (Figs. 2, 4, and 8). The lower end of the raceway 126 is secured to a flat plate 131 affixed to the casing 68 by bolts extending through one of the bars 72. The rest 130 is mounted for lateral adjustment on a pin 132 threadedly secured in a lug 134 formed on the plate 131. A torsion spring 136 is arranged yieldingly to resist subsequent downward swinging movement of the rest, past which the supported can to be installed by the driver bar is thrust, but is sufficiently strong to hold the rest in its normal horizontal work supporting position shown in Fig. 8. As indicated schematically in Fig. 1, depression of the switch 122 to deliver one can into the raceway 126 is also effective to energize a circuit by which the solenoid valve 28 is actuated thereby causing the driver bar 36 to commence its downward stroke, against the resistance of the spring 136, for installing the preceding can previously released from the raceway to the portion 82. Each can introduced into the raceway is thus retained therein by the side of the lowered driver bar 36 as indicated in Fig. 8 until the latter is subsequently retracted in a cycle to present an empty portion 82 in communication with the raceway. Retraction of the pusher 104 is automatically effective upon release of the depression switch 122 by a torsional return spring 140 (Fig. 1) having one end latched onto an arm of the bell crank lever 112 and the other end anchored in the lever 40. It will therefore be seen that, following an initial cycle in which no can is installed in response to operation of the switch 122, in the normal machine cycle each switch actuation results in one can being installed by a driver bar stroke and a succeeding can being directed down the raceway in preparation for installation in the following cycle.

In order accurately to register the connectors 94 or 98, for example, of a component being installed with socket means such as a large single hole or the holes 96 in the wiring board, mechanism is provided for engaging and holding positioned each component after it

is received in the driver bar portion **82**. For this purpose can clamping means in the form of a bell crank lever **142** (Figs. 1, 2, and 7) is pivotally mounted on the lower end of an arm **144** secured to the block portion **66** of the driver bar. The lower arm of the lever **142** is provided with a foot **146**, in this instance L-shaped, arranged for engagement with the adjacent sides of a component being acted on by the driver bar. The foot **146** may have different shapes appropriate to the particular component bodies being installed, the L-shape shown being satisfactory for operation on cylindrical or rectangular bodies. In the normal or retracted position of the driver bar **36** the foot **146** is swung away from a can in the portion **82** or to be received in that portion as shown in Fig. 2. During descent of the driver bar the foot **146** is swung by means about to be described into engagement with the can as indicated in Fig. 7. Referring to Fig. 1, the arm **110** is formed with a vertical slot **150** in which a pin extends for pivotal connection with one end of a link **152**. The other end of the latter is slidably received in the tubular end of a connector block **154** and abuts a compression spring **156** seated therein, a pin **158** in the link **152** extending through parallel slots formed in the block **154**. The other or non-tubular end of the latter is secured to one end of a push-pull type of flexible wire cable **160** which extends for endwise movement through a flexible conduit **162** for operative connection with an arm of the lever **142**. The conduit is supported at its upper end in a stationary bracket **164** affixed to the machine frame, the lower and reciprocable end of the conduit being mounted on an arm **166** secured to the driver bar arm **144**. Accordingly, in the course of a downward operating stroke of the driver bar **36** to install a first component, the aforementioned counterclockwise movement of the lever **112** for feeding a second component into the raceway is also effective to move the cable **160** endwise in a manner to cause the descending foot **146** yieldingly to cooperate with the positioning sides **84, 86** in clamping and alining the can and hence its terminal connectors for registering with the socket means. After completion of the installation the cable **160** is retracted endwise during the clockwise (as shown in Fig. 1) movemen of the lever **112** under the influence of the spring **140**.

As herein shown, anvil mechanism is provided either to back up that portion of a wiring board receiving a component, as shown in Fig. 8, or to clinch the terminal connectors when they have been thrust through a wiring board, as indicated in Fig. 7. This anvil mechanism may be largely as disclosed in the Alderman et al. application referred to above. It will therefore suffice for present purposes briefly to note that the motor **12** is operatively connected by linkage shown in Fig. 1 to an anvil **170** to move the latter heightwise in appropriate time relation to the strokes of the driver bar. The linkage mentioned includes a bell crank lever **172** pivoted in the base **14**, links **174** (one shown) having pin-and-slot connection with the lever **172**, a toggle operating link **176** also having pin-and-slot connection with the lever **172**, toggle links **178, 180** having their knee connected to the link **176**, and a cylinder **182** by which the anvil **170** is carried upward during straightening of the toggle. An anvil **184** (Figs. 6 and 7) may be employed, for example, in lieu of the anvil **170** for clinching multi-pronged components.

One means by which the illustrative machine may readily be supplied with a number of components is afforded by the use of rectangular packs or clips **186** (Figs. 1, 8, and 10) in which groups of cans or the like may be similarly arranged and stored. A clip, when loaded, is inserted in the hopper **100** and has an open end through which successive cans may exit to rest on the bracket **102** and thus assume the lowermost position in the stack. A detent **188** (Fig. 10) is pivotally mounted on a side of the clip and is normally held by a leaf spring **190** affixed on the clip in a position to extend for abutment with a can in the pack and thus prevent premature release of the stacked cans. Upon placing a loaded clip in the hopper, the lower portion of the clip will engage a part of the uppermost can remaining in the hopper, the detent being thereby cammed to a dot-dash position indicated in Fig. 10. The cans of the clip and the clip are thereupon free to descend by gravity on the cans in the hopper, the clip itself being prevented from descending so far as to interfere with operation of the pusher **104** by a pair of stop pins **192** (one shown in Fig. 8) affixed in the hopper.

Briefly to review a cycle of operations, assuming cans occupy the hopper **100** and the retracted driver bar portion **82** holds the upper part of a can, the switch **122** is depressed to energize the solenoid **120** and actuate the valve **28**. As a consequence the motor **12** causes the driver bar **36** to descend, the portion **80** bearing on the top of the can about to be installed to push it down on and past the yieldable rest **130**, the spring **74** being stronger than the spring **136**. Almost simultaneously the descending foot **146** is caused yieldingly to engage a corner portion of the can and firmly position the can by clamping it into the corner formed by the sides **84, 86**, as shown in Fig. 5. As thus alined the connectors of the component are thrust into the socket means of the wiring board, an anvil **170** preferably being raised by the motor **12** to engage and brace the underside of the board, or means similar to the anvil **184** being substituted if clinching of the inserted connectors is to be effective. The latter portion of an installation stroke of the driver bar may involve lost motion, the spring **74** being compressed when no further insertion is required and the pin **64** merely being forced downwardly in the slots **62**. During the installing stroke the pusher **104** has acted to introduce the lowermost can in the hopper to the raceway, the can being allowed to fall by gravity into the portion **82** when the driver bar is retracted. It will be understood that as herein shown the driver bar will not be retracted for repeat operation until the switch **122** is released.

Having thus described our invention, what we claim as new and desire to secure by Letters Patent of the United States is:

1. An assembling machine comprising a support for chassis having socket means for receiving the connectors of an article to be mounted, a machine head fixed with respect to said support, a driver bar mounted in said head for movement toward and from the chassis support, said driver bar having an end portion formed to engage the article and an adjacent side portion open to receive each article to be mounted, a raceway in communication with said open side portion when the driver bar is retracted, means for feeding an article into said raceway when the driver bar is being advanced to eject and mount a preceding article from the machine head, and means mounted for movement with the driver bar and for movement transversely into its path for positioning and clamping the article against the article receiving portion of the driver bar for register of said connectors with said socket means.

2. In a machine for installing terminal connectors of components in the socket apertures of chassis, a support for the chassis, a driver bar mounted for movement toward and from said support and having a component driving end open on one side and formed with two adjacent, angularly related positioning surfaces, means for feeding a component into proximate position with respect to said driver bar end when it is retracted, means movable into said open side for engagement with the component during advance of the driver bar clampingly to position the component in cooperation with said positioning surfaces for registry of said connectors with the socket apertures, and means for disengaging said

positioning means from the component upon its installation.

3. In a machine for mounting electrical components on chassis, the latter having means for receiving terminal connections of the components, a support for the chassis, an applying member mounted for movement toward and from said support, said member having a recessed end portion adapted to bear on each component and providing adjacent walls of a configuration corresponding to surfaces of the components to register their terminal connections with said receiving means, means for feeding successive components into said recessed end portion with their surfaces adjacent to the corresponding surfaces of said walls, and means controlled by the feeding means and movable transversely of the recessed end portion during mounting movement of the member for urging a component therein to be positioned by said walls.

4. A machine as set forth in claim 3, and further characterized in that the last-mentioned means consists

of a clamp pivotally mounted on the applying member for travel therewith, said clamp having yielding connection with said feeding means whereby the clamp is urged to bear on the component only until the latter has been mounted.

References Cited in the file of this patent

UNITED STATES PATENTS

579,148	Hay	Mar. 23, 1897
1,508,467	Novick	Sept. 16, 1924
1,520,159	Uttley	Dec. 23, 1924
1,632,374	Havener	June 14, 1927
1,791,967	Mansfield	Feb. 10, 1931
1,817,462	Phelps	Aug. 4, 1931
2,172,847	Nydegger	Sept. 12, 1939
2,186,841	Rylander	Jan. 9, 1940
2,357,693	Samson	Sept. 5, 1944
2,396,356	Wickens	Mar. 12, 1946
2,540,572	Engeln	Feb. 6, 1951