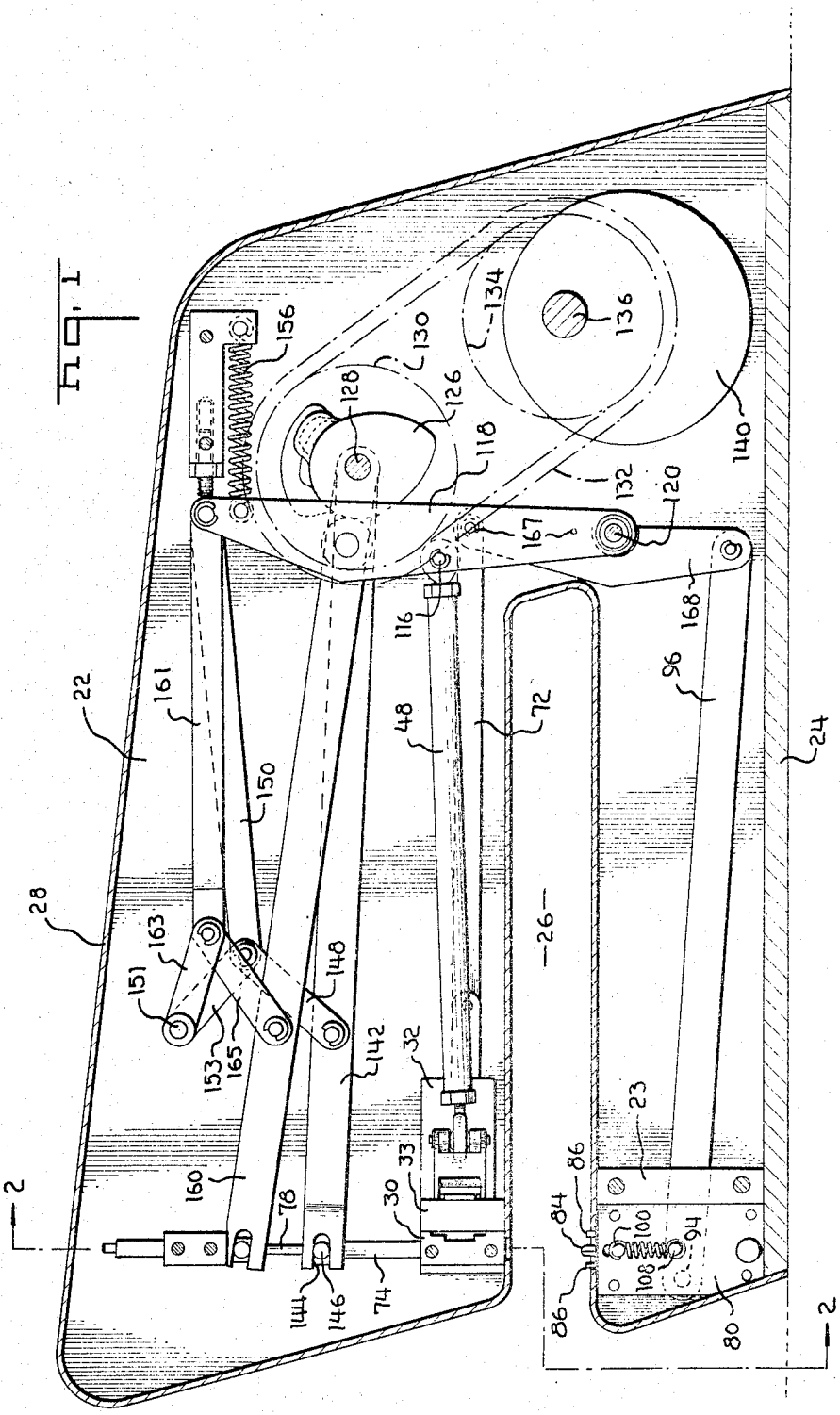
Oct. 4, 1966 C. M. LOVENDUSKY 3,276,653

CONTACT INSERTING APPARATUS

Filed Aug. 24, 1964 6 Sheets-Sheet 1



Oct. 4, 1966 C. M. LOVENDUSKY 3,276,653

CONTACT INSERTING APPARATUS

Filed Aug. 24, 1964 6 Sheets-Sheet 2

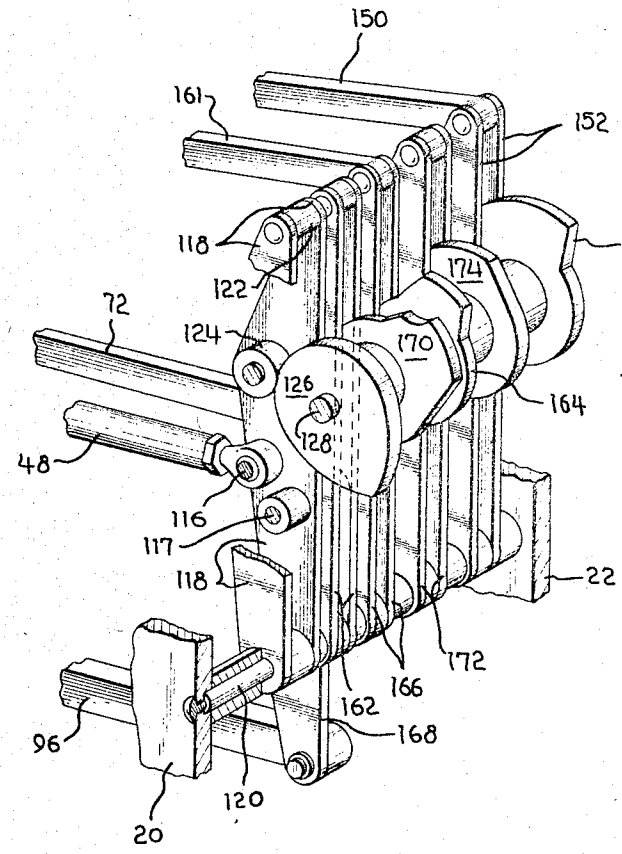


Fig. 1

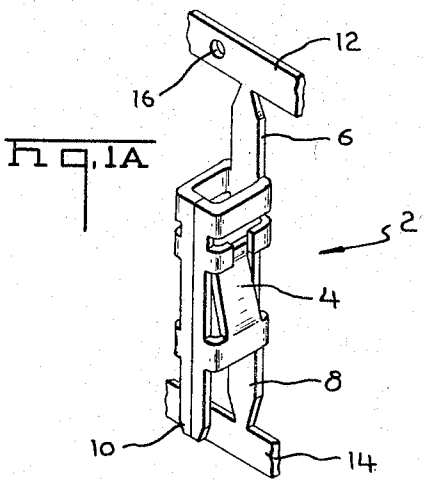


Fig. 1A

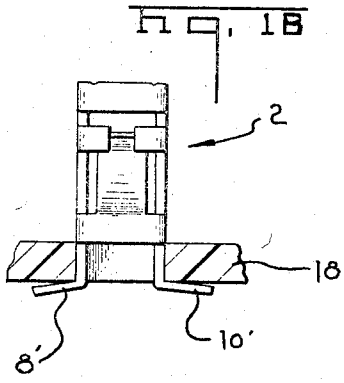


Fig. 1B

Oct. 4, 1966 C. M. LOVENDUSKY 3,276,653

CONTACT INSERTING APPARATUS

Filed Aug. 24, 1964 6 Sheets-Sheet 3

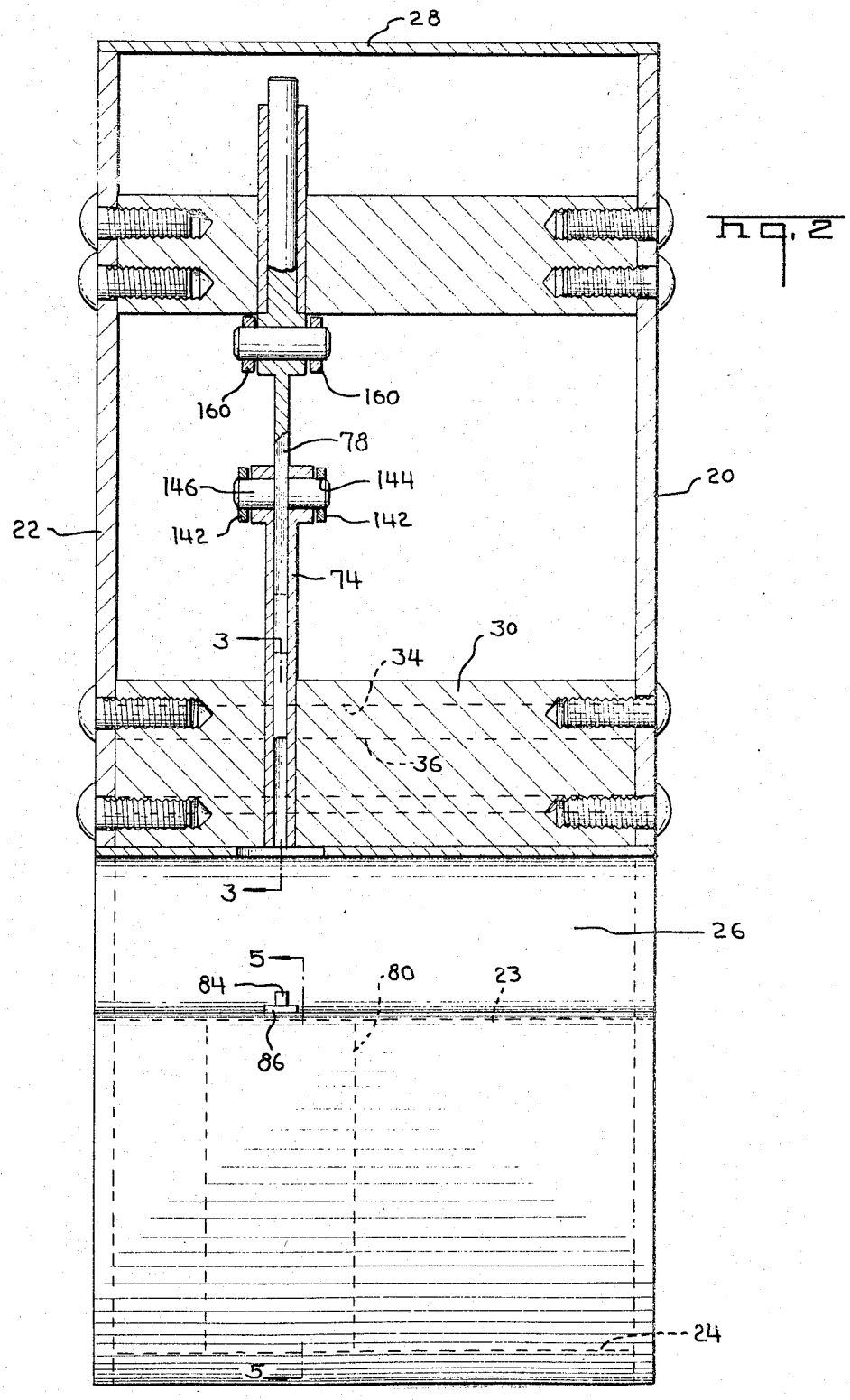


Fig. 2

Oct. 4, 1966 C. M. LOVENDUSKY 3,276,653

CONTACT INSERTING APPARATUS

Filed Aug. 24, 1964 6 Sheets-Sheet 4

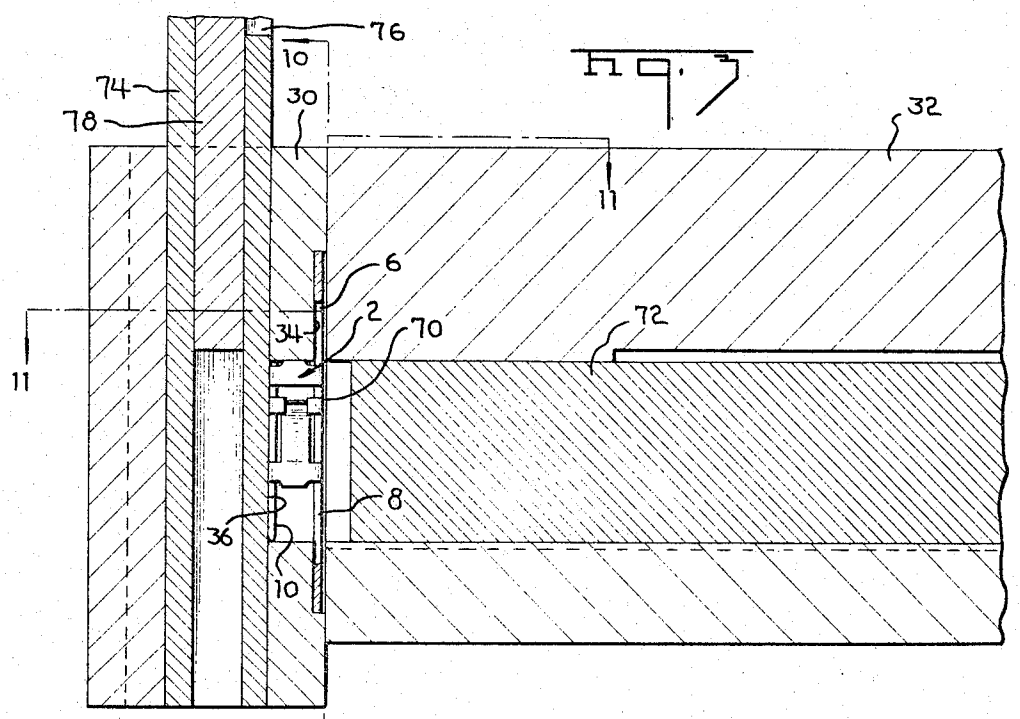


Fig. 3

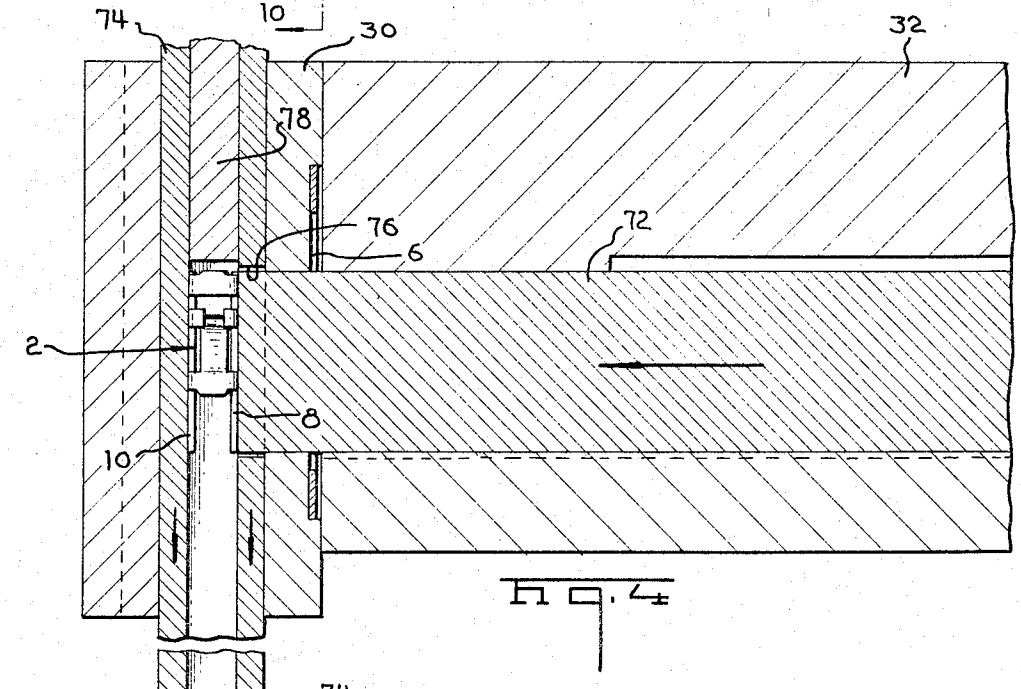
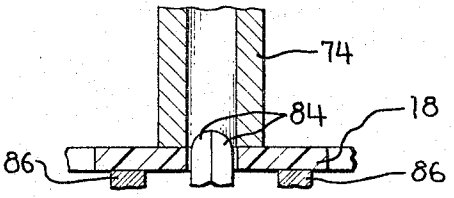


Fig. 4



Oct. 4, 1966 C. M. LOVENDUSKY 3,276,653

CONTACT INSERTING APPARATUS

Filed Aug. 24, 1964 6 Sheets-Sheet 5

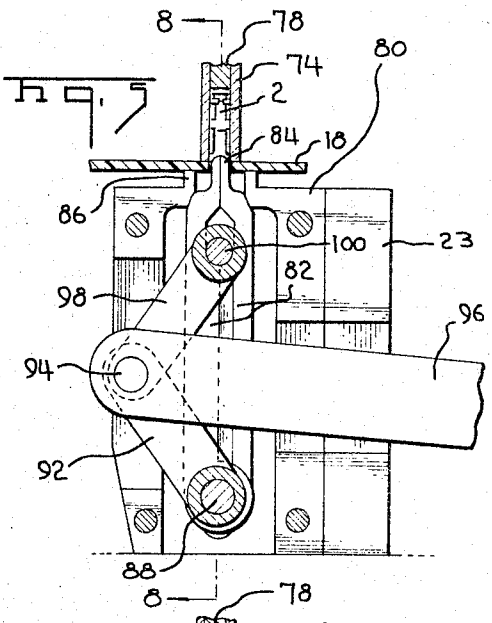


Fig. 5

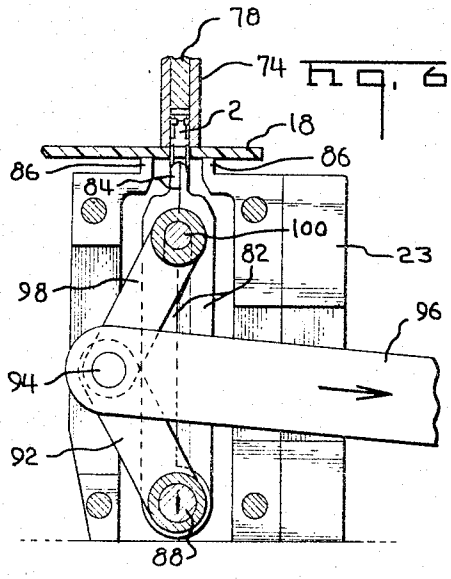


Fig. 6

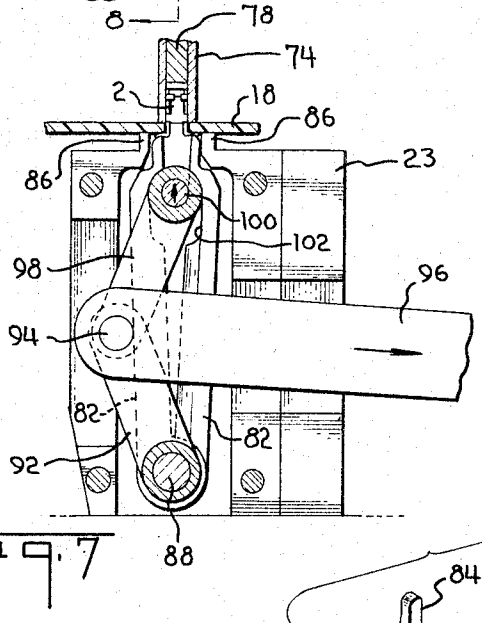


Fig. 7

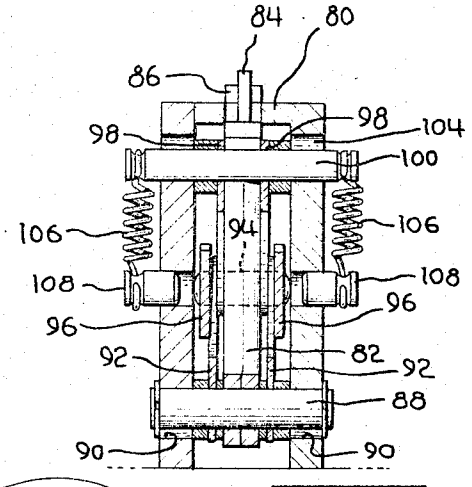


Fig. 8

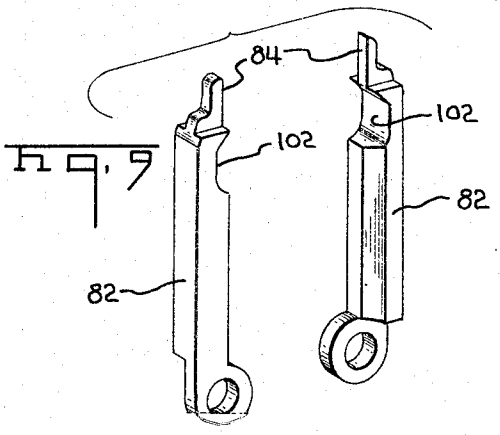


Fig. 9

Oct. 4, 1966 C. M. LOVENDUSKY 3,276,653

CONTACT INSERTING APPARATUS

Filed Aug. 24, 1964 6 Sheets-Sheet 6

Fig. 10

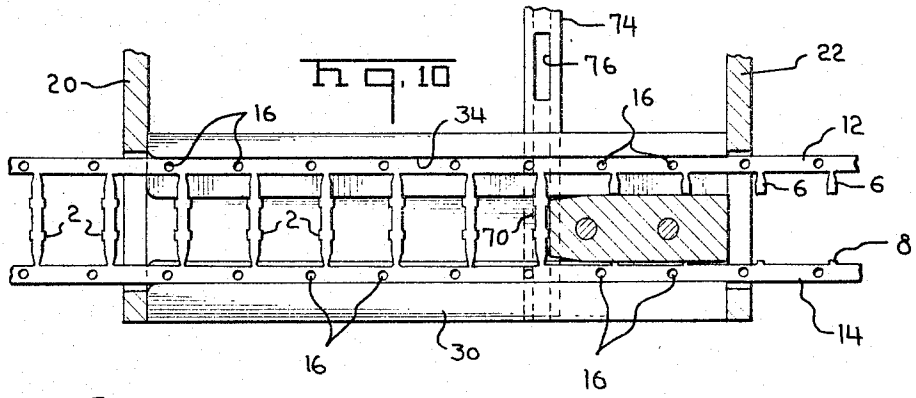


Fig. 11

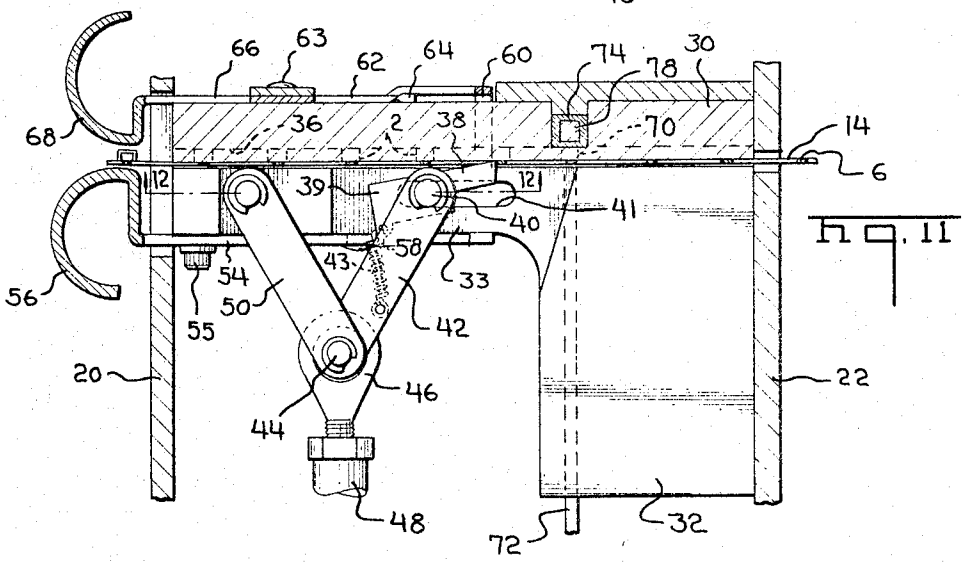
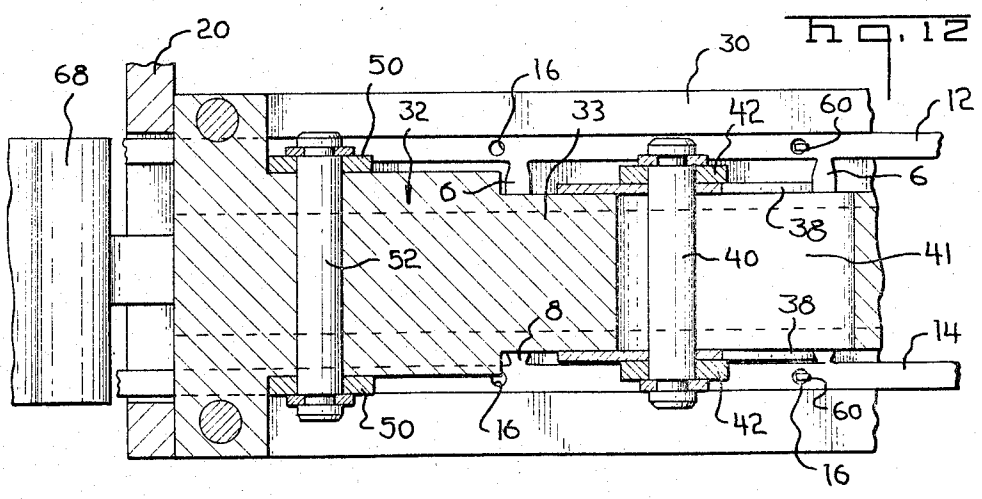


Fig. 12



United States Patent Office 3,276,653 Patented Oct. 4, 1966

3,276,653

CONTACT INSERTING APPARATUS

Charles Michael Lovendusky, Enola, Pa., assignor to AMP Incorporated, Harrisburg, Pa.

Filed Aug. 24, 1964, Ser. No. 391,490
3 Claims. (Cl. 227—95)

This invention relates to apparatus for inserting contact devices into panels such as printed circuit boards.

An object of the invention is to provide an improved inserting device for inserting contacts into panels such as printed circuit boards. A further object is to provide an inserting apparatus which is adapted to insert contact devices in ladder strip form into panels. A further object is to provide inserting device including means for shearing the individual contact devices from a ladder strip, means for inserting the individual contacts into the panels, and means for clinching the contact devices to the panel board. A further object is to provide a contact inserting apparatus having an improved actuating means.

These and other objects of the invention are achieved in a preferred embodiment comprising a supporting means for supporting a panel board such as a printed circuit board, and a guide tube having an opening therein for reception of an individual contact. The guide tube is reciprocable past a loading station which is spaced from the supporting means and at which the leading contact in a strip of contact devices is severed from the strip and loaded into the guide tube. The guide tube is movable against the panel board to clamp the board against the supporting means. A punch or pushing means is slidably mounted in the guide tube and is movable towards the clamped panel board to push the contact axially towards the panel board until the contact member extends partially through the board. The preferred embodiment also includes means in the form of a pair of spreadable fingers in the supporting means for bending portions of the contact element laterally of the axis of the element thereby to clinch the contact element to the panel board.

In the drawing:

FIGURE 1 is a sectional side view of a preferred form of contact inserting apparatus in accordance with the invention;

FIGURE 1A is a perspective view showing a short section of ladder strip comprising contact elements in side-by-side strip form;

FIGURE 1B is a sectional view showing a contact element of the type shown in FIGURE 1A secured and clinched to a panel board;

FIGURE 2 is a sectional frontal view taken along the lines **2—2** of FIGURE 1;

FIGURE 3 is a view taken along the lines **3—3** of FIGURE 2 showing the guide tube and the shearing means for shearing the leading contact element from a strip of contact elements;

FIGURE 4 is a view similar to FIGURE 3 but showing the relative positions of the parts after the guide tube has been moved against a panel board;

FIGURE 5 is a view taken along the lines **5—5** of FIGURE 2 showing the supporting means for supporting the panel board during the inserting operation;

FIGURES 6 and 7 are views similar to FIGURE 5 but showing the relative positions of the parts during progressive stages of inserting the clinching operation;

FIGURE 8 is a view taken along the lines **8—8** of FIGURE 5;

FIGURE 9 is a perspective view showing the clinchor spreading fingers which function to spread the legs of the contact apart after insertion through the panel board;

FIGURE 10 is a view taken along the lines **10—10** of FIGURE 3, showing the guide feed track for the ladder strip and illustrating the manner in which the strip of contact elements are fed to the guide tube;

FIGURE 11 is a sectional plan view, taken along the lines **11—11** of FIGURE 3, showing the feed mechanism by means of which the ladder strip of contact elements is fed to the inserting station;

FIGURE 12 is a view taken along the lines **12—12** of FIGURE 11; and

FIGURE 13 is a fragmentary perspective view showing the actuating mechanism for actuating the various strip feeding, shearing, inserting, and clinching mechanisms shown in the preceding figures, this actuating mechanism being contained in the right-hand side of the apparatus as viewed in FIGURE 1.

Referring first to FIGURES 1A and 1B, the disclosed embodiment of the invention is intended to insert contact sockets **2** into a panel board **18**, the sockets **2** initially being in side-by-side ladder strip form. This type of socket contact is fully described in the copending application of William R. Evans, Serial No. 302,653, filed August 16, 1963. Each socket of the disclosed type is of rectangular cross-section and has inwardly bent tongues **4** on opposite sides. Legs **6**, **8** which extend from opposite ends of the socket on one side thereof are integral with carrier strips **12**, **14**. As explained below, the leg **6** is normally removed during insertion and the leg **8** is inserted through an opening in the socket as indicated in FIGURE 1B. An additional leg **10** is formed on the opposite side of the socket from the leg **8**, this leg **10** also being clinched to the underside of the board after insertion as shown at **10'**. Sockets of the type shown are manufactured by stamping and forming operations and will normally have an open seam extending along the side from which the leg **10** projects. Pilot holes **16** are stamped in the carrier strips **12**, **14** during manufacture and are utilized in the disclosed apparatus for feeding purposes as is explained below.

The disclosed embodiment of the invention comprises a housing including side plates **20**, **22** which project from, and which are secured to, a base plate **24**. A gap or slot **26** extends inwardly from the front of the apparatus so that any edge portion of a relatively large panel can be positioned beneath the contact inserting tooling. Advantageously, a suitable cover **28** is provided in surrounding relationship to the side plates **20**, **22**.

A guide track block **30** extends between and is secured to side plates **20**, **22** by suitable fasteners adjacent to the front end of the apparatus and above the gap **26** as is shown in FIGURE 2. An additional block **32** is secured to the side plate **22** in back of the block **30** (FIGURE 11) and has a laterally extending arm **33** which is disposed against the rearward side of the guide track block **30**. A groove or channel **34** (FIGURES 3 and 10) is provided on the rearward side of the block **30** and extends transversely between the side plates. This groove is of a width sufficient to receive the ladder strip, FIGURE 1A, and has a central deepened portion **36** of a depth sufficient to receive the individual contact sockets **2** in the strip. As shown in FIGURES 10 and 11, the strip of contact sockets is fed from a suitable reel (not specifically shown) through the feed track **34** in the guide plate to position the leading socket of the strip at an inserting station **70**, the plane of the strip during feeding extending normally of the plane of the printed circuit board into which the individual sockets are to be inserted.

The strip is intermitterently fed by means of a pair of spaced apart feed pawls **38** which are reciprocable along the upper and lower surfaces of the arm **33** of the block **32**. The pawls **38** are pivotally connected to a pin **40**

which extends through an elongated slot 41 in the block extension 33 parallel to the path of movement of the strip of contact sockets. Pin 40 is connected by means of a pair of parallel spaced apart links 42 to a pin 44 extending through an eye 46 on the end of a control rod 48. An additional pair of links 50 are pivotally connected at one end to the pin 44 and at their opposite ends to a pin 52 which extends through an opening in the block extension 33. It will be apparent that upon upward movement of the rod 48 as viewed in FIGURE 11, that is, movement of this rod towards the front of the apparatus, the pin 40 will be forced to move rightwardly thus advancing the feed pawls which bear against the legs 6, 8 of the strip to feed the leading contact socket to the inserting station 70.

The feed pawls 38 are enlarged on their lefthand ends 39 as viewed in FIGURE 11 and springs 43 connect these enlarged ends to the links 42 in a manner such that the feed pawls are biased in a counterclockwise direction as viewed in FIGURE 11. It is desirable to provide a means for disengaging the feed pawls from the strip in the event that it is necessary to remove the strip from the feed track. To this end, a plate 54 is slidably mounted against the rearward surface of the arm 33 by means of fasteners 55. Ears 58 on the enlarged ends 39 of the feed pawls extend through slots in the plate 54 so that upon leftward movement of the plate 54 from the position shown in FIGURE 11, the feed pawls will be biased in a clockwise direction when they are engaged by the plate 54. A semicylindrical finger piece 56 is provided on the plate 54 adjacent to the external surface of the frame plate to facilitate pulling of the plate 54 leftwardly. The curved surface of this finger piece also functions as a guide for the strip in cooperation with a similar curved surface 68 on a plate 66 described below.

A pair of stop pawls 60 extend inwardly from the frontal surface of the plate 30 on the upper and lower sides thereof and engage the pilot holes 16 of the strip to prevent rearward movement of the strip while the feed pawls 38 are being retracted. These stop pawls extend from, and are integral with, a plate 62 which is normally spaced from the frontal surface of the guide track plate 30. The plate 62 is bent downwardly against the frontal surface of the plate 30 and secured to the plate 30 by means of a fastener 63. In order to disengage the feed pawls 60 from the strip, there is provided a wedge 64 which is disposed against the surface of the plate 30 and between the plate 30 and the plate 62 on which feed pawls 60 are mounted. The wedge 64 is integral with a plate 66 slidably mounted against the frontal surface of the guide track plate 30 and extends through the side plate to the previously identified finger piece 68. It will thus be apparent that upon leftward movement of the plate 66, the wedge 64 will bias the plate 62 and the stop pawls 60 outwardly and out of engagement with the pilot holes of the strip.

Referring now to FIGURES 3 and 4, the leading contact socket of the strip is severed from the strip at the inserting station 70 and transferred into a guide tube 74 which is movable against a printed circuit board. The severing and transferring operations are carried out by means of a transfer slide 72 which is reciprocable through the block 32 and which moves against the leading contact socket shown in FIGURE 3. The guide tube 74 has as opening 76 on its rearwardly facing side and is moved downwardly from the position of FIGURE 3 to the position of FIGURE 4 to locate this opening in alignment with the leading contact socket in the strip. Thereafter, the transfer slide 72 is moved leftwardly from the position of FIGURE 3 to the position of FIGURE 4 through the block 32 against the socket. The transfer slide shears the socket from the carrier strip during this interval and moves it leftwardly until it is positioned within the guide tube. It will be noted that in this embodiment, the single upwardly extending leg 6 in FIGURE 1A is completely removed from the socket while the lower leg 8 is only partially removed so that the severed contact socket, after being positioned in the guide tube, will have two downwardly extending legs as shown in FIGURE 4.

The printed circuit board is first positioned on a supporting means, described more fully below and generally indicated at 80 so that upon downward movement of the guide tube, the board is clamped against the supporting means with the socket receiving opening in the board in alignment with the bore of the guide tube. The contact socket within the guide tube is then pushed downwardly by means of a punch or push rod 78 which is slidably mounted within the guide tube 74.

The suporting means comprises a hollow support block 80 mounted between the side plates 20, 22 and secured to the frame plate 23, see FIGURES 5–9. The block 80 has as opening on its upper surface with upstanding flanges 86 in surrounding relationship to the opening. A pair of fingers 84, which are normally disposed against each other, project through the opening in the upper surface of the block 80 and, as explained below, are adapted to bend the legs of the socket outwardly during operation of the device. The fingers 84 extend from, and are integral with, a pair of levers 82 contained within the block 80 and pivoted at their lower ends to a pin 88 which extends through opposite sides of the block 80. The ends of the pin 88 are mounted in oversized slots 90 in the sides of the block 80 so that the pin 88 is permitted to move slightly downwardly from the position of FIGURE 5 to the position of FIGURE 6 for reasons which will be apparent as this description proceeds. A pair of spaced apart links 92 are pivotally mounted on the pin 88 at one end and are pivoted at their other ends to a pin 94 on the end of a rod 96. An additional pair of links 98 pivotally connected at one end to the pin 94 are pivoted at their opposite ends to a pin 100 which extends through oversized slots 104 in the upper portion of the block 80. The pin 100 is normally biased downwardly as viewed in FIGURE 8 by means of springs 106 which are secured to the projecting ends of the pin 100 and to anchor pins 108 mounted in the sides of the block 80 as shown in FIGURE 8. The pin 100 extends through opposed cut-out sections 102 in the levers 82 so that upon upward movement of pin 100 from the position of FIGURE 5 to the position of FIGURE 7, the fingers will be wedged apart.

The levers 82 and the fingers 84 are normally in the position shown in FIGURE 5, that is the fingers are against each other and project upwardly beyond the upper ends of the ribs 86 so that these fingers will project through an opening in the printed circuit board 18 to which a contact socket is to be affixed. The lever or rod 96 will normally be at the limit of its leftward travel as viewed in FIGURES 5–7 so that the pin 88 will be at the upper end of the slots 90 and the pin 100 will be at the lower ends of the slots 104 and will be maintained in this position under the influence of the springs 106. Upon rightward movement of the rod 96 from the position of FIGURE 5 to the position of FIGURE 6, the pin 88 moves downwardly to the lower ends of the slots 90 whereby the levers 82 and the fingers 84 are lowered until the upper ends of the fingers are below the surface of the printed circuit board. Upon further rightward movement of the rod 96, from the position of FIGURE 6 to the position of FIGURE 7, the links 92, 98 are brought more nearly into alignment with each other and the pin 100 is forced upwardly against the influence of the springs 106. Such upward movement of the pin 100 causes the levers 82 and, therefore, the fingers 84 to move relatively apart thereby bending the legs 8, 10 of the socket contact laterally and against the underside of the printed circuit board 18.

The strip feed mechanism, the guide tube, the punch or socket pushing device 78, and the clinching or spreading fingers 84, can be actuated by any suitable means.

In the disclosed embodiment, all of these devices are actuated by a motor **140** which will normally be operated in conjunction with a suitable single revolution clutch through a system of cams and levers generally shown in FIGURES 1 and 13 which will now be described.

The rod **48** which actuates the strip feed device is pivotally connected at its right-hand end **116** between a pair of spaced apart levers **118** secured together by suitable fastening means **117, 122**. The lower ends of the levers are pivotally mounted on a stationary shaft **120** extending between the side plates. Adjacent to the upper ends of the levers **118**, a cam follower **124** is rotatably mounted on a pin extending between their opposed surfaces. This cam follower is in engagement with a cam **126** mounted for rotation with a cam shaft **128** which is coupled by means of a pulley **130**, belt **132**, and pulley **134** to the output shaft **136** of the previously identified motor **140**. It will thus be apparent that during each single revolution of the cam shaft **128**, the pair of levers **118** will be swung leftwardly from the position of FIGURE 13 through a short arc to bring about the previously described actuation of the feeding mechanism of FIGURE 11. The levers **118** are normally biased rightwardly in FIGURE 1, that is in a clockwise direction about the shaft **120**, by suitable spring means generally indicated at **156** (FIGURE 1).

The guide tube **74** is vertically reciprocated by means of a rod **142**. This rod has a bifurcated end **144** which receives the ends of a pin **146** on the upper end of the guide tube **74**. The right-hand end of rod **142** is mounted on the cam shaft **128** but is not rotated by this cam shaft; that is to say, the cam shaft **128** is permitted to rotate freely in the rod and the shaft functions only as a pivotal axis for the rod. A link **148** is pivoted to the rod **142** intermediate its ends and extends to a second rod **150** which extends rightwardly and is pivotally mounted between a pair of spaced apart levers **152** similar to the previously described levers **118**. The levers **152** are pivoted at their lower ends to the shaft or rod **120** and contain a suitable cam follower similar to the cam follower **124**. This cam follower is engaged by a cam **154** on the shaft **128** to cause leftward movement of the rod **150** from the position of FIGURES *E* and 13. It should also be noted that the left-hand end of the rod **150** is connected by means of a link **153** to a pin **151** which extends between the plates. Thus, the leftward movement of the rod **150** has the effect of straightening the toggle mechanism comprising the links **153, 148**, thereby to move the end of rod **142** downwardly and to lower the guide tube **74** as previously described.

The punch or contact pushing device **78** is similarly actuated by means of a rod **160** pivoted at its right-hand end on the shaft **128**. The rod **160** is actuated by the cam **164** on the shaft **128** which engages a follower contained between a pair of parallel arms or levers **166** mounted on the shaft **120**. A rod **161** is secured to the levers at their upper ends and is pivotally connected at its left-hand end to a pair of links **163, 165**, the link **165** being pivoted to the rod **160** as shown in FIGURE 1. It will thus be apparent that upon rotation of the shaft **128** through a single revolution, the levers **166** will be swung leftwardly thereby move the rod **160** leftwardly and drive the pushing device downwardly. The rod **160** is returned to its normal position at the conclusion of the cycle by means of a spring similar to the spring **156**.

The control rod **96** which effects spreading of the fingers **84** is pivotally connected at its rearward end to a lever **168** which extends upwardly past the shaft **120** and is secured by means of pins **167** to spaced apart levers **162** which bear the same relationship to the shafts **120** and the cam shaft **128** as the previously described levers. The levers **162** are oscillated by a cam **170** on shaft **128** as previously described to effect rightward movement of the rod **96**.

The transfer slide **72** is actuated by means of a cam **174** which engages a cam follower mounted between a pair of parallel levers **172** which, like the pairs of levers **118, 162, 166, 152**, are mounted on the shaft **120**. It will be apparent that in this instance, the slide **72** can be actuated directly by the levers **172** since the slide reciprocates in a horizontal plane.

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.

I claim:

1. Apparatus for inserting electrical elements into panel boards, said elements being in ladder strip form and each element having a pair of spaced apart legs extending from one of its ends, said apparatus comprising, supporting means for supporting a panel board, a pair of fingers having end portions extending through the plane of a panel board supported on said supporting means, a guide tube having an opening on one side thereof for reception of one of said elements, said guide tube being disposed in axial alignment with said fingers and movable towards said fingers whereby, upon positioning a panel board on said supporting means with said fingers extending through an opening in said panel board and upon movement of said guide tube towards said panel board, said panel board is clamped against said supporting means, strip feeding means for feeding said ladder strip in a plane extending normally of the plane of a clamped panel board along a path extending past said guide tube and past said opening in said guide tube, transfer means for removing the leading element from said ladder strip and transferring said leading element into said guide tube, pushing means in said guide tube for pushing said leading element towards said clamped panel board until the legs of said leading element extend through said opening in said panel board and straddle said fingers, and means for moving said fingers apart whereby said legs are bent laterally to clinch said leading element to said panel board.

2. Apparatus for assembling contact sockets to panel boards, said sockets being in ladder strip form and each socket having two legs which are insertable through an opening in said panel board, said apparatus comprising, supporting means for supporting said panel board, a pair of forming fingers normally extending beyond said supporting means whereby, upon positioning a panel board on said supporting means with said fingers extending through an opening in said panel board, said opening is positioned for an inserting operation, a guide tube disposed in axial alignment with said aligning fingers, means for feeding a strip of said socket contacts in a plane extending normally of said panel board and past said guide tube, means for shearing the leading contact from said strip and transferring said contact to the interior of said guide tube, means for moving said guide tube axially towards said fingers and against said panel board thereby to clamp said panel board against said supporting means with the interior of said guide tube in alignment with said opening, contact pushing means slidably contained in said guide tube, means for moving said pushing means relatively towards said panel board whereby said contact is pushed against said panel and said feet portions are inserted through said openings, and means for subsequently lowering said fingers and moving said fingers relatively apart thereby to spread said feet portions and clinch said socket to said panel board.

3. Apparatus for assembling contact sockets to panel boards, said sockets being in ladder strip form and each socket having two legs which are insertable through an

opening in said panel board, said apparatus comprising, supporting means for supporting said panel board, a guide track block extending parallel to, and spaced from, said supporting means, guideway means in said guide track block for guiding a strip of said socket contacts in a plane extending normally of the plane of a panel board positioned on said supporting means, a guide tube reciprocable through said block and towards said supporting means, an opening in said guide tube, a transfer slide reciprocable along a path extending parallel to said supporting means, transversely of said guideway means and towards said guide tube, spreadable fingers disposed in axial alignment with said guide tube and normally extending partially beyond said supporting means and towards said guide tube, and socket pushing means said guide tube whereby, upon positioning a panel board on said supporting means with said fingers extending through an opening in said panel board, and upon movement of said guide tube towards said panel board, said panel

board is clamped against said supporting means, and upon movement of said transfer slide towards said guide tube, the leading socket of said strip is transferred from said guideway means into said guide tube, and upon actuating of said pushing means and subsequent spreading of said fingers, the legs of said socket are inserted through said opening in said panel board and are bent laterally by said fingers to clinch said socket to said panel board.

References Cited by the Examiner

UNITED STATES PATENTS

988,365	4/1911	Mayo	227—97
1,507,600	9/1924	Hallam	227—155 X
2,781,144	2/1957	Allison	227—97 X
2,902,689	9/1958	Petersen	227—155 X
2,979,721	4/1961	Held.	227—97

GRANVILLE Y. CUSTER JR., *Primary Examiner.*