

[54] **APPARATUS FOR SHAPING A PLURALITY OF LEAD WIRES OF A MINIATURIZED CIRCUIT**[75] Inventor: **Seymour Golub**, Woodland Hills, Calif.[73] Assignee: **Electronic Packaging Associates, Inc.**, Tarzana, Calif.[22] Filed: **Jan. 4, 1971**[21] Appl. No.: **103,759**[52] U.S. Cl. **140/1, 72/294, 72/332, 72/DIG. 10, 140/105**[51] Int. Cl. **B21f 1/00, B21f 11/00**[58] Field of Search **140/1, 71, 105; 72/294, 72/305, 306, 312, 313, 332, 338, 384, 385, DIG. 10**[56] **References Cited****UNITED STATES PATENTS**

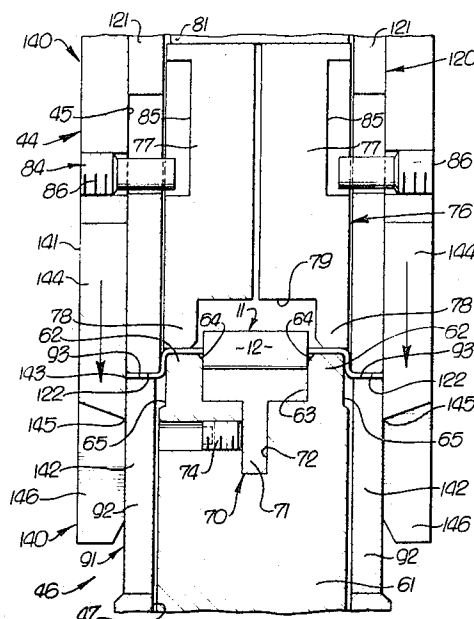
3,195,581	7/1965	Brosseit	140/71
3,131,745	5/1964	Hotze	72/294
2,713,878	7/1955	Stahl	140/71
3,519,033	7/1970	Pepin	140/71
3,515,175	6/1970	Hudson	140/105

Primary Examiner—Lowell A. Larson*Attorney, Agent, or Firm*—Miketta, Glenly, Poms & Smith

miniaturized circuit includes a base mounting a C-shaped frame with guide rails on which a movable carrier is mounted. An upper jaw assembly is mounted on said carrier while a lower jaw assembly, fixed to said frame, has a saddle with locating plates for receiving and properly locating the body of the miniaturized circuit. Lead wires extending therefrom rest on anvil portions of the saddle to be clamped thereto by opposing clamping members carried by the upper jaw assembly. The clamped leads are bent between opposing die members in response to relative movement of the jaw assemblies, into a stepped configuration and mating shear plates trim them to a desired length. The jaw assemblies move in response to manual movement of a handle member mounted to a lever member pivoted on a frame and engaging a cam member on the carrier. The clamp members and the upper die members are spring mounted to insure independent and correct clamping and shaping of the lead wires. The saddle is mounted on a calibrated adjuster for movement relative to the lower die members to very accurately adjust the stepped configuration of the lead wires. Cam lever and handle members are mountable on either side of the frame for right or left hand operation. The lever member is pivoted on an eccentric bushing in the frame for selectively changing the location and length of the stroke of the carrier. The handle member-lever member junction is provided with a clutch permitting the arcuate relationship therebetween to be selectively changed for ease in operation.

[57] **ABSTRACT**

Apparatus for shaping a plurality of lead wires of a

10 Claims, 11 Drawing Figures

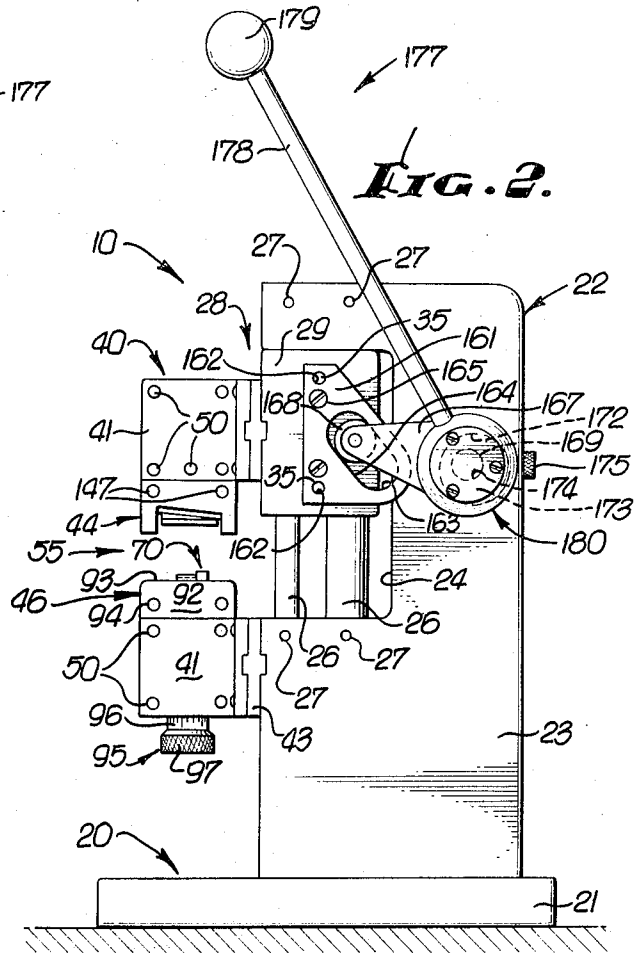
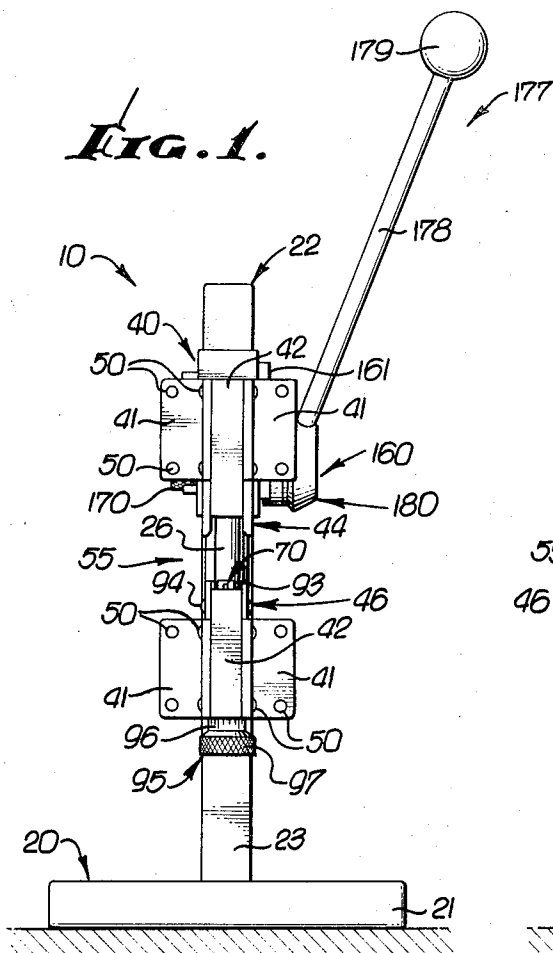
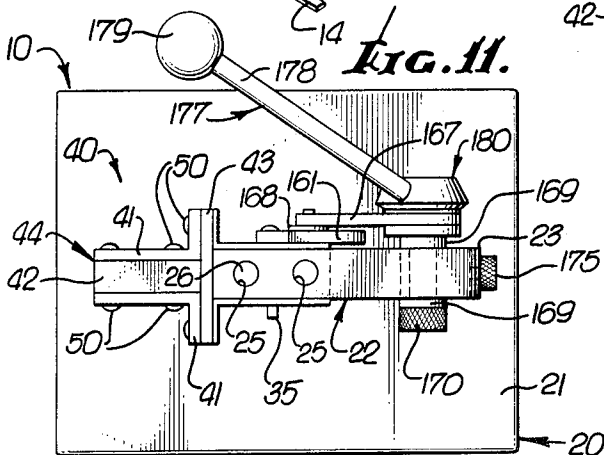
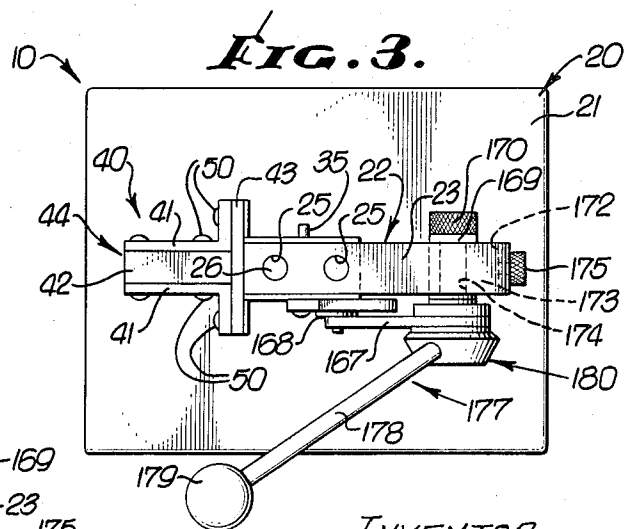
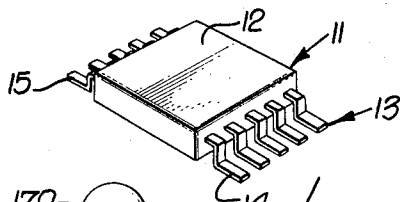


Fig. 4.



INVENTOR.

SEYMOUR GOLUB

By
Miketta, Glenn, Poma & Smith
ATTORNEYS.

FIG. 5.

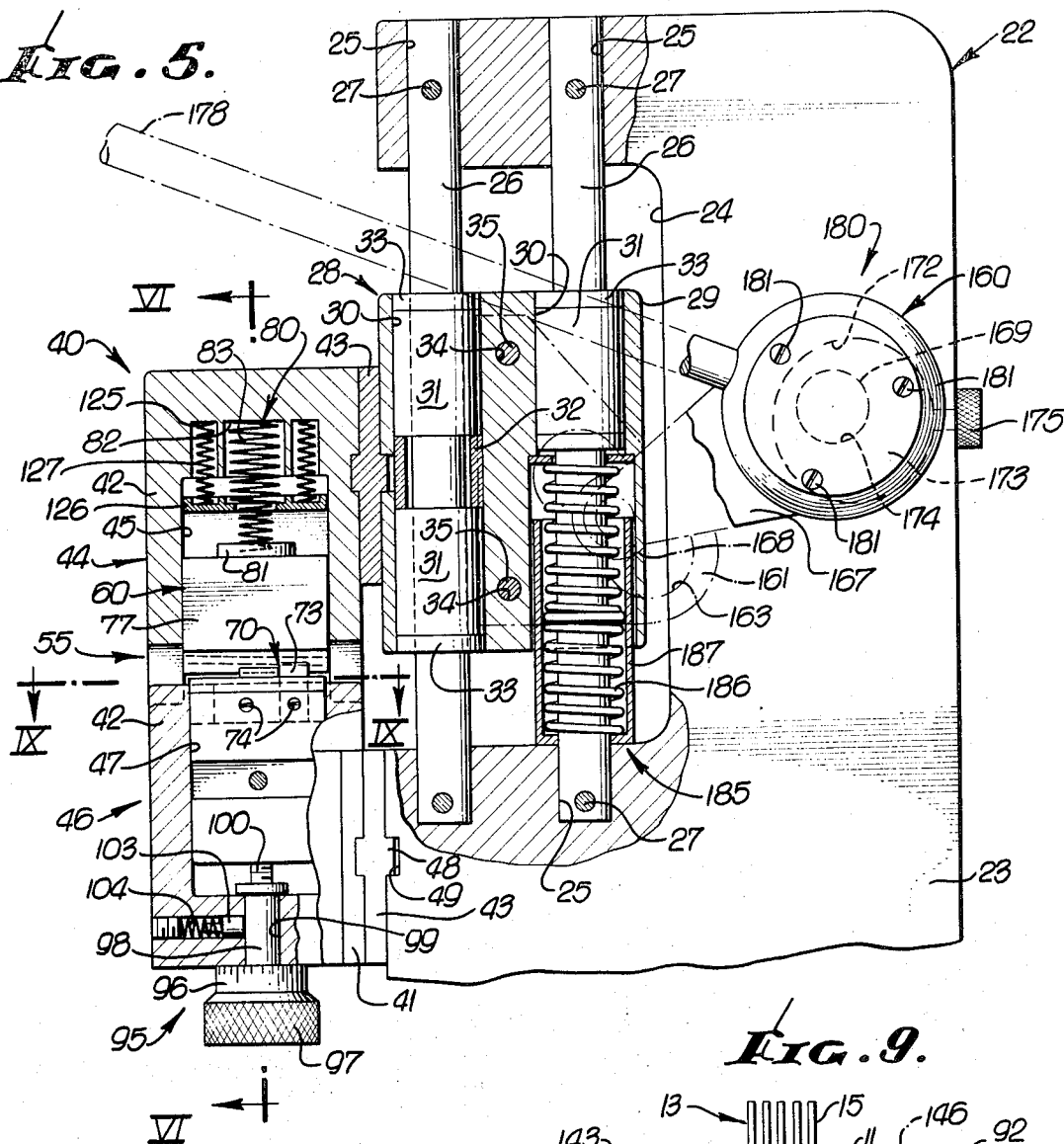
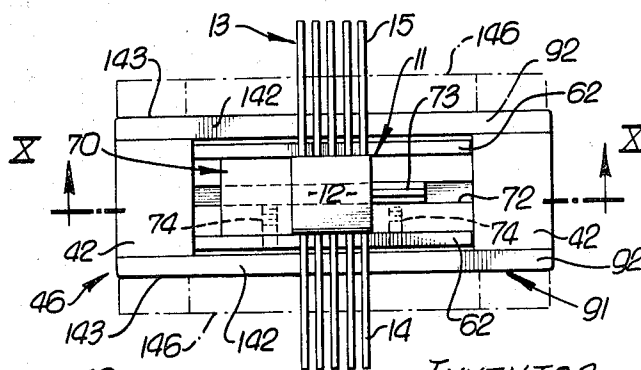


FIG. 9.



INVENTOR.

SEYMOUR GOLUB

By

Miketta, Glenn, Pome & Smith
ATTORNEYS.

FIG. 6.

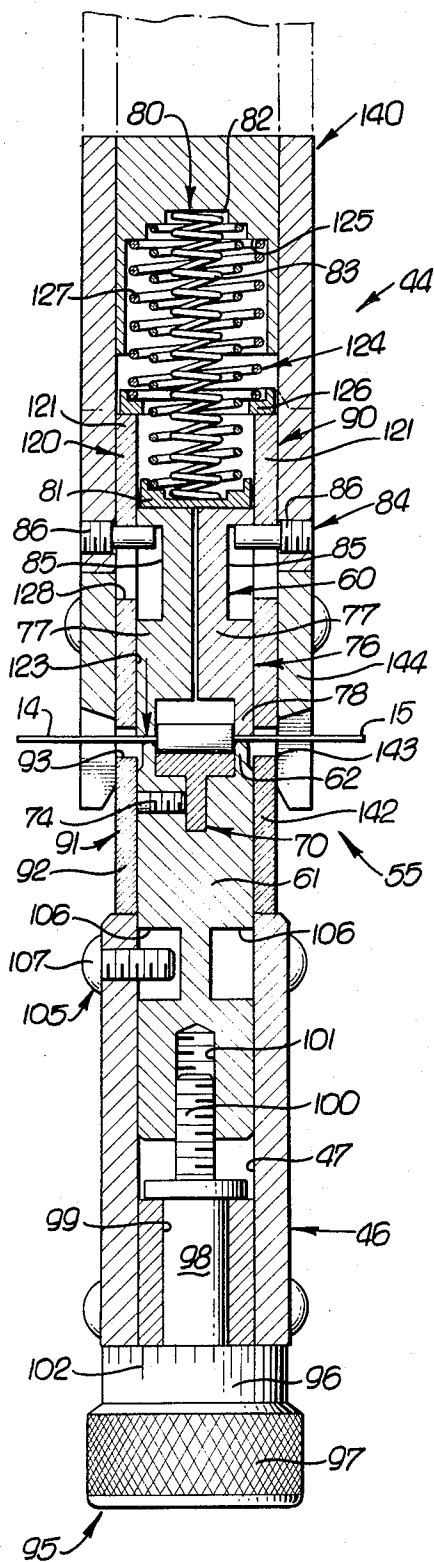


FIG. 7.

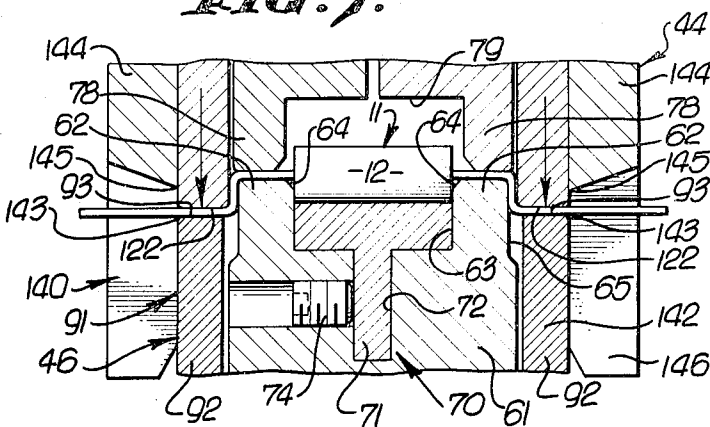
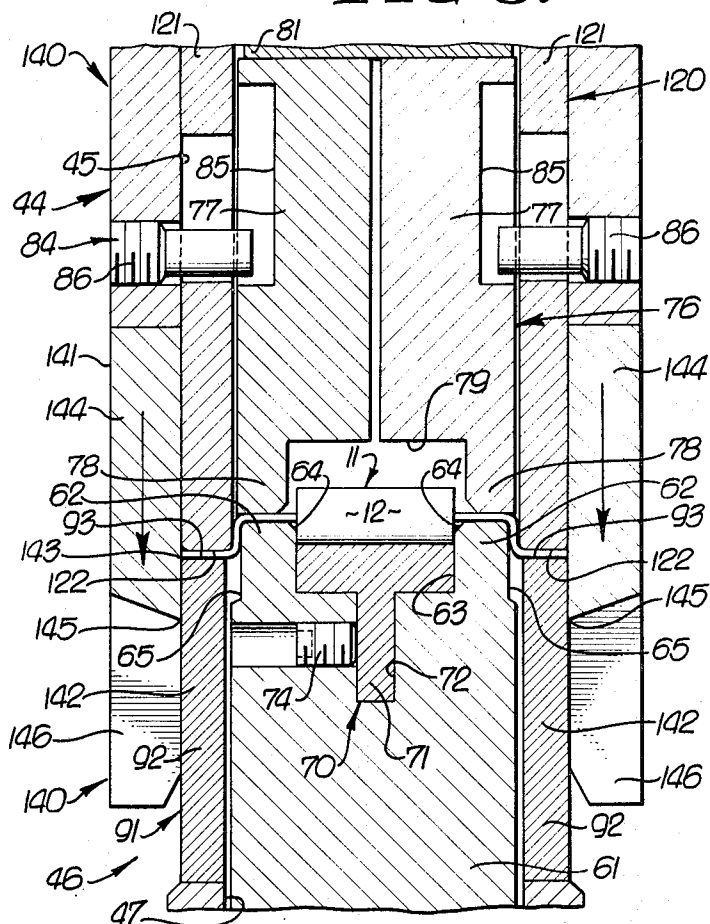


FIG. 8.



INVENTOR.

SEYMOUR GOLUB

By Miketta, Glenny, Pome & Smith
ATTORNEYS.

APPARATUS FOR SHAPING A PLURALITY OF LEAD WIRES OF A MINIATURIZED CIRCUIT

BACKGROUND OF THE INVENTION:

This invention relates to an apparatus for shaping, and more particularly to an apparatus for shaping the lead wires of a miniaturized circuit.

Miniaturized circuits have been widely adapted in the electronics industry. These miniaturized circuits normally include a multiplicity of silicon chips encased in a glass body. The glass body has a multiplicity of lead wires or sets of lead wires extending therefrom for soldering to the conductive metal paths of a circuit board within an electronic instrument. As the glass bodies are usually made in upper and lower halves, the lead wires generally protrude from the sides of the body, midway between the top and bottom thereof. However the lead wires must be soldered to the conductive paths of the circuit board which are essentially flush with the top of the circuit board, and therefore the lead wires of the miniaturized circuit must be bent so as to contact the metal paths.

Probably the most suitable shape into which to bend these lead wires for soldering is a stepped shape. Lead wires of a stepped shape or configuration, will contact the metal paths of the circuit board with sufficient surface area to eliminate any resistance to the flow of current across the junction thereof and will additionally support the body of the miniaturized circuit away from the board if need be. As the length of the step of the lead wires is extended, the body will be supported a greater distance away from the surface of the board, permitting it to be mounted over other electrical elements such as other miniaturized circuits, condensers and/or resistors to provide an even more compactly arranged electronic instrument. The desired step configuration for the lead wires of a miniaturized circuit presents many advantages but also presents a basic problem of shaping the lead wires into a stepped configuration simply, easily and accurately for production quantity runs.

The stepped configuration of the lead wires may be of course shaped manually in each lead wire if one is very careful not to crack the body or to pull the lead wires out of the body, but such a method is very time consuming and exacting. Therefore the manual method is not suitable for forming the lead wires of the large quantities of miniaturized circuit needed modernly.

What is needed then is an apparatus which will receive and properly position the body of the miniaturized circuit, clamp the lead wires extending therefrom, bend the lead wires into a stepped configuration and trim the lead wires to the proper length. It would be desirable if this apparatus would accept different sizes of bodies, and bend the lead wires into stepped configurations of different lengths as is dictated by the planned mounting location of the particular miniaturized circuit on the circuit board.

SUMMARY OF THE INVENTION

Therefore it is the primary object of this invention to provide an apparatus for use in shaping a plurality of lead wires extending from a body of a miniaturized circuit.

Other and additional objects of this invention are to provide such an apparatus which will receive and properly position the body, which will clamp the lead wires,

and which will shape the clamp lead wires; to provide such an apparatus which will form the clamp lead wires into a stepped configuration, and which will sequentially trim the lead wires to their proper length; to provide such an apparatus where the length of the step into which the lead wires are formed may be selectively changes as needed; to provide such an apparatus which clamps, forms and trims the lead wires in successive steps; to provide such an apparatus with relatively movable clamping and forming members to accommodate different sized sets of lead wires; to provide such an apparatus which has a calibrated adjuster to selectively change the length of the steps formed in the lead wires; and to provide such an apparatus with control means which may be operated from either hand, which may selectively vary the operating position thereof, and which may simply, easily and quickly operate the apparatus to shape the lead wires of the miniaturized circuit.

Generally the apparatus, according to this invention, for use in shaping a plurality of lead wires in a miniaturized circuit, protruding from a body formed about the circuit, includes support means, a pair of opposed relatively movable jaw assemblies mounted on the support means for opening and closing movement, mating clamping means on the jaw assemblies and cooperable to receive the body in the open position of the jaw assemblies and to clamp the lead wires therebetween in a clamping position of the jaw assemblies, mating shaping means on the jaw assemblies for movement relative to the clamping means for shaping the lead wires, and control means operably associated with the frame assembly and the jaw assemblies for movement of the jaw assemblies between the positions. The shaping means may include forming means and/or trimming means. The jaw assemblies may include locating means for locating the body relative to the jaw assemblies, anvil portions on clamp members to clamp the lead wires, die members which adjust to give a stepped configuration to the lead wires, and shear plates for individually trimming the wires to length. The control means may be mounted on either side of the frame for right or left hand operation. An eccentric lever pivot may be provided to control the length of the jaw assembly movement. A clutch may be provided between an operating handle and the balance of the control means to selectively change the operating position of the handle.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view of the apparatus, according to this invention, for use in shaping a plurality of lead wires of a miniaturized circuit, with the control means thereof mounted for right hand operation, and the jaw assemblies thereof shown in the open position;

FIG. 2 is a side elevational view of the apparatus of FIG. 1;

FIG. 3 is a top view of the apparatus of FIG. 1;

FIG. 4 is a perspective view of a finished miniaturized circuit with the lead wires thereof shaped into a stepped configuration by the apparatus of FIG. 1;

FIG. 5 is a fragmentary partially cutaway side elevational view of the apparatus of FIG. 1 with the jaw assemblies thereof shown in the clamping position;

FIG. 6 is a cutaway front elevational view taken along the plane VI—VI of FIG. 5 showing a portion of the apparatus of FIG. 1, with the jaw assemblies thereof shown in the clamping position;

FIG. 7 is a view similar to FIG. 6 with the jaw assemblies shown in the forming position;

FIG. 8 is a view similar to FIG. 7 with the jaw assemblies shown in the trimming position;

FIG. 9 is a cross-sectional view taken along the plane IX—IX of FIG. 5, showing the body of an unfinished miniaturized circuit properly positioned on the lower jaw assembly with the lead wires thereof resting on the anvil portions of the saddle;

FIG. 10 is a cross-sectional view taken along the plane X—X of FIG. 9 showing the body of the unfinished miniaturized circuit resting against the locating plates of the saddle of the lower jaw assembly; and

FIG. 11 is a view similar to FIG. 3, but showing the control means of the apparatus of FIG. 1 mounted for left hand operation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings, and particularly to FIGS. 1, 2 and 3, the apparatus according to this invention is generally indicated by the numeral 10. The apparatus 10 is for use with a miniaturized circuit 11 which, as seen best in FIG. 4, includes a body 12 with a plurality of lead wires 13 extending therefrom. The lead wires 13 may be divided into a right hand set 14 and a left hand set 15 for convenience in description. The miniaturized circuit is suitable for attachment to a conventional circuit board (not shown) with the lead wires 13 of the miniaturized circuit 11 being soldered to the metal paths on the circuit board. To facilitate the soldering of the lead wires 13, the lead wires, as shown in FIG. 4, are bent into a stepped configuration. The apparatus 10 is suitable for bending the lead wires 13 from the generally straight configuration of FIG. 6 into this configuration as well as other possible configurations.

The apparatus 10 according to the preferred embodiment of this invention generally includes a support means 20 with a base 21, frame assembly 22 with vice portions 28; jaw assembly means 40 mounted on the vice portions 28; shaping means 55 including locating means 70 mounted on the jaw assembly means 40 and control means 160 mounted between the frame assembly 22 and the jaw assembly means 40 for controlling the movement thereof. The shaping means 55 may include clamping means 60, wire forming means 90 and wire trimming means 140.

Referring now to FIGS. 1, 2 and 3, the support means 20 includes a base 21 and a frame assembly 22. The frame assembly 22 has an upstanding frame 23 which is mounted centrally of the base 21 and which, together with the base, may be provided with a hard anodized finish. The upstanding frame 23 has a C-shaped opening 24 and spaced vertical bores 25, aligned across the C-shaped opening 24. Round guide rails 26 of steel, hardened to a suitable hardness such as 60 Rockwell, are inserted into the vertical bores 25 and locked therein by pins 27.

The frame assembly 22 also includes vice portions 28 which in the preferred embodiment include a carrier 29. The carrier 29 has spaced vertical bores 30, one of which has enlarged downwardly opening counter bore for a purpose which will appear later. As seen in FIG. 5, ball bushings 31 are located in the three similarly sized opening of the bore 30 with the two adjacent bushings 31 being separated by a spacer 32. Seals 33

are provided for the ball bushings 31 to keep dirt and grime out of the bushings 31. The carrier 29 is movably carried by the guide rails 26 via the ball bushings 31, for movement of the carrier 29 relative the frame assembly 22. The carrier 29 is also provided with a pair of vertically spaced holes 34 into which dowels 35 are inserted. The dowels 35 extend outwardly of the surface of either side of the carrier 29 to mount the control means 160 as will be explained later.

The support means 20 also includes jaw assembly means 40. In the preferred embodiment, the jaw assembly means 40 includes L-shaped side blocks 41, upper and lower central blocks 42 and rear mounting plates 43 to form an upper jaw assembly 44 with a downwardly opening cavity 45 and a lower jaw assembly 46 with an upwardly opening cavity 47.

The rear mounting plates 43 are provided with rear horizontal ridges 48 which mate with horizontal cavities 49 in either the carrier 29 or the frame 23. The rear mounting plates are provided with a series of counter bored holes (not shown) into which the heads of attaching screws (not shown) are received when the screws attach the plates 43 to the carrier 29 or the frame 23. Other screws 50 attach the blocks 41 and 42 and the plate 43 together.

The shaping means 55 according to the preferred embodiment of the apparatus 10 includes clamping means 60, wire forming means 90, and wire trimming means 140.

The clamping means 60 according to the preferred embodiment of the invention includes a central die member or saddle 61 located in the cavity 47 of the lower jaw assembly 46. The central die member or saddle 61 has a pair of spaced anvil portions 62. The spaced anvil portions 62 as best seen in FIGS. 6 through 9 define a central opening 63 for receiving the body 12 of the miniaturized circuit 11. The edges of the anvil portions 62 adjacent the central opening 63 are chamfered at 64 to prevent the lead wires 13-body 12 seal from being broken by the breaking of a bead which sometimes forms at this juncture. The central die member or saddle 61 also has formed outer walls 65 which terminate the anvil portions 62.

The locating means 70 for receiving and locating the body 12 with respect to the lower jaw assembly 46, as best seen in FIGS. 6 through 10, includes a longitudinal T-cross section plate 71 in a slot 72 in the saddle 61 and a terminal vertical plate 73 also in slot 72. Set screws 74 are provided to lock the plates 71 and 73 in position relative the saddle 61. The body 12 when resting on the plate 71 and against the plate 73, is positioned with the lead wires 13 resting across the anvil portions 62 as shown in FIG. 6.

The clamping means 60 is also provided with a clamp 76 located in the cavity 45 of the upper jaw assembly 44. The clamp 76, as best seen in FIG. 6, has right and left members 77, each having an anvil portion 78 located directly over a respective anvil portion 62 and which together form a central opening 79 therebetween over the central opening 63. The clamp members 77 are mounted to the upper jaw assembly 44 by spring means 80 and stop means 84. The spring means 80 as best seen in FIGS. 5 and 6 includes a seat 81 over the upper end of each clamp member 77, and a seat 82 formed in the upper jaw assembly 44 with springs 83 therebetween. The stop means 84 includes a slot 85 in the side of each of the clamp members 77, and opposed

threaded pins 86 in the sides of the upper jaw assembly 44 and extending into the slots 85.

As best seen in FIG. 6, the anvil portions 78 of the clamp members 77 upon relative movement of jaw assembly means 40 clamp the lead wires 13, to the anvil portions 62 of the central die member or saddle 61. Should there be some difference in the diameters of the right and left lead wire sets 14 and 15, the clamp members 77 will accommodate this difference by limited relative movement therebetween while the springs 83 exert a suitable pressure such as 20 pounds, on each of the clamp members 77.

The shaping means 55, as well as including the clamping means 60 also includes wire forming means 90 for bending the lead wires into a desired shape. In the preferred embodiment of the apparatus 10 the wire forming means 90 has a non-scoring male die 91 associated with the lower jaw assembly 46 and a female die or wire bending jaw 120 associated with the upper jaw assembly 44.

The male die 91 includes the central die member or saddle 61 previously described, and a pair of outer male die members 92 having upwardly facing anvil portions 93. The outer male die members 92 are located on either side of the saddle 61 along the outer walls 65 thereof and rest on the upper edges of the L-shaped side blocks 41. The outer male die members 92 are not secured to the saddle 61 but are secured by screws 94 to the lower central block 42 of the lower jaw assembly 44.

The central die member or saddle 61 is provided with means 95 for adjustably mounting the saddle 61 to the lower jaw assembly 44. In the preferred embodiment, the means 95 includes a calibrated adjuster 96, seen in FIGS. 5 and 6, with a thumb nut 97 on a shaft 98 extending through a hole 99 in the lower end rectangular plate into the cavity 47 and which is threaded on the upper end 100 to thread into a tapped hole 101 in the lower end of the saddle 61. The thumb nut has a scale 102 therearound to correlate the position of the nut 97 to the position of the saddle 61. The means 95 also includes a locking pin 103 located in a hole through the lower jaw assembly 46 and biased by spring 104 into engagement with the shaft 98 of the calibrated adjuster 96 to hold it in any desired position. With the saddle 61 being adjustably mounted to the lower jaw assembly 46, the position of the anvil portions 62 thereof can be moved relative to the position of the anvil portions 93 of the outer male die members 92 to change the length of the step therebetween. Suitable variations in length may be from 0.0 to 0.125 inches of step.

The means 95 also includes limiting means 105 for limiting the adjustment of the saddle 61 to prevent the saddle 61-shaft 98 connection from being disconnected inadvertently. The limiting means 105 includes slots 106 formed in the outer walls 65 and a screw 107 in the lower jaw assembly 46 protruding into one of the slots 105 to engage the sides thereof in the limit positions of the saddle's 61 movement.

The female die or wire bending jaws 120 includes opposite female die members 121 mounted outboard of the clamp members 77 in the cavity 45 of the upper jaw assembly 44. The female die members 120 together have downwardly facing anvil portions 122 located over the anvil portions 93 of the outer die members 92. The anvil portions together define an opening 123 into which the anvil portions 62 of the central die member

or saddle 61 may be received. The female die members 121 are mounted to the upper jaw assembly 44 by spring means 124 and stop means 84. The spring means includes a seat 125 with half thereof engaging the upper end of each of the female die members 121, and a seat 126 formed in the upper jaw assembly 44. Springs 127 extend between the two seats 125 and 126 to exert a suitable force on both of the female die members 121. The stop means 84 again are pins 86 this time extending through horizontal slots 128 in the sides of the female die members 121 to limit the relative movement of the female die members 121 relative the clamp members 77 as well as each other.

As best seen by comparing FIGS. 6 and 7, the female die 120, specifically the female die members 121, engage the clamp lead wires 13 extending out of the body 12 in the clamping position, and move relative the clamp members 69 to bend the lead wires 13 from the plane of the annular portion 62 over the outer walls 65 and onto the annular portions 93 of the outer male die members 92 to form steps therein. The relatively movable female die members 121 permit a slight misalignment in the anvil portions 93 of the outer male die member 92 and yet insure complete bending of the lead wires 13 to the stepped configuration.

The shaping means 55 according to the preferred embodiment also includes wire trimming means 140 which as best seen in FIGS. 6, 7 and 8 include mating shear plates 141. The lower shear plates 142 are the outer male die members 92 already described, and each having an outer edge 143 thereon. The upper shear plates 144 have angled edges 145 terminating in downwardly extending self-aligning extensions 146 at either end thereof for extending over the outer male die members 92 to guide the upper shear plates 142. The upper shear plates 142 engage with their upper edge, the lower edges of the L-shaped blocks 41 and screws 147 which attach the shear plates 144 to the upper jaw assembly 44.

As best seen by comparing FIGS. 7 and 8, the clamped and formed lead wires 13 are caught between the edge 143 and the angle edge 145 to be progressively sheared to the proper length, completing the shaping of the miniaturized circuit 11 as shown in FIG. 4.

It should be noted at this point that the extensions 146 facilitate ease in initially aligning the upper and lower jaw assemblies 44 and 46. When the jaw assemblies 44 and 46 are first attached to the apparatus 10, the attachment is loose. The assemblies are moved towards each other and the assemblies 44 and 46 moved laterally until the extension 146 passes over the outer male die members 92, at which time the attachment of the jaw assemblies are tightened to maintain the alignment of the upper and lower jaw assemblies 44 and 46.

The apparatus 10 according to the preferred embodiment also includes control means 160 for controlling the movement of the jaw assemblies between the several operating positions. As best seen in FIGS. 2, 3 and 5, the control means 160 includes a cam member 161 having vertically spaced holes 162 therethrough and a slanted slot 163 which is provided with a cam surface 164. The cam member 161 may be made of steel with a black chrome covering for durability. The cam member 161 is mounted on the carrier 29 by sliding the cam

member 161 on to the dowels 35 and holding the cam member 161 thereto by screws 165.

The control means 160 also includes a lever member 167 having a ball bearing roller 168 mounted on one end for engaging the cam surface 164 of the slanted slot 163 of the cam member 161. The other end of the lever 167 has a hole therethrough for receiving shaft 169.

The shaft 169 has an enlarged head and a threaded end for receiving a nut 170. The frame 23 has a circular aperture 172 into which is inserted a bushing having an eccentric hole 174 therethrough which by rotating the bushing may be moved to various positions to give a height adjustment to the carrier 39. A set screw 175 is provided in the frame assembly 22 to lock the bushing 173 in a particular desired position. The shaft 169 then extends through the lever member 167 through the eccentric hole 174 in the bushing 173 to receive the nut 170.

A handle member 177 is provided which includes a rod 178 with a ball knob 179 on the outer end. The inner end of the rod 178 is inserted into a hole in a clutch 180 which selectively and non-rotatably interlocks with the enlarged head of the shaft 169 when screwed thereto by screws 181. When not secured by the screws 181, the handle member 180 can be rotated relative the lever member 167 over 360° to the best position for operation and the screws 181 tightened to maintain this position.

It should be noted that the cam member 161, lever member 167 and handle member 177 may be operably mounted on the right hand side of the frame assembly 22 as is shown in FIG. 3 for right hand operation, or can be mounted on the left hand side of the frame assembly 22 as is shown in FIG. 11 for left hand operation. This is made possible because the dowels 35 protrude from both sides of the frame assembly 22 and because of the symmetry of the lever member 167 and the handle member 177.

The control means 160 also includes return means 185 of a return spring 186 around the inner rail of the two guide rails 26 with a spring cover 187 therearound. The spring 186 biases the carrier 29 upwardly to move the jaw assembly means 40 to the open position.

In operation, an unformed miniaturized circuit 11 is placed in the opening 63 while the apparatus is in the open position of FIGS. 1, 2 and 3. The body 12 of the circuit 11 is located against the vertical plate 73 with the lead wires 13 therefrom resting on and extending across the anvil portions 62. The handle member 177 is pulled downwardly pivoting the lever member 167 against the cam member 161 to move the carrier 29 downwardly, moving the jaw assembly means 40 together.

As the jaw assembly means 40 reaches the clamping position of FIGS. 5 and 6, the anvil portions 78 have lowered to engage the lead wires 13 and clamp them between the anvil portions 78 and 62 with the springs 83 maintaining the clamping action.

The jaw assembly means 40 continues closing from the clamping position of FIG. 6 towards the forming position of FIG. 7 moving the anvil portions 122 of the female die members 121 against the lead wires 13 outboard of the anvil portions 78 and 68, to bend the wires 13 downwardly over the outer walls 65 and onto anvil portions 93, forming the wires 13 into a stepped configuration. The springs 127 maintain the bent lead wires 13 in the stepped configuration.

The jaw assembly means 40 still continues closing from the position of FIG. 7 to the trimming position of FIG. 8 moving the angled edge 145 of the upper shear plates 144 passing along the outer edges 143 to progressively shear the lead wires 13 to length.

Once the jaw assembly means 40 reaches the trimming position the handle member 177 is released and the return spring 186 moves the carrier 29 upwardly, opening the jaw assembly means 40 until the open position is reached. The miniaturized circuit 11 is now completely formed ready to be removed from the apparatus 10 and another unformed circuit 11 placed in opening 63 to repeat the forming steps.

The apparatus 10 while ideally suited for use in shaping the lead wires 13 of a miniaturized circuit 11 is also suited for similar shaping of other parts, as desired.

Having thus described a preferred exemplary embodiment of the apparatus for shaping a plurality of lead wires of a miniaturized circuit according to the present invention:

I claim:

1. In an apparatus for use in shaping separate sets of plurality of lead wires of a miniaturized circuit protruding from a body of insulation formed about said circuit, said apparatus including a frame assembly having vice portions adapted for movement towards and away from each other, a pair of jaw assemblies and means for mounting the jaw assemblies on respective vice portions to be moved therewith into and out of engagement with each other, the the apparatus having:

locating means and means for mounting the locating means on one of the jaw assemblies for receiving and locating the body with respect to the one jaw assembly in an open position thereof,

mating clamping means and means for mounting the clamping means on the jaw assemblies for clamping the lead wires extending outwardly of the body, in a clamping position of the jaw assemblies to hold the lead wires therebetween,

mating shaping means and means for mounting the shaping means on the jaw assemblies for movement relative to the clamping means for shaping the lead wires held between said clamping means without pulling the lead wires from the body as the shaping position of the jaw assemblies is reached; and

control means operably associated with the frame assembly and the jaw assemblies for moving the jaw assemblies between the positions the improvement comprising the provision of:

a saddle on one of the jaw assemblies, said saddle having spaced anvil portions defining an opening into which the body is received enabling the lead wires thereof to rest on and extend outwardly of the anvil portions, and

a mating clamp on the other jaw assembly, said mating clamp having spaced anvil portions which engage the lead wires on the saddle anvil portions in the clamping position of the jaw assemblies to clamp the lead wires therebetween and wherein:

the mating clamp has a clamp member for each set of lead wires, each clamp member having an anvil portion, and the means for mounting the clamping means includes spring means between each clamp member and the other jaw assembly for pressurizing the individual clamp members while permitting limited relative movement therebetween and stop means are provided between the clamp members to

limit the relative movement therebetween, enabling each of the individual clamp members to hold its respective lead wire set independently of the other clamp member.

2. In an apparatus for use in shaping a plurality of lead wires of a miniaturized circuit protruding from a body of insulation formed about said circuit wherein the body has separate sets of lead wires, said apparatus including a frame assembly having vice portions adapted for movement towards and away from each other, a pair of jaw assemblies and means for mounting the jaw assemblies on respective vice portions to be moved therewith into and out of engagement with each other,

locating means and means for mounting the locating means on one of the jaw assemblies for receiving and locating the body with respect to the one jaw assembly in an open position thereof,

mating clamping means and means for mounting the clamping means on the jaw assemblies for clamping the lead wires extending outwardly of the body, in a clamping position of the jaw assemblies to hold the lead wires therebetween,

mating shaping means and means for mounting the shaping means on the jaw assemblies for movement relative to the clamping means for shaping the lead wires held between said clamping means without pulling the lead wires from the body as the shaping position of the jaw assemblies is reached, said shaping means including wire forming means for bending the lead wires into a desired shape; and,

control means operably associated with the frame assembly and the jaw assemblies for moving the jaw assemblies between the positions, the improvement in wire forming means comprising the provision of:

a male die member on one of the jaw assemblies, said male die member having spaced anvil portions, and wall portions which together are shaped into the desired lead wire shape, and

a mating female die on the other jaw assembly said female die having mating spaced anvil portions for engaging the lead wires in the clamped position and bending the lead wires over the male die spaced anvil portions and wall portions into the desired shape as the jaw assemblies are moved to the shaping position and wherein:

the male die has anvil portions and wall portions for each set of lead wires, the female die includes a plurality of female die members, one for each set of lead wires, each of said female dies having anvil portions, and

the means for mounting the forming means includes spring means between each female die member and the other jaw assembly for pressuring the female die member individually while permitting relative movement therebetween, and stop means between the female die members to limit said relative movement, enabling each female die member to independently bend its respective set of lead wires.

3. In an apparatus for use in shaping a plurality of lead wires of a miniaturized circuit protruding from a body of insulation formed about said circuit, said apparatus including a frame assembly having vice portions adapted for movement towards and away from each other, a pair of jaw assemblies and means for mounting the jaw assemblies on respective vice portions to be

moved therewith into and out of engagement with each other,

locating means and means for mounting and locating means on one of the jaw assemblies for receiving and locating the body with respect to the one jaw assembly in an open position thereof,

mating clamping means and means for mounting the clamping means on the jaw assemblies for clamping the lead wires extending outwardly of the body, in a clamping position of the jaw assemblies to hold the lead wires therebetween,

mating shaping means and means for mounting the shaping means on the jaw assemblies for movement relative to the clamping means for shaping the lead wires held between said clamping means without pulling the lead wires from the body as the shaping position of the jaw assemblies is reached, said shaping means including wire forming means for bending the lead wires, and

control means operably associated with the frame assembly and the jaw assemblies for moving the jaw assemblies between the positions, the improvement comprising:

a male die member on one of the jaw assemblies, said male die member having spaced anvil portions, and wall portions which together are shaped into the desired lead wire shape, the male die member including a central male die member having a spaced pair of anvil portions, and wall portions, and includes outer die members along the wall portions of the central male die member, said outer male die member having anvil portions being in step relationship with the anvil portions of the central male die members to form the lead wires into a step configuration, and

a mating female die on the other jaw assembly said female die having mating spaced anvil portions for engaging the lead wires in the clamped position and bending the lead wires over the male die spaced anvil portions and wall portions into the desired shape as the jaw assemblies are moved to the shaping position and wherein:

the means for mounting the shaping means includes: means for fixedly mounting the outer male die members to the one jaw assembly;

means are provided for adjustably mounting the central male die member to the one jaw assembly for selective movement relative the outer male die members to selectively change the length of the step relationship of the anvil portions;

the female die member includes a plurality of female die members, one for each outer male die member, each of said female die members having respective anvil portions, and

the means for mounting the shaping means includes means for mounting the female die members to the other jaw assembly to mate with the various stepped configurations of the male die members.

4. The apparatus as in claim 3 wherein the means for adjustably mounting the central male die member includes a calibrated adjuster assembly for precisely and controllably changing the length of the stepped relationship of the anvil portions of the male die members.

5. In an apparatus for use in shaping a plurality of lead wires of a miniaturized circuit protruding from a body of insulation formed about said circuit, said apparatus including a frame assembly having vice portions

adapted for movement towards and away from each other, a pair of jaw assemblies and means for mounting the jaw assemblies on respective vice portions to be moved therewith into and out of engagement with each other,

locating means and means for mounting the locating means on one of the jaw assemblies for receiving and locating the body with respect to the one jaw assembly in an open position thereof,

mating clamping means and means for mounting the clamping means on the jaw assemblies for clamping the lead wires extending outwardly of the body, in a clamping position of the jaw assemblies to hold the lead wires therebetween,

mating shaping means and means for mounting the shaping means on the jaw assemblies for movement relative to the clamping means for shaping the lead wires held between said clamping means without pulling the lead wires from the body as the shaping position of the jaw assemblies is reached, said shaping means including wire trimming means for cutting the lead wires to a desired length; and

control means operably associated with the frame assembly and the jaw assemblies for moving the jaw assemblies between the positions, the improvement in wire trimming means comprising:

a pair of mating shear plates on the jaw assemblies, one of said shear plates having extensions which extend over the other shear plate in the clamping position of the jaw assemblies, enabling the other shear plate to guide the path of the one shear plate to shear the wires to the desired length.

6. The apparatus as in claim 5 wherein the means mounting the shaping means includes means removably mounting the shear plates to the jaw assemblies to permit the removal and replacement thereof without disturbing the location of the other means mounted to the jaw assemblies.

7. A lead shaping apparatus for shaping lead wires of a miniaturized circuit having a body with lead wires extending therefrom, said apparatus comprising:

support means;

opposed relatively movable jaw assembly means and means for mounting said assembly means to the support for movement between an open position, through a clamping position to a shaping position, said relatively movable jaw assembly means including clamping means comparable to receive the body in the open position, and to clamp the lead

wires from the body therebetween in the clamping position and the shaping position, and including shaping means for engaging the clamped lead wires to shape the lead wires into a desired shape as the relatively movable jaw assembly means are moved into the shaping position, and

control means are operably attached to the support means and associated with said relatively movable jaw assembly means for moving said jaw assembly means between said positions, wherein the control means include:

a cam member mounted on one of said jaw assemblies, said member having a cam surface,

a lever member having a camming end,

means pivotally mounting the other end of the lever member to the support means to locate the camming end of the lever member in engagement with the cam surface of said cam member,

a handle member, and

means for mounting the handle member to the support means in association with said lever member whereby manual movement of said handle member causes pivoting of said lever member to move said cam member and thereby move said one of said jaw assembly means relative to the other of the jaw assembly means.

8. The apparatus as in claim 7 wherein said support means is provided with means for mounting said cam member on either of the two sides thereof, and means for pivotally mounting the lever on either of the two sides thereof, to selectively permit either right hand or a left hand operation.

9. The apparatus as in claim 7 wherein said support means includes a circular aperture therein, and the means for pivotally mounting the lever member includes an eccentric bushing for pivotally mounting said lever member eccentrically of said aperture in which said bushing is mounted, said bushing being selectively rotatable in said aperture to vary the pivot location of the lever member and thereby adjust the travel of the associated jaw assembly means.

10. The apparatus as in claim 7 wherein the means for attaching the handle includes clutch means between the handle member and the lever member for selectively changing the position of the handle member relative to the lever member to permit manual operation of the handle member from various positions.

* * * * *

50

55

60

65