United States Patent [19]

Galloway

[11] **3,738,398**

[45] **June 12, 1973**

[54] **APPARATUS FOR CUTTING AND FORMING LEADS OF ELECTRICAL COMPONENTS**

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[22] Filed: **July 6, 1971**

[21] Appl. No.: **159,708**

[52] **U.S. Cl.** **140/1**, 72/384, 72/DIG. 10, 140/105, 72/418

[51] **Int. Cl.** **B21f 1/00**, B21f 11/00

[58] **Field of Search** ..... 140/1, 105, 71; 72/335, 384, 385, 389, 418, DIG. 10; 29/203 D

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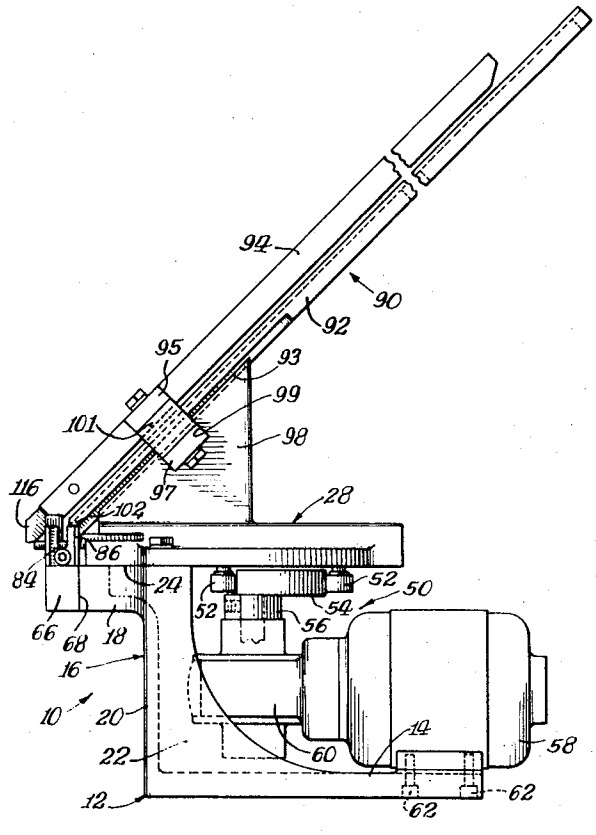
Primary Examiner—Lowell A. Larson

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[57] **ABSTRACT**

Appaatus for cutting and forming leads of electrical components utilizes a movable block reciprocally driven relative to a fixed block having a pair of spaced shearing surfaces that cooperate with a pair of cutters carried by the movable block to cut the ends of an electrical component supported crosswise to the cutters on a component carrying section of the movable block. The component carrying section has a stop to catch the inner ends of the component after the cutting operation and to hold the component as the component carrying section moves between a pair of opposing lead forming surfaces on the fixed block.

14 Claims, 16 Drawing Figures



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SHEET 1 OF 4

Fig. 1.

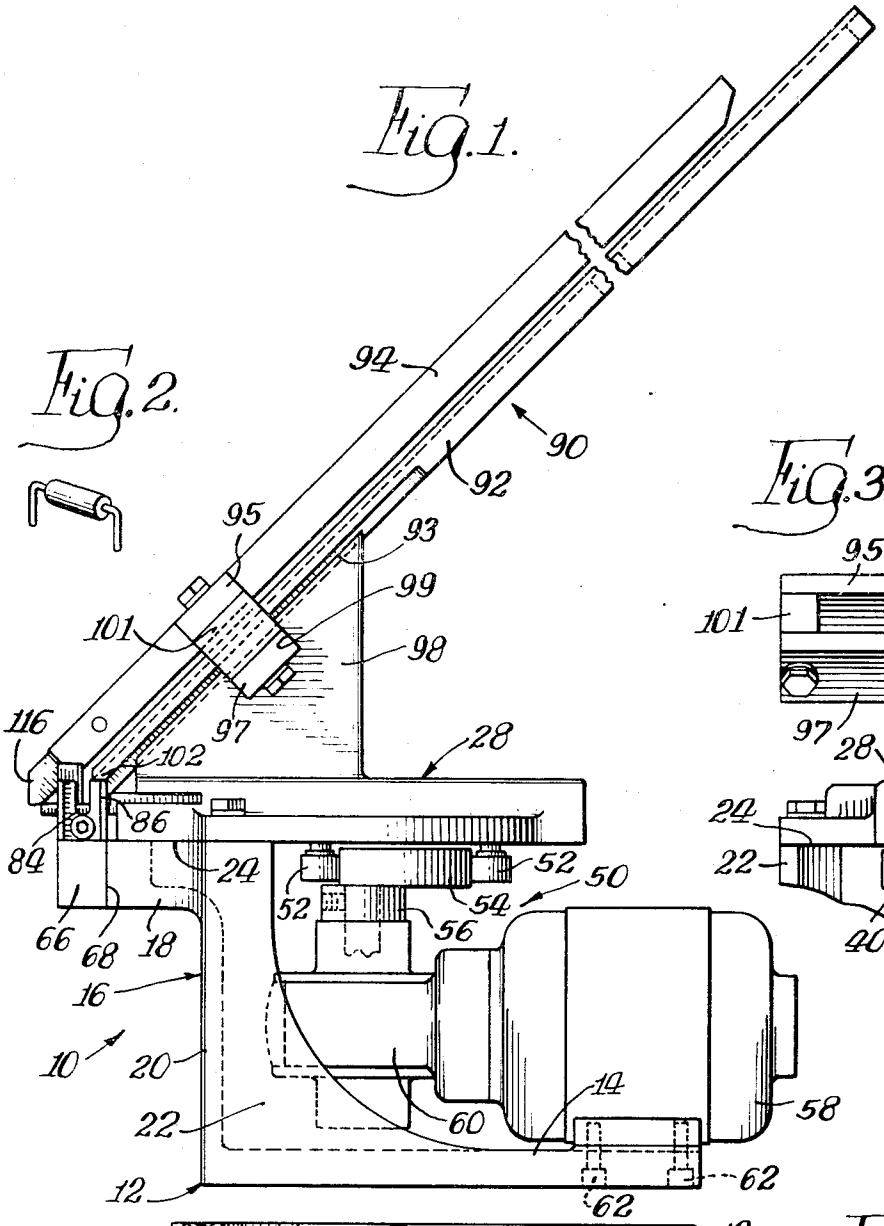


Fig. 2.

Fig. 3.

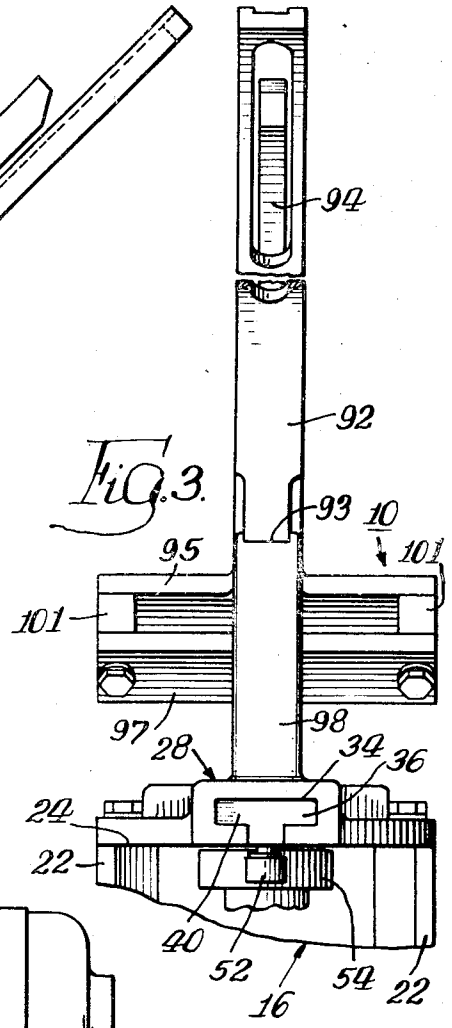
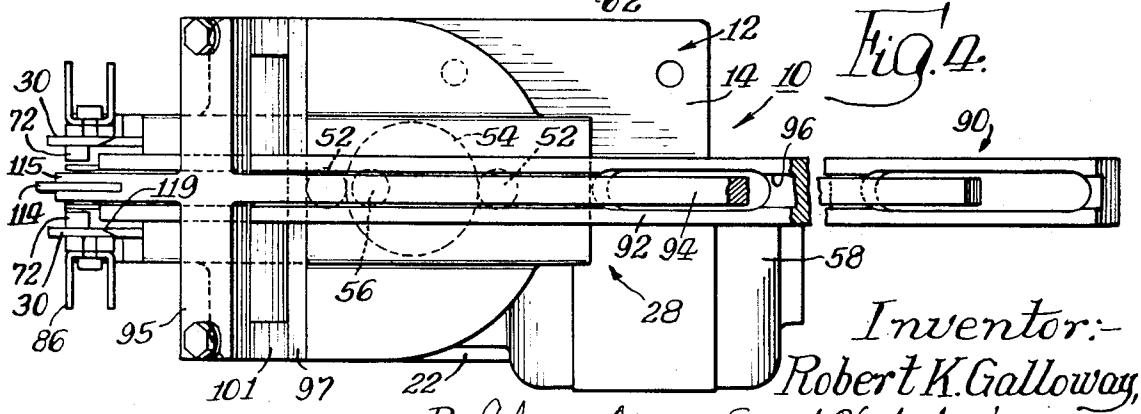


Fig. 4.



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Fig. 5.

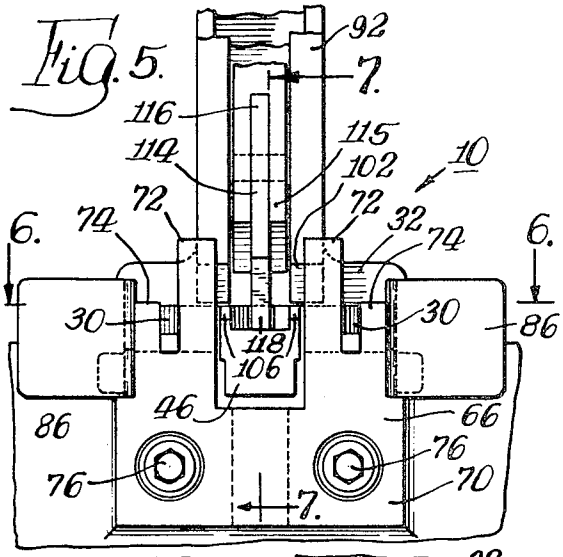


Fig. 7.

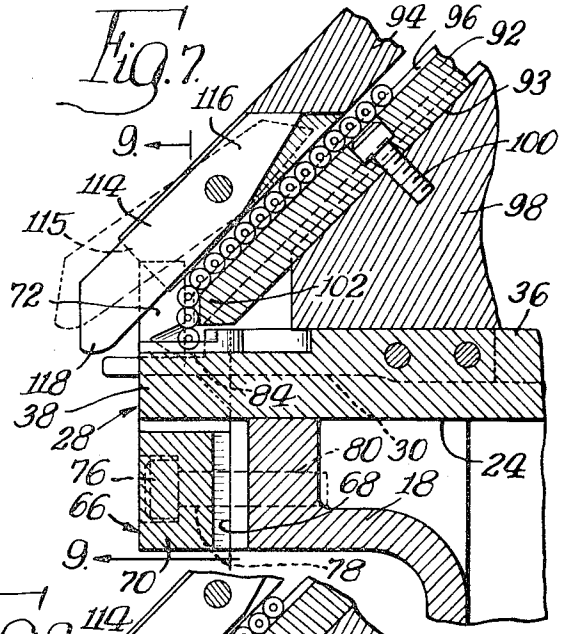


Fig. 6.

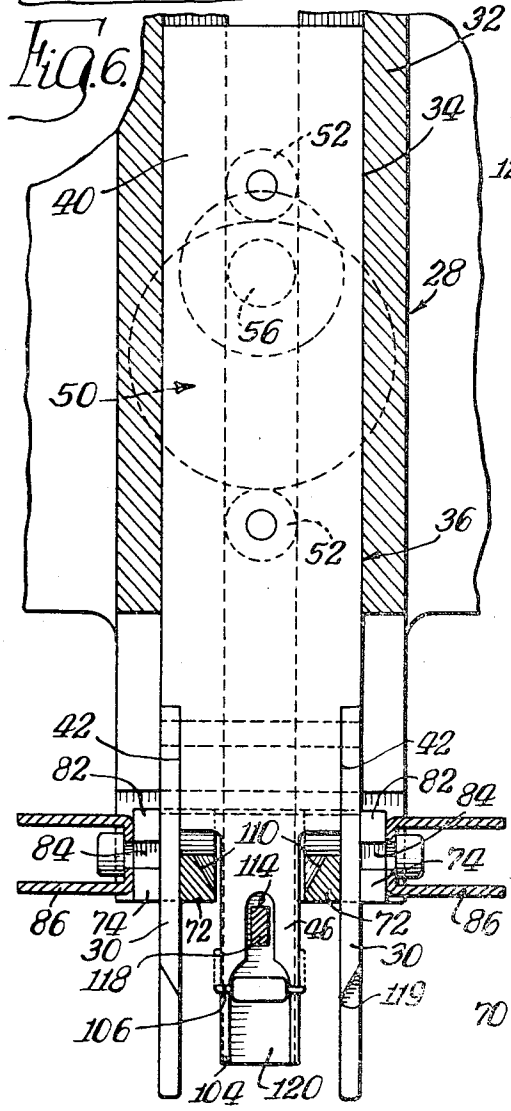


Fig. 8.

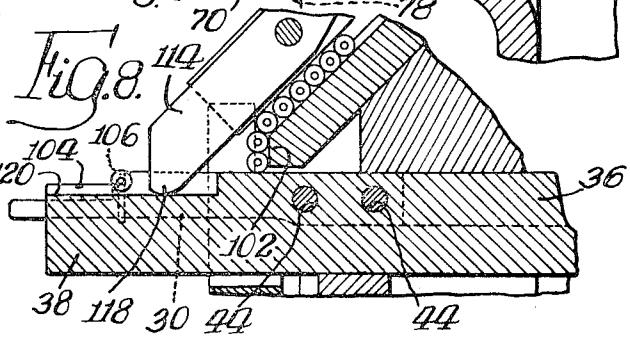


Fig. 9.

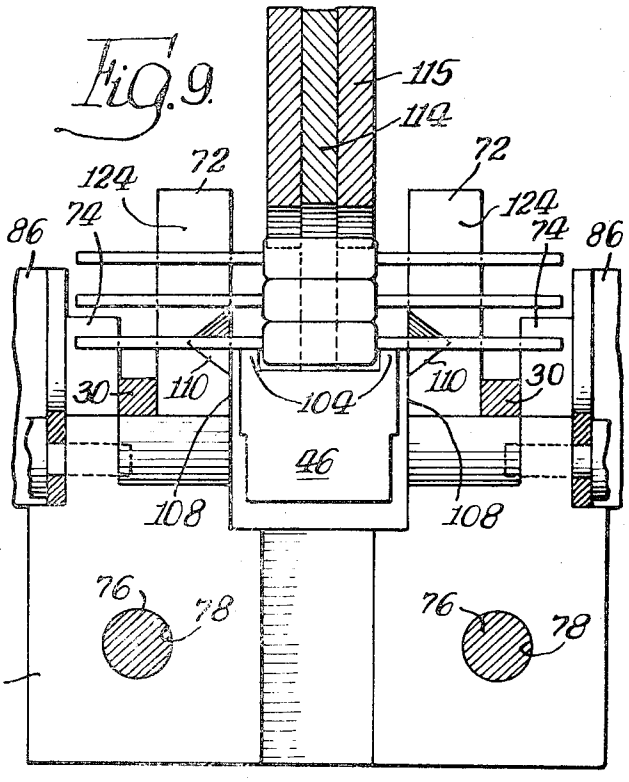


Fig. 10.

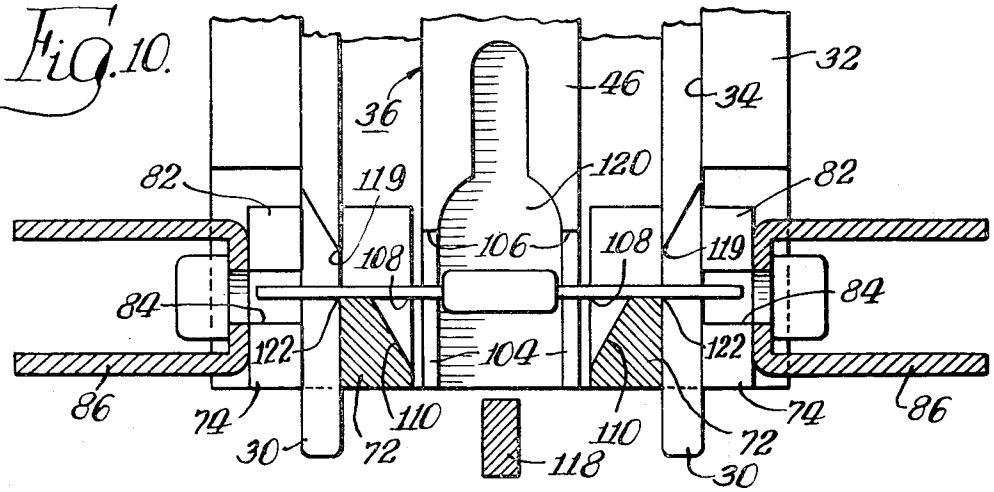


Fig. 11.

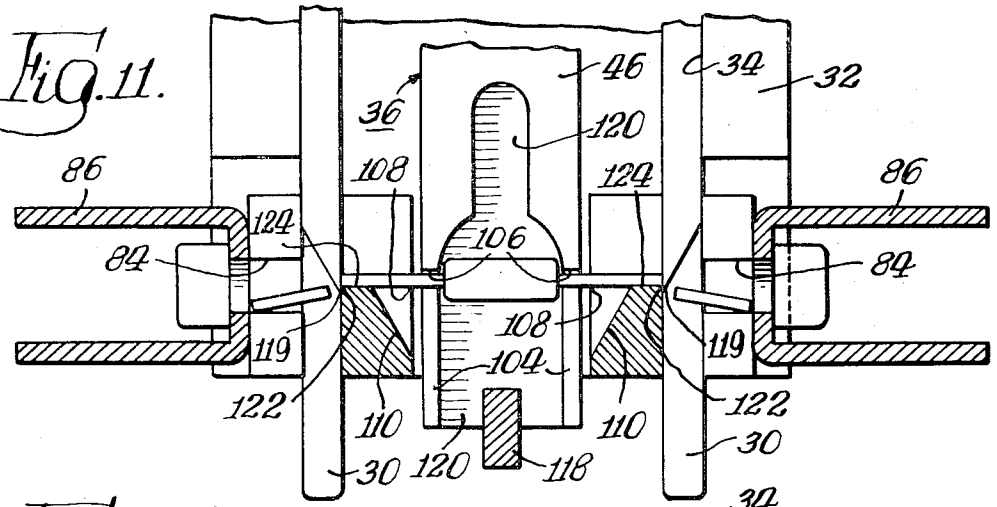
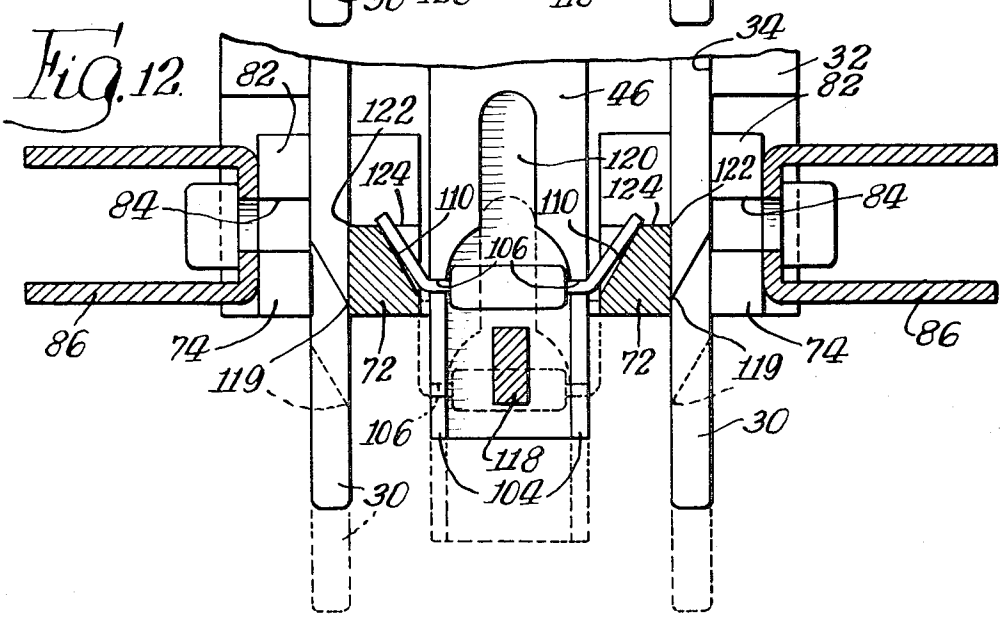


Fig. 12.



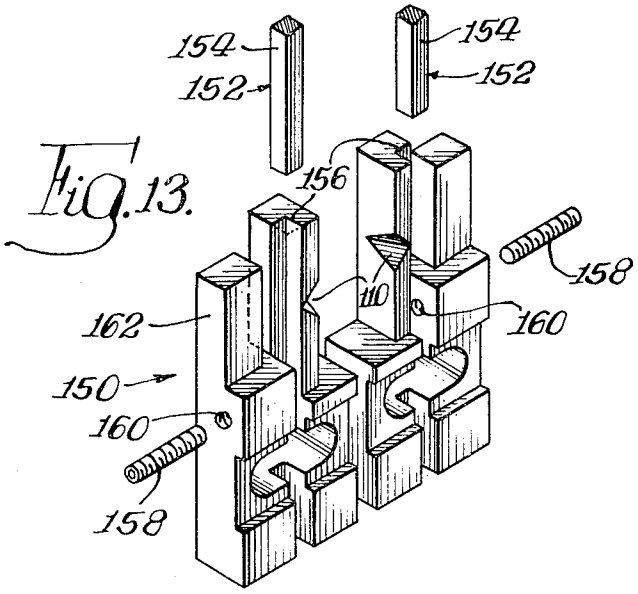


Fig. 13.

Fig. 14.

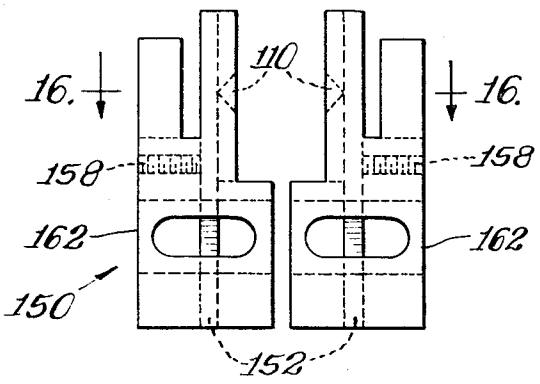


Fig. 15.

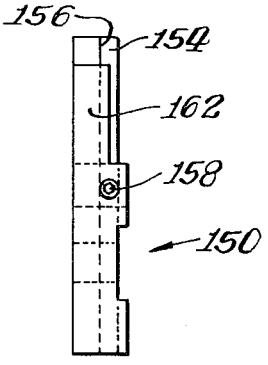
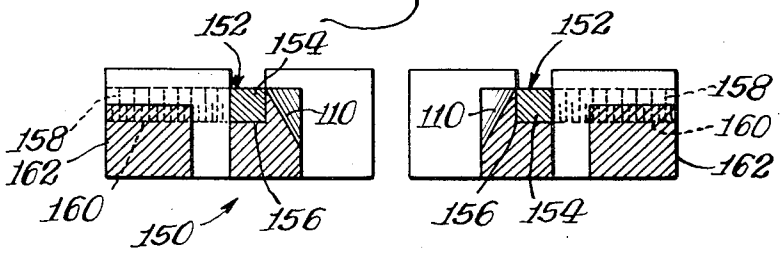


Fig. 16.



APPARATUS FOR CUTTING AND FORMING LEADS OF ELECTRICAL COMPONENTS

BACKGROUND OF THE INVENTION

In the present state of the art, there are a large number of machines designed to automatically cut and form the leads of electrical components. These machines employ a number of cooperating moving parts and many are capable of performing the additional operation of inserting the formed component into a circuit board. All of these machines have the common disadvantages of being relatively expensive to manufacture due to their large number of cooperating moving parts and being subject to frequent breakdowns.

The object of this invention is to provide an apparatus for cutting and forming leads of electrical components utilizing a single reciprocally-driven moving part, which is capable of automatically feeding the components sequentially, cutting their leads to a desired length and forming the leads to a desired shape.

SUMMARY OF THE INVENTION

This invention relates to a machine for cutting and forming leads of electrical components comprising a reciprocally driven movable block that cooperates with a fixed block to first shear the ends of the leads to a desired length and then form the electrical leads. The fixed block includes a pair of spaced shearing surfaces that cooperate with a pair of cutters carried by the movable block to cut the ends of the electrical component and a pair of opposing forming surfaces that cooperate with the component carrying section of the movable block to form the leads after they have been cut.

DESCRIPTION OF DRAWINGS

For a better understanding of this invention, reference may be had to the accompanying drawings, in which:

FIG. **1** is a side elevational view of a machine for cutting and forming leads of electrical components which embodies the principles of this invention;

FIG. **2** is a perspective view of a typical electrical component after its leads have been cut and formed by the machine of FIG. **1**;

FIG. **3** is a partial rear view of the machine illustrated in FIG. **1** taken from the right side of FIG. **1**;

FIG. **4** is a top plan view of the machine of FIG. **1**;

FIG. **5** is a partial front view of the machine of FIG. **1** taken from the left side of FIG. **1**;

FIG. **6** is a sectional view taken along the line **6—6** of FIG. **5** and looking in the direction of the arrows;

FIG. **7** is a cross-sectional view taken along the line **7—7** of FIG. **5** and looking in the direction of the arrows;

FIG. **8** is a partial view identical to FIG. **7** showing the movable block as it reaches the end of its forward stroke;

FIG. **9** is a sectional view taken along the line **9—9** of FIG. **7** and looking in the direction of the arrows;

FIGS. **10** through **12** are sequential views depicting, respectively, the feeding of an electrical component onto the movable block, cutting the outer end portions of its leads and forming the leads; and

FIGS. **13** through **16** show, respectively, a modified version of the fixed block showing, respectively, a rear perspective view, a front view, a side view, and a cross-sectional view taken along the line **16—16** of FIG. **14**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

There is shown in FIGS. **1** and **4**, a machine designed to form the leads of electrical components, having a central body portion and axial extending leads, such as resistors, capacitors and inductors and is designated by the reference numeral **10** and which embodies the principles of this invention. Lead forming machine **10** is constructed on a pedestal or base member **12** having a base plate **14**, a riser portion **16** and an elevated horizontal platform **18** which projects forwardly of the riser **16**. The base plate **14**, riser **16** and elevated platform **18** are integrally formed from a thick high strength material to provide a very sturdy frame for the lead forming machine **10**. The riser **16** comprises a front wall portion **20** and a pair of side flanges **22** that slope downwardly toward the rear of the machine. The upper surface formed by riser **16** and contiguous horizontal elevation platform **18** is generally flat to define a mounting surface **24** on which the major operating components of the lead forming machine are supported.

A slide unit assembly **28** carrying a pair of spaced cutter blades **30** is supported by the mounting surface **24**. The slide unit assembly **28** comprises a slide housing **32** in which is formed an elongated channel passageway **34**, and a movable block **36** slidably disposed in the passageway **34**. The movable block **36** is elongated with a forward working portion **38** and rearward guide portion **40**. The guide portion has a T-shaped cross section which slidably fits in the T-shaped channel passageway **34** formed in the slide housing **32**.

The forward working portion **38** of the movable block **36** (FIG. **6**) is integrally formed with the rearward guide portion **40** and has recesses **42** (FIG. **6**) formed inwardly of both lateral surfaces of the movable block **36** by a distance equal to the thickness of the cutters **30**. The cutters are removably fastened thereto by means of a pair of screws inserted through aligned apertures in the rearward end of the cutters **30** and screwed into threaded bores **44** (FIG. **8**) formed in the sides of the recesses **42**. The forward end of the guide portion **40** is provided with a component carrying section **46** which is specially designed for purposes to be described hereinafter.

The movable block **36** is reciprocally driven in the T-shaped passageway **34** by means of an eccentric drive mechanism **50** (FIG. **1**) that cooperates with a pair of spaced cam follower rollers **52** supported from the lower surface of the rear working portion **38** of the movable block **36**. Referring to FIG. **1**, the eccentric drive mechanism **50** comprises a circular cam eccentrically mounted on the top of vertical drive shaft **56**. The drive shaft **56** is interconnected to the output of an electric motor **58** by means of a gear box **60**. The housing of the electric motor **58** is fastened to the base plate **14** of the lead forming machine **10** by means of a pair of bolts **62** to make the lead forming machine a complete self-contained portable device.

A fixed block member **66** is secured to the forward vertical surface **68** of the elevated block member **18** of base **12**, and cooperates with the movable block **36** to cut and form the leads of electrical components having axially extending leads. Fixed block member **66** has a relatively narrow thickness and a rectangular-shaped lower portion **70** (FIG. **9**). An inner and outer pair of

upstanding legs 72 and 74 extend upwardly at the forward edge of the base portion 70. The fixed block member 66 is mounted on the forward vertical surface 68 by means of a pair of threaded bolts 76 which extend through openings 78 formed in the base portion 70 and screw into threaded bores 80 (FIG. 7) provided in the elevated block 18, such that the pair of cutters 30 are adapted to move between the inner and outer upstanding legs 72 and 74 and the component carrying section 46 moves between the opening separating the inner legs 72.

Rearwardly of the outer pair of upstanding legs 74 is a third pair of upstanding legs 82 which together with the outer pair of legs 74 define a pair of vertical slots 84 for receiving the opposite ends of the leads for the electrical component to be cut and formed. Outwardly of each slot 84 is a shield 86. Each shield 86 comprises a pair of parallel flanges extending a substantial distance beyond the lead slots 84 both laterally and vertically to deflect the cut ends of the electrical components for safety purposes.

As depicted in FIG. 7, the electrical components are sequentially delivered into the lead slots 84 from a feed chute 90 using a gravity feed arrangement. The feed chute 90 comprises an elongated feed bar 92 and a parallel elongated guide bar 94 which is spaced above the feed bar by a slight distance to ensure that the electrical components are lined up in a single file arrangement. The feed bar 92 has a U-shaped cross section to define a pair of skid surfaces 96 which are spaced apart a sufficient distance to be engaged by the opposite axial leads of the electrical component as it is fed down the feed bar. The feed chute 90 is mounted on the lead forming machine 10 at an approximate 45 degree angle by means of securing the feed bar 92 to the hypotenuse surface 93 of a right-angled triangular member 98 that extends upright from the center of the slide unit housing 28 by using a pair of mounting screws 100 (FIG. 7). The guide bar 94 is also mounted on the triangular member 98 by means of an integral cross bar 95 fastened at its opposite ends to a mounting bar 97 that seats in a U-shaped cut-out 99 formed in the hypotenuse 93. The pair of spacers 101 that interconnect the cross bar 95 and mounting bar 99 determine the spacing between the guide bar 94 and feed bar 92. The lower end 102 of the feed bar 92 has a vertical face and terminates at the outer end of the lead slots 84 for directing the electrical components into the lead slots.

The component carrying section 46 of the movable block 36 is specially designed to catch and hold the inner ends of the electrical leads during the lead forming phase of machine's operation. The outermost end of section 46 has a pair of parallel upstanding flanges 104 (FIGS. 6 and 10) spaced apart a sufficient distance to engage the inner ends of the electrical leads. At the inner end of the upstanding flanges 104 there is provided a stop in the form of a pair of abutting shoulders 106, which stop is located slightly behind the plane of the cutting edge of the cutters 30 in order to catch the electrical component after its leads have been cut, as depicted in FIG. 11.

After the ends of the electrical leads have been cut, the component carrying section 46 drives the electrical component between the inner pair of legs 72 of the fixed block 66. At the inner corners 108 of the pair of inner legs 72 there is formed a pair of wedge-shaped notches 110 (FIGS. 9 and 10) in the plane of the electrical leads to assist in forming the leads. As the movable block 36 continues to move through the inner legs 72, the electrical leads are bent backwardly at a 90 degree angle (as indicated in the dotted lines of FIG. 12) since the distance between the sides of section 46 and legs 72 is only slightly greater than the thickness of the leads.

The electrical component that is formed is ejected from the lead forming machine 10 by means of a novel ejection means employing a pivoted lever 114 cooperating with section 46 of the movable block 36. The ejection lever 114 has one end 116 pivotally mounted between the bifurcated lower end 115 (FIG. 4) of the guide bar 94 such that its lower pointed end 118 is adapted to rest on the recess surface 120 formed between the upstanding flanges 104 and extending rearwardly beyond stop 106.

Referring to FIG. 7, it will be appreciated that the ejection lever 114 rides over the electrical component as the movable block approaches the end of the forward stroke and then falls into the recess 118 behind the electrical component. During the return stroke, the formed electrical component is engaged by the tip 118 and is held in place as the movable block moves rearwardly until the forward edge of the component carrying section 46 moves rearwardly beyond the electrical component to permit the component to drop down into a receptacle (not shown) located directly below the section 46.

In operation, the electrical components to be cut and formed are fed into the feed chute 90 in a single file arrangement as depicted in FIG. 7, and the lowermost component drops between the lead slots 84. The eccentric drive mechanism 50 is energized and when the movable block 36 approaches the end of the return stroke, the opposite leads of the lowermost component drop onto the skid surfaces 96 of section 46, as depicted in in FIG. 10. On the next forward stroke, the cutting edge 119 of the cutters 30 engage the outer ends of the electrical leads and these leads are sheared as the cutting edges 119 pass by the outer corners 122 of the inner pair of legs 72. The electrical component is then momentarily held against the rearward face 124 of the inner pair of leads 92 until the inner ends of the leads are engaged by the abutting shoulders 106. Further forward movement of the movable blocks 36 causes the leads to be bent in the manner depicted in FIGS. 11 and 12. On the return stroke the pointed tip of the ejection lever 114, which has ridden over and is now behind the electrical component, engages the component and holds it in place as movable block 46 travels rearwardly and upon the forward edge of section 46 passing the component, it drops down into a receptacle (not shown). The finished component is depicted in FIG. 2.

One important feature of this invention is that the fixed block 66 can be quickly replaced by another since it is mounted by means of two bolts 76. The need for having this feature is that it is occasionally necessary to substitute a different fixed block to vary the length of the cut leads or to replace the fixed block due to wear on the outside corner 120 of the inner pair of legs 72 caused by the continuous wear after shearing a large number of electrical components.

A modified version of the fixed block 66 is depicted in FIGS. 13 through 16. The modified version of the fixed block, generally designated by the reference nu-

meral **150**, has substantially the same shape as the fixed block **66** and is mounted on the lead forming machine **10** in the same manner, but differs in the addition of a pair of wear resistant elements **152** seated in slots formed at the outside corner of the pair of inner legs which provide a shearing surface in cooperation with the cutters. The wear resistant elements **152** are preferably in the form of elongated square shaped carbide bars **154** which are removably mounted in right-angles recesses **156** formed lengthwise of the fixed block **150** at the outside corner of the inner pair of legs. The bars **154** are held in place by means of a pair of set screws **158** screwed in threaded bores **160** formed through the opposite sides **162** of the fixed block **150**. The use of the carbide elements **154** provide longer life and versatility for the fixed block **150**, and they can be turned **90** degrees or repositioned vertically to provide a new shearing surface to cooperate with the cutting elements.

While various specific examples and embodiments of the invention have been described in detail hereinabove, it will be obvious that various modifications may be made from the specific details described without departing from the spirit and scope of the invention.

What is claimed is:

1. An apparatus for cutting and forming the axial leads of electrical components comprising a base member, a slide housing supported on said base, a movable block slidably supported in a passageway formed in said housing, drive means for reciprocally moving said movable block in a straight line path, said movable block including a component carrying section extending forwardly of said passageway disposed between a pair of parallel cutters, said component carrying section having a pair of skid surfaces for supporting the leads of the component and stop means located behind the plane of the cutting edges for said cutters for engaging the inner ends of the components, a fixed block mounted on said base member, said fixed block having a pair of spaced shearing surfaces disposed in the path of said cutters and spaced apart a distance slightly less than said cutters and having a pair of opposing forming surfaces disposed in the path of said component carrying section and spaced apart a distance slightly greater than said pair of skid surfaces for bending the leads as said section passes therebetween on its forward stroke, and eject means for engaging and holding the electrical component against movement during the return stroke of said movable block to permit said component to drop as the forward edge of said component carrying section passes thereby.

2. An apparatus as defined in claim **1**, wherein said fixed block comprises a pair of inner and outer upstanding legs disposed crosswise to the linear movement of said movable block such that said cutters move between adjacent inner and outer legs and said component carrying section moves between said inner pair of legs, whereby said outer corners of said inner legs define said shearing surfaces and said inner corners and opposing lateral surfaces define said lead forming surfaces.

3. An apparatus as defined in claim **2**, wherein said inner pair of legs include wedge-shaped notches formed in said inner corners in the path of component's leads to assist in bending the leads.

4. An apparatus as defined in claim **3**, wherein said fixed block further comprises a slot formed lengthwise in each of said outer corners of said inner legs, a high wear resistance element seated in each of said slots to define said shearing surfaces and means to removably mount said elements.

5. An apparatus as defined in claim **4**, wherein said slots are formed as right-angle recesses and said elements comprise carbide square bars, whereby said bars can be turned ninety-degrees or moved vertically to provide a new shearing surface.

6. An apparatus for cutting and forming the axial leads of electrical components comprising a base member having a horizontal base, a riser portion and an elevated horizontal platform portion, a slide unit housing mounted on said elevated platform and having a channel passageway formed lengthwise of said base member, a movable block slidably mounted in said passageway, eccentric drive means for reciprocally moving said movable block, said movable block including a component carrying section extending forwardly of said passageway disposed between a pair of parallel cutters, said component carrying section having a pair of skid surfaces for supporting the leads of the component and having a pair of abutting upstanding shoulders at the rearmost end of said skid surfaces, said shoulders being located behind the plane of cutting edges for said cutters for engaging the inner ends of the components, a fixed block having a mounting portion secured to said elevated platform and having a pair of spaced apart upstanding legs disposed in the path of said movable block such that said component carrying section travels between them, said legs being spaced apart a distance slightly greater than the width of said component carrying section to provide a lead forming surface and being of a thickness slightly less than the distance between the lateral sides of the component carrying section and said cutters to provide a shearing surface, and ejector means for engaging and holding the component during the return stroke of said movable block to permit said component to drop as the forward edge of said component carrying section passes thereby.

7. An apparatus as defined in claim **6**, wherein said pair of legs include wedge-shaped notches formed at their inner corners in the path of component's leads to assist in bending the leads.

8. An apparatus as defined in claim **6**, wherein said fixed block further comprises a slot formed lengthwise in each of said legs at their outer corners, a high wear resistance element seated in each of said slots to define said shearing surfaces and means to removably mount said elements.

9. An apparatus as defined in claim **8**, wherein said slots are formed as right angle recesses and said elements comprise carbide square bars, whereby said bars can be turned 90-degrees or moved vertically to provide a new shearing surface.

10. An apparatus as defined in claim **6**, further comprising a feed chute supported on said elevated platform adapted to hold a large number of electrical components in single file arrangement, said feed chute extending upwardly at a transverse angle and terminating above the path of said component carrying section and to the rear of said upstanding legs.

11. An apparatus as defined in claim **10**, wherein said ejector means comprises a lever having an upper end pivoted on the lower end of said feed chute and of sufficient length that the lower pointed end extends for-

wardly and rests on the surface of said component carrying portion located between said skid surfaces.

12. An apparatus as defined in claim **6**, wherein said channel passageway and the rear guide portion of said movable block have T-shaped cross sections to provide a straight line of travel for said movable block.

13. An apparatus as defined in claim **6**, wherein said eccentric drive means comprises a pair of spaced cam follower rollers extending downwardly from the rear end of said movable block, a circular cam eccentrically mounted on the upper end of a vertical drive shaft and disposed between said cam follower rollers and power means supported on said horizontal base for rotating said vertical drive shaft.

14. An apparatus as defined in claim **1**, wherein said eject means comprises a lever having an upper end pivotally supported by said slide housing such that its lower end extends forwardly and rests on the surface of said component carrying portion located between said skid surface.

* * * * *