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Winter

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[54] **COMPONENT REMOVAL TOOL**

[76] Inventor: **Robin L. Winter,** Conn Rapids, Minn.

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[52] **U.S. Cl.** ..... **219/230;** 29/203 H; 81/417; 219/533; 228/19; 228/51

[51] **Int. Cl.** **H05b 1/00;** B23k 3/00; B25b 7/00

[58] **Field of Search** ..... 219/221, 227, 230, 231, 219/236, 533; 81/9.5 R, 9.5 B, 9.5 A, 415, 417, 341; 228/51, 54, 55; 29/203 H, 203 HM

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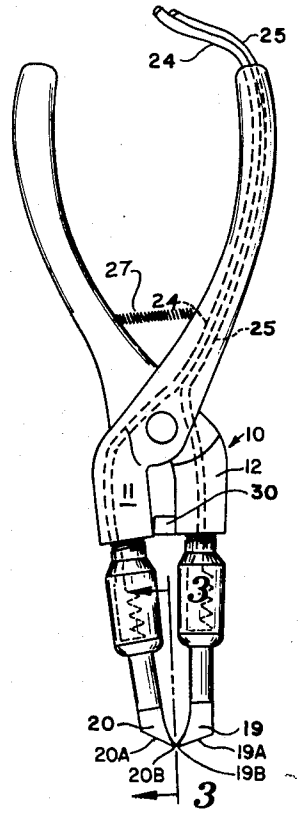
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Primary Examiner—A. Bartis

[57] **ABSTRACT**

Apparatus for removing solder-mounted components from substrate surfaces comprises plier means having a pair of relatively movable arms pivotally mounted together and forming a pair of oppositely disposed gripping handles and a pair of oppositely disposed working legs. Each working leg has a head secured thereto and electric heating means is provided for heating each of the heads. The heads are characterized in that each terminates in a generally planar exposed surface arranged at an acute angle with respect to the longitudinal axis of the leg and having a generally sharpened linear tip edge mutually opposed to the sharpened tip edge of the other head. The tip edges are disposed along a line generally transverse to and intermediate the longitudinal axes of the legs. The forward and inward exposed surfaces of each of the heads are arranged in mutually converging relationship at an acute angle relative to the longitudinal axis of the leg to which it is secured to define a wedge-shaped configuration. The heads are designed to both melt the solder and to lift the component from the substrate surface. The legs are resilient biased apart by a spring between the handles. Stop means are provided to prevent contact between the tip edge portions.

3 Claims, 3 Drawing Figures



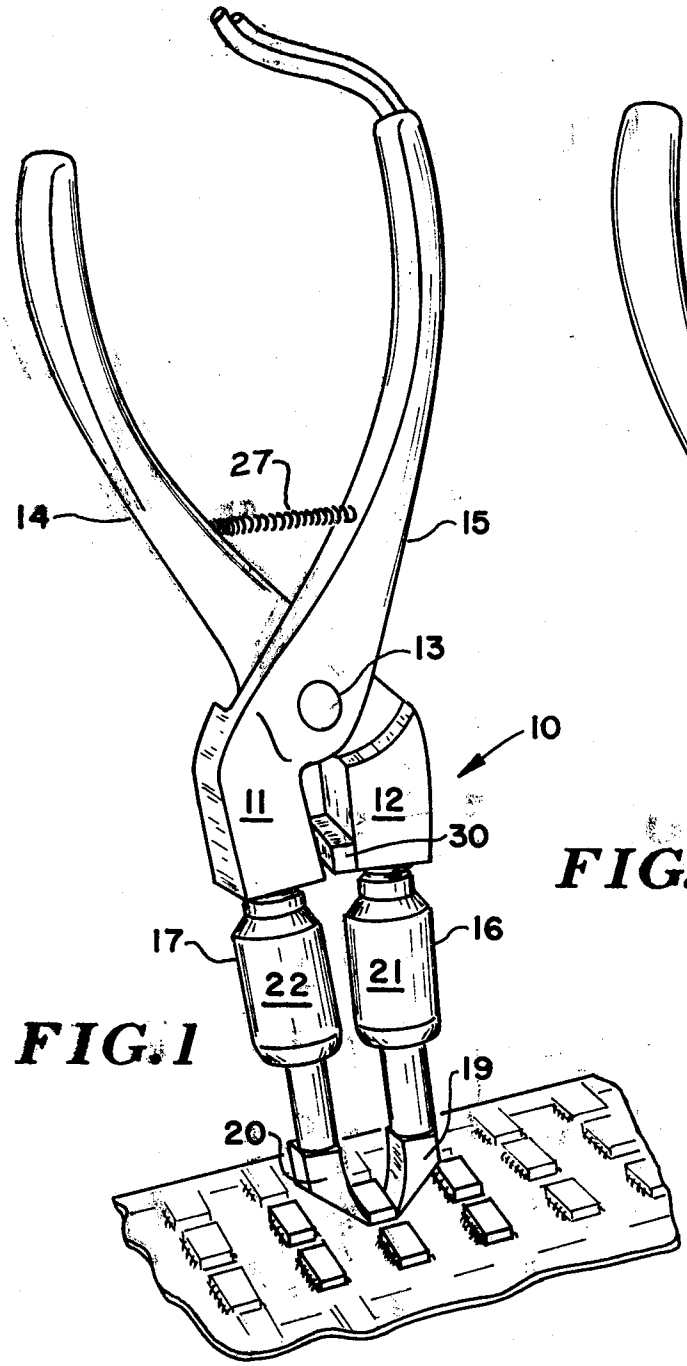


FIG. 1

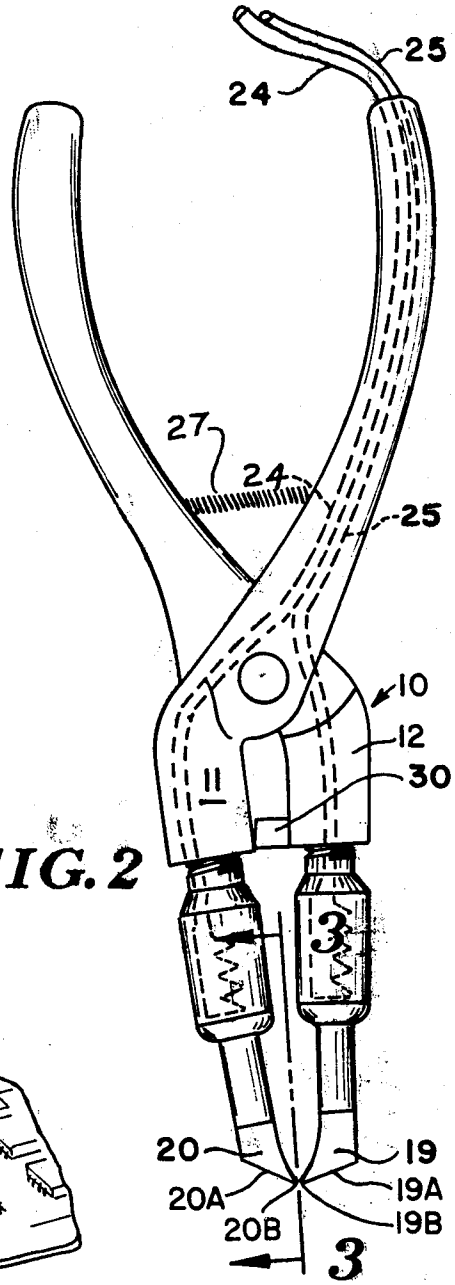


FIG. 2

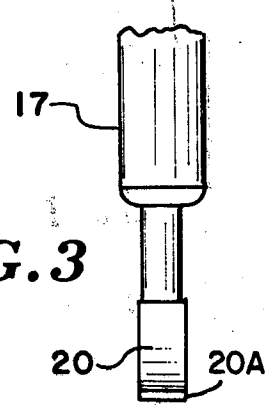


FIG. 3

COMPONENT REMOVAL TOOL

CROSS-REFERENCE TO RELATED APPLICATION

This is a continuation of application Ser. No. 226,493, filed Feb. 15, 1972.

BACKGROUND OF THE INVENTION

The present invention relates generally to an improved apparatus for removing solder-mounted components from substrate surfaces, and particularly for lifting semiconductor chips from a printed circuit board. More specifically, the apparatus of the present invention may be described as a chip-lifter which is provided with the gripping action of a conventional pair of pliers and with the heating action of a pair of soldering irons. This combination provides an expeditious means for removing integrated circuit chips from printed circuit boards.

In the past, various apparatus have been designed for removing chips, particularly integrated circuit chips from printed circuit boards, these devices being provided with heated tips for lifting the component from the printed circuit board. Frequently, these chip-lifting devices apply heat directly to the substrate surface, and frequently damage occurs to the foil surface. The apparatus of the present invention reduces the danger of heat damage to the substrate surface, reduces the incidents of conductive foil being lifted from the substrate, and also reduces the occurrences of electrical shorts occurring due to solder deposits.

SUMMARY OF THE INVENTION

Briefly, in accordance with the present invention, a means is provided for removing solder-mounted components from substrate surfaces, such as a chip-lifter, the apparatus including plier means having a pair of relatively movable arms which are pivotally mounted together, and form a pair of oppositely disposed gripping handles and a pair of oppositely disposed working legs. The conventional pivot separates the gripping handles from the working legs. Each of the legs is provided with a head which has heating means provided for each of the heads, the heads being characterized in that a generally sharpened tip edge is provided along a plane arranged generally transverse to the axis of the legs. This structure provides a safe, efficient, and expeditious means for accomplishing removal of integrated circuit chips from printed circuit boards, while reducing the danger of damage to the components through the application of heat.

Means are provided for delivering heat to the working tips, this being accomplished either by means of the direct application of heat to the tip, or by the medium of resistance heating. When direct heat is utilized, a separate heating element is normally provided for each of the working tips, with each of the tips being, therefore, independently heated. When resistance heating is employed, each tip becomes an electrode, and high currents are permitted to pass between the individual tips, under low potential. The Joule heat is then adequate to cause the solder layer to become molten, thereby making it possible to lift the chip from the board surface.

It will be observed that the individual tips have a wedge-shape configuration, particularly a wedge shape which increases in thickness in a direction extending inwardly away from the center or bight zone of the jaw.

This wedge-shape configuration provides a lifting force necessary to remove the chip from the board, with the lifting force occurring upon closing of the working heads toward the center of the jaw.

Therefore, it is a primary object of the present invention to provide an improved means for removing solder-mounted electrical components from substrate surfaces wherein the device accomplishes safe and expeditious removal of the component from the printed circuit substrate board.

It is yet a further object of the present invention to provide an improved means for removing solder-mounted electrical components from substrate surfaces, particularly integrated circuit chips from printed circuit boards, wherein the apparatus accomplishes removal without risking damage to the board surface.

It is yet a further object of the present invention to provide an improved apparatus for removing solder-mounted electrical components from substrate surfaces, wherein the individual working heads of the structure have a sharpened wedge-shaped tip to provide a lifting action to lift the individual circuit chips from the board surface.

Other and further objects of the present invention will become apparent to those skilled in the art upon a study of the following specification, appended claims, and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the removal tool of the present invention, with this view illustrating the apparatus in use on a printed circuit board, the printed circuit board also being shown in FIG. **1**;

FIG. **2** is a plan view of the apparatus of the present invention, and showing, in phantom, the arrangement of electrical leads within the confines of the gripping handles; and

FIG. **3** is a partial elevational view of one of the working legs of the structure, this figure being taken along the line and in the direction of the arrows **3—3** of FIG. **2.**

DESCRIPTION OF THE PREFERRED EMBODIMENT

With attention now being directed to FIG. **1** of the drawings, the component removing tool generally designated **10** includes a plier means having a pair of relatively movable arm members **11** and **12,** with these arm members being pivotally mounted together about pivot pin **13.** The individual arm members **11** and **12** each have a gripping handle portion and a working leg portion, such as the gripping handles **14** and **15,** and the working leg portions **16** and **17.** As is apparent in the drawing, each working leg has a head secured thereto, particularly at the free tip thereof, the heads being shown at **19** and **20.** Heads **19** and **20** terminate in generally planar forward exposed surfaces **19*a*** and **20*a*** arranged at an acute angle with respect to the longitudinal axis of the respective leg portions and sharpened tip edges **19b** and **20b** respectively, with the tip edges being arranged in opposed relationship, one to another. Heating means are also provided for each of the working heads, such as the heating means shown at **21** and **22.** In this connection, heating means **21** and **22** are provided for heating the individual heads **19** and **20,** and it will be appreciated that elements **21** and **22** are electrically energized. Leads are shown as at **24** and **25**

in FIG. 2, these leads delivering electrical power to the heating means 21 and 22, as indicated in FIG. 2.

If desired, a spring bias may be provided as at 27, the biasing means being in the form of a compression spring secured across the individual gripping handles 14 and 15. The use of a bias element such as spring 27 provides a constant and smooth force to the individual heads.

Particular attention is now directed to FIGS. 2 and 3 of the drawings wherein the configuration of the heads is illustrated in detail. It will be readily apparent that the individual heads are wedge-shaped so as to provide the lifting force necessary to remove the component from the board, upon achieving a molten state in the solder. As is apparent in the drawing, the wedge-shaped configuration provides an increasing head thickness as one moves away from the center of the jaw formed between the individual working legs 16 and 17 of the removal tool structure. Also, as is apparent, the tips of the individual wedge-shaped heads are reasonably sharp, thus permitting ingress of the working head to the area between the chip and the substrate surface.

For materials of construction, any convenient material may be employed, the working heads 19 and 20 preferably being fabricated from copper or brass, and with iron or steel being employed for the arm members. It will be appreciated that the materials of construction are not critical, and those skilled in the art may select appropriate materials without experimentation being required.

As has been indicated, either direct application of heat to the working heads may be employed, or resistance heating may be employed. In instances where resistance heating is desired, each working head becomes an electrode, and the high currents, at low potential, are permitted to pass between the heads.

In order to preserve the configuration of the individual working heads, a stop member such as the stop member 30 may be employed between the legs 16 and 17. Such a stop element, interposed between the working legs, will protect the tips of the heads 19 and 20 from contact with each other.

The apparatus illustrated here is illustrative of those structures which may be prepared pursuant to the various aspects of the present invention.

I claim:

1. Means for removing solder-mounted components from substrate surfaces comprising:

a. plier means having a pair of relatively movable arm members pivotally mounted together and forming a pair of oppositely disposed gripping handles and a pair of oppositely disposed working legs;

b. each of said working legs having a head secured thereto adjacent the free tip thereof and heating means for each of said heads;

c. said heads being characterized in that each includes a forward exposed surface terminating in a generally sharpened linear tip edge mutually opposed to the generally sharpened tip edge of the other head said sharpened tip edges being disposed along a line generally transverse to and generally intermediate the longitudinal axes of said legs, and in that the forward exposed surface of each of said heads is generally planar and arranged at an acute angle with respect to the longitudinal axis of the leg, the forward and inward exposed surfaces of each of said heads being disposed in mutually converging relationship and at an acute angle relative to the longitudinal axis of the working leg with which the leg is secured, and with said mutually converging relationship being in a forward direction away from said working legs and toward said sharpened tip edge to define a wedge-shaped configuration.

2. The component removal structure as defined in claim 1 being particularly characterized in that resilient means are provided normally urging said working legs in a direction away from contact with each other.

3. The component removal structure as defined in claim 1 being particularly characterized in that stop means are provided for preventing mutual contact from occurring between the tip edge portions of said heads.

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