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APPARATUS FOR APPLYING LIQUID ALLOYS

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FIG. 1

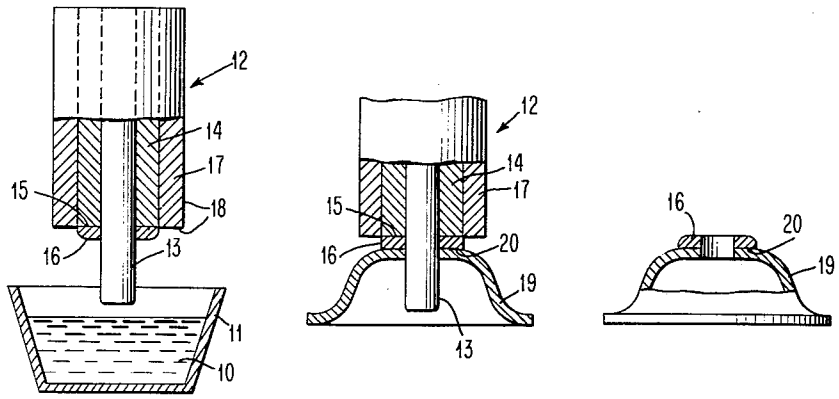


FIG. 2

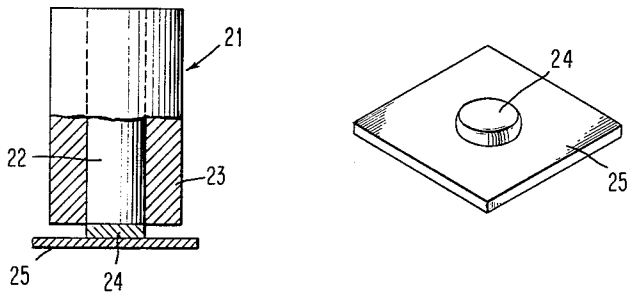
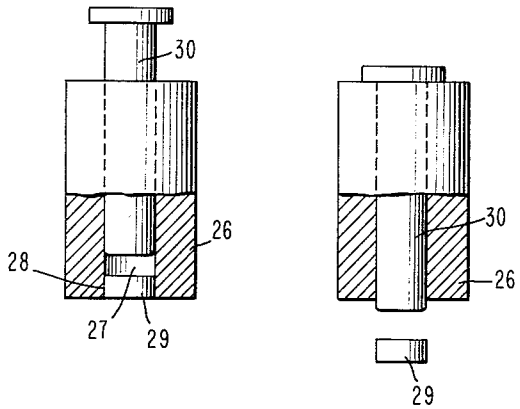


FIG. 3



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This invention relates to apparatus for applying a liquid metal such as an alloy to a surface and more particularly to a defined area of a surface which is wettable by said alloy.

It is often necessary to transfer liquid alloys from a liquid bath to a surface which is wettable by the alloy. Such is the case in soldering operations and also where a metal alloy is deposited on a semiconductive surface. In the usual instance such a transfer involves only a small quantity of the alloy but this quantity must be accurately deposited on the surface within a well defined and specified area thereof. Since the speed involved in such deposition is of prime importance, tools for implementing such depositions in a rapid fashion are in demand. This invention has for its main object the provision of such a tool.

It is also an object of this invention to provide an apparatus for transferring liquid alloys to a surface in such a manner that the deposition thereon is controlled as to configuration and quantity.

These and other objects will become apparent from a detailed description of the accompanying drawings.

In the drawings:

FIGURE 1 is a plan view of a tool constructed in accordance with this invention for transferring a solder alloy from a liquid solder bath to a metal surface wettable by the solder;

FIGURE 2 is a plan view of another embodiment of a tool constructed in accordance with this invention for transferring a liquid alloy to a surface such as a semiconductor material and also showing in perspective the semiconductor material with the liquid alloy deposited thereon in the form of a pellet; and

FIGURE 3 is a plan view of another embodiment of a tool constructed in accordance with this invention.

Referring to the figures, the liquid alloy **10** is contained in a heated pot or bath **11**. The tool generally designated by numeral **12** has a key portion **13** which is constructed of a material which is not wettable by the alloy **10**. Surrounding the key **13** is a tubular member **14**. This member **14** has a surface **15**, which upon the insertion of the tool into the bath **11**, is wetted by the alloy **10**. The extent of insertion of the tool into the bath is not critical. The alloy which is transferred from the bath to the surface **15** is designated by the numeral **16**. Defining the surface **15** is another tubular member **17**. Surface **15** may be at least flush with the end surface of member **17**. This member **17** is not wettable by the alloy or at least has an alloy contacting surface **18** which is not wettable thereby.

The tool **12** with the liquid alloy **16** deposited onto the surface **15** is then transferred to the member **19**. In this particular case the member **19** has an aperture therein through which fits the key **13**. At least the surface **20** of the member **19** is wettable by the alloy **16**. Upon contact of the liquid alloy **16** with the surface **20**, said alloy is transferred from the tool to said wettable surface. The deposition of the liquid metal **16** to the member **19** provides the structure shown in the right-hand view in connection with FIGURE 1 after the tool has been removed. It can be seen therefore that because of the ability of the liquid alloy to wet certain metal surfaces and not others, an alloy having a specific configuration may be transferred from a liquid bath to a surface wettable by the alloy by

the use of the tool constructed in accordance with this invention. The configuration of the deposited alloy is determined by the configuration of the surface **15** of tool **12** which is defined between two non-wettable materials, in this case the key **13** and the annular member **17**, both of which are not wettable by the alloy **10**. An example of a metal surface which is wettable under ordinary flux conditions by metal alloys is copper, iron, gold, platinum. An example of a metal surface that is not easily wet under ordinary conditions is aluminum, tungsten, titanium. It is also possible to use ceramics for non-wetting areas, Therefore, it can be seen that if the tool is so constructed that the area to be transferred is made of a wettable surface, defined between non-wettable surfaces, then upon the application of a molten alloy the alloy will adhere only to the wettable surface. The amount that adheres is controlled by the surface tension. When this tool is applied to a surface wettable by the alloy carried by the tool, the alloy will be transferred to this surface in some proportion related to its total volume. In some instances it may be desirable to use flux to effect this transfer but this is not always necessary.

Referring to FIGURE 2, there is shown another embodiment of the tool constructed in accordance with this invention. The tool **21** is composed of a central rod member **22** which is wettable by the liquid metal and the surrounding tubular member **23** which is not wettable thereby. The liquid alloy **24** adheres to the central member **22** and is transferred to the surface **25** which is wettable by said alloy. In this particular case, a small pellet **24** is deposited on the surface **25**. This may function as an ohmic contact **24** applied to semiconductor material **25** or the deposition of an alloy onto a semiconductor for a subsequent alloying or diffusing. This is also representative as is the case of FIGURE 1 of the application of a soldering alloy to a metal surface.

In FIGURE 3 there is shown another embodiment of a tool constructed in accordance with this invention. The tool comprises a tubular member **26** not wettable by the liquid alloy but having an inner wall **27**, at least a portion of whose surface **28** is wettable by said alloy. The extent of this surface can be used to control the amount of alloy transferred. The alloy pellet **29** carried by the tool may be ejected therefrom and positioned upon a desired surface by a plunger **30**. When transferring the alloy from the bath to the tool, the plunger **30** is positioned in its withdrawn position such as shown in FIGURE 3 and then to eject the metal pellet **29** the plunger **30** is depressed as shown.

The transfer surface, that is, the wettable surface to which the alloy adheres upon the introduction of the tool into the alloy bath, may be constructed in many ways. For example, this transfer surface may be made of some metal which is wettable by the liquid alloy. The areas to which the alloy is desired to adhere will be left bare while the areas to which it is not desired for the alloy to adhere will be covered with some non-wettable material such as a metal oxide. This oxide may be deposited by oxidizing the base metal itself or it may be coated thereon by other suitable means. The wettable and non-wettable areas may also be made of different materials.

While the tool for accomplishing the alloy transfer in accordance with this invention finds particular utility in connection with solder applications and in connection with construction of semiconductor devices, the manufacture of printed circuitry also is adaptable to such a tool. In connection with semiconductor applications the liquid alloy may be molten indium.

What has been described are various embodiments of the present invention. Other embodiments obvious from the teachings herein to those skilled in the art are con-

templated to be within the spirit and scope of the accompanying claims.

What is claimed is:

1. A tool for depositing a liquid alloy onto a surface wettable thereby, comprising a solid cylindrical member composed of a material non-wettable by said liquid, a first tubular member composed of a material wettable by said liquid and having a surface tension of a value for supporting a portion of said liquid, said first tubular member surrounding said cylindrical member, and a second tubular member composed of a material non-wettable by said liquid, said second tubular member surrounding said first tubular member, the axial length of said first and second tubular members being less than that of said cylindrical member.

2. A tool for depositing a liquid alloy onto a base having a surface wettable by said alloy, said tool comprising a tubular member and a plunger reciprocably mounted within said tubular member, said tubular member having a flat end surface of material non-wettable by said liquid alloy, said tubular member having an inner wall having a circumferential band of material wettable by said liquid alloy, said band being contiguous with said flat end surface, the width of said band determining the depth of liquid alloy to be deposited on said base and said plunger adapted to expel by reciprocation the liquid alloy carried within said tubular member for deposition onto said base.

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