May 11, 1965 J. J. DE SANTE ETAL 3,183,177

ELECTROPLATING BARREL WITH CURRENT REVERSAL MEANS

Filed Jan. 12, 1962 3 Sheets-Sheet 1

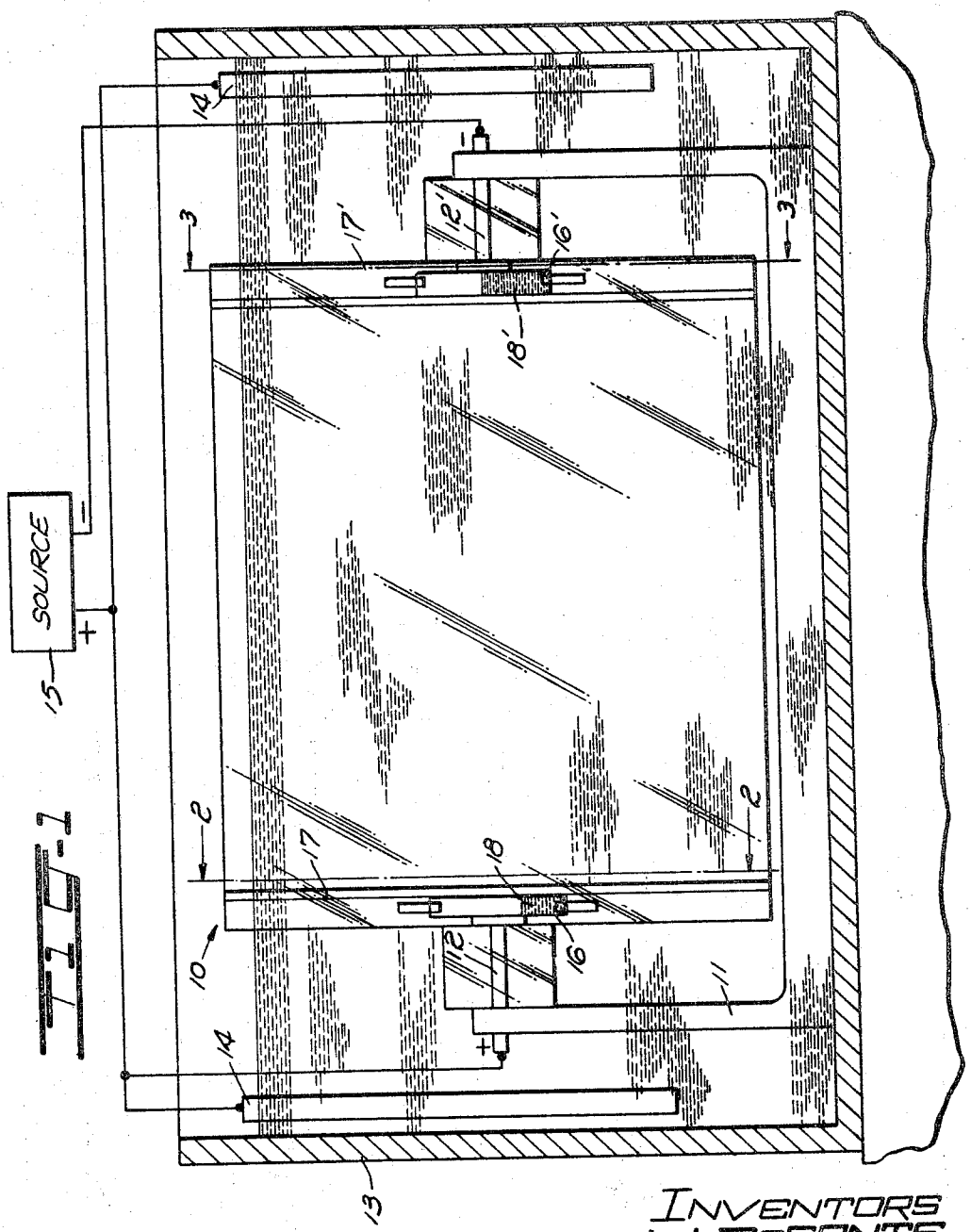


FIG. 1

INVENTORS
J. J. DeSANTE
L. K. SCHULTZ

By A. J. Nugent
ATTORNEY

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FIG-2

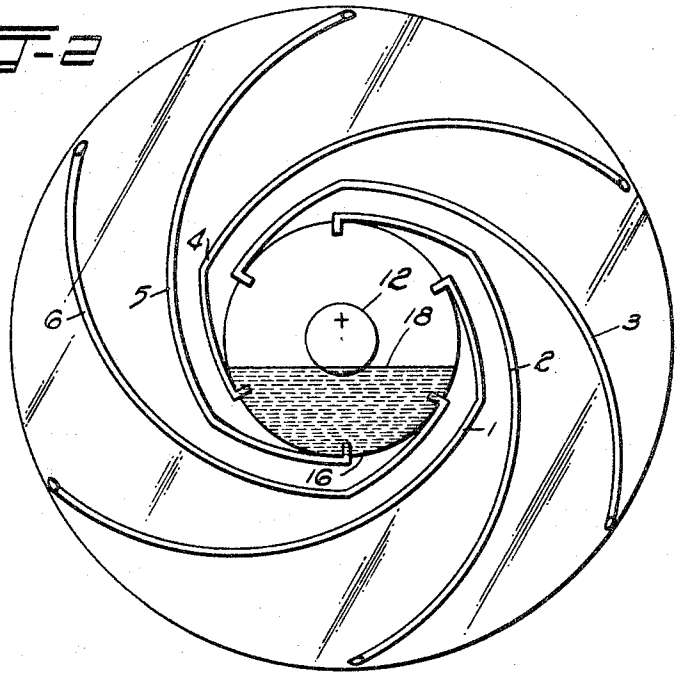
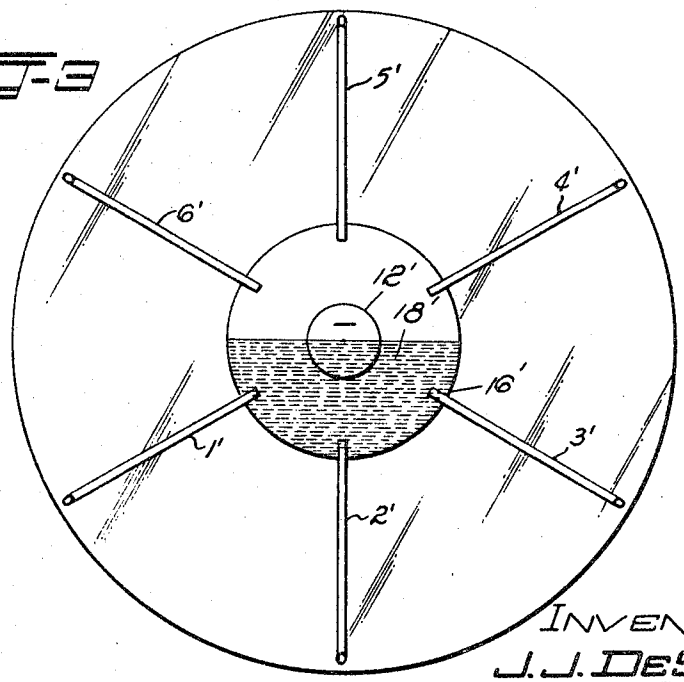


FIG-3



INVENTORS
J. J. DeSANTE
L. K. SCHULTZ

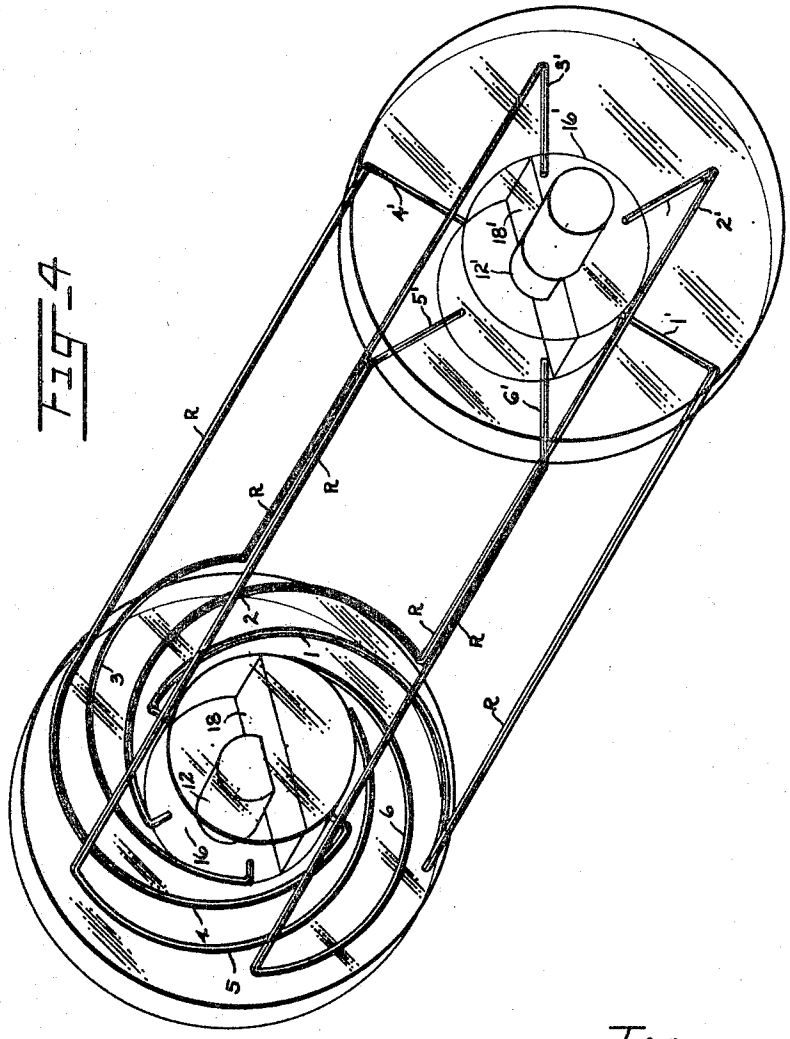
BY A. J. Nugent
ATTORNEY

May 11, 1965 J. J. DE SANTE ETAL 3,183,177

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Fig. 4



INVENTORS
J. J. DESANTE
L. K. SCHULTZ

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ELECTROPLATING BARREL WITH CURRENT REVERSAL MEANS

Joseph J. De Sante, Coaldale, Pa., and Lewis K. Schultz, Wappingers Falls, N.Y., assignors to Western Electric Company, Incorporated, New York, N.Y., a corporation of New York

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9 Claims. (Cl. 204—213)

This invention relates to electroplating apparatus and particularly to a rotatable type plating apparatus used for plating articles, such as transistor headers.

In conventional type rotatable plating apparatus, commonly referred to as barrel platers, current conducting rods within the barrel, when rotated to an upper position, are placed out of contact with the articles. In such position, the rods become areas of high current density causing a very rapid plating of the plate material thereon as compared to the rods in contact with the articles. Consequently, the rods must be changed often and subjected to a stripping process which ultimately shortens the life of the rods.

The object of this invention is to obviate the above-mentioned undesirable occurrences and to provide a barrel plater capable of automatically stripping the plate material from the current conducting rods during the plating operation.

Broadly, the invention includes a plating barrel having means for providing a potential of one polarity at one side of the barrel and for providing a potential of the opposite polarity at the other side of the barrel. A plurality of conducting rods are connected between the sides of the barrel and arranged such that when the barrel is rotated, one end portion of a rod makes contact with the potential of one polarity, while its opposite end portion is out of contact with the potential of the opposite polarity.

In a preferred embodiment, the barrel includes a pair of opposing barrel end faces each provided with a shaft for rotation of the barrel. A well is sealed within each end face containing a conductive fluidic material in contact with each shaft, a potential of negative polarity being passed through one shaft and conductive material and a potential of positive polarity being passed through the other shaft and conductive material. A plurality of conducting rods extend between the wells, and their respective end portions are arranged such that upon rotation of the barrel when one end portion of a rod passes through the conductive material of negative potential, the opposite end portion has broken contact with the conductive material of positive potential. In this manner, a reversal of polarity is obtained thereby permitting the rods to be cathodic during one phase of the barrel rotation to plate the articles in contacting relationship therewith, and to be anodic during the other phase of the barrel rotation to strip the plate material that may have been deposited thereon during the plating of the article.

Other objects will be apparent and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing, in which:

FIG. 1 is a schematic view of the invention;

FIG. 2 is a view taken along the line 2—2 of FIG. 1;

FIG. 3 is a view taken along the line 3—3 of FIG. 1; and

FIG. 4 is a perspective view of the plating barrel with portions removed for illustrating the invention.

With reference to the drawing, a plating barrel, generally referred to as **10** and consisting of a dielectric material such as Plexiglas, is supported in a holder **11** by shafts **12**, **12'**, the holder being located within and connected to a receptacle **13** containing a desired electrolytic plating solution.

A pair of anodes **14** of the desired plating material, such as gold, are suspended in the solution and connected to the positive terminal of a voltage source **15**. Also connected to the positive terminal is shaft **12** which extends into a sealed well **16** located in barrel end face member **17**, the well being filled to a desired level with a conductive fluidic material **18**, such as mercury. A negative potential is connected from voltage source **15** to shaft **12'** located in the opposite barrel end face member **17'**, shaft **12'** extending similarly, as shaft **12**, into a sealed well **16'** also filled with mercury **18'** to a desired level.

A plurality of rods, generally referred to as R and having end portions **1**, **2**, **3**, **4**, **5** and **6** and associated opposite end portions **1'**, **2'**, **3'**, **4'**, **5'** and **6'** are connected between wells **16** and **16'**. As seen in FIG. 2, the rod end portions **1–6** are arcuately shaped and equidistantly spaced through and about the periphery of well **16**. As seen in FIG. 3, the associated opposing end portions **1'–6'** are linear and equidistantly spaced through and about the periphery of well **16'**.

In operation, the barrel is rotated by conventional drive means (not shown) and the movement of the rods is such that as one end portion of a rod passes through its respective conductive fluidic material, its opposite end portion rotates external the other conductive fluidic material. For instance, as rod end portion **1'** enters and passes through mercury **18'**, its opposing end portion **1** leaves and passes through the upper half of well **16** out of contact of mercury **18**. In so doing, the rod becomes cathodic since a negative potential is applied through shaft **12'** to the mercury **18'**. In turn, the articles in contacting relationship with said cathodic rod attract the metallic gold ions from the anodes **14**, the ions losing their respective charge as they are deposited on the parts as a layer of pure neutral gold plate. Conversely, as rod end portion **1'** passes from the mercury and moves about the upper half of well **16'**, its respective end portion **1** enters and passes through mercury **18**. In so doing, the rod now becomes anodic and possesses a high current density thereby resulting in the gold ions, which tend to form a plate on the rod when it is cathodic, to be stripped therefrom and dropped into the plating solution.

It is apparent from the above disclosure that the reversal of polarity to the rods permits a continuous automatic stripping of plate on the rods during a plating operation. However, in order to insure that no short circuit occurs across the rods, the level of mercury in well **16** should be lower than that in well **16'** so that the rods are neutral for a short interval prior to the reversal of polarity.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. A plating barrel which comprises a pair of opposing end face members, a receptacle located within each face member, a conductive fluidic material disposed within each receptacle, means for applying a potential of one polarity to the fluidic material in one receptacle, means for applying a potential of the opposite polarity to the fluidic material in the other receptacle, and a plurality of rods each connected between the two receptacles, the end portions of each rod being arranged such that during rotation of the barrel for a part of its cycle one end portion passes through the fluidic material of one potential while the other end portion passes free of

the fluidic material of the other potential, and during rotation of the barrel for another part of its cycle, said one end portion passes free of the fluidic material of said one potential while said other end portion passes through said fluidic material of the other potential thereby causing a plating of the articles and stripping of plate material from the rods respectively during the respective cycle rotations of the barrel.

2. A plating barrel which comprises a pair of opposing barrel end face members, a first unit located in one end face member, a conductive fluidic material disposed within said first unit, a second unit located in the other end face member, a conductive fluidic material disposed within said second unit, means for applying a potential of one polarity to the conductive fluidic material in the first unit, means for applying a potential of the opposite polarity to the conductive fluidic material in the second unit, a plurality of rods each connected between the first and second units and whose end portions are adaptable for contact therewith, each rod end portion being arranged such that during rotation of the barrel for a part of its cycle one end portion thereof passes through the fluidic material of one polarity while the other end portion passes external the fluidic material of the opposite polarity, and during rotation of the barrel for another part of its cycle, said one end portion passes external the fluidic material of one polarity and said other end portion passes through the fluidic material of the opposite polarity, thereby causing a reversal of polarity of the rods during rotation of the barrel.

3. An electroplating system including a receptacle for containing an electrolytic plate solution and having a desired anodic plate material immersed in said receptacle for plating articles, a barrel having a pair of opposing barrel end face members, a shaft connected to each end face member for rotation of the barrel, a well sealed within each end face member, a conductive fluidic material disposed within each well and in contact with each shaft, means for applying a potential of negative polarity through one shaft to one conductive fluidic material, means for applying a potential of positive polarity through the other shaft to the other conductive fluidic material, and a plurality of conducting rods extending between the wells, the end portions of each rod projecting through and about its respective well for contact with their respective conductive fluidic materials such that during rotation of the barrel when one end portion of a rod contacts the negative conductive fluidic material the other end portion breaks contact with the positive conductive fluidic material, thereby causing the rod to be cathodic and permitting articles in contact therewith to be plated.

4. A system according to claim 3 in which the end portions of the rods are equidistantly spaced about their respective wells, the end portions passing through one conductive fluid being arcuately shaped, and the opposing end portions passing through the other conductive fluid being substantially linear.

5. A system according to claim 3 in which the conductive fluidic material in each well is mercury, the level of the mercury in one well being different than the level of the mercury in the other well to permit the rods to be neutral for a short interval of time when changing polarity.

6. An electroplating system comprising a receptacle for containing an electrolytic plate solution and having a desired anodic plate material immersed therein for plating articles, a barrel having, a pair of opposing barrel

end faces, a shaft connected to each end face for rotation thereof, a well sealed within each end face, a conductive fluidic material disposed within each well and in contact with each shaft, means for applying a potential of negative polarity through one shaft to one conductive fluidic material, means for applying a potential of positive polarity through the other shaft to the other conductive fluidic material, a plurality of conducting rods extending between the wells, the end portions of each rod projecting through their respective well for contact with their respective conductive fluidic materials such that during rotation of the barrel when one end portion of a rod contacts the positive fluidic material the other end portion breaks contact with the negative fluidic material thereby causing the rod to be anodic and permitting any plate material on the rods to be stripped therefrom, said stripped plate material falling back into the electrolytic solution.

7. A system according to claim 6 in which the end portions of the rods are equidistantly spaced about their wells, the end portions passing through one conductive fluid being arcuately shaped, and the opposing end portions passing through the other conductive fluid being substantially linear.

8. A system according to claim 6 in which the conductive fluidic material in each well is mercury, the level of the mercury in one well being different than the level of the mercury in the other well to permit the rods to be neutral for a short interval of time when changing polarity.

9. An electroplating system including a receptacle for containing an electrolytic plate solution and having an anodic plate material immersed in said receptacle for plating articles, a barrel having a pair of opposing barrel end face members, a shaft connected to each end face member for rotation of the barrel, a well sealed within each end face member, a conductive fluidic material disposed within each well and in contact with each shaft, means for applying a potential of negative polarity through one shaft to one conductive material, means for applying a potential of positive polarity through the other shaft to the other conductive material, and a plurality of conducting rods extending between the wells, the end portions of each rod projecting through their respective wells for contact with their respective fluidic materials such that during rotation of the barrel when one end portion of a rod contacts the negative fluidic material the other end portion thereof breaks contact with the positive fluidic material thereby causing the rod to be cathodic and permitting articles in contact therewith to be plated, and when the other end portion of a rod contacts the positive fluidic material the one end portion breaks contact with the negative fluidic material thereby causing the rod to be anodic to permit plating material on the rod to be stripped therefrom and re-enter the electrolytic solution.

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JOHN H. MACK, *Primary Examiner.*
JOHN R. SPECK, *Examiner.*