

July 8, 1969

A. BELL

3,453,710

METHOD OF MANUFACTURING PIN FACEPLATE

Filed June 7, 1966

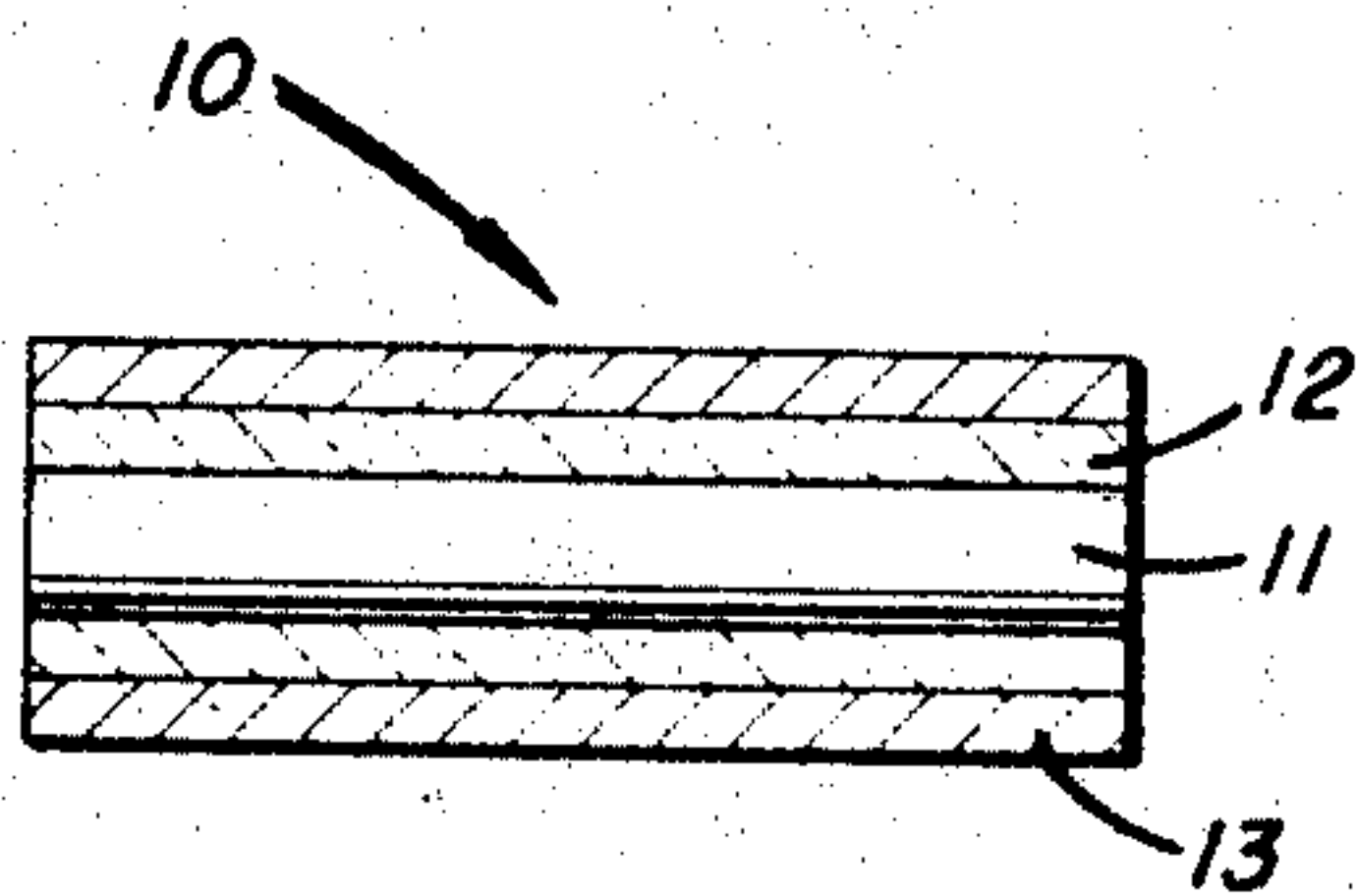


FIG. 1.

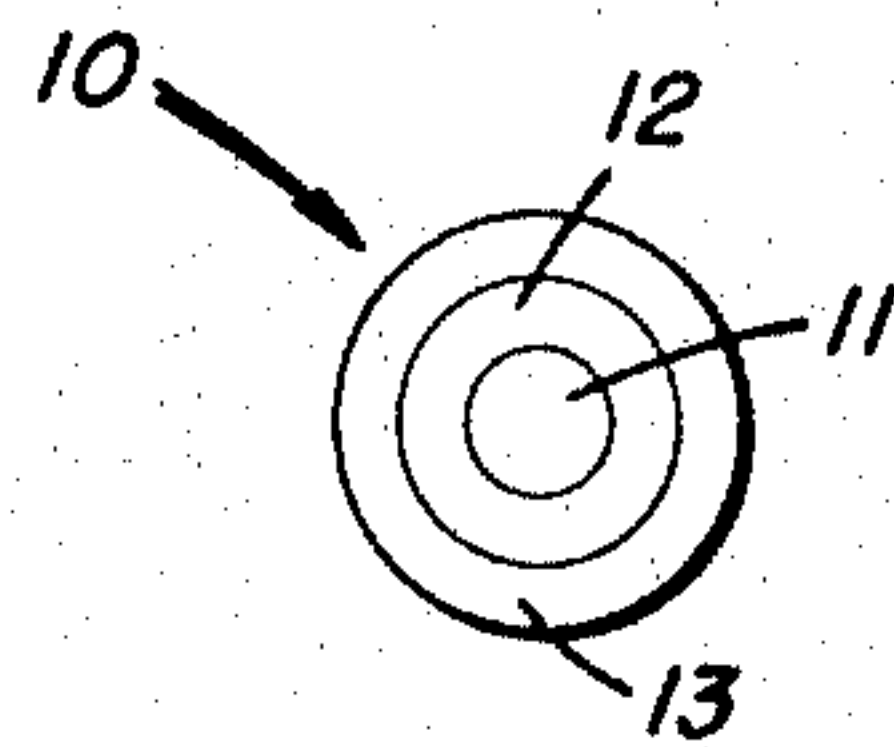


FIG. 2.

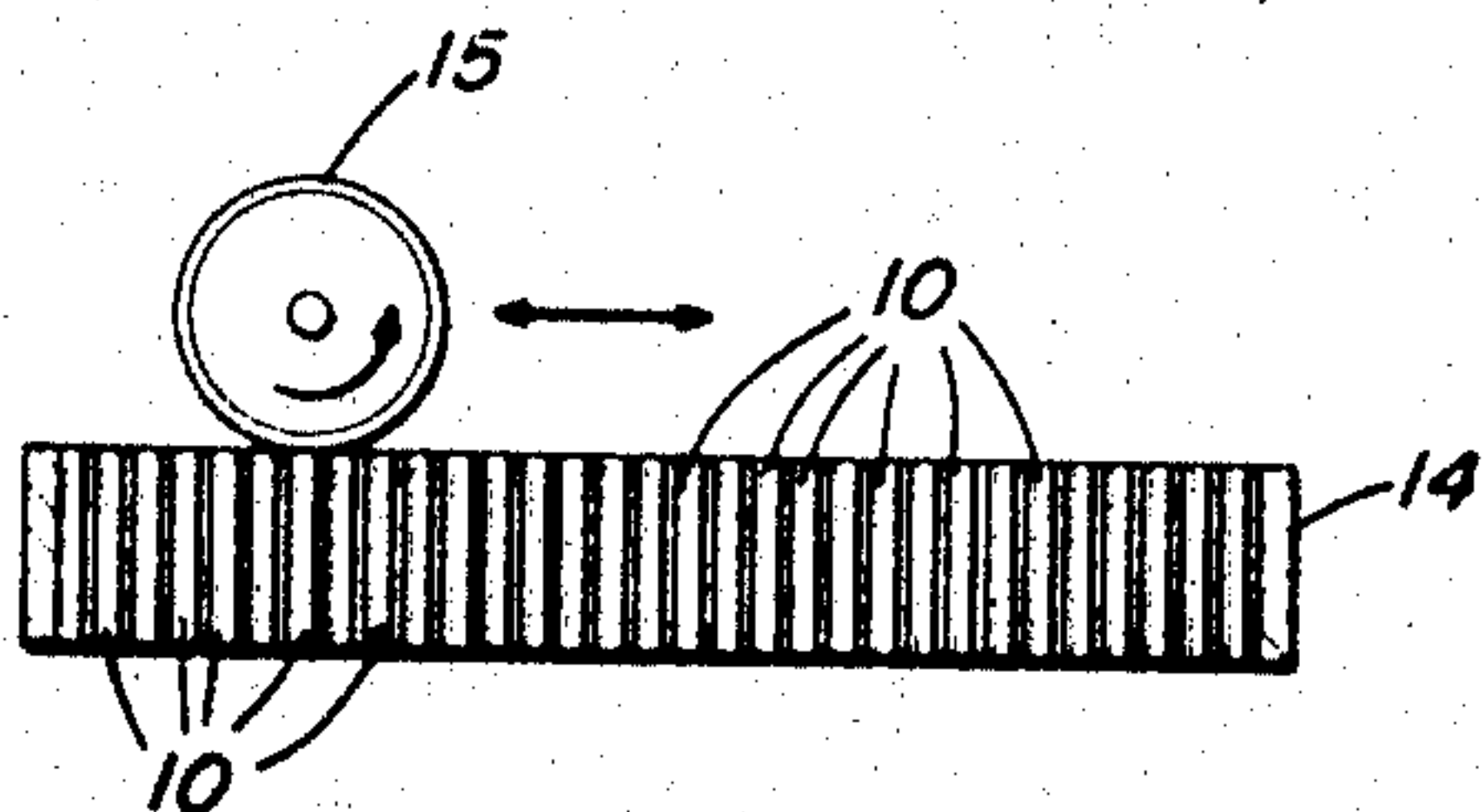


FIG. 3.

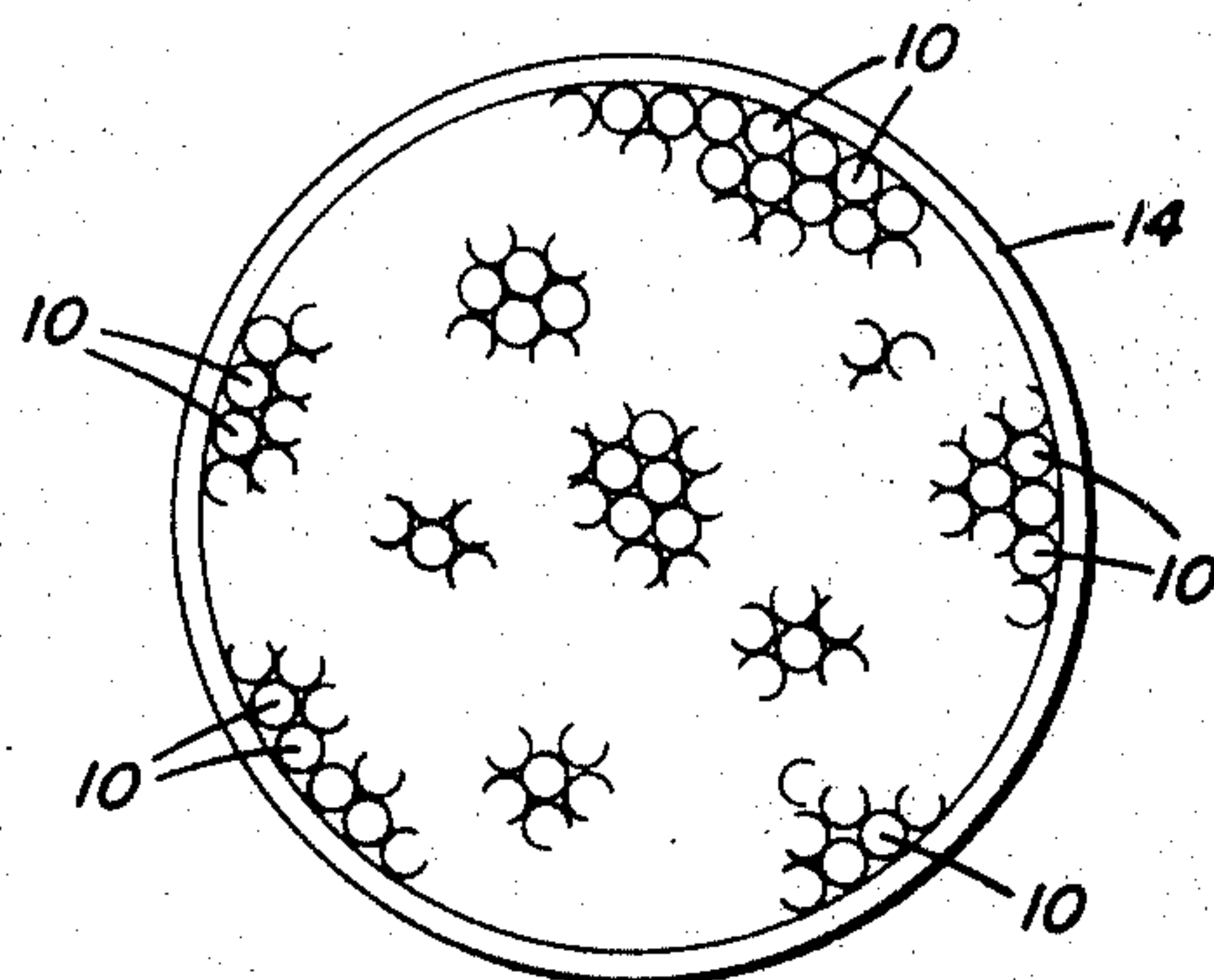


FIG. 4.

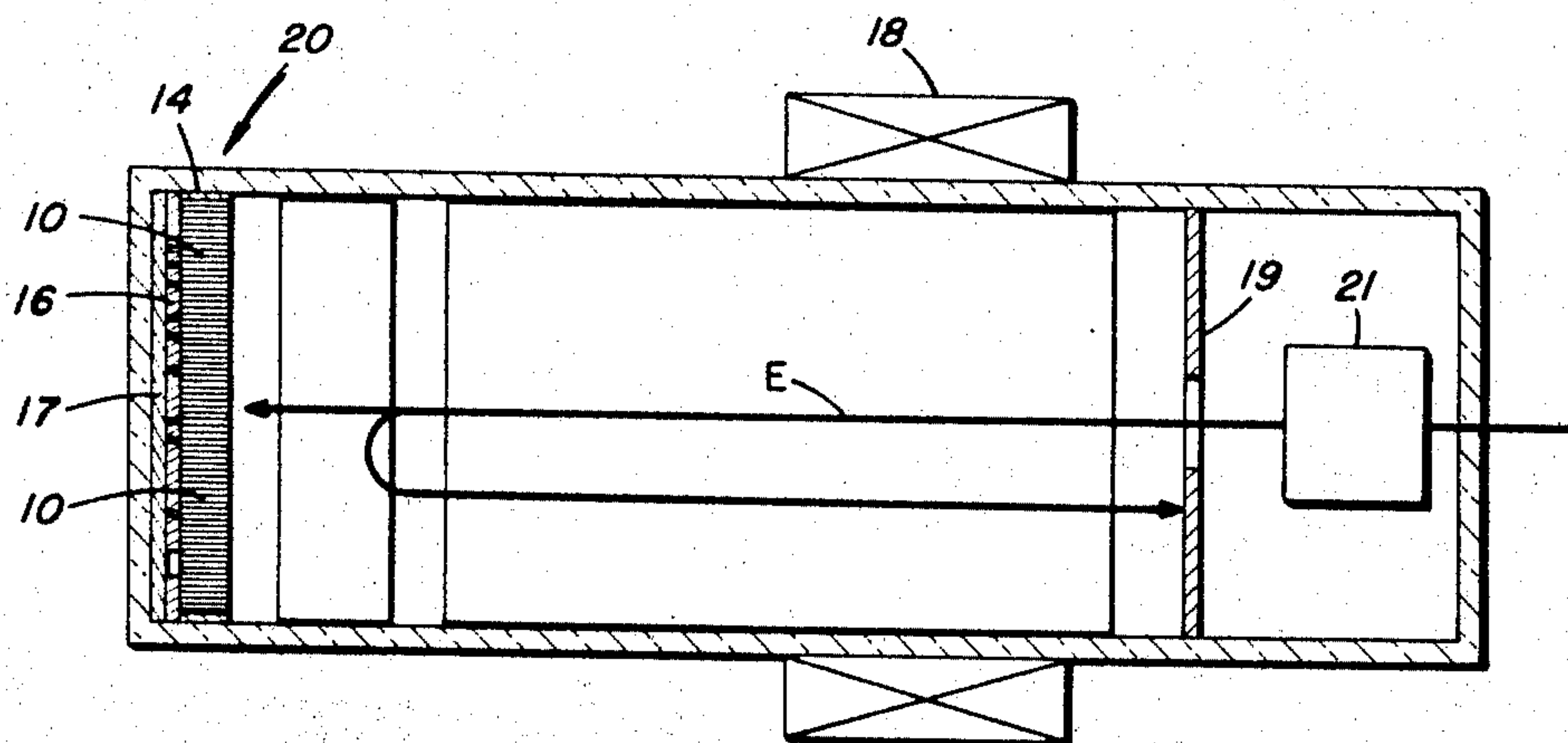


FIG. 5.

ALEXANDER BELL
INVENTOR

BY

Liske & Craig

ATTORNEYS

1

3,453,710

METHOD OF MANUFACTURING PIN FACEPLATE
Alexander Bell, Carlsbad, Calif., assignor to Stromberg-Carlson Corporation, Rochester, N.Y., a corporation of Delaware

Filed June 7, 1966, Ser. No. 555,826

Int. Cl. H01j 9/18; B23p 19/04

U.S. Cl. 29—25.14

10 Claims

ABSTRACT OF THE DISCLOSURE

Method for forming a pin faceplate for target assemblies of electron discharge devices wherein a plurality of pin assemblies, consisting of a central conductive pin positioned in an insulating sleeve which is positioned in a conductive sleeve, are metal plated, with a brazing metal, assembled into a conductive ring to fill the ring, coated with a flux, heated to a first temperature to melt the insulating material, and then heated to a second temperature to braze the assembly together.

The present invention relates in general to electronic devices and more particularly, to a method of manufacture of a target assembly for use in cathode ray tubes.

A target assembly in accordance with the instant invention comprises a pin faceplate consisting of a plurality of closely spaced minute electrically conducting pins disposed in insulating relationship to one another in an electrically conducting plate. Electrodes of this type have been utilized heretofore in many applications in cathode ray tubes, such as in xerographic printing applications wherein a cathode ray beam is directed onto the surface of the faceplate so that a charge image may be applied to the pattern of the conductive pins for application to a paper tape or similar means disposed in contact with one face of the pin faceplate. Other applications for such an electrode relate to electronic devices for generating electrical signals in response to visual patterns, such as, various forms of television pick up tubes.

An additional application for such a target assembly which is disclosed in application Ser. No. 557,701, filed June 15, 1966, in the names of Donald J. Pugh and William C. Knisley, and assigned to the same assignee as the instant application, is a character generator which produces a video signal representative of selective characters or symbols of a plurality of characters or symbols appearing on one face of a pin faceplate in the form of a charge pattern. The projection of an electron beam of low velocity into the vicinity of the pin faceplate carrying the charge pattern provides for modulation of the beam which is then returned to a collector electrode.

In the pin faceplate constructions known to the prior art, difficulty has been encountered in providing a uniform spacing of the conductive pins in the faceplate so as to achieve an overall evenly spaced distribution of these conductive pins providing for high resolution in the charge image projected in one way or another upon the face of the pin faceplate. This difficulty in obtaining uniform spacing of the conductive pins has been especially critical in faceplates wherein the conductive pins are supported within a conductive disc, but spaced from the conductive disc by suitable insulating means. Since the proper spacing and alignment of the conductive pins in such a plate relies not only upon the accuracy obtained in providing the apertures in the conductive plate for mounting of the pin assemblies, but also the accurate spacing of the pins within the apertures by the insulating material interposed therebetween, this particular construction has proven especially difficult to manufacture with accuracy.

It is therefore an object of the instant invention to pro-

2

vide a novel and improved method for manufacture of a pin faceplate for cathode ray devices which is capable of producing a construction wherein the disadvantages and inherent difficulties in prior art arrangements are eliminated.

It is another object of the instant invention to provide a method for manufacture of an electrode of the type described which is capable of providing substantially complete uniform spacing between the conductive pin electrodes of the construction in a relatively simple manner.

It is a further object of the instant invention to provide a method for manufacture of an electrode of the type described which not only provides for high accuracy of construction, but is also simple and economic.

In brief, the method in accordance with the instant invention comprises producing a plurality of pin assemblies consisting of an electrically conductive wire inserted into a hollow insulating tubing, which is in turn inserted into a hollow electrically conductive tubing, dipping each wire assembly into a plating bath, placing the pin assemblies into a metal ring so that each pin assembly is in physical contact with each of the adjacent pin assemblies within the ring, coating one side of the disc assembly with a flux, heating the coated disc assembly to a first temperature sufficient to bond the insulating tubing of each pin assembly to the wire and outer conductive tubing thereof, and then heating the coated disc assembly to a second temperature higher than said first temperature for brazing each of the wire assemblies to one another to form a substantially solid disc.

These and other objects, features and advantages of the present invention will become more apparent from the following detailed description of the invention when taken with the accompanying drawings, wherein:

FIGURE 1 is a sectional view of a pin assembly which forms part of the pin faceplate construction in accordance with the instant invention;

FIGURE 2 is an end view of the pin assembly of FIGURE 1;

FIGURE 3 is a cross-sectional view through the pin faceplate constructed in accordance with the invention;

FIGURE 4 is a top plan view of the pin faceplate of FIGURE 3; and

FIGURE 5 is a schematic sectional view of an electron discharge device with which the pin faceplate construction of the invention may be utilized.

The first step of the method of making a cathode ray tube pin faceplate in accordance with the instant invention is to produce a plurality of pin assemblies, such as illustrated in FIGURE 1 of the drawings. The pin assemblies each include a prescribed length of conductive wire 11 inserted into a hollow insulating sleeve 12 whose inner diameter is substantially equal to the outer diameter of the wire 11. The combination of the wire 11 and sleeve 12 is then inserted into a conducting sleeve 13 whose internal diameter is substantially equal to the outer diameter of the insulating sleeve 12. With the sleeves 12 and 13 cut to the same length as the wire 11, the pin assembly 10 provides a concentric arrangement of the wire 11, insulating sleeve 12, and conductive sleeve 13 forming a cylindrical pin assembly.

As seen in FIGURE 2, the sleeves 11 and 12 are preferably of cylindrical shape; however, it is within the spirit and scope of the instant invention to also provide these sleeves of other shapes which might provide for additional advantages. For example, the conductive sleeve 12 may be provided with an outer hexagonal shape having a central circular bore for accommodating the sleeve 12 therein. A hexagonal shape for the sleeve 13 will provide for a more contiguous association of pin elements in the faceplate as will be apparent from the forthcoming description of the invention.

Each pin assembly 10 such as illustrated in FIGURE 1 is dipped into a copper plating bath until plated with copper to a thickness of approximately .0003 inch. The pin assemblies 10 are then assembled into a metal ring of diameter equal to the diameter desired for the pin faceplate with the wires 11 of each pin assembly arranged parallel to the axis of the ring 14 as seen in FIGURES 3 and 4. The material from which the ring 14 is made is preferably a metal having a coefficient of expansion which is slightly lower than the coefficient of expansion of the conductive material from which the sleeves 13 are made. The pin assemblies 10 are placed within the ring 14 in such a way that the ring is completely filled by the pin assemblies and each pin assembly is in physical contact with each of the pin assemblies adjacent thereto and possibly also with the conductive ring 14.

One side of the disc assembly including the pin assemblies 10 and ring 14 is then coated with cuprous oxide and placed into a controlled atmosphere furnace for brazing. The temperature is raised at a regular rate to a first temperature at which the insulating sleeve 12 melts, thus sealing the wires 11 to the conductive sleeves 13. At this point, the temperature is held for several minutes and then increased at a constant rate until it reaches the temperature necessary to complete copper brazing between the pin assemblies. The temperature is then held at this level for several minutes and then reduced at the constant rate until room temperature is reached. The disc is then allowed to cool.

At this point a substantially solid disc has been produced having small apertures therein where the cylindrical pin assemblies 10 fail to contact one another. If, however, the outer conductive sleeves were provided with a hexagonal shape, these apertures in the faceplate could be eliminated. Obviously, other configurations could also be used within the teachings of the instant invention.

Due to the brazing of the pin assemblies to one another, the disc is rigid providing a plurality of pin elements which are insulated from one another and are equally spaced across the surface of the pin faceplate. After the faceplate is removed from the furnace, both sides thereof are ground and polished by a grinding wheel, such as wheel 15 in FIGURE 3, until a smooth surface is provided on both sides of the disc and each of the wires 11 is exposed at both of these surfaces.

Example

One specific example of the method in accordance with the instant invention for a three inch diameter face plate provides for the use of a stainless steel wire 11 having a diameter of .0015 inch inserted into capillary glass tubing having an inside diameter of 0.002 inch and an outside diameter of 0.0035 inch. The assembly of the stainless steel wire 11 and glass tubing 12 is inserted into a stainless steel tubing 13 having an inside diameter of .004 inch and an outside diameter of .006 inch. The material is chemically cleaned and cut into 12 inch long pieces prior to assembly and the completed assembly is dipped into a copper plating bath until a copper thickness of approximately .0003 inch is provided on the stainless steel tubing 13.

For a three inch diameter pin faceplate, the pin assembly 10 is cut into .600 inch lengths and assembled into a nickel alloy ring having a three inch inside diameter. One side of this disc assembly is then coated with cuprous oxide and placed into a controlled atmosphere furnace for brazing. The temperature is raised at 5° C. per minute until a temperature of 1020° C. is reached wherein the wires 11 are sealed to the stainless steel tubing 13. At this point, the temperature is held for approximately 10 minutes and is then raised in 5° C. increments per minute to a temperature of 1085° C. to complete the copper brazing. The temperature is then lowered at increments of 5° C. per minute until room temperature is reached.

As indicated above, a pin faceplate produced in accordance with the method of the instant invention may find utility in many varied applications relating to cathode ray tube constructions; however, this construction finds particularly advantageous use in the character generator construction disclosed in the aforementioned application Ser. No. 557,701. Such a device is illustrated generally in FIGURE 5. An electron beam E of low velocity is projected toward a target which includes the pin face 20 produced in accordance with the instant invention. A charge pattern is produced across the surface of the pin face 20 in the form of characters or symbols, which charge pattern is produced by the interposition of a conductive matrix 16 between one face of the pin face and a conductive plate 17 connected to a positive potential source. The low velocity electron beam E is modulated by the charge pattern as it approaches the immediate vicinity of the pin face target in accordance with the character symbol which it scans, a deflection system 18 being provided to select under control of an exterior selection signal one of the available characters or symbols provided on the charge pattern. The low velocity beam reaches substantially zero velocity in the vicinity of the target, where it is modulated by the charge pattern thereon and returned by the field provided in the device back in the direction of the cathode 21 to be collected on the collector electrode A. The signal derived from the collector electrode 19 is thus in the form of a video signal modulated in accordance with the symbol or character that is scanned.

While I have shown and described several embodiments in accordance with the present invention, it is understood that the same is not limited thereto but is susceptible of numerous changes and modifications as known to a person skilled in the art, and I therefore do not wish to be limited to the details shown and described therein but intend to cover all such changes and modifications as are encompassed by the scope of the appended claims.

I claim:

1. Method of producing a pin faceplate for target assemblies of electron discharge devices comprising the steps of:

assembling a plurality of concentric pin arrangements each consisting of an electrically conductive pin snugly mounted within a dielectric sleeve which is, in turn, snugly mounted within an electrically conductive sleeve,

dipping each pin arrangement into a copper plating bath until a predetermined thickness of copper is obtained thereon;

inserting said plated pin arrangements into a conductive ring so as to fill said ring to the extent that each pin arrangement is immovably held by the other pin arrangements and said ring;

coating one side of said pin arrangement and ring combination with cuprous oxide;

heating said pin arrangement and ring combination to a first temperature sufficient to melt the dielectric sleeve of each pin arrangement; and

heating said pin arrangement and ring combination to a second temperature sufficient to braze each pin arrangement to the elements with which it is in contact.

2. A method of producing a pin faceplate as defined in claim 1 wherein said pin arrangements are assembled by: first cutting said pins, said dielectric sleeves and said electrically conductive sleeves to a predetermined length suitable for handling,

next inserting said pins into said dielectric sleeves and then inserting said dielectric sleeves into said conductive sleeves, and

after plating each pin arrangement with copper, cutting each pin arrangement into lengths equal to the depth of said ring.

3. Method of producing a pin face plate as defined in

5

claim 1 wherein said heating of said pin arrangement to said first temperature and to said second temperature is effected at a rate of 5° C. per minute.

4. Method of producing a pin faceplate as defined in claim 3 wherein upon reaching said first temperature, the temperature is maintained constant for several minutes before increasing to said second temperature.

5. Method of producing a pin faceplate as defined in claim 1 wherein said pins and said conductive sleeves are made of stainless steel and said dielectric sleeves are made of glass.

6. Method of producing a pin faceplate as defined in claim 5 wherein said conductive ring is made of a nickel alloy having a coefficient of expansion lower than the coefficient of expansion of stainless steel.

7. Method of producing a pin faceplate as defined in claim 1 wherein said first temperature is within the range of 1000° C. and 1040° C.

8. Method of producing a pin faceplate as defined in claim 1 wherein said second temperature is in excess of 1045° C.

9. Method of producing a pin faceplate as defined in

6

claim 1 and further including the step of grinding and polishing said combination after cooling thereof from said second temperature.

10. Method of producing a pin faceplate as defined in claim 3 wherein subsequent to heating to said second temperature, said combination is cooled at a rate of 5° C. per minute.

References Cited

UNITED STATES PATENTS

10	2,091,863	8/1937	Kessler	29—25.17
	2,189,340	2/1940	Donal	29—25.14
	2,197,753	4/1940	Liebmann	29—25.14
	3,140,528	7/1964	Hilderbrand et al.	29—25.14
15	3,321,657	5/1967	Granitsas et al.	313—89
	3,305,743	2/1967	Drake	313—89

JOHN F. CAMPBELL, *Primary Examiner.*

R. B. LAZARUS, *Assistant Examiner.*

U.S. Cl. X.R.

29—25.11, 458, 460