Dec. 27, 1960 W. E. ALLAN 2,965,965

METHOD OF MANUFACTURING CONTACT PINS FOR SUB-MINIATURE ELECTRONIC TUBES

Filed April 17, 1956

FIG. 1

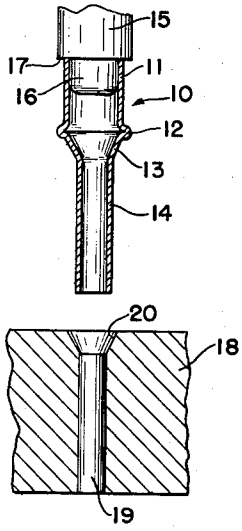


FIG. 2

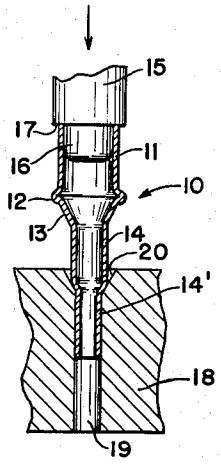


FIG. 3

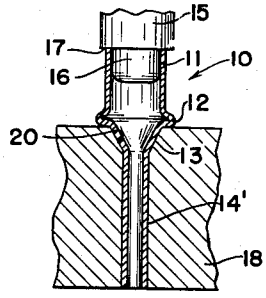
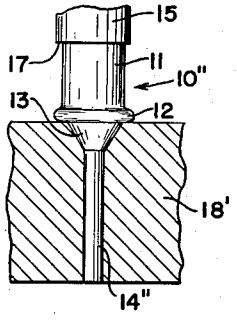


FIG. 4



INVENTOR
WALTER E. ALLAN

BY

Pennie, Edmonds, Morton, Barrows & Taylor

ATTORNEYS

United States Patent Office 2,965,965 Patented Dec. 27, 1960

2,965,965

METHOD OF MANUFACTURING CONTACT PINS FOR SUB-MINIATURE ELECTRONIC TUBES

Walter E. Allan, Woodbury, Conn., assignor to The Anaconda American Brass Company, Waterbury, Conn., a corporation of Connecticut

Filed Apr. 17, 1956, Ser. No. 578,766

3 Claims. (Cl. 29—553)

The present invention relates generally to the art of metal working, and more particularly to a novel and improved method of manufacturing small contact pins of the type incorporated in sub-miniature electronic tubes or similar articles.

Conventional electronic tubes are usually provided with a plurality of contact pins which project from the base of the tube and enable the tube to be quickly connected into or taken out of a circuit by plugging the contact pins into or removing them from a suitable female socket fitting. It is conventional practice to manufacture contact pins of this type in hollow or tubular form, so that the conductors of the tube may be inserted in the interior of the pins and secured therein in good electrical contact by soldering.

Contact pins of the type concerned herein conventionally include an upper or collar portion having a bead or shoulder at the lower end, and joining with a necked-down portion which merges with an elongated cylindrical contact portion of reduced diameter. A common method of manufacturing pins of this type involves the use of an automatic punch press or eyelet machine, in which circular discs are blanked from a flat strip of copper or like material. In a plurality of separate operations in the same machine, the blanked disc is formed in the shape of a cup or cylinder, flanged to provide a bead about the lower edge of the collar, and then drawn with suitable dies and mandrels to reduce the diameter of the lower or contact portion of the pin. While these conventional methods are generally satisfactory for the manufacture of pins of ordinary size, many difficulties have arisen in connection with the use of these same methods in the manufacture of pins for sub-miniature tubes. Thus, in order to draw the contact portion of a small pin to a diameter of 0.050 inch, with a side wall thickness of 0.006 inch, it is necessary to employ a mandrel of only 0.038 inch in diameter. However, the use of mandrels of such small size is both uneconomical and dangerous since frequent breakage of the mandrels may be expected, and in such cases injury to the machine operator has been known to occur; and in any event the entire automatic machine must be shut down while the mandrel is replaced.

In accordance with the present invention, after the contact pin has been partly formed, the elongated cylindrical contact portion thereof is reduced to the desired small size by a sinking operation, using no mandrel and pushing the pin into the die from the collar end thereof. With the improved method, it has been found that substantially greater reductions in the pin diameter are made possible, and the likelihood of machine stoppage or injury to the machine operator is wholly obviated.

For a better understanding of the invention, reference may be made to the following detailed description and accompanying drawing in which:

Fig. 1 is an enlarged fragmentary cross-sectional view of a reducing die, with a contact pin for a sub-miniature electronic tube in position to be inserted therein;

Fig. 2 is an enlarged fragmentary cross-sectional view

of the pin and die of Fig. 1, with the pin partly inserted in the die;

Fig. 3 is an enlarged fragmentary cross-sectional view of the pin and die of Fig. 1, with the pin fully inserted in the die; and

Fig. 4 is an enlarged elevational view of a finished contact pin inserted in a second reducing die.

Referring now to Fig. 1 of the drawing, the numeral **10** designates generally a partly finished contact pin intended for incorporation in a sub-miniature electronic tube. The initial steps in the manufacture of the pin **10** form no part of the present invention, and accordingly are not described in detail herein. However, in general, the pins are usually formed in a continuous process in an automatic punch press or eyelet machine, not shown. A thin strip of copper is fed into the machine, where, by means of a suitable punch and die, a small circular disc is blanked from the strip. In the next operation, the flat disc is formed into a shallow cup, and in further operations, the blank is cupped deeper, flanged, and reduced in diameter. After these initial operations, the partly formed pin will have an upper or collar portion **11** of relatively large diameter as compared to other parts of the pin. At the lower end of the collar **11** is a bead **12** of slightly greater diameter, forming a shoulder. The collar **11** is adapted to receive a conductor wire of an electronic tube, which is secured therein and electrically connected thereto by means of solder, and in the completed tube the collar **11** is inserted in and secured to the base of the tube in sealed relation.

Integral with the bead or shoulder **12** of the pin, and extending downwardly and inwardly therefrom, is a neck **13** which merges with an elongated cylindrical portion **14**. The cylindrical portion **14** eventually forms the prong or contact portion of the pin, and may be open at the bottom, as shown, or closed, as may be desired.

When the contact pin reaches the stage of manufacture, and is in the form illustrated in Fig. 1, the cylindrical contact portion **14** is of considerably greater diameter than the final desired diameter, which may be in the order of 0.034 inch. Thus, the cylindrical portion **14** may have a diameter somewhat in excess of 0.050 inch, requiring a reduction in the order of 0.020 inch to obtain the desired final diameter.

In accordance with the invention, the partially formed contact pin **10**, as shown in Fig. 1, is engaged by a shouldered punch **15**. The punch **15** has a portion **16** of reduced diameter adapted to be received within the collar portion **11** of the pin, and has a shoulder **17** against which the upper end of the collar **11** abuts. In the automatic machine, the shouldered punch **15** is positioned opposite, or moved to a position opposite a die **18** having a die opening **19** therein of a diameter less than that of the partly finished contact portion **14** by from 17 to 20 percent. At the top of the die **18**, the opening **19** is flared outwardly, as at **20**, at an angle substantially equal to that at which the walls of the neck portion **13** lie.

When the punch **15** and partially formed pin **10** are properly aligned with the die opening **19**, the punch **15** is forcibly moved toward the die, and the leading end of the cylindrical portion **14** of the pin is caused to enter the die opening **19**, after first being compressed in the flared portion **20** thereof. The partially reduced pin is illustrated in Fig. 2.

Upon continued application of force to the shouldered punch **15**, the cylindrical portion **14** of the pin is fully inserted into the die opening **19**, at which time the neck **13** of the pin lies in the flared portion **20** of the opening and the bead or shoulder **12** lies against the top surface of the die. The cylindrical portion **14'** of the pin is thus reduced approximately 17 to 20 percent; and since the operation is effected without the use of an internal man-

drel, the side walls of the cylindrical portion **14'** are substantially the same thickness as the side walls of the cylindrical portion **14** prior to the reducing operation. This is very desirable since unnecessary weakening of the cylindrical portion **14'** is thereby avoided.

After the pin is fully inserted in the die **18**, as shown in Fig. 3, it is withdrawn from the die and may be transferred to a new working station, in which a further reduction is effected by inserting the pin in a second die **18'**. Again, the reduction in diameter of the cylindrical portion **14'** may advantageously be in the range from 17 to 20 percent.

In two reduction steps, the diameter of the cylindrical or contact portion of the pin is reduced to a final diameter in the order of 0.034 inch. Of course, the length of the contact portion **14''** of the completed pin **10''** is somewhat greater than the length of the cylindrical portion **14** of the partly formed pin **10**. This may be readily accommodated, however, by proper design of the various dies employed in the complete manufacturing process.

The new method is advantageous in that it permits a substantially greater reduction in the size of contact pins used in sub-miniature electronic tubes, for example. Using heretofore-known methods, the prongs or contact portions of such pins could be reduced only to about 0.050 inch, and even then there was substantial danger of injury to the machine operator, and considerable time lost in the maintenance of drawing mandrels. In the new method, the partially completed pin is held at its enlarged end and pushed through a die opening, effecting a reduction of as much as 17 to 20 percent. Generally, two reducing operations are sufficient to reduce the prong of the contact pin to a diameter of 0.034 inch, or approximately 32 percent smaller than has been considered practical or possible heretofore.

It should be understood that while specific reference has been made herein to the use of the pins made by the new method in connection with sub-miniature electronic tubes, the invention is not limited to such use, as the pins may be incorporated in other components, such as capacitors, pointed circuit components, etc., where desirable and practical.

I claim:

1. In the method of manufacturing an integral substantially cylindrical tubular contact pin for a subminiature electronic tube or other electrical component which includes the steps of forming a collar portion at one end of the pin and a partially reduced contact portion at the opposite end with a tapered neck portion therebetween, wherein said partially reduced contact portion has a diameter not less than 0.050 inch, the improvement which comprises further reducing the diameter of the tubular contact portion of said pin at substantially atmospheric temperatures by an amount not substantially exceeding 17 to 20 percent by engaging said pin at the collar thereof and pushing said contact portion while free from any internal mandrel into a die opening of reduced diameter, and then further reducing the diameter of the reduced tubular contact portion by a further amount not substantially exceeding 17 to 20 percent to a diameter substantially less than 0.050 inch by pushing against the collar of said pin to insert said contact portion while free from any internal mandrel into a second die of further reduced diameter.

2. In the method of manufacturing an integral substantially cylindrical tubular contact pin for a subminiature electronic tube or other electrical component which includes the steps of forming a collar portion at one end of the pin and a partially reduced contact portion at the opposite end with a tapered neck portion therebetween, wherein said partially reduced contact portion has a diameter not less than 0.050 inch, the improvement which comprises further reducing the diameter of said contact portion at substantially atmospheric temperatures by an amount not substantially greater than 17 to 20 percent to a diameter substantially less than 0.050 inch by pushing against the collar of said pin to insert the tubular contact portion thereof into a die opening of reduced diameter while the interior of said contact portion is devoid of any mandrel support.

3. In the method of manufacturing an integral substantially cylindrical tubular contact pin for a subminiature electronic tube or other electrical component which includes the steps of forming a collar portion at one end of the pin and a partially reduced contact portion at the opposite end with a tapered neck portion therebetween, wherein said partially reduced contact portion has a diameter not less than 0.050 inch, the improvement which comprises further reducing the diameter of said contact portion at substantially atmospheric temperatures by an amount not substantially greater than 17 to 20 percent to a diameter substantially less than 0.050 inch by pushing against the said collar portion of said pin to insert the cylindrical tubular contact portion thereof into a die of reduced diameter while at least the lower part of said contact portion is free of internal support.

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