June 4, 1935. R. C. SHIPP 2,003,475

WIRE DRAWING DIE

Filed July 21, 1932

Fig. 1.

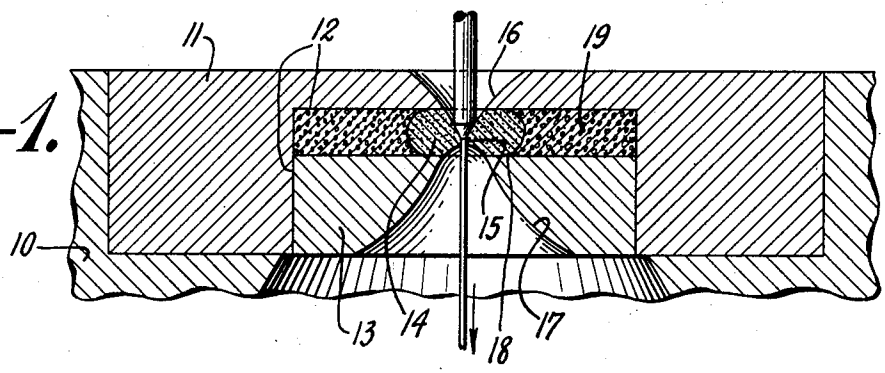


Fig. 2.

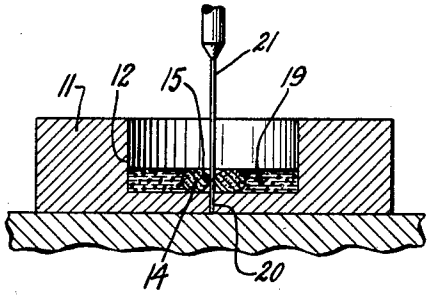


Fig. 4.

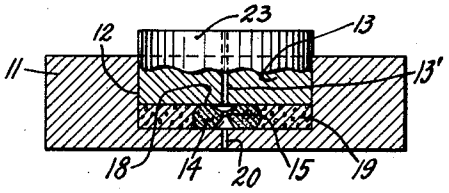


Fig. 5.

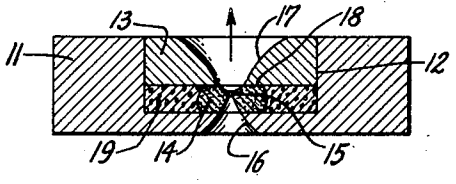
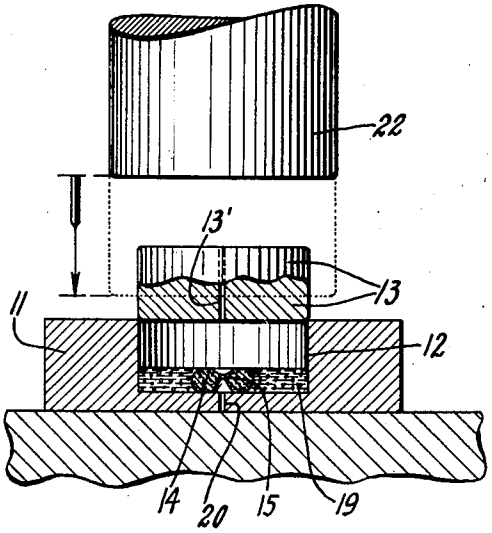


Fig. 3.



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WIRE-DRAWING DIE

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7 Claims. (Cl. 205—29)

This invention relates to improvements in the mountings of wire-drawing dies and relates particularly to dies for drawing tungsten filament wire for incandescent electric lamps.

Dies of the character referred to herein as wire-drawing dies, consist of a body of hardened material or a naturally hard body such as a diamond having a hole formed therein with tapered approaching surfaces and a wire to be reduced in diameter is forced through the opening and drawn to the size thereof.

Inasmuch as wire-drawing dies are employed under conditions where long service is required and are subjected to relatively rough usage, under variations in temperature conditions, they must be held in a firm and permanent manner.

Heretofore, in mounting a diamond die, the diamond was held in a mount by surrounding the diamond with melted metal, such as copper or brass, or by spinning a flange of metal about the diamond. The use of a moldable material presented certain disadvantages in that during use, when the mount was subjected to heat, the diamond became loosened. This was also true when a die was held by spun metal. Consequently, the product, such as the wire being drawn, was damaged or the diameter of the wire varied owing to the play between the mount and the diamond die.

The detrimental results attending the wire-drawing operation were caused by the expansion or contraction of the moldable material which constituted an enclosing body. When subjected to heat, as is necessary in connection with tungsten and molybdenum wire-drawing, the surrounding material in which the diamond was embedded would expand, resulting in a certain amount of compression which would be transferred along the surface of the die so that when the die was cooled and the material holding the die contracted, the tendency would be to loosen the die and permit a small amount of play.

It has been found that when securing diamond dies by an enclosure of melted material, the direction of movement of the material under high temperature conditions is radial and a tendency is for the material to break away from the diamond.

It is an object of the present invention to provide a diamond die held in position by a material capable of expansion in all directions to maintain intimate contact with the die.

Another object of the invention is to secure a wire-drawing die in a compact mass of material free from expansion or contraction detrimental to the effective operation of the die.

Another object of the invention is to provide a medium for securing a wire-drawing die in a mount so that the intimate contact between the die and its supporting material is maintained under variations in temperature conditions.

Other objects and advantages will be evident from the following description together with the accompanying drawing in which:

Figure 1 is a cross-sectional view of a die mount having a wire-drawing die secured therein in accordance with the present invention;

Figure 2 is a cross-sectional view showing a wire-drawing die positioned to be secured in a mount;

Figure 3 is a view partly in cross section showing a die positioned in a mount ready to have an insert or plug applied to complete the mount;

Figure 4 is a view similar to Figure 3 but showing the plug in position ready to be ground off; and

Figure 5 is a cross-sectional view of a wire-drawing die secured in a mount in accordance with the present invention.

In accordance with the present invention, a cementitious material such as sodium silicate is employed as the medium for securing the wire-drawing die in position in a cavity of a mount. The material may be mixed with a suitable filler, such as kaolin, and then baked.

Figure 1 shows a die holder 10 in which a mount 11 is positioned. The mount is provided with a cavity 12 and is in the form of a cup which receives an insert 13. A wire-drawing die 14 is positioned so that its wire-drawing aperture 15 is in line with an aperture 16 in the mount and an aperture 17 in the insert. The aperture in the insert may be shaped after the insert is in position in the cup.

The insert is so proportioned as to occupy the portion of the cavity between one side 18 of the die and the mount of the cavity. Around the die is provided a filling of cementitious material 19 which may consist of kaolin and sodium silicate in the proportions as follows:

Kaolin and sodium silicate in the proportions of 4 to 3 respectively by weight. Kaolin constitutes the filler and may be any good grade of china clay and the sodium silicate used may be what is known in the trade as grade E, specific gravity at 20° C. of not more than 1.40 nor less than 1.36 and containing not more than 9.1% or not less than 8.9% Na_2O. This commercial grade of sodium silicate is readily obtainable in the open market. The filler and sodium silicate is mixed to provide a composition in the form of a paste. The mount is then ready for use.

When completing a mount as shown in Figure 1, the die, as shown in Figure 2, is so positioned as to lie on the bottom surface of the cavity 12 with the wire-drawing aperture 15 of the die in alignment with a passage 20 in the mount. The passage through the mount and the diamond may be aligned by means of a centering instrument 21 or by placing the die so that a beam of light com-

ing up through the hole in the mounting or blank passes through the hole in the diamond.

Next, the diamond supporting material 19, which is in a plastic condition, is disposed around the die after which the insert 13, which is provided with a hole 13' for the escape of air, is applied and forced into position by a force member 22. The insert or plug is positioned so that it makes contact with the die.

When the insert is forced into the position, as shown in Figure 4, the portion 23 thereof may be ground off after which the die is polished and finished by shaping to form the tapered passages 16 and 17 which lead to the wire-drawing aperture of the die. The hole is then cleaned of any excess material and the mount is heated to about 400° C. This baking converts the paste to a hardened mass which expands slightly and fills up any voids that may be present.

In the manufacture of fine wire such as is used for the filaments for electric incandescent lamps, for example, it is necessary to draw wire such as tungsten to very fine diameters, as for example, from 1 to 10 mils. It has been found that a die held by a mass of cementitious material, as above set forth, meets operating requirements for such sizes satisfactorily. When larger diameters are desired it has been found an advantage to strengthen the holding material by adding metallic powder such as copper, brass or the like with a small amount of zinc. The metallic powder may be substituted for the filler and a tenacious and durable setting for the die is obtained. When using a metallic powder in combination with sodium silicate as a binding agent, sodium silicate is added to the metallic powder until it has the consistency of a thick paste so as to be conveniently handled.

The paste is easily applied by pressing about the positioned diamond in the bottom of the cup of the mount after which the insert or plug is forced into position and the baking operation is performed.

It has been found in practice that the use of sodium silicate as a holding medium for dies avoids previous disadvantages and that the die does not change its position when subjected to the temperatures attending the drawing operation and a tight bond is maintained between the die and the holding medium.

The use of a powdered metal has the advantage of allowing free expansion and contraction of the particles when subjected to temperature variations and, by reason of the strength of this holding medium, wire of from 1 to 20 mils or above may be drawn.

The present construction of die mount differs from that heretofore employed in that the mount as described includes, in addition to the cup for holding the wire-drawing die, the insert or plug which, as explained, is forced into the cup and occupies the portion thereof not occupied by the die and the cementitious or holding medium. The insert is proportioned to have a tight fit with the interior cylindrical wall of the cup and, therefore, serves as a protective wall for the material which holds the die. By reason of the insert or closure for the cup, the die and the layer of material in which it is embedded is effectively removed from the direct heat during the wire-drawing operation.

Furthermore, by reason of the insert, a relatively long tapered passageway may be provided leading to the aperture in the wire-drawing die. A mount, therefore, constructed in accordance with the present invention, is provided with a material which not only serves to rigidly and securely support the die, but the mount itself, by reason of the insert, provides means for protecting the die as well as the holding medium.

It has further been found that when using dies surrounded by melted metal the lack of intimate contact between the die and the metal limits the use of the die to the drawing of wire through a relatively small range of diameters and if such a die were used to draw wire at relatively large diameters, the drawing operation would exert a pressure greater than the die would ordinarily stand causing it to crack, particularly when using a diamond die. For example, if a diamond were selected to draw wire of one to two mils such a diamond ordinarily would not stand drawing wire of ten mils.

By reason of the present invention, wherein the die is supported by the metallic particles, a sufficient opposing force is present to permit a diamond die to draw wire, as above mentioned, of from one to 20 mils. This is of considerable advantage from a manufacturing and cost standpoint since it means that, whereas heretofore a 1/6 or 1/4 karat diamond was used to draw one mil wire, it was necessary to use a one-half karat diamond to draw ten to 20 mil wire. In the present case, and by reason of the supporting medium for the diamond, the diamond will take care of large sizes.

Although a preferred embodiment of the invention is shown and described herein, it is to be understood that modifications may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. A mount for a wire-drawing die comprising a cup, a wire-drawing die disposed on the bottom of the cup and embedded in a mass of sodium silicate.

2. A mount for a wire-drawing die comprising a cup, a layer of a mixture of baked sodium silicate and a filler in the bottom of said cup and a die embedded in said layer.

3. A mount for a wire-drawing die comprising a cup, a layer of a mixture of baked sodium silicate, a filler in the bottom of said cup and a metallic closure for said cup.

4. A mount for a wire-drawing die comprising a cup, a layer of dehydrated sodium silicate and a metallic powder in the bottom of said cup and a die embedded in said layer.

5. A mount for a wire-drawing die comprising a cup, a layer of dehydrated sodium silicate and a metallic powder in the bottom of said cup, a die embedded in said layer and a metallic closure for said cup.

6. A mount for a wire-drawing die comprising a cup, a wire-drawing die disposed on the bottom of the cup and imbedded in a mass of sodium silicate and a metallic closure for said cup.

7. A mount for a wire-drawing die comprising a cup, a die disposed at the bottom of said cup, and imbedded in an adhesive composition comprised of separate metallic particles free to expand and contract in all directions for holding said die in position in said cup.

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