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DRAWING DIE

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Fig. 1.

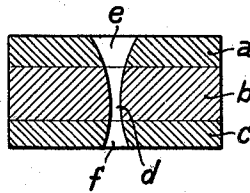
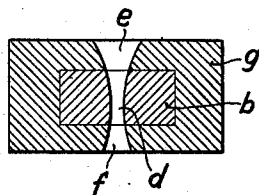


Fig. 2.



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UNITED STATES PATENT OFFICE

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DRAWING DIE

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4 Claims. (Cl. 205—29)

The invention relates to drawing dies, more particularly drawing dies made from hard alloys.

In order to obtain the highest possible drawing capacity, drawing dies of this class must be made from the hardest alloy available. The harder the alloy used for the manufacture of drawing dies is, however, the greater, in general, is its brittleness and thus the danger of the die bursting when the drawing bore is drilled or finished, or during the drawing work itself.

This danger is avoided to a great extent by composing the die, according to the invention, of a core body including the central portion of the drawing hole and made from a sintered or molten very hard alloy, and of one or several external layers or envelopes which include the external portions of the drawing hole and are made from an alloy of the same type, which, however, is less hard but tougher. With a die composed in the described manner a very satisfactory drawing capacity is secured by the core body which is made from the very hard alloy, whilst the tendency of the die to burst, which mainly occurs in boring the drawing hole, is prevented by the far less hard but tougher external layers. The external layers or envelopes, which consist of the tougher hard metal alloy, act as cushions, so to speak, which take up the stresses occurring in the core body in drilling the drawing hole and in the drawing operation.

Now it is known with drawing dies to enrich with carbon the external layers and thus to change them relatively to the core body. By this treatment, however, the external layers are made harder compared with the core, whereby, however, as experience has shown, bursting of the die, in particular in drilling the drawing hole, cannot be prevented. It is further known, to embed drawing dies in a mounting of less hard material. Mountings of this type, however, as a rule consist of steel or brass, at any rate not of a sintered or molten hard metal alloy of the same kind as the hard metal alloy used for the manufacture of the drawing die. Furthermore, no drawing hole is provided in such mountings, since they are applied to the die proper only after the latter has been manufactured.

In order that the invention may be clearly understood and readily carried into effect, two embodiments of drawing dies constructed according to the invention are illustrated in the accompanying drawing in section by way of example.

The drawing die represented in Figure 1 is composed of three layers *a*, *b*, *c* superimposed

in the drawing direction. The central layer or core body *b* has such a thickness, that it includes the central portion *d* of the drawing hole, which portion constitutes the drawing hole proper. The external layers *a* and *c* of smaller thickness contain the external portions of the drawing hole, that is, the inlet and outlet taper holes *e*, *f*. The core body *b* consists of the hardest metal alloy available, for example an alloy composed of 93% tungsten, 4% carbon and 3% cobalt. The external layers *a*, *c*, however, are made from an alloy of the same type, but of greater toughness, for example an alloy containing 88% tungsten, 6% carbon and 6% cobalt.

The drawing die illustrated in Figure 2 comprises likewise a core body *b* including the central portion *d* of the drawing hole and made from a very hard alloy. In this embodiment, however, the core is surrounded on all sides by an envelope *g* of an alloy of the same type, but of greater toughness. In the portions of the envelope *g* that are adjacent to the frontal surfaces of the core body *b* are provided the inlet and outlet tapered hole portions *e*, *f*.

The drawing die illustrated in Figure 1 is manufactured preferably by means of a graphite mold of, say, 13 mm. in diameter which is open on one side. An adequate quantity of the tougher alloy, about 3 g., is slightly pressed by hand onto the bottom of the mold. Thereupon an adequate quantity of the hard and brittle alloy, viz. about 10 g., and thereupon again an adequate quantity of the tougher alloy, say about 4 g., is poured and slightly pressed by hand, onto the bottom layer. The total content of the mold is then sintered, which advantageously is done with simultaneous application of pressure. After the sintering operation the drawing hole *e*, *d*, *f* is applied in the usual manner by drilling and polishing to the work piece which forms now a "sandwich" die; or the drawing hole, which has been formed already in pressing the layers into the mold is dressed and polished. Again, the drawing hole may be applied by first preliminarily sintering the pressed sandwich body, thereupon cutting the drawing hole proper and the inlet and outlet openings thereinto, and, finally, finish sintering the body. Furthermore, the central layer *b* which forms the core, may be manufactured separately previously by pressing, sintering or casting. In finish sintering all layers this core body then likewise, intimately unites with the external layers.

In manufacturing the drawing die illustrated in Figure 2, first the core body *b* is prepared

separately by pressing, sintering or casting and thereupon embedded in a powder of the tougher alloy enclosed in a graphite mold open on one side. The further manufacture of the die takes place in the same manner as described with reference to the die shown in Figure 1, viz. by pressing, sintering and cutting of the drawing hole.

The die shown in Figure 1 may, further, consist of more than three layers, that is, two or more external layers may be provided on both sides of the central layer *b* which includes the central portion of the drawing hole. These external layers advantageously increase in brittleness stepwise toward the core, in other words, their toughness increases stepwise from the core. In a similar manner the core body *b* of the die shown in Figure 2 may be embedded in two or more envelopes of the tougher alloy, the envelopes advantageously likewise increasing in toughness stepwise outwards.

Instead of carbides, also borides, nitrides, silicides or other hard materials, with or without addition of more easily fusible metals or metal alloys, may be used for the manufacture of the core body or of the external layers or envelopes or also simultaneously of the core and the external layers or envelopes.

What we claim and desire to secure by Letters Patent is:

1. A drawing die composed of a central portion consisting of a very hard metal alloy and at least one external layer situated on each front side of said central portion and consisting of an alloy of the same type as that of said central portion but of less hardness and greater toughness, said cen-

tral portion including the central part of the drawing hole, while said external layers include the inlet and outlet parts thereof.

2. A drawing die comprising a central portion consisting of a very hard metal alloy and of an envelope enclosing said central portion at least on two opposite sides and consisting of an alloy of the same type as that of said central portion, but of less hardness and greater toughness, said central portion including the central part of the drawing hole, while said envelope includes the inlet and outlet parts thereof.

3. A drawing die composed of a central portion consisting of an alloy composed of about 93% tungsten, 4% carbon and 3% cobalt, and an external layer situated on each front side of said central portion and consisting of an alloy composed of about 88% tungsten, 6% carbon and 6% cobalt, said central portion including the central part of the drawing hole, while said external layers include the inlet and outlet parts thereof.

4. A drawing die composed of a central portion consisting of a hard carbide alloy of extreme hardness, and an external layer situated on each front side of said central portion and consisting of a hard carbide alloy of a lower degree of hardness but of a substantially greater degree of toughness than the alloy of which said central portion is composed, said central portion including the central part of the drawing hole, while said external layers include the inlet and outlet parts thereof.

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