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WIRE DRAWING DIE

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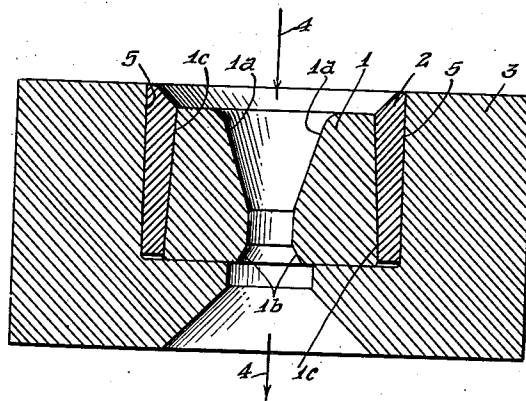


Fig: 4

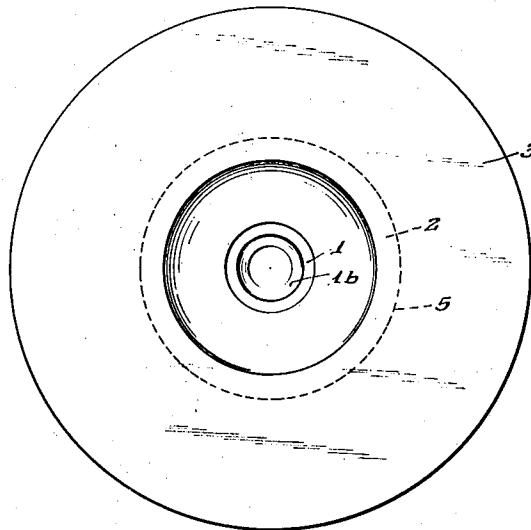


Fig. 2

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WIRE DRAWING DIE

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5 Claims. (Cl. 76—107)

My invention relates to a new and improved wire drawing die.

One of the objects of my invention is to provide a new and improved holder for large dies, and more particularly for dies which employ nibs made of a well known commercial material which has been on the market for several years and which comprises or consists of tungsten carbide, boron carbide and the like. Said tungsten carbide material usually has a cobalt binder, and it is sold under various trade names such as "Carboly", "Widia", and the like.

Another object of my invention is to provide a nib and a jacket, the adjacent walls of said nib and of said jacket being correspondingly tapered, the direction of said taper being opposite to the direction of movement of the wire through the nib, during the wire drawing operation.

Another object of my invention is to provide a device of this kind, in which the parts are mounted and assembled so that the pull of the wire, during the wire drawing operation, will not pull the nib out of the holder, even if the wire is pulled in the direction which is reverse to the direction of wire-drawing.

Other objects of my invention will be set forth in the following description and drawing which illustrate a preferred embodiment thereof, it being understood that the above statement of the objects of my invention is intended to generally explain the same without limiting it in any manner.

Fig. 1 is a vertical central sectional view, which illustrates the improved device.

Fig. 2 is a bottom plan view of Fig. 1.

The drawing is substantially to scale.

As shown in Fig. 1, the device consists essentially of a casing 3 having a recess 5, a jacket or bushing 2 located in said recess 5, and a nib or die 1.

The casing 3 and the bushing 2 may be made of ordinary tool steel. The nib or die 1 can be made of any suitable material. More particularly the nib or die 1 can be made of the well known tungsten carbide material, in which said material is cemented by means of a cobalt binder or the like. This material is relatively fragile and nibs or dies made of such material break frequently under the stress which is produced by the wire drawing, if the nib is of large size.

In order to assemble the parts, the die 1 is first assembled with the bushing 2, by inserting the die into the bushing 2 with the use of either no pressure or of very slight pressure. The adjacent walls of the nib 1 and of the bushing 2 are slightly tapered, the angle of taper being about 3°.

It will be understood that the drawing is generally to scale, and that Fig. 1 more or less accurately shows the angles of the various parts. For example the angle of the wall 1a of the nib 1 is about 18° and the angle of the wall 1b is about 60°.

After the nib 1 and the bushing 2 have been assembled, the casing 3 is heated to a temperature which is below and which is close to the temperature of red heat.

The diameter of the external wall of the bushing 2 is several thousandths of an inch greater than the inside transverse diameter of the longitudinal or axial wall of the recess 5, when the casing 3 and bushing 2 are cold, and at about the same temperature.

The assembled bushing 2 and die 1 are then inserted with little or no pressure into the recess 5 of the casing 3, since the heating of the casing 3 has expanded the same and thus increased the lateral diameter of the recess 5.

The casing 3 is then allowed to cool gradually so that it contracts, so that the axial wall of recess 5 firmly grips the bushing 2. The bushing 2 is preferably relatively unheated when it is inserted into the recess 5 of casing 3.

When the unheated bushing 2 and the heated and expanded casing 3 are being assembled, the outer wall of the bushing 2 may have substantially the same lateral diameter as the heated and laterally expanded axial wall of the casing 3. I prefer to have the external diameter of bushing 2 slightly less than the lateral diameter of the axial wall of recess 5, when the cool bushing 2 is inserted, together with die 1, into the heated casing.

The adjacent axial walls of the bushing 2 and of the recess 5 of casing 3 may be substantially cylindrical.

As shown in Fig. 1, the inner end wall of the die or nib 1 is slightly in advance of the inner end wall of the bushing 2, and the inner end wall of the die 1 therefore firmly abuts the inner end wall of the recess 5, while the inner end wall of the bushing 2 is slightly spaced from said inner end wall of the recess 5. Said inner end wall of bushing 2 may be pressed against and abut said inner end wall of the recess 5.

It will be noted that the outer wall 1c of the nib 1 is tapered so that the transverse diameter of said outer wall 1c increases in the direction of the pull upon the wire during the wire drawing operation. Said direction of pull is indicated by the arrow 4. This taper of the outer wall 1c of the nib 1 is opposite in direction to the taper

which has previously been used in devices of this kind.

In former devices, the taper was formed so that the pull of the wire upon the nib seated the nib more firmly against the adjacent wall of the bushing.

In this device the tendency of the pull of the wire is to pull the die out of the bushing. However, this is prevented because the die directly abuts the inner end wall of the recess 5, which takes up the pull directly.

The shrinkage of the casing 3, when said casing cools, laterally compresses or stresses the bushing 2, so as to exert a lateral inward pressure upon the nib 1, said lateral inner pressure being substantially perpendicular to the axis of the device. That is, the normal transverse diameter of recess 5 is less than the external transverse diameter of bushing 2. This lateral compression of the nib may vary from zero to any desired limit.

Experience has shown that this type of device is advantageous in minimizing the breakage of the nib 1, especially if it is made of the refractory material previously mentioned, such as a tungsten carbide alloy having a cobalt binder or the like. This is probably due to the fact that the pull of the wire does not force the nib against the adjacent tapered wall of the bushing, in such manner as to increase the lateral inner pressure upon the nib.

The pressure of the bushing against the nib tends to force the nib against the inner end-wall of the recess 5. When the wire is drawn, heat is generated which causes the nib and bushing and holder to expand in all directions, due to the increase in temperature. If the nib is made of said tungsten carbide alloy, its coefficient of expansion under heat is about fifty percent of the expansion of the bushing and casing. The diameter of the cross-section of the inner wall of bushing 2 increases from the inlet end thereof to its outlet end. This taper may be designated as a "reverse" taper, because in previous designs, the inlet end of said bushing 2 was larger than its outlet end. When the parts are heated by the drawing of the wire, the bushing 2 expands more than nib 1, so that the expanded bushing 2 presses against nib 1 along the tapered outer wall of nib 1. This pressure tends to urge the nib 1 inwardly. Since nib 1 contacts with the end wall of recess 5, it cannot move inwardly in an axial direction. Hence the greater expansion of bushing 2 produces a force which is perpendicular to the outer wall of nib 1, and this force compensate for the disruptive force which arises from the drawing of the wire. Since the abutting walls of die 1 and bushing 2 have a common tapered cross-section, said walls may be defined as having a common transverse diameter, namely, the diameter of said cross-section. Said common transverse diameter increases from the inlet of die 1 to its outlet.

That is, when the device becomes heated, the casing 3 continues to grip the bushing 2 firmly, as the casing 3 and the bushing 2 have substantially the same co-efficient of expansion.

Hence the bushing 2 does not shift relative to the casing 3. The expansion of the bushing 2 would tend to release the nib 1 therefrom, or to diminish the lateral compression upon the nib 1. However, the initial lateral compression of the bushing 2, when the device is cold, is sufficient to maintain the necessary lateral pressure upon

the nib 1, when the device is heated as the result of the wire drawing operation.

I prefer to shrink the casing 3 upon the assembly of the bushing 2 and the die 1, in the manner aforesaid, as this gradual shrinkage creates the lateral pressure upon the bushing 2 and the die 1, slowly and gradually, so as to prevent fracturing the die 1. However, the claims for the article of manufacture are not to be limited to any particular method of manufacture. While I have referred to the member 2 as a bushing, for convenience, I can use any suitable means for holding the die in position, and the use of the bushing 2 can be eliminated in the broader aspect of the invention. Likewise the invention is not necessarily limited to the use of a die having a tapered wall.

I claim:

1. An improved wire drawing die device comprising a casing having an inlet and an outlet, a bushing located in a longitudinal recess of said casing, a die located in said bushing, said die also having an inlet and an outlet, the adjacent longitudinal walls of said bushing and of said die abutting each other and being tapered so that the common transverse diameter of said walls increases from the inlet of the die to the outlet of the die, the recess of said casing having an inner end wall, the die also having an inner end wall which abuts the inner end wall of said recess, said inner end wall of the die being located inwardly relative to the inner end wall of the bushing, so that the inner end wall of the bushing is spaced from said inner end wall of the die, said casing being dimensioned to maintain said bushing and said die under inward lateral pressure.

2. An improved wire drawing die device comprising a casing having an inlet and an outlet, a bushing located in a longitudinal recess of said casing, a die located in said bushing, said die also having an inlet and an outlet, the adjacent longitudinal walls of said bushing and of said die abutting each other and being tapered so that the common transverse diameter of said walls increases from the inlet of the die to the outlet of the die, the casing and the bushing having greater coefficients of heat expansion than the die, the transverse diameter of said recess being less than the external transverse diameter of the bushing, when said casing and said bushing are at the same temperature.

3. An improved wire drawing die device comprising a casing having an inlet and an outlet, a bushing located in a longitudinal recess of said casing, a die located in said bushing, said die also having an inlet and an outlet, the adjacent longitudinal walls of said bushing and of said die abutting each other and being tapered so that the common transverse diameter of said walls increases from the inlet of the die to the outlet of the die, said recess having an inner end wall, the die also having an inner end wall which abuts the inner end wall of the recess, said inner end wall of the die being located inwardly relative to the inner end wall of the bushing, so that the inner end wall of the bushing is spaced from said inner end wall of the die, the casing and the bushing having greater coefficient of heat expansion than the die, the casing being shrunk on said bushing.

4. A method of making a wire-drawing die device, which consists in forming a bushing having an inlet and an outlet and having an outer wall of substantially uniform circular cross-section and

having a tapered inner wall whose transverse diameter increases from said inlet end to said outlet end, forming a die with a bore and with an outer wall whose contour is substantially the same as the contour of the inner wall of the bushing, forming a casing having a longitudinal recess having an end wall and also having a longitudinal wall of substantially uniform circular cross-section whose diameter is less than the diameter of the outer wall of the bushing when the bushing and the casing are at the same temperature, assembling the die and the bushing with the end wall of the outer end of the die projecting beyond the end wall of the outlet end of the bushing, heating the casing until the assembled die and bushing can be inserted into said recess with substantially no pressure, inserting said die and bushing into said recess until the die abuts the end wall of the recess, and allowing the casing to cool and shrink.

5. An improved wire-drawing die device, comprising a casing having an inlet and an outlet, a bushing located within said casing, said bushing

having an outer longitudinal wall which abuts an inner wall of said casing, a wire-drawing die located in said bushing, said die also having an inlet and an outlet, said die having an inner wall, said inner wall having a first tapered wall portion at its inlet end and a second tapered wall portion at its outlet end and an intermediate wall portion, said tapered wall portions being of smallest transverse diameter at their proximate ends, the outer longitudinal wall of the die abutting the inner longitudinal wall of the bushing, said abutting longitudinal walls of the die and bushing being tapered so as to increase in transverse diameter from the inlet of the die to the outlet of the die, said casing and bushing and die being held against longitudinal movement relative to each other, the normal transverse diameter of the outer longitudinal wall of the bushing being greater than that of the abutting inner wall of the casing, said holder being dimensioned to maintain said bushing and said die under inward lateral pressure.

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