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METAL DRAWING DIE

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Fig. 1.

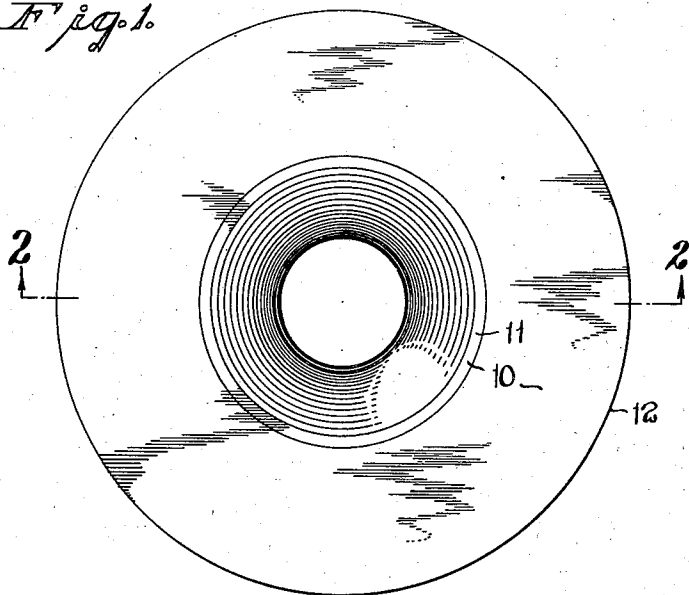
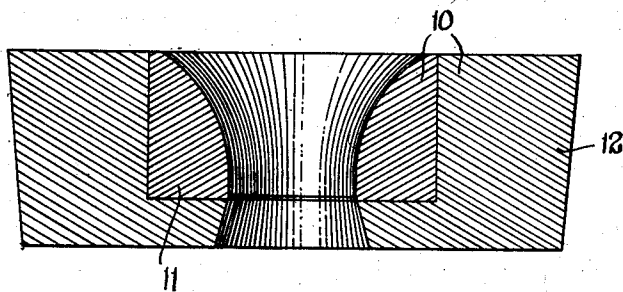


Fig. 2.



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UNITED STATES PATENT OFFICE

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METAL-DRAWING DIE

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2 Claims. (Cl. 205—26)

This invention relates to improvements in metal-drawing dies, and more particularly to metal-drawing dies having a die-nib or insert reinforced by a surrounding reinforcing-ring.

One object of this invention is to provide an improved metal-drawing die formed of a die-nib or insert characterized by heat-resistance and wear-resistance, and surrounded by a reinforcing-ring capable of preventing cracking of the die-nib.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art.

In the accompanying drawing forming part of the present disclosure, in which one way of carrying out the invention is shown for illustrative purposes:

Fig. 1 is a front elevation of a metal-drawing die made in accordance with the present invention; and

Fig. 2 is a sectional view on line 2—2 of Fig. 1.

In the description and claims, the various parts and steps are identified by specific terms for convenience, but they are intended to be as generic in their application as the prior art will permit.

The metal-drawing die 10 illustrated in the drawing, is for drawing metal tubes, and includes a die-nib or die-insert 11 formed of material characterized by heat-resistance and wear-resistance, and is preferably formed of high-speed steel characterized by heat-resistance and by being capable of being heat-treated to give it wear-resistance, and is reinforced by a reinforcing-ring 12 shrunk upon the die-nib 11. The reinforcing-ring 12 is formed of steel characterized by being capable of being heat-treated to give it a combination of substantial elongation and high elastic strength, and is preferably formed of alloy steel characterized by being capable of being heat-treated to give it a combination of substantial ductility or elongation and high elastic strength or elastic limit.

The die-insert 11 is preferably formed of high-speed steel having a high tungsten content.

Where such high-speed steel is used, it is hardened by heating it to 2330° F., then cooled in still air to room temperature, then raised to 1050° F. and held at that temperature for a suitable time to further increase its hardness. After cooling, the die-insert 11 is finish-ground to true size and perfect surface condition ready to have the reinforcing-ring 12 shrunk upon it.

A suitable high elastic strength alloy steel for use in making the reinforcing-ring 12, is S. A. E. steel No. 4340 which when heated to 1500° F. and quenched in oil or otherwise suitably rapidly cooled below its critical-hardness temperature gives it a high elastic strength or elastic limit of between 200,000 and 220,000 lbs. per square inch but very low elongation. The ring is then tempered at a suitable tempering temperature such as 1050° F. for about three hours to give it a substantial elongation characteristic or ductility, such, for example, as from about 10 to 20% elongation, this tempering treatment reducing the elastic strength to between 130,000 and 190,000 lbs. per square inch, depending on the tempering temperature used. The ring is then machine-finished to bring its surfaces true to size and with the inside diameter of the ring a suitable amount smaller than the outside diameter of the die-insert. The ring is then heated to a temperature not substantially higher than the tempering temperature, and the die-insert is heated to about 400° F. and placed inside of the ring, and the ring is permitted to cool and shrink upon the insert and grip the same. In this operation of constructing an adequately-reinforced die-nib or insert, after the ring has been tempered or drawn to increase its ductility, care is taken not to heat the ring substantially above the tempering or drawing temperature when the ring is to be shrunk on the die-insert. The shrinkage allowance or amount that the inside diameter of the ring is made smaller than the outside diameter of the die-insert, may vary from about one and one-quarter to about two and three-quarters thousandths of an inch per inch of inside diameter of the ring, depending on the ratio of the outside diameter of the ring to its inside diameter. Thus, where these ratios are one and one-half to one, the shrinkage allowance would be about one and one-quarter thousandths per inch of inside diameter of the ring, and where these ratios are two to one, the shrinkage allowance would be about two and one-half thousandths per inch of inside diameter of the ring. The limiting factors in all cases will be, that the ring must be tempered at a temperature that will give an elongation of at least about 10% and an elastic limit of at least about 100,000 lbs. per square inch, and that the ring must be heated to a temperature high enough to permit the die-insert and ring to be telescoped together but not substantially above the tempering temperature so as not to substantially lower the elastic limit produced by the tempering.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. A metal-drawing die comprising: a die-nib formed of steel capable of being hardened by heat-treatment to give it a combination of high heat-resistance and high wear-resistance, and which die-nib has been given said heat-treatment; and a reinforcing-ring shrunk on said die-nib to reinforce the same; said reinforcing-ring being formed of steel capable of being hardened when subjected to relatively-high-temperature heat-treatment and then rapidly cooled to below its critical-hardness temperature, and capable of then being given a substantial elongation characteristic and a high elastic-limit characteristic when subjected to relatively-low-temperature heat-treatment below said critical-hardness temperature, and which reinforcing-ring has been given the said treatments prior to having been shrunk on said die-nib, and the said rein-

forcing-ring having been shrunk on said die-nib while at an initial temperature not substantially higher than gives the said elongation and elastic-limit characteristics.

2. A metal-drawing die comprising: a die-nib formed of high-speed steel capable of being hardened by heat-treatment to give it a combination of high heat-resistance and high wear-resistance, and which die-nib has been given said heat treatment; and a reinforcing-ring shrunk on said die-nib to reinforce the same; said reinforcing-ring being formed of alloy steel capable of being hardened when subjected to relatively-high-temperature heat-treatment and then rapidly cooled to below its critical-hardness temperature, and capable of then being given a substantial elongation characteristic and a high elastic-limit characteristic when subjected to relatively-low-temperature heat-treatment below said critical-hardness temperature, and which reinforcing-ring has been given the said treatments prior to having been shrunk on said die-nib, and the said reinforcing-ring having been shrunk on said die-nib while at an initial temperature not substantially higher than gives the said elongation and elastic-limit characteristics.

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