

Nov. 28, 1944.

M. SIMONS

2,364,005

METHOD OF FORMING DRAWING DIES AND APPARATUS THEREFOR

Filed Oct. 19, 1943

Fig. 1.

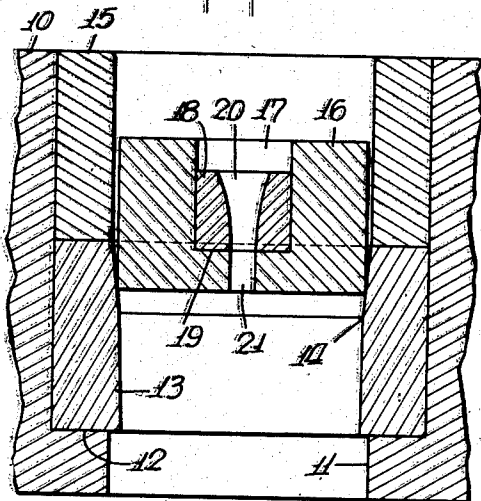


Fig. 2.

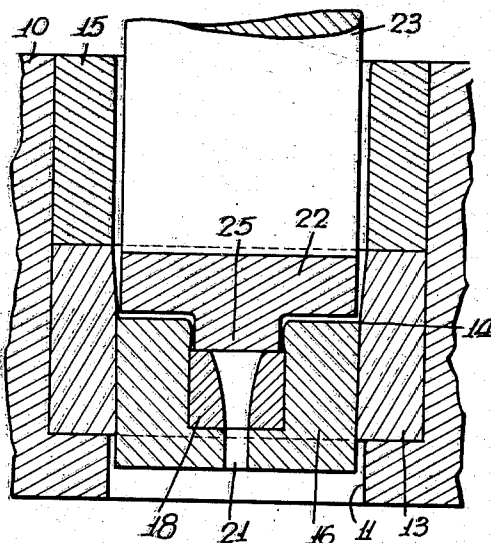
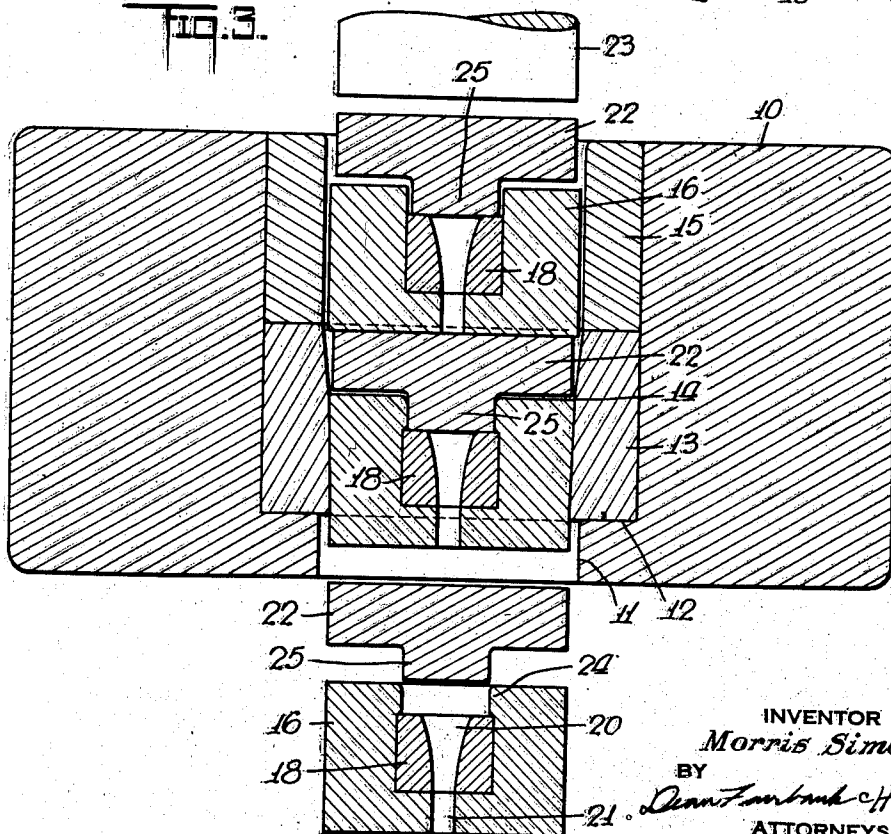


Fig. 3.



INVENTOR
Morris Simons
BY
Denn F. ...
ATTORNEYS

23-227

UNITED STATES PATENT OFFICE

2,364,005

METHOD OF FORMING DRAWING DIES AND
APPARATUS THEREFOR

Morris Simons, Ridgefield, Conn.

Application October 19, 1943, Serial No. 506,840

5 Claims. (Cl. 76—107)

This invention relates to the manufacture of that type of drawing die in which a very hard nib is supported in a steel casing. The nib is usually formed of tungsten carbide or analogous material, which includes such metals as tungsten, tantalum, and the like, in combination with a binder. The insert, although extremely hard, has relatively low tensile strength, and as the use of the die in drawing operations exerts a very great outward pressure on the die, it is important that the hard material hereinafter referred to as tungsten carbide, be externally supported by a strong, tightly fitting casing.

Various methods have been proposed for forcing the metal of the casing into proper engagement with, and the necessary pressure against the nib or insert of the tungsten carbide. One process which has proved satisfactory in commercial use is that disclosed and claimed in my prior Patent 1,952,388, issued March 27, 1934. Other methods involve the casting of the casing around the nib or the grinding of the outside of the insert and the inside of the casing to allow a clearance of about 0.002 inch when the casing is heated so that when the casing cools and shrinks, it firmly engages and holds the insert.

The process of my prior patent above referred to eliminated a great deal of the work and reinforced the insert more securely than did other prior methods, but the process is costly, slow, and requires the use of only those certain steels which can be properly forged. Furthermore, variations in the operation of the percussion press resulted in varying degrees of strength in the final product, as a low pressure exerted by the press, will not forge the casing against the nib with the required pressure, and too great a pressure in the forging press develops stresses which weaken the die.

The main objects of the present invention are to provide a process in which uniform results are insured; the desired inward pressure of the casing on the nib is obtained, and the speed of production is greatly increased, thereby lowering the cost.

In carrying out my invention, I employ a forming die of tungsten carbide or other analogous extremely hard material of low tensile strength, and having a passage therethrough which slightly tapers so that the casing of the die to be manufactured may be forced through this outer or forming die to force the metal of the casing inwardly against the nib so as to exert the desired pressure on the nib and independent of

slight variations in the size of the chamber in the casing or the size of the nib inserted therein.

As an important feature of the invention, the outer or forming die is so constructed that a series of the dies to be manufactured may be forced through in succession and in superposed positions so that each one acts to force the preceding one on through the forming die. This extrusion method is thus very simple, produces uniform results, and permits of high speed production.

In the accompanying drawing, I have shown apparatus which may be employed in carrying out my improved process and have illustrated the parts in the successive positions which they occupy during the process.

Fig. 1 is a longitudinal section through a portion of a forming die with the nib carrying casing of the die to be produced, loosely inserted therein.

Fig. 2 is a view of the same parts with the die forced part way through the forming die, and

Fig. 3 shows the forming die with a series of the dies being manufactured and in positions they occupy in passage through the forming die.

In the apparatus illustrated, there is provided a forming die having a casing 10 formed of strong, hard alloy steel and having an inwardly extending flange 11 at the lower end and presenting a shoulder 12. Seated on this shoulder is a sleeve 13 of hard material such as tungsten carbide. The sleeve tightly fits within the passage through the casing 10 and is strongly supported externally by said casing. The passage of the sleeve 13 tapers; the internal diameter at its upper end being slightly greater than the external diameter of the casing of the die to be formed, and the internal diameter of the lower end being slightly smaller than said external diameter of the die casing. The amount of the taper is such as will result in the inward forging or forcing of the metal of the die casing into the desired pressure engagement with its nib. The tapering may be at a slightly greater angle for a short distance down from the top of the sleeve, for instance, to a point 14, than it is from the point 14 to the lower end of the sleeve. The sleeve 13 may be held in place by a superposed sleeve or liner 15 which may be of hard alloy steel and which has a passage therethrough of an internal diameter which may be substantially the same as that of the upper end of the passage through the sleeve 13.

The die to be formed includes a casing 16 of hard alloy steel with a central chamber 17 within which is placed the nib 18 to rest on a shoulder 19. This insert 18 is shown as having a tapered passage 20 therethrough and the casing 16 is

shown as having an aperture 21 in alignment with said passage 20, but these need not be formed until after the forging operation on the die casing.

In carrying out my process, the nib 18 is formed of such diameter that it may be slipped into the cavity 17 when the casing 16 has been heated to bright cherry red or other suitable forgeable condition. The hot expanded casing, with its nib, is then dropped into the forging die and will slip through the liner 15 and come to approximately the position shown in Fig. 1 with the lower end of the casing 16 engaging the upper tapered section of the tungsten carbide sleeve 13 at some distance above the point 14. This upper tapered section is primarily to properly center the die casing 16 within the sleeve 13. A hardened steel spacer is then dropped through the liner 15 above the assembly of nib 18 and die casing 16. This spacer is in the form of a disc 22, the external diameter of which is such that it may pass through the lower smaller end of the sleeve 13. A press plunger 23 is then moved downwardly on to the disc 22 to force the latter and the die casing 16 and its nib 18 downwardly part way through the lower tapered portion of the sleeve 13. The parts will then be in the position shown in Fig. 2. In this operation, the peripheral wall of the die casing 16 is forced inwardly by the tapered wall of the sleeve 13 and pressed into the desired firm pressure contact with the inset or nib 18. The taper in the sleeve 13 is such that the metal of the peripheral wall of the casing 16 will be forced inwardly to firmly grip the periphery of the nib, and the upper part above the nib will flow inwardly to form an annular flange 24 above the nib 18, as shown in Fig. 2.

The exterior of the casing 16, as formed and inserted to the position shown in Fig. 1, may vary slightly and the flowing of the metal from the peripheral wall inwardly above the nib thus takes care of slight excess thickness of the original wall of the casing 16, as well as the slight reduction of such wall thickness during the forcing of the casing through the tapered sleeve 13.

The disc 22 may lie directly upon the top of the die casing 16, but preferably this disc has a boss 25 of a diameter somewhat smaller than the external diameter of the nib 18 and of such thickness that it contacts the top of the nib, leaving the bottom of the disc slightly above the top of the casing 16. During the downward forcing movement, the force is exerted from the press plunger through the disc 22 and its boss 25 directly on to the nib so that the metal of the top portion of the peripheral wall of the casing will be free to flow inwardly toward the boss. Thus, the forging or drawing of the casing 16 of the die is by downward pressure applied on the nib instead of on the casing, and by the action of the taper of the sleeve 13 on the outer surface of said casing.

The press plunger has substantially reached the end of its downward stroke when in the position shown in Fig. 2. In this position the die casing 16 has reached a position slightly beyond the lower end of the sleeve 13, although this is not at all essential. The sleeve 13 might be of greater length so that the die casing is wholly within the sleeve when the press plunger is at the lower end of its stroke. The plunger is then raised; another die casing and nib inserted in the liner 15 to rest upon the disc within the forging die, and another similar disc 22 is placed on top

of the newly inserted die casing and nib. The press plunger then descends and the parts will be in the position shown in Fig. 3. During the downward movement of the press plunger, the pressure is applied on the upper disc and transmitted therefrom to the nib of the upper die and from the bottom of the upper die to the next disc and on to the lower die. When the plunger reaches the lower end of its stroke, the die which was first inserted, together with the disc resting thereon, drops out of the forming die. The drawing die is thus completed, as shown at the bottom of Fig. 3, and the disc 22 may be returned for re-use. Thus, only a small number of the discs or spacers 22 are required and the drawing dies may be manufactured as rapidly as the press plunger can be reciprocated with the assemblies of casing and nib fed beneath the plunger when the latter is at the upper end of its stroke and the finished drawing dies removed from beneath the forming die when the plunger is at the lower end of its stroke.

By means of my improved process, the speed of manufacture is greatly increased and uniform drawing dies are produced regardless of any slight variations in the spacing between the exterior of the nib and the interior of the casing 16 at the time they are assembled. The taper of the sleeve 13 will force the metal in to leave the casing 16 of uniform external diameter and will force it in to impart the desired pressure against the nib and any excess of metal will flow across the top of the nib to form a narrow flange which may vary in internal diameter. The spacer or disc 22 presents a flat upper surface so that during the forging operation, the underside of the drawing die being manufactured will remain flat and any tendency of this surface to bulge due to the inward forcing of the peripheral wall of the casing will be prevented.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. An apparatus for forming drawing dies including a hard sleeve having a tapering passage therethrough, a spacer movable through said passage for separating superposed drawing die assemblies, each consisting of a nib and a casing therefor, said spacer engaging the nib of the assembly therebeneath, and means for forcing said spaced assemblies through said tapering passage to thereby reduce the external diameter of the casing of the drawing die, force the inner surface of said last mentioned casing into firm holding and supporting engagement with said nib and to discharge the assembly from the smaller end of the passage.

2. An apparatus for forming drawing dies including a steel casing, a tungsten carbide sleeve therein, and having a tapering passage therethrough, a spacer movable through said passage for separating superposed drawing die assemblies, each consisting of a nib and a casing therefor, said spacer engaging the bottom of the casing of the superposed assembly and only the top of the nib of the assembly below, and a press plunger for forcing said spaced assemblies through said tapering passage to reduce the external diameter of the casing of said drawing dies during movement through the smaller portion of said passage.

3. An apparatus for forming drawing dies including a steel casing, a hard sleeve therein, and having a tapering passage therethrough, a spacer movable through said passage for separating su-

perposed drawing die assemblies, each consisting of a nib and a casing therefor, said spacer having a boss for engaging the nib of the assembly therebeneath and a press plunger for forcing said spaced assemblies through said tapering passage to thereby reduce the external diameter of the casing of the drawing die, force the inner surface of said last mentioned casing into firm holding and supporting engagement with said nib and to discharge the assembly from the smaller end of the passage.

4. The process of making a drawing die, which includes applying pressure against one end of a tungsten carbide nib which has its opposite end seated on a shoulder in a tubular casing of high tensile strength, to thereby directly force the nib and cause the nib to force the casing through a tapered passage in a forming die, whereby the

nib is held firmly seated on said shoulder while the peripheral wall of said casing is being forced inwardly into firm engagement with the periphery of the nib and while a portion of the wall of the casing above the nib is free to flow inwardly above the first mentioned end of the nib.

5. The process of making a drawing die, which includes applying pressure against one end of a tungsten carbide nib which has its opposite end seated on a shoulder in a tubular casing of high tensile strength, to thereby directly force the nib and cause the nib to force the casing through a tapered passage in a forming die, whereby the nib is held firmly seated on said shoulder while the peripheral wall of said casing is being forced inwardly into firm engagement with the periphery of the nib.

MORRIS SIMONS.