W. D. COOLIDGE.

DIE AND DIE SUPPORT.

APPLICATION FILED JAN. 17, 1907.

935,463. **Patented Sept. 28, 1909.**

Fig. 1

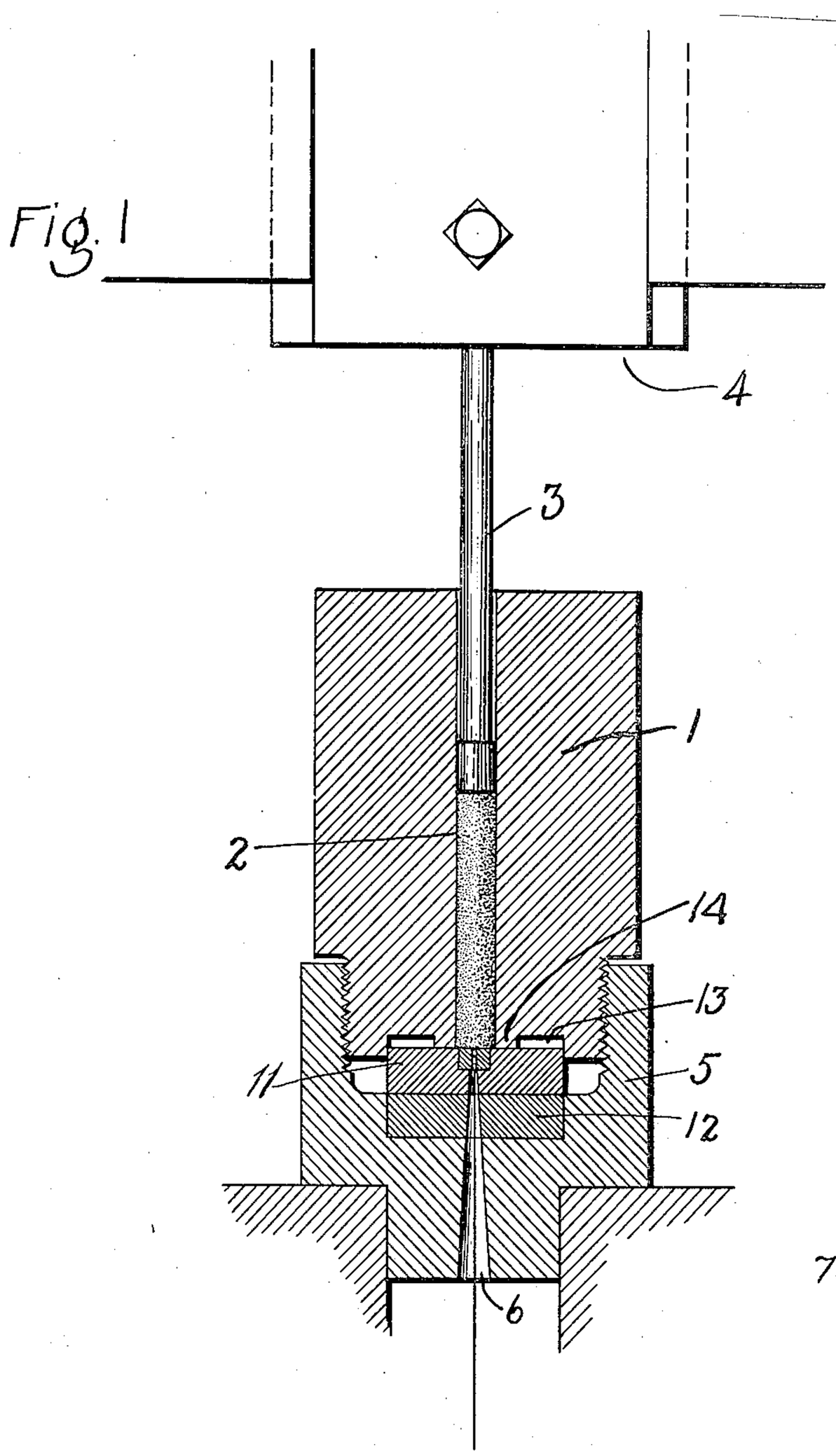


Fig. 3

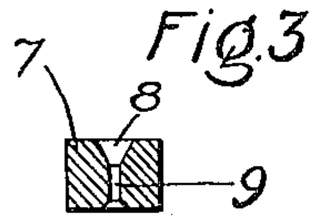
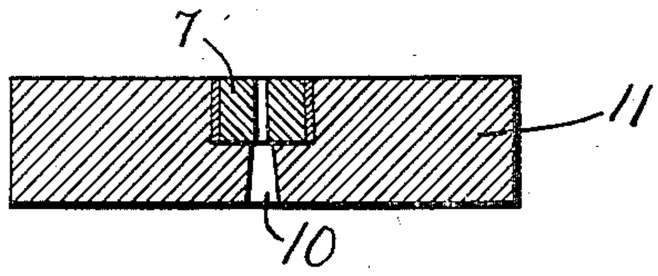


Fig. 2



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UNITED STATES PATENT OFFICE.

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DIE AND DIE-SUPPORT.

935,463. Specification of Letters Patent. Patented Sept. 28, 1909.

Application filed January 17, 1907. Serial No. 352,743.

To all whom it may concern:

Be it known that I, WILLIAM D. COOLIDGE, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Dies and Die-Supports, of which the following is a specification.

This invention relates to an improved apparatus for the extrusion or squirting of metal or other material to form wire. The apparatus includes a die and means for supporting the die in such a way that metal may be passed therethrough at a pressure as high as 150,000 pounds to the square inch.

Referring to the drawing forming a part of this specification, Figure 1 is a sectional elevation of the apparatus; Fig. 2 is an enlarged detail of the diamond die and the disk on which it is mounted; and Fig. 3 is a detail of a modified form of die.

The pressing mechanism comprises a cylindrical block 1 of hard tool steel having a central cavity 2, containing the material to be extruded. Within this cavity is a steel piston or plunger 3 having a plunger head which may be forced downward by means of suitable pressing mechanism 4. The lower end of the cylindrical block 1 is fitted with a cylindrical cap 5 having a central cone shaped opening 6 through the center thereof. This cap also has suitable cavities for holding other elements of the apparatus. The cap 5 is made of unhardened tool steel and may be secured to the cylinder 1, as shown in the drawing.

The diamond die through which the extruded metal passes may be of the type commonly used in wire drawing, but I prefer to use a die of a different shape for reasons hereinafter set forth. A die suitable for wire drawing is shown in Fig. 3 and consists of a cylindrical jewel having a conical cavity 8 at the top communicating with a small, straight, cylindrical orifice 9, which extends downward to near the lower surface of the die, and opens into an abrupt enlargement. When such a die is used for wire drawing the metal under treatment is passed in through the conical end of the cavity and is "necked down" by the flaring walls of this opening. It might be assumed that such a die is well adapted for the extrusion of metal and that the conical end of the hole would serve to start the metal through the orifice. I find, however, that though the die will operate in the pressing mechanism shown in Fig. 1, nevertheless the output of extruded metal can be greatly increased and the pressure of extrusion can be greatly diminished by inverting the die so that the conical cavity is at the exit end of the orifice. When the conical cavity is at the exit end of the orifice it plays no essential part in the extrusion of metal and may be entirely dispensed with, as shown in Fig. 2. Its omission gives a greater wearing surface in the diamond and prevents rapid change in diameter or form. In Fig. 2, the diamond has a perfectly straight cylindrical bore in alinement with the flaring cavity 10 of the metal parts below.

I have found that when a diamond die is worked at a pressure of many thousand pounds per square inch, it is subject to such bending strains that it is liable to crack and become useless unless special provisions are made for its support. It should be supported throughout the entire cross-sectional area in such a way that the foundation on which it rests will not become deformed during operation. I find that the arrangement hereinafter described is satisfactory.

The under surface of the diamond die is first ground to a plane surface. The diamond is then set into a steel disk 11 with its top substantially flush with the top of the disk. I find it desirable to take care in cutting out the cavity in which the diamond is to be placed, and I make the bottom of the cavity as near a plane surface as possible. The cavity is slightly larger in diameter than the diamond and the annular space is filled with silver solder to secure the diamond in the disk. The tight fit between the diamond and the bottom of the cavity prevents the silver solder from entering between these surfaces; the diamond therefore bears directly on the steel. I reinforce the steel disk 11 with an extremely hard steel disk 12. The conical hole through the center of the hardened steel disk is directly in line with a similar hole through the other disk so that the stock immediately below the diamond is rigidly supported against shearing stress and is maintained in its original position with respect to the die.

When the elements are assembled as shown in Fig. 1, there is, of course, a tendency for the charge 2 to ooze out between block 1

and disk 11. To prevent this I provide for an intimate contact between the upper surface of the disk and the bottom of the block immediately adjacent to the material under pressure. An annular groove or channel 13 is made in the lower surface of the block 1 to diminish the area of the material in contact with disk 11. A relatively narrow annular flange 14 is left about the central cavity of the block and serves to form the necessary tight joint with the disk. When the parts are assembled, I tighten up cap 5 with a powerful wrench and squeeze the annular flange 14 into intimate contact with the upper surface of the disk 11.

I have referred herein to diamond and other jewel dies and I desire these terms to be given a broad interpretation to include equivalent materials of a hard and resisting character and suitable for use in the relations set forth.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. In an extruding device, the combination of a jewel die, a steel block supporting said die, and a harder block below said first mentioned block and extending well under the edges of said die to reinforce the intervening metal.

2. In an extruding device, a jewel die having a flat end surface, a steel support in direct and intimate contact with said surface, and a steel block reinforcing said support immediately below said jewel.

3. The combination of a block having a chamber in which metal may be compressed, a flange surrounding one end of said chamber, a steel disk held in intimate contact with said flange, and a diamond die supported by said disk.

4. The combination of a block having a chamber in which metal may be compressed, a brittle die held in alinement with said chamber, a disk supporting said die, a flange on said block in intimate contact with said disk, and a hardened steel block reinforcing said disk immediately beneath said die.

5. The combination of a metal block provided with a chamber in which material may be compressed, a cap threaded to said block, a hardened steel block carried by said cap, a second steel block reinforced by said hardened block, a diamond die embedded in said second block, and a flange for preventing the escape of compressed metal over the surface of the die supporting block.

In witness whereof, I have hereunto set my hand this 15th day of January, 1907.

WILLIAM D. COOLIDGE.

Witnesses:

BENJAMIN B. HULL,

HELEN ORFORD.