

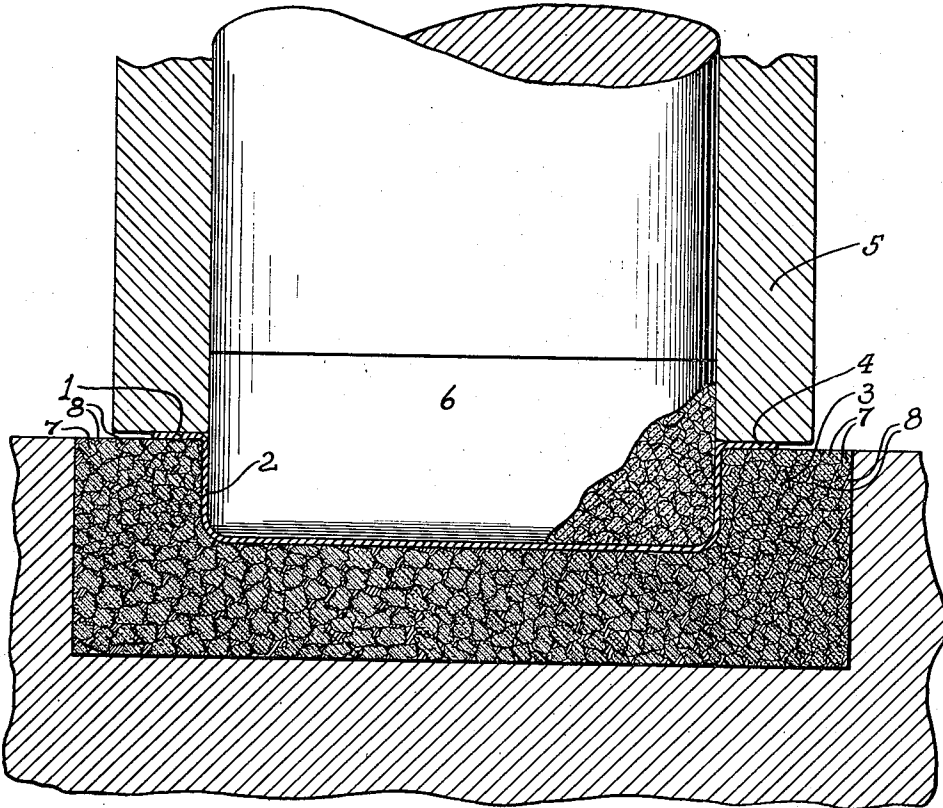
Dec. 19, 1933.

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1,940,294

DIE

Filed Nov. 13, 1930



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1,940,294

DIE

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Application November 13, 1930
Serial No. 495,544

3 Claims. (Cl. 113-49)

This invention relates to improved forming dies.

Heretofore, in die forming operations, particularly those in which deep drawing of sheet metal is accomplished, considerable difficulty has been encountered in overcoming the tendency of the metal to stick and load up on the surfaces of the die parts where maximum pressures and drawing depths occur.

This action is aggravated materially when hardened steel die parts are used and in some cases the sheet metal is severely scored and even broken. The use of gray cast iron dies partly overcomes this difficulty due to the lubricating effect of the contained graphite, but as the iron matrix in which the graphite is embedded is comparatively soft and subject to abrasion, it wears and as a result the life of such dies is relatively short.

The main objects of this invention are to provide die parts to which the metal being formed does not stick or load thereonto; to provide anti-friction forming dies; to provide improved die parts throughout which are distributed particles of a solid lubricating element; to provide an improved matrix or body portion for forming dies that has extreme wear resisting qualities and which secures the lubricating particles against detachment from the exposed surfaces of the dies; to provide die parts which consist of a porous metal composition that is capable of absorbing a substantial quantity of liquid lubricant; and to provide die parts of this kind which bleed lubricant at their exposed surfaces when they are applied to the work under pressure.

Further objects of the invention are to provide an improved porous metal composition for die parts that is mainly formed of iron; and to provide die parts consisting of a porous metal composition in which is present a predominating quantity of iron particles of a spongy porous nature that are capable of being hardened by carbonization.

An illustrative embodiment of my invention is shown in the accompanying drawing, in which:

The figure is a central vertical section of a pair of porous die parts illustrating diagrammatically the manner in which the die parts are used in drawing operations.

In drawing sheet metal by die forming operations, such as are employed in the production of lamp reflectors, lamp casings, pans and other articles, it is customary to place a piece of sheet metal stock 1 over the recess 2 of a female die part 3 and to firmly clamp the marginal por-

tions 4 of the stock against movement by a hollow clamping member 5 which is automatically pressed upon the stock by mechanism of a toggle press, not shown. The male die part 6 is then extended through the clamping member 5 and forced into the recess 2 of the female die part 3 by the mechanism of a toggle press, thereby forcing the sheet metal stock 1 into the recess 2 and imparting to the stock the shape of the recess.

In the form shown, both the female and male die parts 3 and 6 comprise a porous metal composition which includes a mass of comminuted iron particles 7 that are tightly compressed and bonded together by copper 8 or other suitable metal which has a melting point below that of iron. Distributed through the mass of iron and copper particles is a substantial quantity of powdered graphite which is firmly held against displacement by the bonded together particles of iron.

The iron, component of the composition, is preferably sponge iron which is an amorphous form of iron having a large degree of porosity. Sponge iron may be produced by direct gas reduction of iron ore, or oxides of iron, such as powdered ferric and ferrous oxides.

A satisfactory porous metal composition is formed by mixing together substantially 88.5 parts, by weight, of sponge iron, 10 parts, by weight, of powdered copper and 1.5 parts, by weight, of powdered graphite. These ingredients are thoroughly mixed and preferably passed through a 150 mesh screen. Either a solid lubricant such as stearic acid or a liquid lubricant such as paraffin oil is introduced into the mixture. When stearic acid is used, it may be thoroughly distributed through the mixture by introducing it in a solution of ether and later evaporating the solvent.

The mixture of the powdered materials is then compressed into briquettes of shapes which correspond to the shapes of the die parts under a pressure of from 25,000 to 50,000 pounds per square inch. This may be conveniently accomplished by forming the briquettes in moulds which are negative in shape to the die parts and which are machined to within very close limits of dimensions. The briquettes are removed from their moulds and placed in a muffle furnace where they are heated to substantially 2100° Fahrenheit in a reducing atmosphere or in a non-oxidizing atmosphere. During the sintering operation, the copper particles melt and fuse to the iron particles which are not reduced to a fluid

state by the temperature to which the briquettes are subjected. The copper forms bonds between the iron particles and the graphite is firmly held in the mass.

5 The porosity of the iron particles renders the die parts capable of absorbing considerable liquid lubricant, such as oil. When the dies are in operation, the pressure under which they are placed causes the oil with which the dies are 0 impregnated, to bleed out through the pores of the iron particles at the working surface of the dies providing a film of oil which lubricates the working surfaces and the surfaces of the sheet metal stock which the dies engage. The graphite 5 also aids in providing an anti-friction engagement between the die parts and the stock, and in some cases it may be relied upon in the absence of liquid lubricant. The lubricating actions of the liquid lubricant and of the graphite reduces 10 the friction between the contacting areas of the stock and the die parts, which occurs where the stock is being drawn.

Die parts of extreme hardness may be formed in the above manner by either carbonizing the 25 particles of iron before they are introduced into the mixture or by carbonizing the iron of the composition before or after the briquettes have been sintered. In the first case, the iron particles may be conveniently carbonized by sub- 30 jecting them to an atmosphere of carbonizing gases and in the second case, the completed briquettes or die parts may be effectively carbonized by embedding them, while hot, in a body of carbonaceous material, such as coke. Upon sub- 35

sequent heat treatment of the carbonized iron content of the dies, a hardness substantially equivalent to that of steel is produced.

Although but one specific embodiment of this invention is herein disclosed, it will be understood that various equivalents may be substituted for the ingredients herein recited and numerous changes may be made in the proportions of such ingredients without departing from the spirit and scope of my invention as set forth in the claims hereto appended. 80 85

What I claim is:

1. A fabricated die part including a compressed mass of sponge iron particles having a large degree of porosity, particles of copper fused to said sponge iron particles forming bonds therebetween, and a solid lubricant comprising powdered graphite distributed throughout said compressed mass mechanically held therein. 90

2. A fabricated die part comprising a compressed mass including carbonized hardened finely divided particles of iron, powdered copper, and graphite mechanically held by said particles, the iron predominating in proportion by weight. 95 100

3. A fabricated die part comprising a compressed mass including, by weight, substantially 88.5 parts of sponge iron having a substantially 1% chemically combined carbon content and a high degree of porosity, 10 parts of copper, and 1.5 parts of graphite mechanically held in said mass, the copper being fused to the particles of sponge iron. 105

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CERTIFICATE OF CORRECTION.

Patent No. 1,940,294.

December 19, 1933.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, claim 1, last line, after the word "mass" insert the word and; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 3rd day of April, A. D. 1934.

F. M. Hopkins

Acting Commissioner of Patents.

(Seal)

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