July 20, 1954 R. E. HAMMOND 2,683,999

FORGING DIE

Filed Oct. 30, 1950

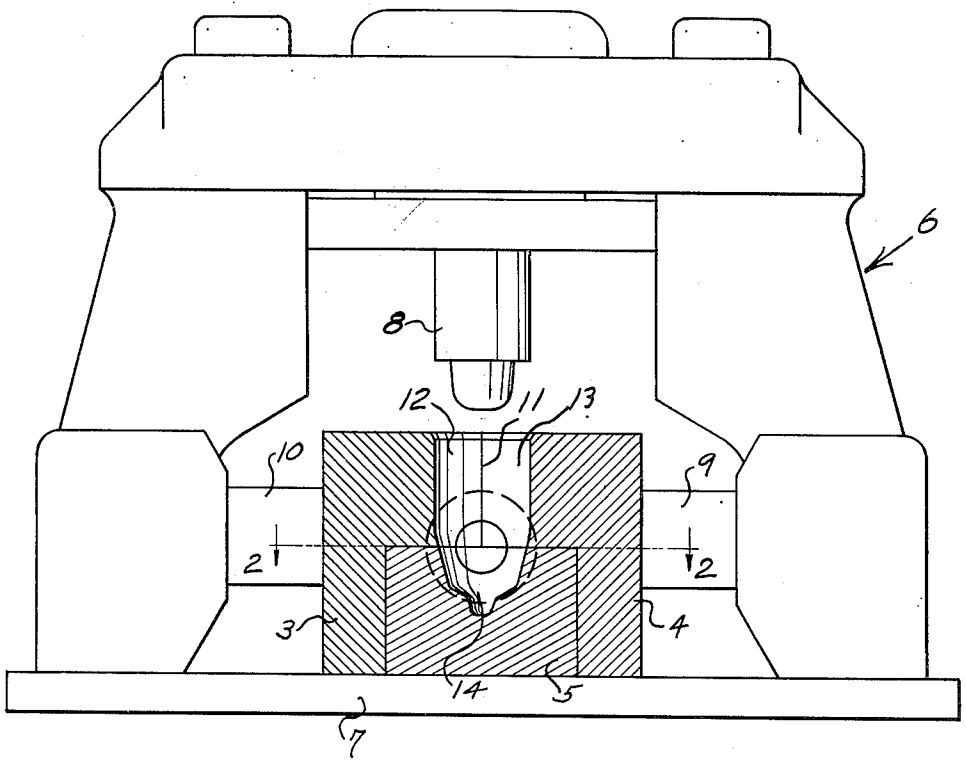


Fig. 1

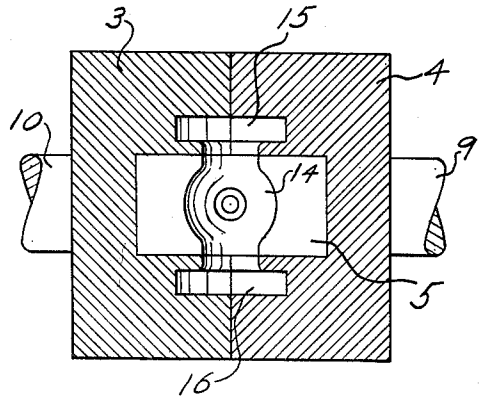


Fig. 2

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Patented July 20, 1954

2,683,999

UNITED STATES PATENT OFFICE

2,683,999

FORGING DIE

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Application October 30, 1950, Serial No. 192,929

1 Claim. (Cl. 78—60)

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This invention relates to improvements in forging dies and refers more particularly to forging dies which are made up of a plurality of separable die parts which are held together as a unit during a forging operation but thereafter are separated to facilitate removal of a forging from the dies, whereby irregularly shaped objects may be forged.

In press forging metal articles in separable dies, very large forces are developed tending to separate the die parts. These forces are due to the force exerted by the metal being forged acting against the walls of the die parts. In order to withstand these forces and maintain the die parts in forging position, side rams of the press have been utilized. Also various arrangements of die holders have been devised which have met with some degree of success. However, when large objects are to be forged the forces to be withstood are very great and difficulty has been encountered in maintaining the proper relationship between die parts. As an example, in forging valve bodies for use in controlling two and three inch conduits, the side rams of presses have been adequate to hold the die blocks close enough together so that no objectionable spreading was encountered. However, when it was attempted to forge four inch valve bodies, and larger, it was found that the lateral forces on the die blocks, due to the increased area of the forging, was such that the side rams were unable to prevent undue spreading of the die blocks. This resulted in distorted forgings with an undue amount of flash and the amount of metal required in the original billet cannot be consistently predicted.

An object of this invention is to provide a forging die made up of a plurality of parts in which the means for holding the laterally separable die parts is not subjected to all of the force due to the action of the forged metal against the wall of the cavity.

Another object is to provide a forging die made up of a plurality of separable parts in which one of the parts is disposed transversely of the line of separation of the laterally movable parts and in which the first part is sufficiently heavy to withstand the lateral forces due to the action of the forged metal against the walls of that part of the die cavity formed in such part and acting in a direction to separate the laterally separable parts.

A further object is to provide, in a three piece die assembly having two laterally separable parts, for the shielding of the holding means for the

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two parts from a portion of the force due to the metal being forged, acting in a directon to separate the laterally movable parts.

Other and further objects of the invention will appear as the description proceeds.

In the accompanying drawings forming a part of the instant specification and wherein like reference numerals are used to indicate like parts in the various views:

Fig. 1 is a schematic view, in front elevation, of a press forge of the side ram type equipped with a die assembly embodying this invention; and

Fig. 2 is a view, in section, of the die assembly of Fig. 1 and taken along the line 2—2 in Fig. 1 in the direction of the arrows.

The invention in general comprises a die made up of a plurality of pieces, such as die parts or blocks 3 and 4, adapted to seperate laterally to facilitate removal of a forging, and a die part 5 which contains a significant portion of the die cavity. This die block 5 is arranged so that the forces due to the forging metal, acting against the portion of the die cavity contained by this part, in a direction to separate the die parts 3 and 4, are held by the die part 5 and are not transmitted to the holding means of preventing lateral separation of the die parts 3 and 4.

Referring to the drawings in detail numeral 6 designates general a press shown schematically in Fig. 1. The press has a base plate 7 for supporting a die assembly and a die punch 8 adapted to be pressed downwardly within the cavity of the forging die. Side rams 9 and 10 are carried by the press and abut the die blocks 3 and 4. These side rams may be connected to the die blocks in any conventional manner to facilitate manipulation of the die blocks in a forging operation. In this type of a forge the side rams 9 and 10 constitute the holding means for securing the laterally separable die parts against separation.

The die shown is one for use in forging valve bodies and includes the three parts or blocks 3, 4 and 5. The two parts 3 and 4 are laterally separable along a plane shown at 11 which includes the axis of the punch 8. In this type of press the plane of separation or line of separation is vertical.

The die cavity is formed in the three parts with the open portion for receiving the heated billet and the punch being formed in blocks 3 and 4 and shown at 12 and 13 respectively. The punch 8 is adapted to be lowered into the cavity formed by portions 12 and 13 after the placement of a heated billet therein to extrude the metal of the billet so as to fill all of the die cavity. The

block 5 has a cavity 14 constituting a portion of the die cavity. This portion 14 of the cavity has upwardly tapering walls whereby the forging may be readily removed from it. In the particular embodiment, the portion 14 of the cavity forms the lower portion of the valve body beneath about the horizontal center line of the valve or the horizontal axis through the flow passage which will be formed in such a valve body.

The die shown is the type which will forge a valve body having flange fittings for securing the body in a conduit to be controlled. The entire portion of the cavity for forming the flanges is formed in the laterally separable die parts 3 and 4 as shown at 15 and 16.

The two parts 3 and 4 are formed with a recess in which the part or insert 5 seats. The recess and insert have a dimension transverse the plane of separation of the die parts 3 and 4 which is considerably greater than that dimension of the portion of the die cavity 14. Also the thickness of the block 5 beneath the lowermost portion of the die cavity portion 14 should be quite great so as to provide a very rigid insert part or block 5 such that the forces developed by the forged metal acting against the walls of cavity portion 14, in a direction normal to the separation line between the blocks 3 and 4, may be held by the block 5 itself and not transmitted through the blocks 3 and 4 to the side rams 9 and 10.

In operation, a heated billet of metal to be forged is placed within the die cavity after the cavity has been assembled in the Fig. 1 position. Then the punch 8 is lowered and pressed downwardly upon the billet so as to extrude the metal of the billet into the closed cavity to completely fill the die cavity. During this extrusion operation considerable force is developed due to the fluid metal acting against the die parts in a direction to separate parts 3 and 4. The side rams 9 and 10 function to prevent separation of these parts but in the particular arrangement these rams are shielded from a considerable portion of this separating force. The shielding effect is due to the presence of the insert or block 5 which is formed sufficiently heavy to itself withstand the lateral forces acting against it in a direction normal to the line of separation of the parts 3 and 4.

The portion 14 of the die cavity is substantially centered along the longitudinal dimension of the part 5. Preferably, the other horizontal dimension of the portion 14 is centered with respect to this horizontal dimension of the overall die cavity.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

In a three piece forging die, a first die part having formed therein, in one face thereof, a substantial portion of the die cavity, a second and third die part comprising a split die movable over said face of said first die part, each of said second and third die parts having a cavity and a communicating recess formed in their adjacent faces, the cavities of said adjacent faces forming a continuation of the cavity of said first die part to create the shape of the article to be forged and said recesses of said split die located normal to said first die face in alignment with the cavity therein, and adapted to direct a forging force toward said cavities and in the main to the cavity of said first die part.

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