

(No Model.)

2 Sheets—Sheet 1.

H. H. FORSYTH.  
DIE FOR FORGING.

No. 384,751.

Patented June 19, 1888.

FIG. 1.

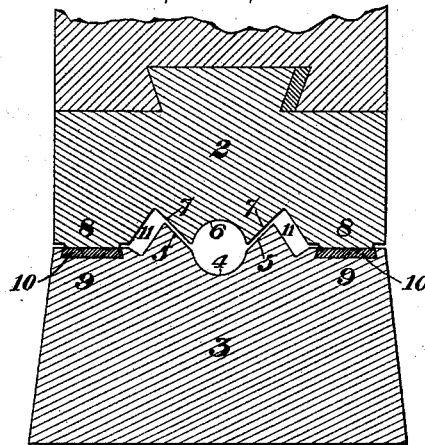


FIG. 2.

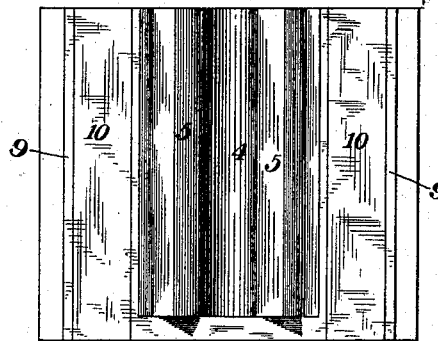
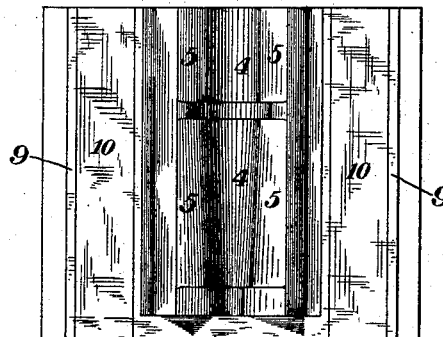


FIG. 3.



WITNESSES.

*H. L. Gill.*  
*N. B. Corwin*

INVENTOR.

*Henry H. Forsyth,*  
*by W. Bassett & Sons,*  
*his Attorneys.*

(No Model.)

2 Sheets—Sheet 2.

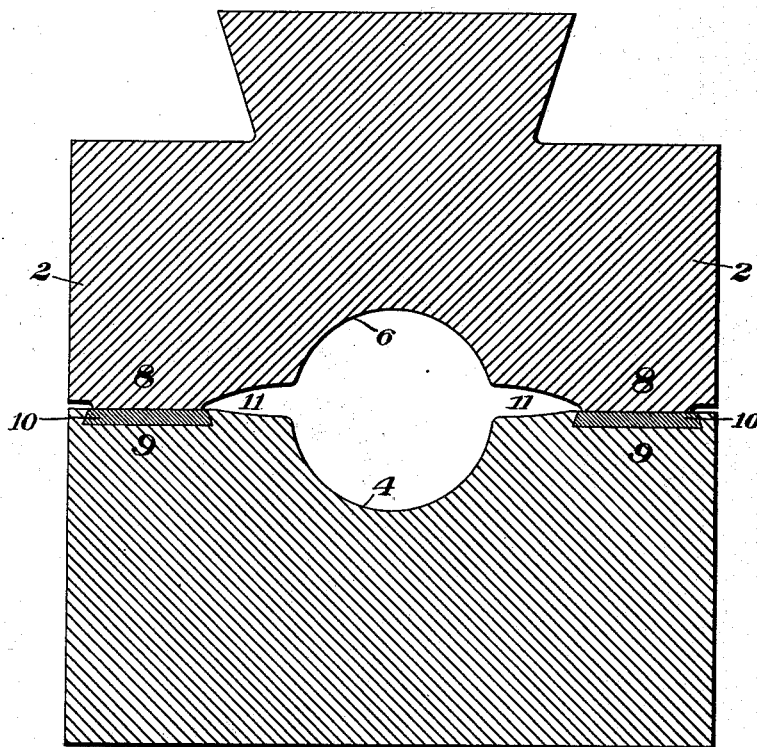
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*Fig. 4*



WITNESSES.

*Thomas W. Baxwell*  
*W. T. Corwin*

INVENTOR.

*Henry H. Forsyth*

# UNITED STATES PATENT OFFICE.

HENRY H. FORSYTH, OF PITTSBURG, PENNSYLVANIA.

## DIE FOR FORGING.

SPECIFICATION forming part of Letters Patent No. 384,751, dated June 19, 1888.

Application filed March 1, 1888. Serial No. 265,819. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY H. FORSYTH, of the city of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Dies; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to an improvement in dies for forging or swaging pieces of iron or steel which are of circular cross-section and either of cylindrical, conical, or irregular longitudinal section. Heretofore it has been the practice in forming such articles to use two dies of similar contour, the edges of the working-cavities of which come into contact in the operation of the dies. The article to be forged—for example, a piston-rod, an axle, or the like—is placed on the lower die, and the upper die or hammer is caused to beat upon it, the iron meanwhile being turned on the bed-die. The difficulty in the use of these dies is that when the conjoined cavities are circular in cross-section they are apt to form fins on the surface of the article. This has caused manufacturers generally to employ dies with elliptical working-cavities, so made in order to avoid the formation of fins; but the use of the elliptical dies is disadvantageous in that it is hard to produce by them articles of uniform circular cross-section, and in any case the contact of the dies batters the edges of the cavities and soon impairs their efficiency where great accuracy of outline and smoothness of surface are required.

The object of my invention is to cure this defect and to provide dies by whose use a perfectly round and uniform article can be produced.

In the accompanying drawings, Figure 1 is a vertical cross-section of my improved dies shown in conjunction. Fig. 2 is a plan view of the lower die. Fig. 3 is a plan view of the lower die modified in order to adapt it to the manufacture of tapered articles. Fig. 4 is a vertical sectional view similar to Fig. 1, illustrating a modified form of the dies.

Like symbols of reference indicate like parts in each.

Referring now to the drawings, 2 represents the upper die, and 3 the lower die. The working-face 4 of the lower die is made with a curved contour on the arc of a circle, the curve being

preferably nearly semicircular in cross-section, and from the top of the semicircle the bottom die extends upwardly and outwardly in flaring lines 5. The working-face of the upper die, 2, is also made with a curved contour whose cross section is that of the arc of a circle somewhat less than a semicircle. The edges of the cavities of the dies are separated by recesses 11, which communicate with the cavities, and while not substantially impairing the general circular shape in cross-section of the conjoined cavities, yet part the edges and prevent the formation of fins on the article. From the extremities of the cavity 6 of the lower die the body of the die extends upwardly and outwardly on diverging lines 7. These cavities need not be continuously arcs of a circle, for they may be made ridged or polygonal; but it will be found that the nearer the approximation to the circle the better will be their operation.

In order that the faces of the dies shall not meet in their work of hammering, I provide them with shoulders 8 9 at their outer sides, which shoulders meet when the moving die is in action, and by receiving the impact of the blows prevent the working-faces of the dies from coming into contact and from being injured. In order to save these shoulders from injury as much as possible, I prefer to face the shoulders 9 with plates 10 of copper, or some other soft metal, which are set in recesses on top of the shoulders, and by opposing a soft body to the action of the moving upper die serve as buffers. Instead of having these shoulders 8 and 9 in connection with the bodies of the dies, I may substitute therefor suitable stops on the plunger or on the slide or piston-rod, which will act in substantially the same way to produce the same result.

The operation of the dies is as follows: In order to forge a bar of iron into the proper cylindrical shape, supposing the die-cavities to be constant in cross-section, the bar is laid on the inclined faces 5 of the lower die, 3, and the upper die, being actuated by a suitable steam hammer or plunger worked by a cam or crank, is caused to reciprocate and to impart its blows to the bar. The bar is turned by a workman or by suitable machinery continually during this operation, and the effect of

the upper die, acting in conjunction with the inclined faces 5, is gradually to diminish the diameter of the bar and to bring it more nearly to a circular form, and finally to force it into the cavity of the lower die, which, in conjunction with the correspondingly-curved cavity of the upper die, gives the bar its finished circular form. I am enabled thus to successfully employ dies the general contour of the cross-section of whose conjoined working-cavities when the dies are most nearly in contact is substantially circular, to conform to the section of the finished article, the conjoined cavities having parted or recessed sides, and thus I get all the advantages of the circular dies without the disadvantages which have heretofore attended their use. This I am enabled to do by reason of the use of the inclined side faces, 5, and by reason of the fact that the working-faces of the dies do not come in contact at the edges. If they should come in contact the effect would be to flatten out the metal bar, to produce fins on it, and to spoil the dies without attaining the desired result. I believe that I am the first to dissociate the edges of the operative faces of the dies from the stop which limits their approach. This is a very important feature of my invention, since it enables me to make the articles of true circular form in cross-section, and also to prevent the dies from becoming battered or misshapen. In case the article to be produced is not of cylindrical but is of tapering form—such as a wagon-axle—the operation is the same, except that the dies, instead of having working-faces with cavities of constant width, have cavities conforming to the shape of the article, as shown in Fig. 3. For producing articles of other forms in longitudinal section the dies are correspondingly modified, as will be readily understood.

My invention is susceptible of many modifications, not only in change of shape of the dies to correspond to the change in shape of the article produced, but also in other changes of form of the parts. For instance, the recesses 11 at the sides of the working-cavities of the dies are solely for the purpose of preventing contact of the working-faces and may be greatly modified in form, and instead of having the dies arranged as shown in the drawings they may be reversed, the present lower die being used as the upper die, and vice versa.

I illustrate a modification in form of the recesses in Fig. 4, in which the inclined faces 5 and 7 of the dies are not used and the recesses 11 are enlarged. Other modifications will suggest themselves to those skilled in the art.

My invention is of great practical utility and will be appreciated by those skilled in the art. It may be used not only for the purpose of forging hot metals into the proper shapes, but for finishing articles by cold-hammering. This last named feature makes it especially desirable in the manufacture of tapered iron axles and other articles of irregular longitudinal section. Hammering by means of these dies preserves the desirable hardness of the article.

I do not claim herein, broadly, dies having their working-faces provided with semicircular cavities, nor do I limit the scope of my claims to dies having working-cavities made on the arcs of a circle, unless expressly so stated therein, since, if the stops be used, the working-cavities of the dies may be otherwise shaped, my invention in this regard relating to the construction of the dies by which the edges of the cavities are prevented from coming into contact, and by which I am enabled, if desired, to use dies the general contour of whose conjoined working-cavities is substantially circular in cross-section.

I claim—

1. An improvement in dies for forging or swaging, which consists in the combination of dies whose opposing faces are provided with suitable working-cavities made substantially in arcs of a circle, the general contour of the conjoined die-cavities when the dies are most nearly together being substantially circular, the edges of the cavities of the dies being separated by lateral recesses, substantially as and for the purposes described.

2. An improvement in dies for forging or swaging straight metal articles, which consists in the combination of dies whose opposing faces are suitably formed and stops whereby the motion of the movable die is limited and the edges of the working-faces are prevented from coming into contact, substantially as and for the purposes described.

3. An improvement in dies for forging or swaging straight metal articles circular in cross-section and either of constant or varying longitudinal section, which consists in the combination of dies whose opposing faces are provided with cavities, the cavity of one of the dies having flaring extensions, substantially as and for the purposes described.

In testimony whereof I have hereunto set my hand this 25th day of February, A. D. 1888.

HENRY H. FORSYTH.

Witnesses:

THOMAS W. BAKEWELL,  
J. K. SMITH.