(No Model.) 2 Sheets—Sheet 1.

J. W. BOWERS.

MACHINE FOR MAKING AX POLLS AND SIMILAR TOOLS.

No. 296,817. Patented Apr. 15, 1884.

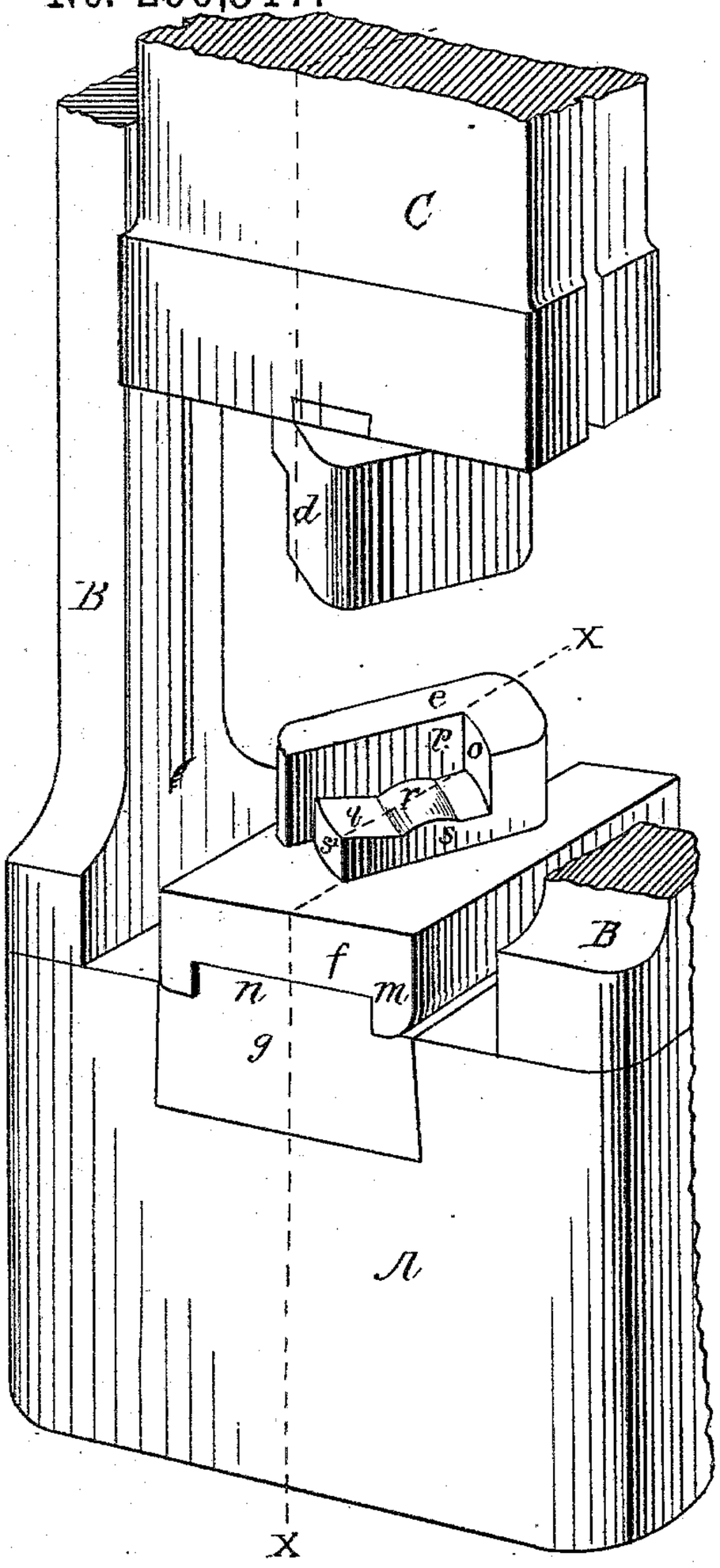

Fig. 1

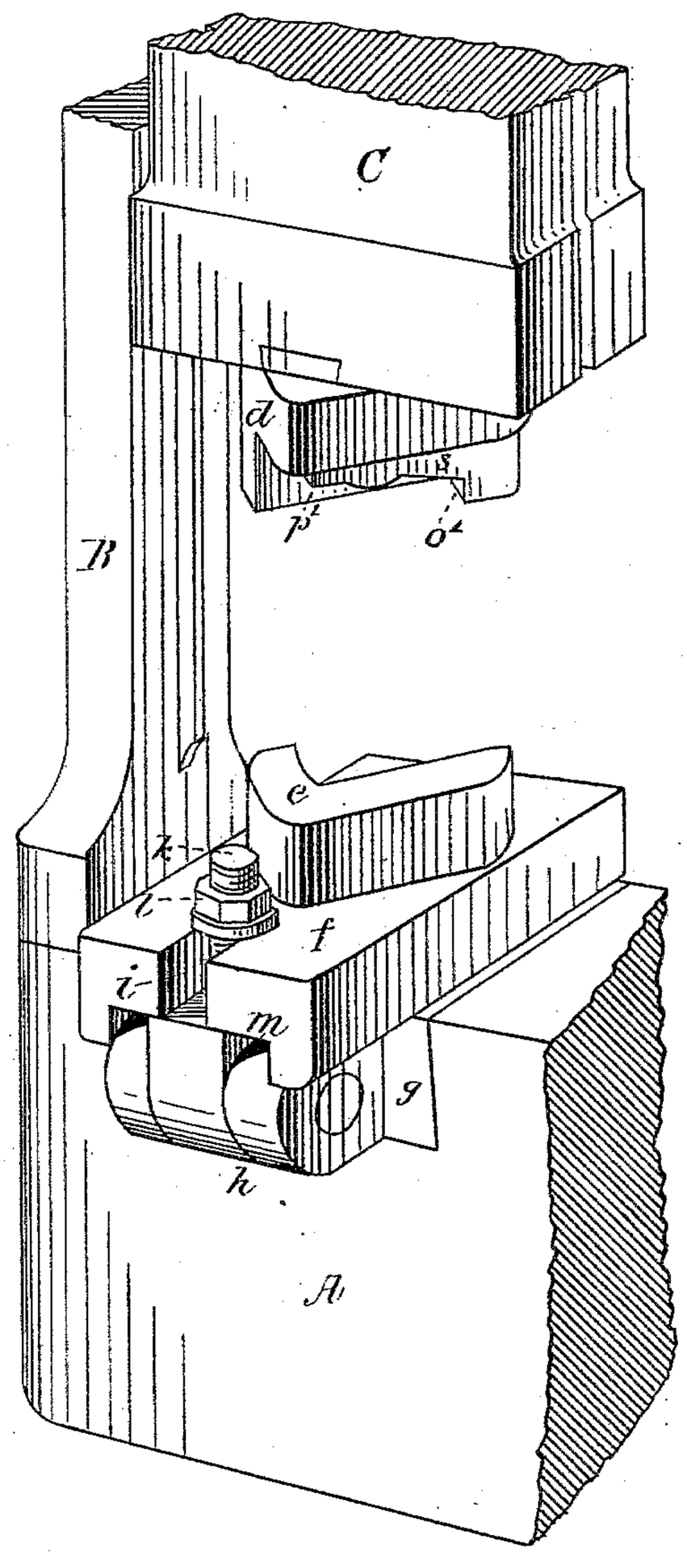

Fig. 2.

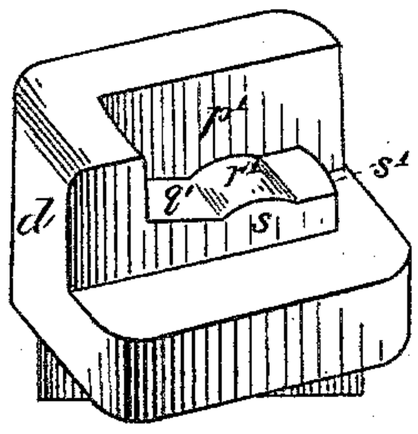

Fig. 3.

WITNESSES

John F. Kennedy.
Frank O. Melcher.

INVENTOR

John W. Bowers

(No Model.) 2 Sheets—Sheet 2.

J. W. BOWERS.

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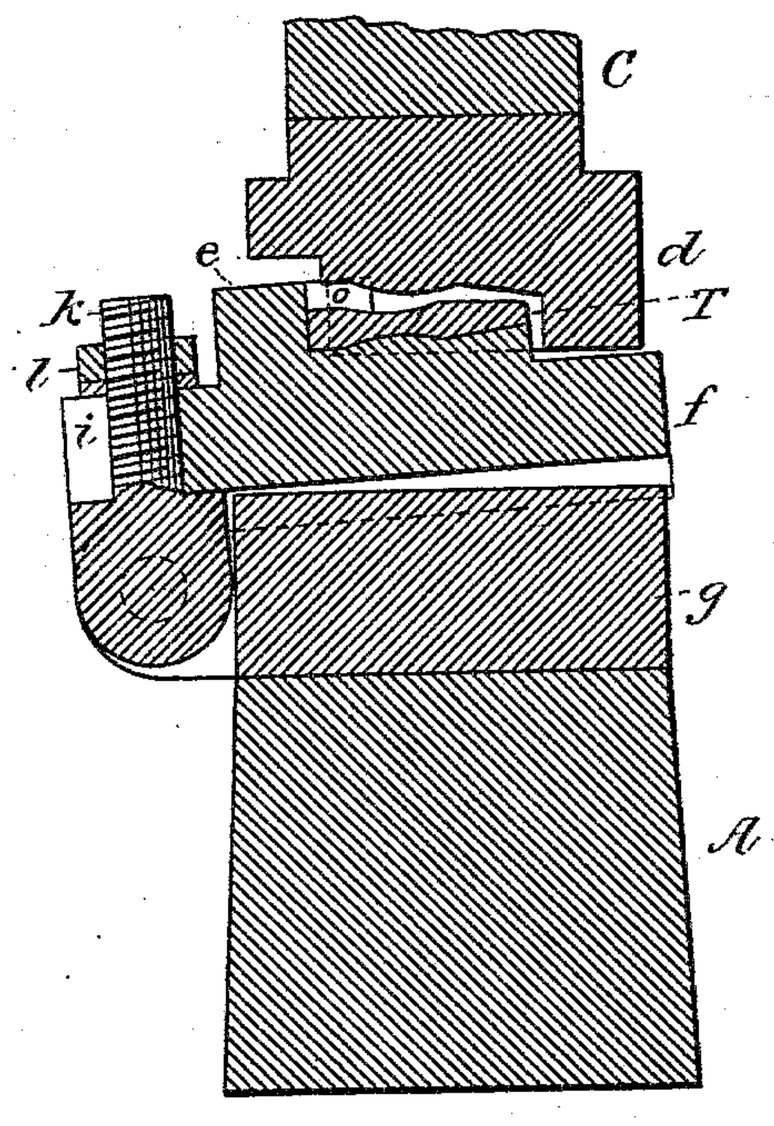

Fig. 4.

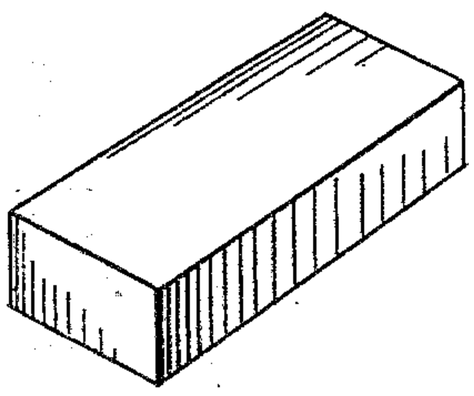

Fig. 5.

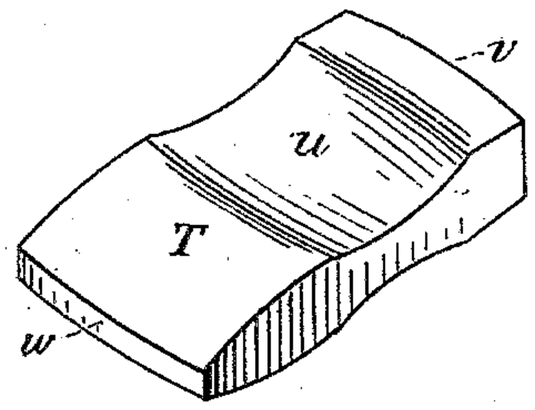

Fig. 6.

WITNESSES

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UNITED STATES PATENT OFFICE.

JOHN W. BOWERS, OF FRANKLIN, ASSIGNOR TO THE DOUGLAS AXE MANUFACTURING COMPANY, OF BOSTON, MASSACHUSETTS.

MACHINE FOR MAKING AX-POLLS AND SIMILAR TOOLS.

SPECIFICATION forming part of Letters Patent No. 296,817, dated April 15, 1884.

Application filed February 23, 1883. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. BOWERS, of Franklin, in the county of Norfolk and Commonwealth of Massachusetts, have invented a new and useful Improvement in Machines for Making Axes, Ax-Polls, and Similar Articles, of which the following is an accurate description.

My invention relates to machines for making axes and similar articles; and it consists in the improved form and construction of the dies used for swaging or pressing axes, ax-polls, pickaxes, &c., and the means for holding and operating the lower or anvil die.

Prior to my invention the manner of making ax-polls has been to heat a strip of metal about double the length of the ax-poll, to pass this between forming-rollers to give it a desired shape before folding, and then to fold it over upon itself by suitable machinery and weld the two ends together. Afterward a wedge or pin was forced between the two laminæ of this folded plate at the part where the eye was to be formed, and the plate, with the pin or mandrel through it, was placed under a drop-hammer, in which was a set of dies formed by cutting the matrix in two equal parts horizontally, thus leaving one half of each of the faces, which formed an edge of the poll, in the upper part, and the other half of each in the lower part, of the die, so that when the two parts of the die approach one another, if the amount of metal in the blank is greater than the capacity of the matrix, the excess will be forced out of the matrix into the space left between the two parts before they can be brought tightly together, which would cause a "fin" to be formed around the ax-poll, at the median lines thereof. Dies with one or more open sides have also been used to form such folded plates into ax-polls, in which case any excess of metal would be forced out at the open sides, and would have to be cut off or hammered into shape before finishing the ax. Ax-polls have also been formed upon the end of a bar of metal by compressing it into shape between jaws containing dies of the proper form, which jaws move downward while the poll is held firmly between them, and thus force a punch partly through the poll from edge to edge in one direction, and then, reversing the poll, repeat the operation, thereby forming the eye. Afterward the ax-poll so formed is cut off from the end of the rod, which is reheated and another poll formed thereon, as before. Making ax-polls in this manner requires a great amount of power and very heavy machinery.

Ax-polls made by either of the above machines require subsequent trimming or hammering before they are subjected to the finishing process, while by my improved dies, hereinafter described, the ax-poll or other article comes out with perfectly-formed edges and angles, ready for the eye to be punched, and the cutting edge to be inserted at the bit end of the poll without any trimming or hammering. I therefore effect not only a great saving of power, but also prevent a large amount of waste of stock in the form of scrap-iron.

The machines in which I find my improved dies are best adapted for use are what are known as the "drop-hammer," although they can be practically employed in a press.

My improved dies are made in two parts, and are constructed so that no portion of any two opposite acting-faces of the matrix is contained in the same part of the die—that is to say, the acting-faces which give shape to one side of the ax-poll, the top of the head, and one other adjacent edge are formed in one part of the die—for instance, the lower or anvil part when used in a drop-hammer—while the acting-faces which give shape to the other side, the "bit" end of the ax-poll, and the other adjacent edge are formed in the upper or hammer part of the die. An offset is made around the two open edges of each of the side-forming faces, and the edge-forming faces in each of the two parts of the die are made to project beyond the side-forming faces a distance at least equal to the greatest thickness of the finished ax-poll, and preferably a greater distance, so that as the two parts of the die approach one another in the swaging operating the edge-forming faces shall shut over and entirely inclose the side-forming faces before they have so far compressed the metal of the blank, or "pattern," as it is called, as to force it against the edge-forming faces. By this construction of dies I am enabled to produce

a matrix which is closed on all sides with accurately-fitting joints where the two parts of the die come together before the heated metal of the pattern from which the ax-poll or other article is to be formed has been forced outward against the edge-forming faces of the die, thus preventing the formation of fins around the edges of the article and producing it with substantially perfect outlines, which cannot be done with dies in use prior to my invention, for the meeting surfaces of the two parts of such prior dies which were intended to form a closed matrix do not come closely together until the maximum pressure has been brought to bear upon the pattern, so that if there is any excess of metal in the pattern above the capacity of the matrix it must of necessity be forced out into the spaces between the two parts of the die as they approach one another, or, in dies having an open side, into such opening, and thus either form a fin around the edges of the poll or extend one edge beyond the desired dimensions.

The variation in the amount of metal which ordinarily occurs in different patterns is immaterial in the use of my improved dies, as there are no openings through which the metal can escape while it is being compressed, and in each instance, therefore, a poll or other article with perfectly-formed outlines will be made, varying, if any, from the others of the same kind only in the slight difference of weight and thickness.

In my improved dies, as well as in prior dies which are intended to form a closed matrix, when sufficient pressure has been applied to them to force the metal of the pattern into every part of the matrix and completely fill it, the ax-poll or other article thus formed fits tightly between the edge-forming faces of the die, so that it is a matter of considerable difficulty to withdraw it therefrom. With my improved dies, however, I overcome all such difficulty by making the lower die-block in two parts, lying one upon the other and hinged together at one end, keeping them in place relatively to each other in the other direction by means of a tongue and groove. The lower or anvil die is formed upon the upper part of this hinged block, with its open side turned away from the hinged end, and is placed thereon in such position that each of the edge-forming faces of that part of the matrix shall make substantially the same angle with a plane passing through the axis of the hinge perpendicularly to the upper surface of the tilting die-block—that is to say, an angle of about forty-five degrees. When the said anvil-die is thus arranged, with the upper or hammer die suitably adjusted in the hammer to operate in connection with it, if the metal of the ax-poll or other article is caused to bind between any two opposite edge-forming faces, the action of the machine in the operation of raising the hammer-die away from the anvil-die will draw up the anvil-die, and with it the hinged block on which it is formed, until the tilting of the block on its hinge causes the edge-forming faces of the anvil-die to recede from the edge-forming faces of the hammer-die, and thus relieve the pressure between the edges of the article and the faces of the die which form them. The hinged die-block will then drop back into place, when the ax-poll or other article can be readily removed and another pattern inserted. If the lower die is arranged on the tilting block so that its edge-forming faces are respectively substantially perpendicular and parallel to the said plane passing through the axis of the hinge perpendicularly to the tilting die-block, then, when the pressure of the upper and lower dies has forced the metal of the ax-poll or other article hard against the several opposite edge-forming faces, causing it to bind therein, any attempt to raise the hammer-die from the anvil-die will be attended with much the same difficulty as was had with dies heretofore in use, for the reason that the edge-forming faces which are perpendicular to the said plane will not be relieved from the pressure of the edges of the ax-poll or other article by the tilting of the lower die-block until sufficient force has been exerted upon the hammer-die to overcome the friction existing between them, which will be liable to twist the ax-poll or other article out of its proper shape within the matrix, and very soon disfigure the faces of the matrix itself.

The best results to be obtained with my improved die are when it is arranged as above mentioned, so that each of the edge-forming faces of the die shall make substantially the same angle with the said plane passing through the axis of the hinge perpendicularly to the tilting die-block, and by as much as the edge-forming faces are made to approximate this position by so much will the advantages of this element of my improvement be measurably obtained. By placing the pivot of the hinge on which the lower die-block tilts below the lower surface of that block, as shown in the drawings, it will readily be seen that the pressure between the edges of the ax-poll and the faces of the die which form them will be more quickly relieved than it would be if the pivot were located higher up, or in line with the upper surface of that block.

A still further advantage of my improved die is the construction of the side-forming faces. Across each of these faces, at the portion corresponding to the location of the eye in the ax-poll, I make a projection approximating in shape and dimensions to that of one-half of a finished eye, so that when the side-forming faces act upon the sides of the ax-poll the metal is displaced by these projections, and a depression is formed across the poll, on either side of it, thereby leaving it thinner at that part than at the portions immediately adjacent thereto. By this means all the superfluous metal is removed from the eye portion of the poll at the same time that the outlines of the poll itself are perfectly formed, while by the use of prior existing machines it

is necessary either to remove this excess of metal from the plate partially before it is operated upon by the dies, and the rest afterward by hammering, or in the use of the compressing-jaws to punch out a piece of metal equal to the size of the eye, or force such amount of metal into adjacent parts of the poll, either of which latter operations requires a great amount of power. After the ax-poll or other article has been operated upon by my improved dies, it is taken to another machine, in which the eye is easily formed by forcing a rod, wedge-shaped at the end, through the poll at the thin portion, which can be readily accomplished by means of a machine which I have made the subject of another patent, and all this can be done at one heat.

My improved dies, being open on two sides when the two parts are not in working contact, can easily, by a slight blast of air, be kept free from all scale and dirt thrown off from the heated metal by the swaging operation; also, by making the edge-forming faces project beyond the side-forming faces a distance greater than the maximum thickness of the poll or other article, several different weights of such articles of the same shape can be made in one set of dies, all of which will readily appear from the drawings annexed to this specification and forming part thereof, showing only dies for forming ax-polls, wherein—

Figure 1 represents a perspective view of my improved dies arranged in a drop-hammer ready for operation, with the open side of the lower or anvil die turned toward the front of the machine. Fig. 2 represents a perspective view of the same when looking at the back of the machine or the hinged end of the tilting die-block. Fig. 3 represents a perspective view of the upper or hammer die turned over into a position the reverse of that which it occupies in Fig. 1. Fig. 4 represents a cross-section of the improved die with the tilting die-block on the line *x x*, indicated in Fig. 1, showing the several parts in the position which they occupy in relation to each other at the instant when the pressure between the edges of the ax-poll and the acting-faces which form them has been relieved by the tilting of the lower die-block on its hinge. Fig. 5 represents the blank or pattern before it is operated upon by the dies. Fig. 6 represents an ax-poll after it has been acted upon by the dies.

Like parts of the machine in the different figures are designated by the same letters.

A is the base-piece or anvil of the drop-hammer machine.

B is the upright standards, between which the drop or hammer is held and guided. (Represented as broken off in the drawings, in order to show the die and die-blocks more fully.)

C is the hammer.

d is the upper or hammer die, keyed to the hammer C.

e is the lower or anvil die, formed upon the upper portion of the die-block *f g*. The upper portion, *f*, of this die-block is connected to the lower portion, *g*, by means of a hinge, *h*. A slot, *i*, is cut in the rear end of the block *f*, Fig. 2, so that it may be adjusted to the proper position backward or forward, in order to bring the anvil-die in proper relation to the hammer-die. The screw-bolt *k* is made a part of the middle knuckle of the hinge *h*, and by means of the nut *l*, screwed onto the end of the bolt *k*, the block *f* can be held firmly in place when it has been properly adjusted. On the under side of the block *f* a groove, *m*, is formed, which fits over a tongue, *n*, on the upper surface of the block *g*. This tongue and groove hold the two blocks *f g* in a fixed position sidewise, but allow them to slide upon one another when adjusting the anvil-die *e* with the hammer-die *d*.

o p are the edge-forming faces of the anvil-die *e*—that is, the faces which respectively form two edges of the ax-poll—namely, the top of the head *v* and one other adjacent edge—and *o′ p′* the two edge-forming faces of the hammer-die *d*, which respectively form the bit end *w* of the poll and the other adjacent edge.

q q′ are respectively the anvil and hammer faces of die—that is, the faces which form the two sides of the ax-poll. *r r′* are the projections upon each of these side-forming faces, which form the depression on either side of the ax-poll, at the eye portion thereof.

s s′ are the offsets on the two open edges of the side-forming faces.

T is the poll after it has been operated upon by the dies.

u is the depression across the eye portion of the poll, (shown in Fig. 6,) formed by the projections *r r′* on the side-forming faces.

v is the head of the poll, and *w* the bit end thereof.

The operation of the machine is as follows: When the two parts of the die *d* and *e* are in the position shown in Fig. 1, the attendant places a heated blank or pattern (like that shown in Fig. 5) in the anvil-die *e*, then releases the hammer, which drops, bringing the hammer-die *d* down upon the anvil-die *e*, which compresses the metal of the pattern vertically, and thereby forces it out laterally against the edge-forming faces of the matrix, and thus makes a poll with perfectly-formed outlines, as shown at Fig. 6. As the hammer-die *d* approaches the anvil-die *e*, their respective lateral or edge-forming faces *o′ p′ o p* each passes by one edge of the side-forming face of the opposite part and moves in close contact with the offset at that edge. For example, the face *o′* moves in contact with offset *s′* of the die *e*, and face *p′* in contact with offset *s* of that die, face *o* in contact with offset *s′* of die *d*, and face *p* in contact with offset *s* of the same die. Thus the matrix formed by the several acting-faces of the die is closed on all sides before the metal of the pattern has been compressed sufficiently to force it out against

the edge-forming faces, and as the lateral or edge-forming faces fit closely against the surfaces of their respective opposite offsets, there is no opportunity for the metal of the pattern to be forced between them, and thereby produce a fin on the ax-poll. When the metal of the pattern has been compressed so as to completely fill the matrix, it will bind between the opposite edge-forming faces *o o' p p'*, so that, except for the means which I have provided for relieving this pressure, it would be a matter of difficulty to withdraw the hammer-die *d* from the anvil-die *e*. However, with my tilting die-block, as soon as the die *d* begins to ascend, it will draw the lower die, *e*, along with it until, by the tilting of the block *f* on the hinge *h*, the edge-forming faces *o p* have receded sufficiently to relieve the pressure existing between the edges of the ax-poll T and the said edge-forming faces, as is illustrated in Fig. 4 of the drawings, at which instant the die block *f* will drop back to its horizontal position again, ready for another operation. By placing a spring between the two parts of the die-block *f g* of sufficient strength to nearly support the upper part, *f*, the operation of tilting it upon its hinge by the pull of the hammer-die in its ascent will be greatly facilitated, although the spring is not necessary to the practical operation of the machine. If the pattern has not been sufficiently heated, it may sometimes be found necessary to strike two blows with the hammer to completely form the ax-poll or other article.

It is obvious that the form of the matrix of the die may be varied so as to make other articles of substantially polyhedral form; but in every instance each of the two parts of the die must contain solid or polyhedral angles made up of adjacent faces of the matrix which are not diametrically opposite to one another; and, also, in order to produce a perfectly-closed matrix, as above described, that portion of each of the faces of the upper and lower dies which passes by and beyond the surfaces of the other faces must be parallel to the line of motion of the hammer.

The ax-poll or other article produced by my improved dies I have made the subject of another application for Letters Patent.

What I claim as my invention is—

1. In a swaging-machine, a hammer-die and an anvil-die, which, when brought together, form a closed matrix, and which are so constructed that each die embraces only such of the acting-faces of the matrix as are substantially opposite to those contained in the other, and that each die has its lateral acting-faces extended in planes parallel to the direction of movement of the hammer-die, so as to shut by and form a close joint with the acting-faces which constitute the hammer and anvil, respectively, whereby the lines of juncture of the dies, when they are in contact, will be located at the intersection of the acting faces of the matrix formed thereby, substantially as described.

2. In a swaging-machine, an anvil-die provided with a hinged or pivoted support, which will permit the anvil-die to tilt upward when the hammer-die begins to ascend after the swaging operation, in the manner and for the purpose specified.

3. In a swaging-machine, a hammer-die and an anvil-die, each of which embraces such of the acting-faces of the matrix as are substantially opposite to those contained in the other, in combination with a hinged support for the anvil-die, all so arranged that the open side of the anvil-die shall be turned away from the hinged end of the said support, and the open side of the hammer-die shall be turned toward the hinged end thereof, substantially as described, for the purpose specified.

4. In a machine for swaging or pressing ax-polls or similar articles of metal of polyhedral form, a pair of partible dies, each of which contains one or more solid or polyhedral angles formed by complete adjacent acting-faces of the matrix, and each of such faces being substantially opposite to one contained in the other die, but no portion of either of them being diametrically opposite to any other face or portion thereof in the same die, substantially as described.

5. In a machine for swaging ax-polls and similar metal blanks, a pair of dies substantially such as are herein described and shown, the same being so constructed that the two dies form a closed matrix when brought together in the act of swaging the blank, that each die contains only complete acting-faces of the matrix, and such as are each substantially opposite to a face in the other die, and that a projection approximating in form and dimensions to one half of the finished eye to be subsequently punched in the blank is situated across one face of each die, at a location coincident with the position of the eye portion of the blank, and diametrically opposite to the like projection upon the similar face of the other die, whereby, during the operation of swaging, the blank is confined upon all sides, the lines of juncture of the two dies are at angles of intersection of the surfaces of the blank, and the metal displaced from the eye portion of the blank is forced into adjacent portions and given the desired shape by other parts of the matrix.

6. In a swaging-machine, a pair of partible dies, each of which contains only such of the acting-faces of the matrix formed thereby as are substantially opposite to those contained in the other, in combination with a hinged support for one of the dies, which will tilt toward the opposite die when the two dies begin to separate after the swaging operation, for the purpose specified.

JOHN W. BOWERS.

Witnesses:
JOHN T. KENNERK,
FRANK O. MELCHER.

Correction in Letters Patent No. 296,817.

It is hereby certified that in Letters Patent No. 296,817, granted April 15, 1884, upon the application of John W. Bowers, of Franklin, Massachusetts, for an improvement in "Machines for Making Ax-Polls and Similar Tools," an error appears in the printed specification requiring correction, as follows, viz: In line 94, page 1, the word "operating" should read *operation;* and that the Letters Patent should be read with this correction therein to make it conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 6th day of May, A. D. 1884.

[SEAL.]

M. L. JOSLYN,
Acting Secretary of the Interior.

Countersigned:

BENJ. BUTTERWORTH,
Commissioner of Patents.