(No Model.) 2 Sheets—Sheet 1.

H. T. RUSSELL.

DIE FOR MAKING THRASHING MACHINE TEETH.

No. 379,730. Patented Mar. 20, 1888.

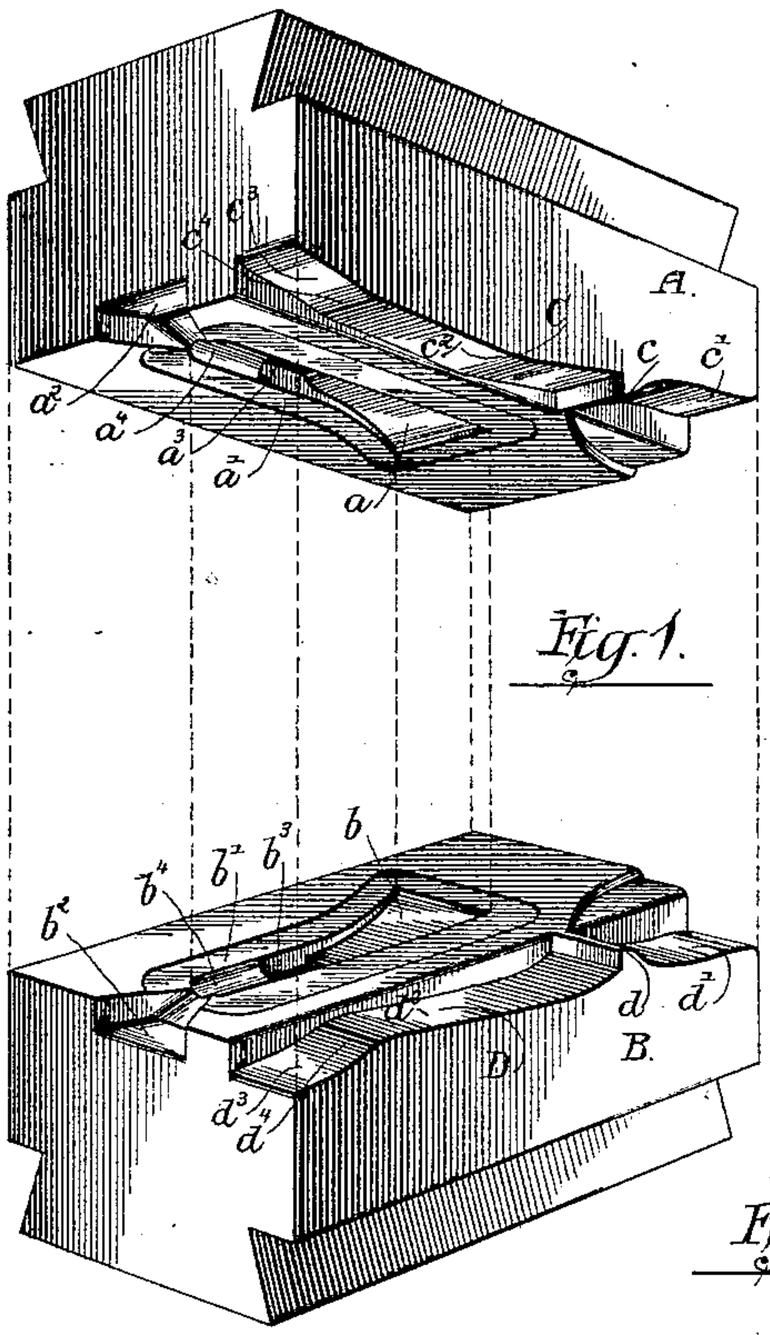


Fig. 1.

Fig. 2.

Fig. 3.

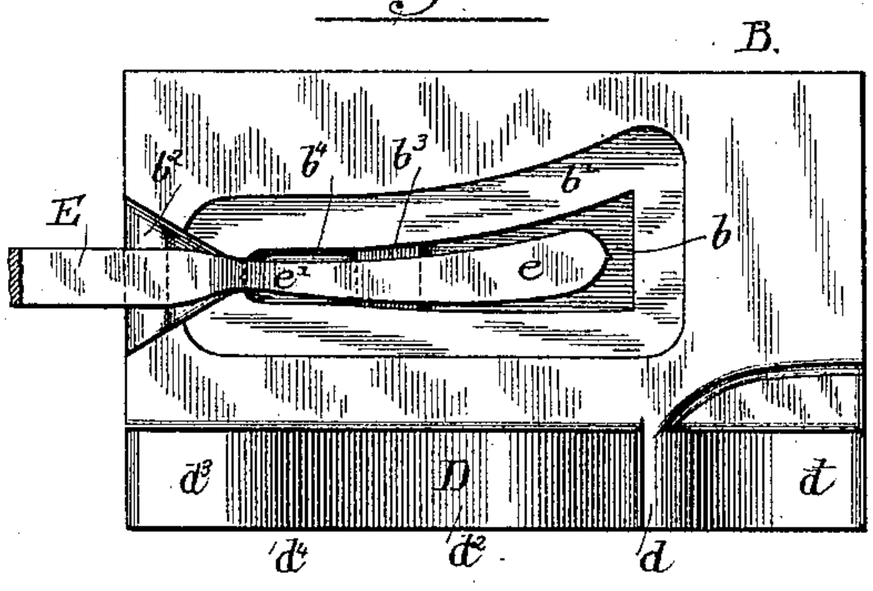
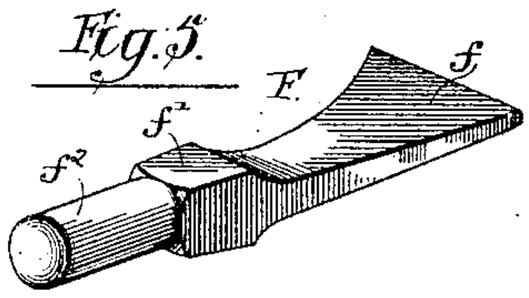


Fig. 5.



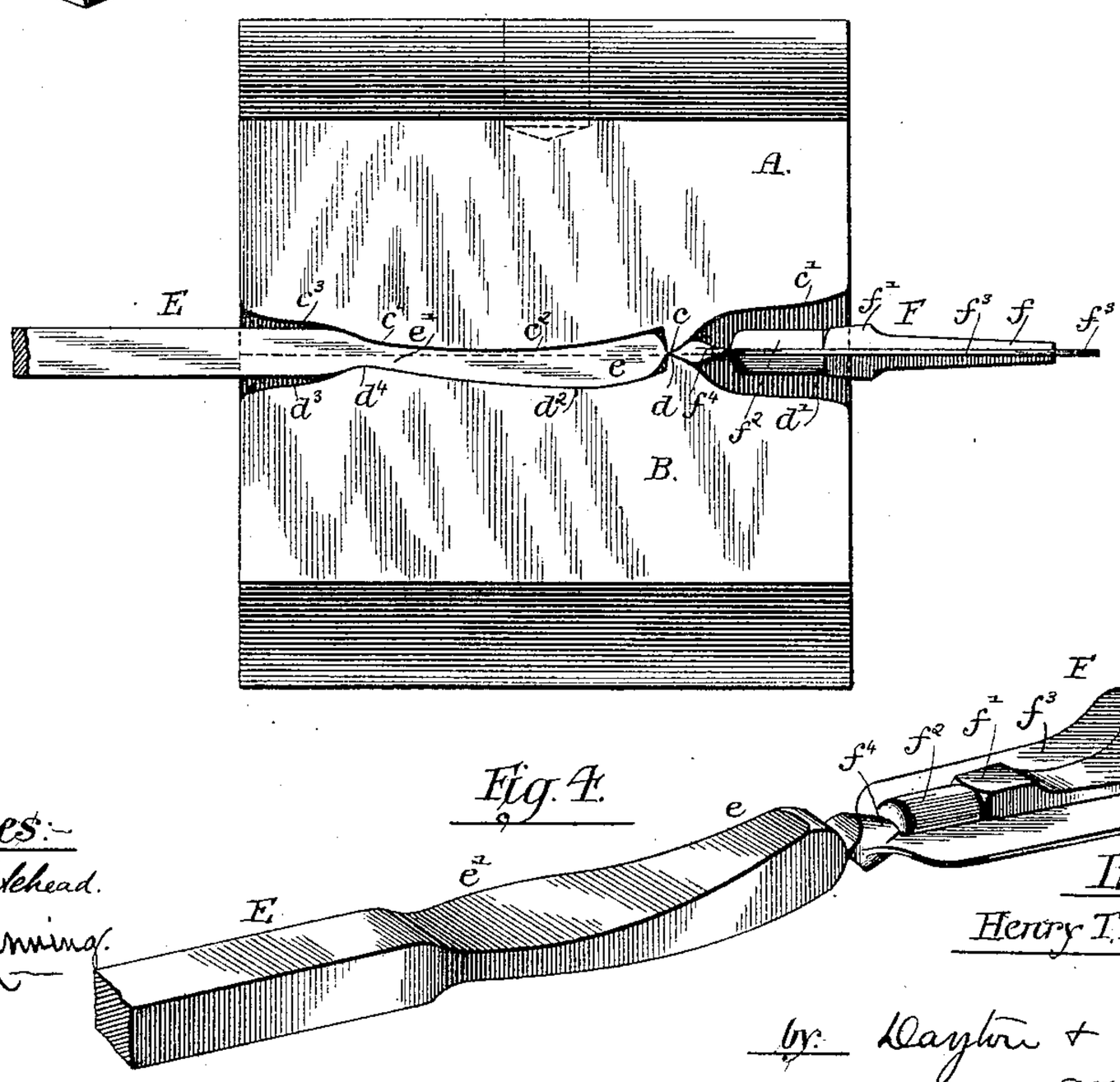


Fig. 4.

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Inventor:—
Henry T. Russell.

by: Dayton & Poole
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(No Model.) 2 Sheets—Sheet 2.

H. T. RUSSELL.

DIE FOR MAKING THRASHING MACHINE TEETH.

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Fig. 6.

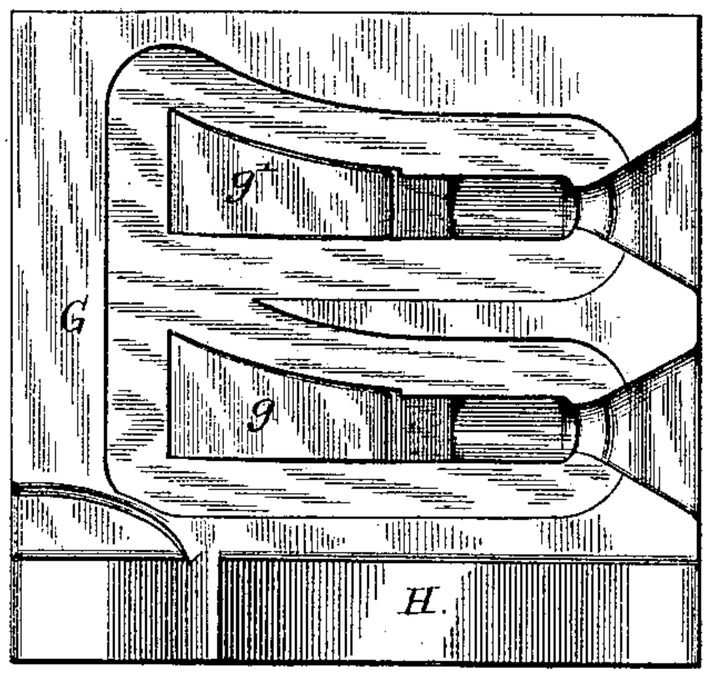


Fig. 8.

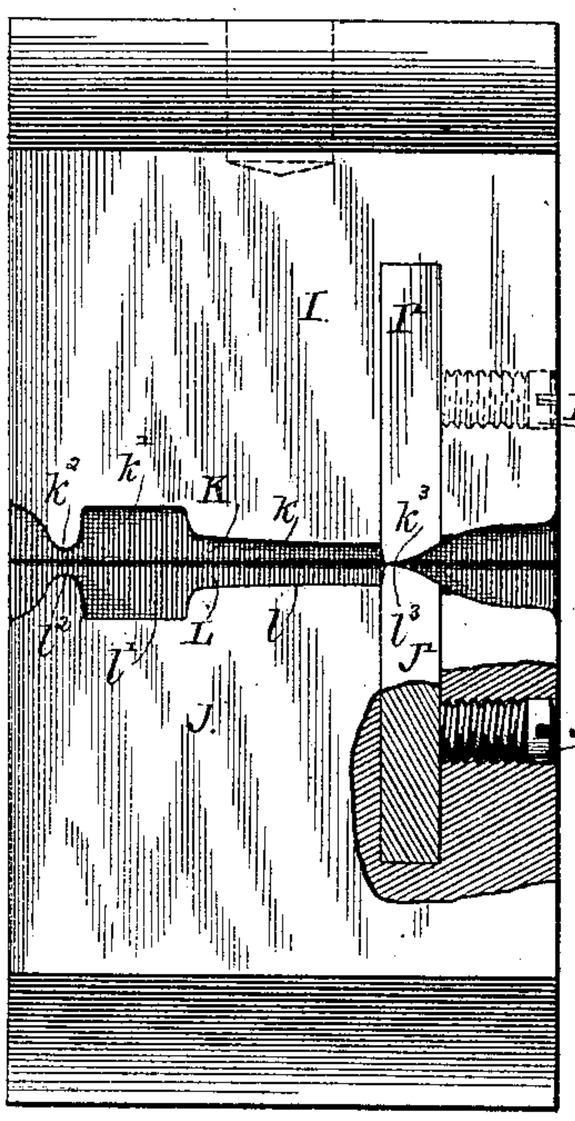


Fig. 7.

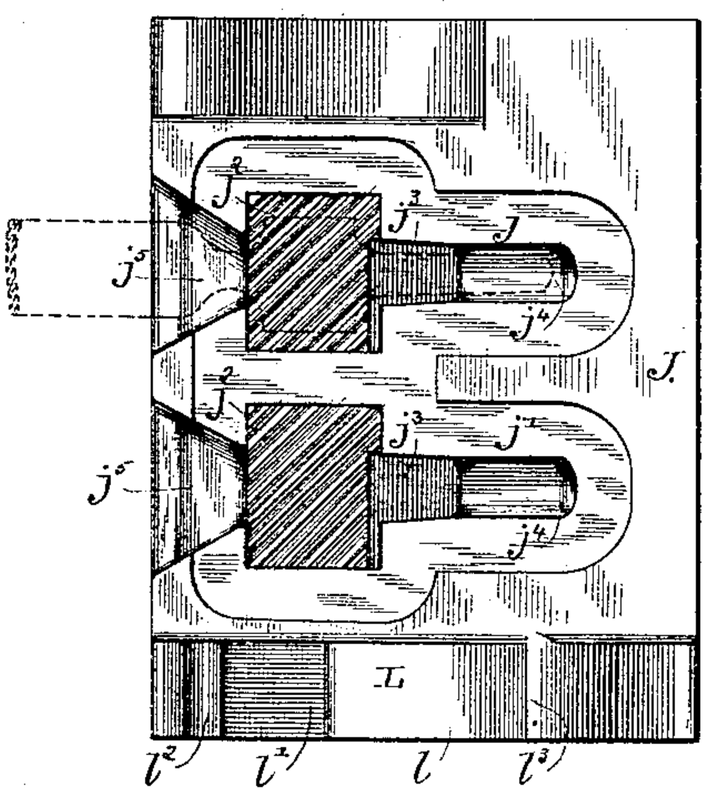


Fig. 10.

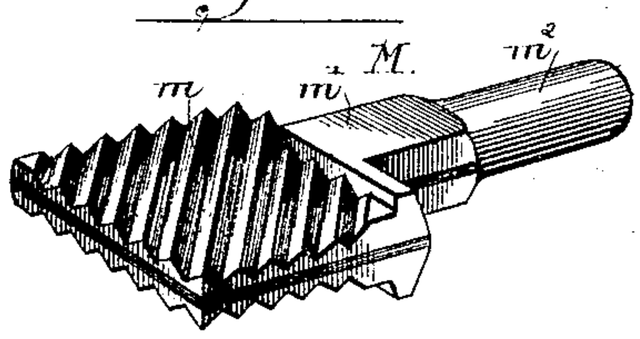
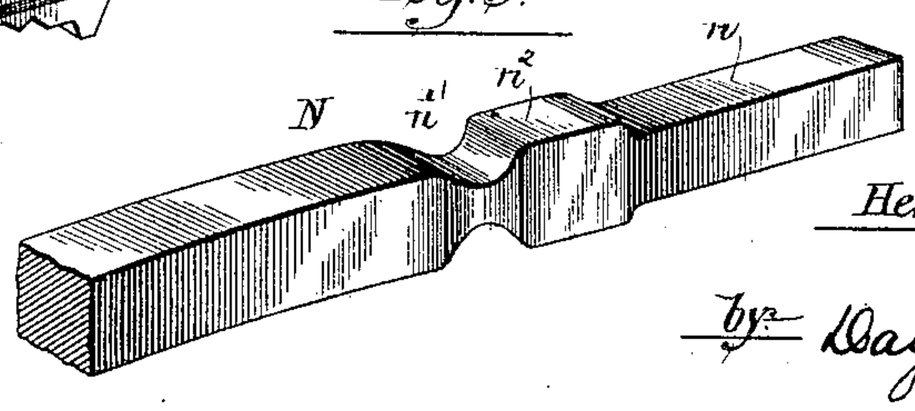


Fig. 9.



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Inventor:-
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by- Dayton & Poole
Attorneys.-

UNITED STATES PATENT OFFICE.

HENRY T. RUSSELL, OF CHICAGO, ILLINOIS.

DIE FOR MAKING THRASHING-MACHINE TEETH.

SPECIFICATION forming part of Letters Patent No. 379,730, dated March 20, 1888.

Application filed March 28, 1887. Serial No. 232,754. (No model.)

To all whom it may concern:

Be it known that I, HENRY T. RUSSELL, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Dies for Drop-Forging; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

The object of this invention is to provide an improved construction in dies used for drop-forging, whereby the manipulation of the metal being operated upon may be facilitated and the article to be formed brought into a finished state with a minimum number of heats and of strokes or blows from the dies, and whereby the wear upon the dies may be decreased and their life thereby prolonged.

The invention consists in the matters hereinafter described, and pointed out in the appended claims.

Some of the improvements herein shown and described are applicable to dies of all kinds, while others are more especially applicable to dies used for forming teeth such as are used upon thrashing-machine cylinders.

In the accompanying drawings, illustrating my invention, Figure 1 shows in perspective the upper and lower die-blocks constituting dies for forming thrashing-machine teeth. Fig. 2 is a side view of the die-blocks shown in Fig. 1 when placed together. Fig. 3 is a plan view of the lower one of the die-blocks shown in Fig. 1. Fig. 4 is a perspective view of a metal bar having an unsevered thrashing-machine tooth upon the end thereof and having its part adjacent to its end bent or curved preliminary to being placed in the forming-recess of the dies. Fig. 5 illustrates a finished tooth made by the die shown in Fig. 1. Fig. 6 is a plan or face view of a die-block similar to that shown in Fig. 1, but containing two forming-recesses. Fig. 7 is a plan or face view of a die-block containing two forming-recesses, the die-block in this case being for the purpose of making teeth having square ends. Fig. 8 is a side view of a die-block shown in Fig. 7, together with the die-block opposed thereto. Fig. 9 is a view of the end of a bar which has been acted on twice by the die-block shown in Figs. 7 and 8.

As illustrated in Figs. 1 to 4, A is the upper and B the lower die-block. Said die-die-blocks are provided with opposing forming recesses or matrices *a b*, of such shape that when the dies are brought together a cavity will be formed having the shape of a thrashing-machine tooth such as is shown in Fig. 5. The recesses *a* and *b* in each block are surrounded with the usual shallow depression, *a' b'*, in which is formed the thin flange or fin produced by the overflow of the metal placed within the cavities of the dies. Recesses a^2 b^2 are arranged to extend from the ends of the cavities *a b* through the front wall of the die-blocks, said recesses being for the purpose of receiving the blank rod from which the article is formed. As far as described, the die-blocks are made in a manner heretofore common and well known.

In the top surface of the block A, adjacent to one side thereof, is a recess or matrix, C, which is opposed to a corresponding recess or matrix, D, in the lower block, B. The recesses C and D extend along the sides of the die-blocks parallel with the longitudinal axes of the recesses *a b*, and terminate at their rear ends in transversely-projecting parts *c d*, the edges of which are approximately in the same plane with the working-faces of the die-blocks and which form opposing cutters, which operate when the dies are brought together to sever the finished articles from the blank rod. The operation of these cutters *c* and *d* is clearly illustrated in Fig. 2.

Outside or at the rear of the transverse cutting-edges or cutters *c* and *d* the metal of the die-block is removed to form recesses *c' d'*, by which an open space is left when the blocks are brought together, in which space the finished part of the bar is located in the operation of cutting, as clearly shown in Fig. 2.

The recess C in its main or central part, c^2, is convexly curved longitudinally, but presents a straight line in cross-section, and the opposing surface d^2 of the recess D is curved longitudinally in concave form, and is similarly straight in cross-sectional shape, as shown in Figs. 1 and 2, so that when the die-blocks

are brought together the rod or bar placed between said surfaces will be bent longitudinally into a curved form. In their parts adjacent to the front faces of the die-blocks the recesses C and D are made deeper by outwardly-flaring parts c^3 d^3 to allow the entrance of the main part or body of the blank rod to a proper position between the working parts or surfaces c^2 d^2 of said recesses C D. The parts c^4 d^4 of said recesses C and D between the outwardly-flaring parts c^3 d^3 and the main parts c^2 d^2 are brought nearer together than the said inner parts of the said surfaces c^2 d^2, so that the blank rod placed between and acted on by the several surfaces referred to is flattened out laterally and thereby made thinner in its part nearest the body of the blank rod, this being the part of the blank rod which enters the deepest part of the finishing recesses or matrices, while the end portion of the rod, or that part thereof acted on by the middle parts of the said recesses C D, is bent or curved from a straight line, as clearly shown in Fig. 2 and in Fig. 4, which latter view shows a blank rod, E, after its end has been acted upon by the dies, and with a tooth still in the position originally occupied by it, but severed therefrom by the action of the cutters *c d*.

As more clearly shown in Figs. 3 and 5, the tooth formed by the recesses *a b*, shaped as shown, is straight upon one side and curved upon the other side, so that its end remote from its shank is much wider or broader than its other parts. The object of bending the end of the blank rod into the shape before described, and shown in Figs. 2 and 4, is to so dispose the metal at the end of the rod that when it is placed between the recesses *a b* it will occupy the middle part of said recesses and will thereby be distributed evenly toward the margins of the recesses as the dies are brought together with the metal between them. The bar, having its end bent in the manner before described, is placed upon the lower die in the position shown in Fig. 3, from which it is obvious that the curved end portion of the rod E occupies a position in the middle of the wide part of the recess *b*, while the narrow or flattened part of the said rod occupies the position over the parts a^3 a^4 b^3 b^4, by which the square shoulder and round shank of the tooth is formed.

The blank rod E illustrated is approximately square in cross-sectional form. After said rod has been subjected to the action of the opposing recesses C and D, it is flattened and curved in such manner as to have a curved end portion, *e*, retaining approximately the same thickness as the original bar, and a narrow or thin part, *e'*, which is considerably compressed by the action of the opposing surface c^4 d^4, above described. When the end of the blank rod thus shaped is placed upon the lower or stationary die block, B, it is inserted in the recess *b* thereof, with its narrow or flattened part *e'* vertical. In this position the curved end part, *e*, obviously occupies the inner portion of the recess *b*, while the thin or narrow part C' comes opposite the narrower and deeper portions, b^3 b^4, which, together with corresponding parts, a^3 a^4, upon the upper die, A, form the square shoulder and shank of the tooth.

F, Fig. 5, indicates the tooth made by the dies above described, said tooth being provided with a widened or extended inner end, *f*, a square shoulder, *f'*, and a round shank, f^2, by means of which the tooth is held in place upon the cylinder or "concave" of the thrashing-machine. The narrow or thin part *e'* of the blank rod is preferably made of less thickness than the width of the deeper parts a^3 a^4 b^3 b^4 of the die-recesses, so that this part of the blank rod, as well as the end portion *e* thereof, will be spread laterally to completely fill the die-recesses as the die-blocks are brought together. The operation of the dies constructed as above described in making a tooth is as follows: The blank rod is properly heated in an adjacent forge, and its end then placed upon the surfaces D of the lower die-block, with its end in contact with the cutting edge *d*. When the upper die-block descends, the end of the bar will be somewhat flattened and bent into the shape shown in Figs. 2 and 4, as above described. The bar is then turned quarter-way around, and its bent and flattened end is then placed in the recess *b* in the position above described, and shown in full lines in Fig. 3. A second blow of the upper die-block then gives final shape to the end of the rod, the surplus metal passing outwardly from the recesses *a* and *b* into the depressions *a' b'* in the form of a fin, f^3, as shown in Fig. 4, and as common in drop-forgings. When a tooth has been formed upon the rod in the manner described, the tooth will remain connected therewith by means of the narrow neck f^4, formed at the inner parts of the recesses a^2 b^2. The rod, with the finished tooth thereon, is then placed again upon the surface D, with the neck f^4 over or adjacent to the cutter *d*, when a succeeding descent of the upper die-block will sever the finished tooth from the end of the bar in the manner clearly shown in Figs. 2 and 4, and at the same time shape the end of the bar in readiness for insertion in the forming-recesses in the manner before described.

The operations above described will be repeated until the bar becomes too cool for suitably working it, when the bar will be again heated and the same series of operations will take place as before.

A form of die-block which, for some reasons, is preferable to that illustrated in Figs. 1, 2, and 3, and above described, is shown in Fig. 6. In this instance a die-block, G, which may represent either the upper or lower of the two die-blocks adapted for use in a single machine, is provided with two forming-recesses, *g g'*, together with a recess, H, for shaping the end of the blank rod preliminary to its insertion in the forming-recesses. The said forming-recesses are alike in shape; but two of them are used

in the same block, so that one of said recesses, as *g*, may receive the extreme pressure necessary for bringing the bar to the general shape of the finished article, while the other recess, *g'*, is employed solely for finishing, and therefore has comparatively little work to do, and is likely to retain its original form for a long time, and thereby give an accurate finish to a great number of articles forged by the same dies. In the use of die-blocks made as last described the heated bar will be first subjected to the action of the recess H and the opposing recesses upon the upper block, whereby it will be given the shape indicated in Fig. 4. It will then be placed in the recess *g*, by which, together with the opposing recess in the upper block, it will be brought to its final shape. When placed in the recess *g'* and given a final blow, a very slight displacement of the metal only need be accomplished by the said recesses to give very accurate form to the forging. The use of a block with two recesses, as *g g'*, obviously requires a greater number of blows to produce the finished article; but it affords the important advantage that a very much greater number of forgings may be made from the same die-blocks than is possible when each die-block contains only a single forming-recess. The great advantage obtained by the use of two forming-recesses in the die-blocks may be more fully appreciated from the fact that while dies with single recesses cannot usually be relied upon to make more than ten thousand articles, the life of dies made with two forming-recesses is sufficient to enable seventy-five thousand articles to be shaped therein.

In Figs. 7 and 8 are shown two die-blocks, I and J, which are employed for forming a tooth for thrashing-machine cylinders of the particular shape illustrated in Fig. 10. In this instance the die-blocks are provided with opposing recesses K L for giving shape to the end of the blank rod before the latter is placed in the forming-recesses, of which two are used, as indicated by *j j'*, Fig. 7.

M, Fig. 10, indicates a finished tooth made by these dies, said tooth being provided with a broad flat serrated or corrugated end portion, *m*, a square shoulder, *m'*, and a cylindric shank, m^2. The forming-recesses *j j'* are provided with wide and shallow parts j^2 j^2, serrated or corrugated, as shown, an intermediate square portion, j^3, and a semi-cylindric portion, j^4, at its inner end. The flat and shallow parts j^2 j^2 of the recesses in this case are arranged adjacent to the front surface of the die-block and are connected therewith by passages j^5. The recesses K and L, for preliminarily shaping the blank rod in this instance, consist of parallel opposing surfaces *k l*, adapted to flatten out the end portion of a square blank rod placed between them, and deep portions *k' l'*, which are of such depth as to leave the rod approximately in its original shape. Projecting transverse parts k^2 l^2 come close together at a point near the front surface of the die-blocks, so as to form a narrow neck upon the blank rod to enter the passages j^5 j^5 when the end of the bar is placed in the forming-recesses. The die blocks I and J are provided with transverse cutters k^3 l^3, arranged in the same manner as before described. When the end of a square blank rod, as N, Fig. 9, is placed within the recess L and the upper die-block descends thereon, the extreme end portion of the rod is flattened horizontally, while its portion coming opposite its recess *k' l'* is left in its original shape. The blank rod in this case is acted upon twice by the dies before being placed in the forming-recess. The first stroke of the dies flattens the bar at the two points at which it is acted upon by the surfaces *k* and *l* and k^2 and l^2. The bar is then turned quarter-way around and the flattened parts are then acted upon edgewise, so as to bring the parts into the shape shown in Fig. 9. The rod is then provided with a square end, *n*, a narrow neck, *n'*, and an intermediate part, n^2, of the full size of the original bar. The bar thus shaped is placed over the forming-recess *j'*, with its rectangular part n^2 centrally upon the shallow part j^2 of the forming-recess, the square part *n* in the deep parts j^3 j^4 of said recess, and the neck *n'* opposite the recess j^5, as clearly shown in dotted lines in Fig. 7. The disposition of the parts of the blank rod in the manner set forth obviously causes a uniform distribution of metal in the forming-recesses when the die-blocks are brought together in the same manner as before described in connection with the dies shown in Figs. 1, 2, and 3.

I have herein shown the rigid or serrated surfaces of the shallow part j^2 of the forming-recesses *j* as made rounded or with blunt edges and the corresponding part of the second or finishing recess, *j'*, as made with sharp or accurate angles and shaped to give final form to the tooth, as indicated in Fig. 10. Inasmuch as less pressure or force is required to bring the metal into the rounded curves or depressions of the recess *j* than of the acute ridges of the recess *j'*, the work of giving final form to this part of the tooth will be divided between the two forming-recesses. By this construction not only will the die-blocks last longer by reason of the division of work between the two forming-recesses, but the recess by which the greater part of the work is done will be less liable to injury by reason of the absence therefrom of the sharp angles present in the finishing-recess.

In dies provided with cutting-edges, as *c* and *d* or k^3 l^3, these edges, if made integral with other parts of the die, are liable to become blunted and wear out, while other parts of the dies are still fit for service. To avoid this undesirable result, I prefer to make said cutting-edges upon separate removable blocks or bars inserted in the die-blocks. A construction of this kind is shown in Fig. 8, in which I' J' indicate two bars having the cutting-edges k^3 l^3 formed thereon, said bars being fitted to suitable recesses in the die-blocks and secured therein by set-screws I^2 J^2. When this con-

struction is used, the bars I′ J′ may be removed when their cutting-edges become worn out and new ones substituted, with obvious economic advantages.

One main feature of novelty in my invention is embraced in a construction wherein die-blocks are provided each with a forming-recess matrix made shallow in its part corresponding with the deeper parts of a finishing-matrix, and thereby adapted to spread or flatten a blank rod or bar into shape most advantageous for filling the finishing-matrices of the same or other die-blocks when said die-blocks are brought together, and this construction is herein broadly claimed without restriction to its use in connection with any of the other features of construction herein illustrated.

Another important part of my invention consists in the novel construction of the die-blocks, whereby each block is provided with two forming recesses or matrices of approximately the shape of the finished article, so that the forging may be finished by the use of other finishing-matrices. The construction herein shown whereby the die-blocks are provided with transverse cutting-edges or cutters at one side of the forming-recesses is also herein claimed as new, as is also the construction in which such cutting-edges or cutters are located at one end of the matrices for flattening the bar, whereby the finished forging upon the end of the blank rod may be severed from the latter at the same time that the adjacent end portion of the rod is bent or flattened by the said matrices.

Die-blocks for forming a bent or curved thrashing-machine tooth, as are shown in Fig. 5, and which are provided with opposing convex and concave matrices giving a curved form to the end of the blank rod or bar preparatory to its insertion into the finishing-matrices, are also new and are herein claimed as part of my invention.

I claim as my invention—

1. The die-blocks for drop-forging, provided with a set of matrices for preliminarily flattening the blank rod or bar and with a set of matrices for shaping and finishing the article, the preliminary matrices being shallowest at the point d^4, corresponding to the thickened or rounded part of the article, and the finishing-matrices being deepest at their part b^3, corresponding with the shallowest part of the preliminary matrices, whereby when the flattened blank is set endwise between the finishing-matrices its widest portion will be in position to fill the deepest part thereof, substantially as described.

2. The die-blocks for making thrashing-machine teeth of that kind which comprise a rounded shank and a tooth having a broad and flat end portion, said die-blocks being provided with finishing-matrices and with matrices which are deepest in their parts corresponding with the shallowest parts of the finishing-matrices, or that part by which the flat part of the tooth is formed, and shallowest in their portions corresponding with the deeper parts of the finishing-matrices, or those by which the shank of the tooth is given shape, substantially as described.

3. The die-blocks for forging thrashing-machine teeth of that kind having cylindric shanks and broad flat ends curved laterally from the axial line of the shanks at one side of the teeth, said dies being provided with finishing-matrices for giving shape to the teeth and with matrices having opposing convex and concave surfaces operating to bend the end of the blank to a curved form, the matrices being shallowest in their parts which correspond with the deeper portions of the finishing-matrices wherein the shank of the tooth is formed, substantially as described.

4. The die-blocks provided with finishing-matrices and with matrices for bending or flattening the blank rod or bar, and opposing cutters located at the ends of the matrices for bending or flattening the blank rod, said cutters being formed by separate bars fitted and secured within recesses formed in the side faces of the die-blocks, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

HENRY T. RUSSELL.

Witnesses:
CHARLES O. BERRY,
CHARLES T. LORING.