(No Model.) W. & G. H. SELLERS. 4 Sheets—Sheet 1.

ART OF UPSETTING AND SHAPING METAL BARS.

No. 291,098. Patented Jan. 1, 1884.

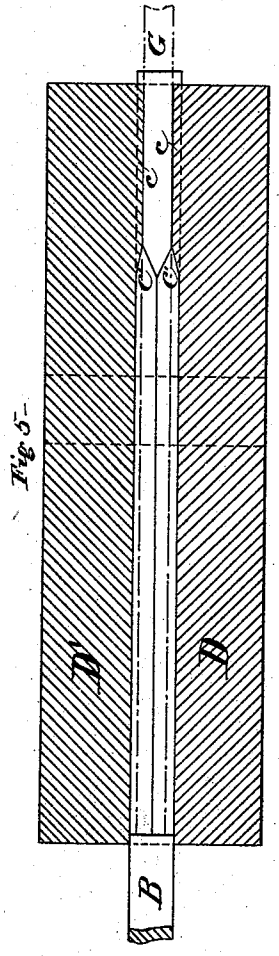


Fig. 5.

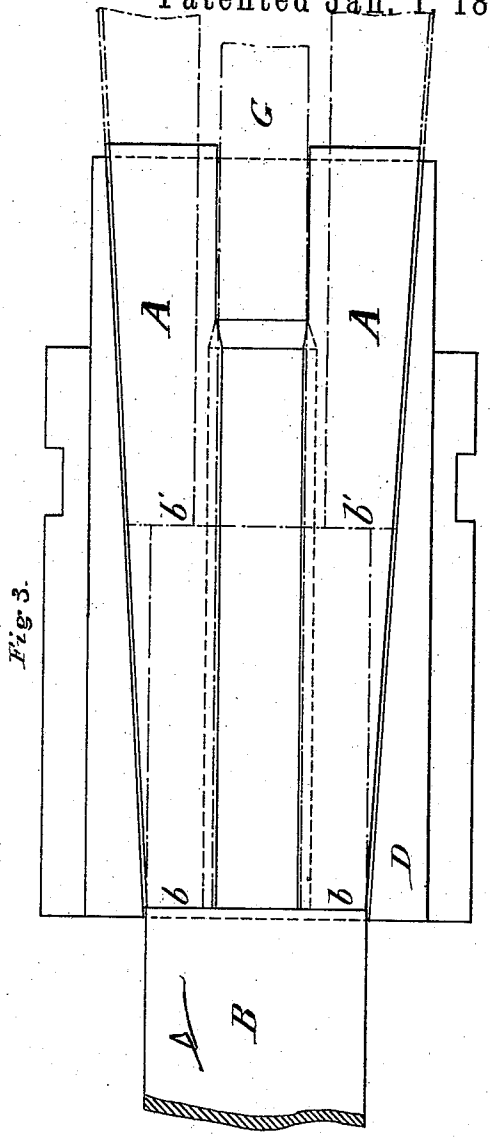


Fig. 3.

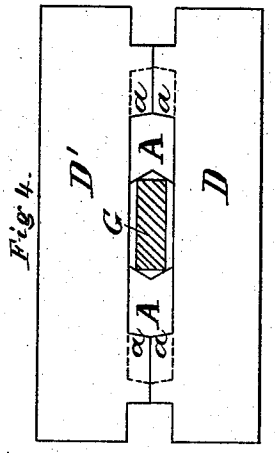


Fig. 4.



Fig. 1.

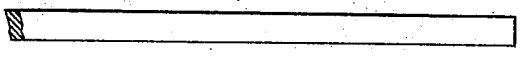


Fig. 2.

Witnesses.

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(No Model.) W. & G. H. SELLERS. 4 Sheets—Sheet 2.

ART OF UPSETTING AND SHAPING METAL BARS.

No. 291,098. Patented Jan. 1, 1884.

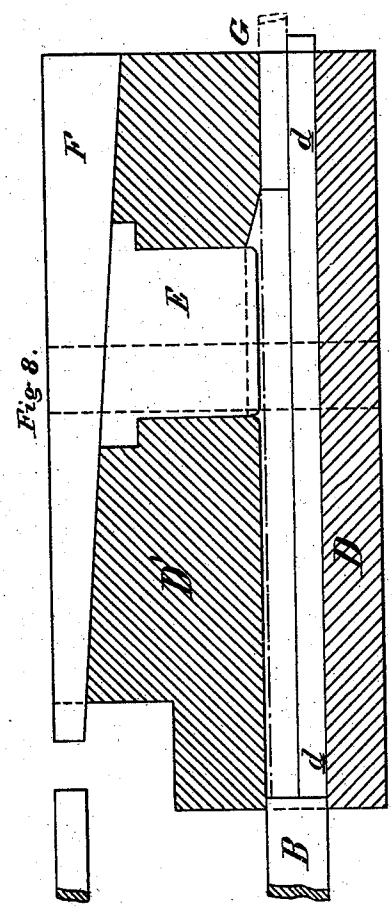


Fig 8.

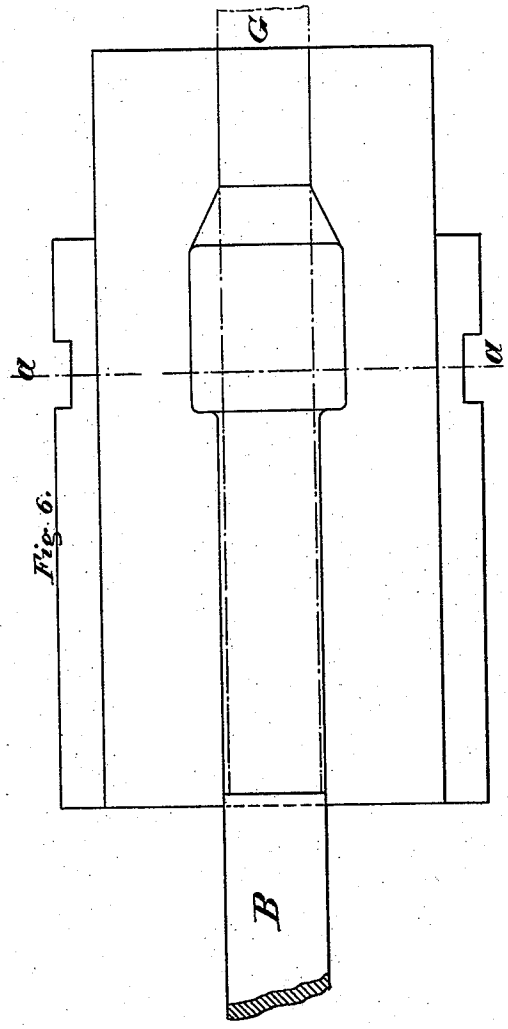


Fig. 6.

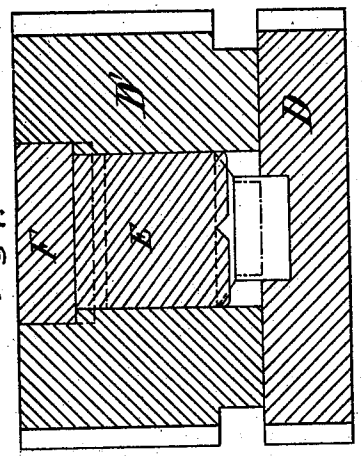


Fig 7.

Witnesses.

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(No Model.)

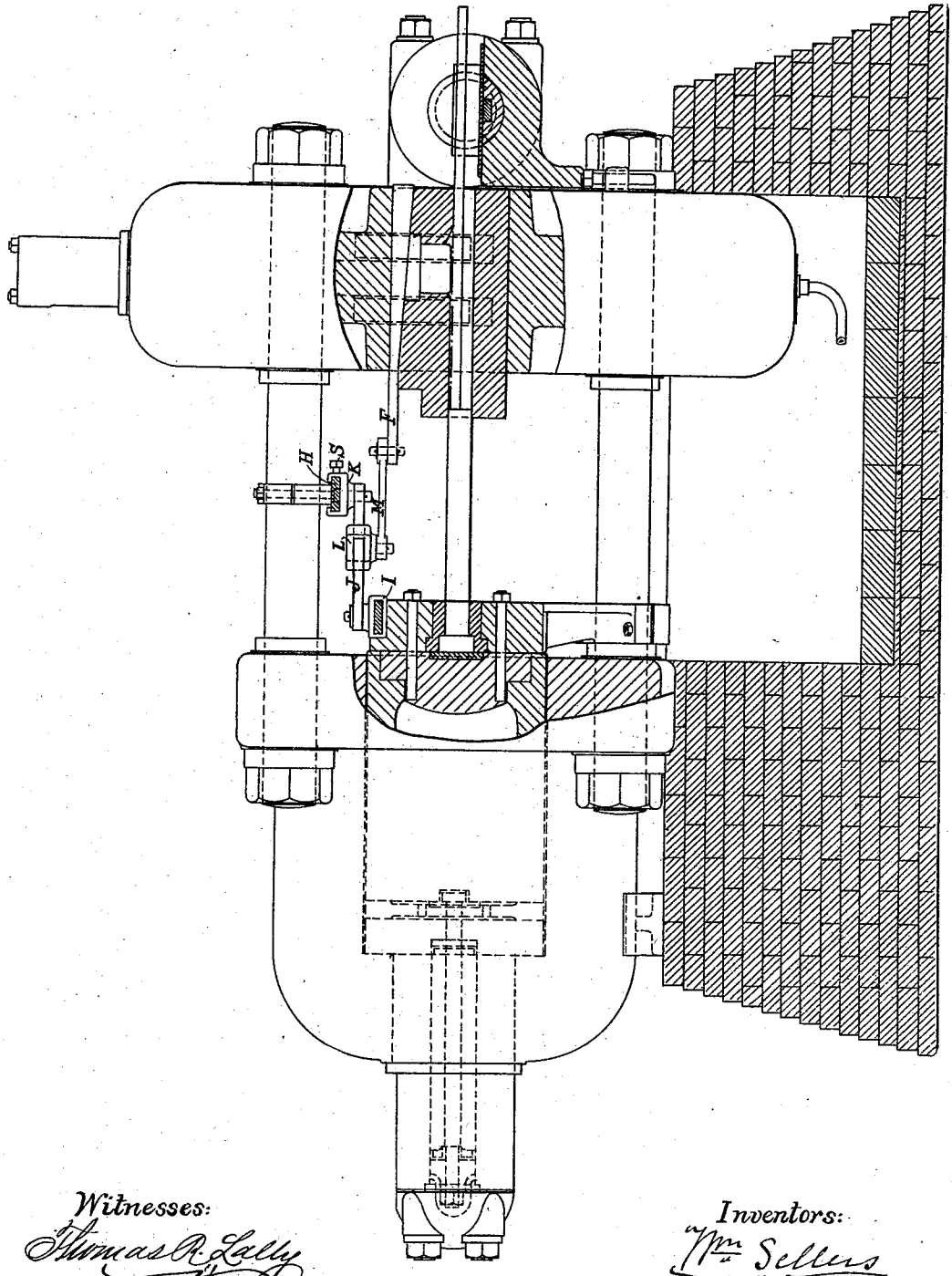
4 Sheets—Sheet 3.

W. & G. H. SELLERS.

ART OF UPSETTING AND SHAPING METAL BARS.

No. 291,098. Patented Jan. 1, 1884.

Fig. 9.



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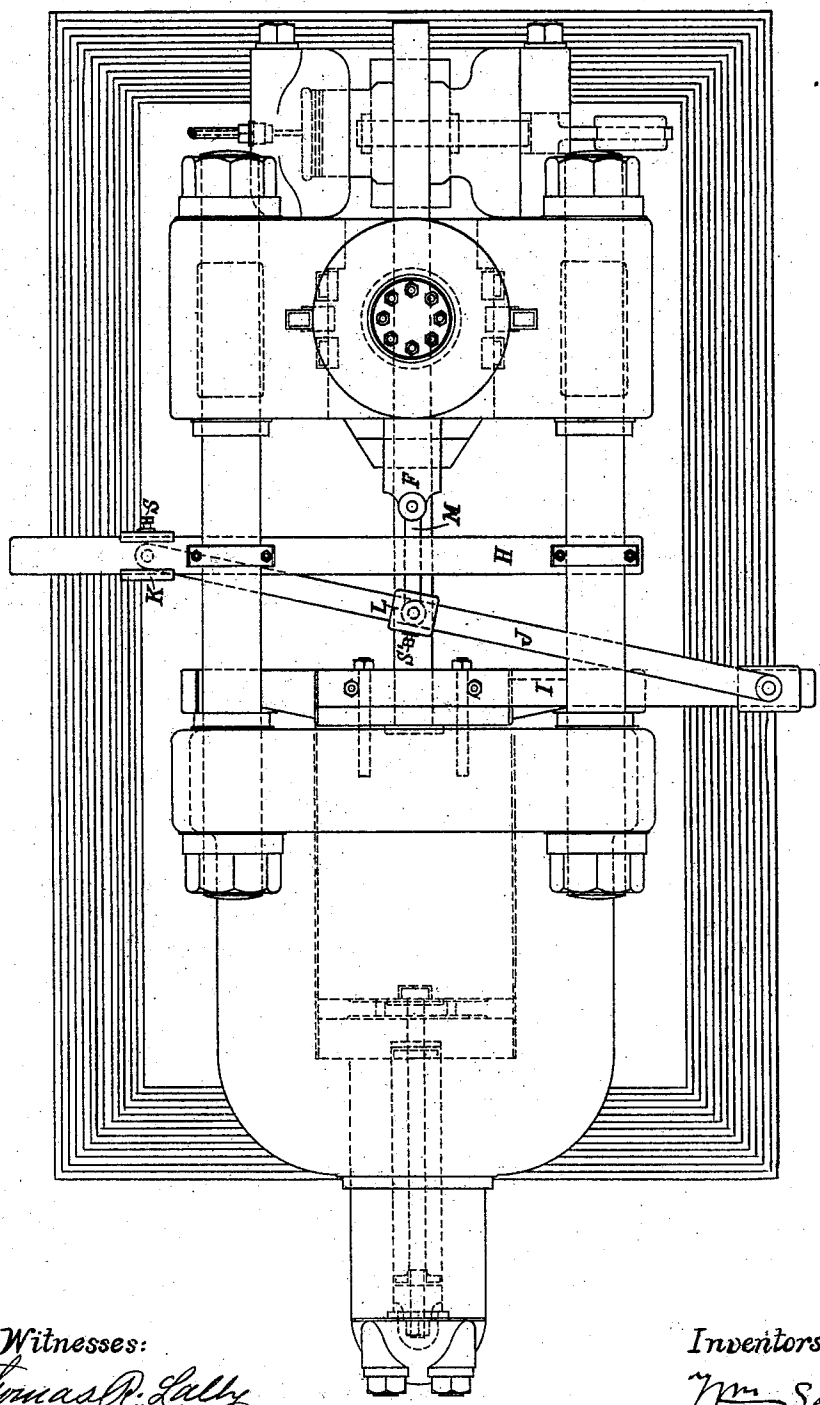
(No Model.) 4 Sheets—Sheet 4.

W. & G. H. SELLERS.

ART OF UPSETTING AND SHAPING METAL BARS.

No. 291,098. Patented Jan. 1, 1884.

Fig. 10.



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UNITED STATES PATENT OFFICE.

WILLIAM SELLERS, OF PHILADELPHIA, AND GEORGE H. SELLERS, OF RIDLEY PARK, PENNSYLVANIA, SAID GEO. H. SELLERS ASSIGNOR TO JOHN SELLERS, JR., OF PHILADELPHIA, PENNSYLVANIA.

ART OF UPSETTING AND SHAPING METAL BARS.

SPECIFICATION forming part of Letters Patent No. 291,098, dated January 1, 1884.

Application filed April 26, 1883. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM SELLERS, of the city and county of Philadelphia, in the State of Pennsylvania, and GEO. H. SELLERS, of Ridley Park, in the county of Delaware and State of Pennsylvania, have jointly invented a new and useful Improvement in the Art of Upsetting and Shaping Metal Bars without piling and without folding, of which improvement the following is a specification.

In a patent for improvement in upsetting and shaping metal issued to us under the date of April 24, 1883, No. 276,291, we have shown and described certain means and methods invented by us for accomplishing this object—to wit., upsetting metal bars without piling and without folding—and discriminated that invention from the then state of the art, pointing out, as an essential feature of those methods as therein developed, that, when the upsetting involved thickening as well as spreading, the thickening and spreading operations must be successive, instead of simultaneous, and this because the supports necessary to prevent bending were fixed, and expansion could only take place in some other direction. In practicing that improvement to the best advantage with existing facilities, it is easier to restore the heat after each operation than to maintain the temperature, or to perform the successive operations so rapidly as to complete the process at one heat, and such restoration involves a loss of time as well as a loss of heat. On the other hand, to perform these upsetting operations simultaneously it would be necessary not only to support the bar, as before, but to make this support yielding, so as to permit expansions of the metal in whatever directions might be required, and the solution of this problem was the basis of our present invention.

The object of our present improvement is, accordingly, to thicken and spread round, square, or flat bars of metal, whether of iron or of steel, at one upsetting operation, and to effect this simultaneous thickening and spreading to any desired extent without bending the bar so as to form sinuous folds, and without any piling and welding.

It is a further object of our improvement to provide dies in which these simultaneous operations can be effected; and to meet the requirements of this simultaneous operation, it is a further object of our improvement to increase the stiffness of the upsetting-plunger through which the pressure is transmitted to the bar to be upset; and to these ends our improvement consists in sustaining so much of the bar as is to be upset by means of supports, one or more of which, without ceasing to act as such, will recede (in whatever direction may be required) with a movement proportioned to the designed increase of thickness and width, and then thicken and spread the bar simultaneously by upsetting it while thus supported; and it further consists in combining with an upsetting-die supports, one or more of which, without ceasing to act as such, will recede with a movement proportioned to the designed increase of thickness and width in the upset; and it further consists in combining with an upsetting-die a guiding relieving-plunger, which, with the die, will support the upset throughout its length from the commencement to the end of the upsetting operation; and it further consists in combining with the upsetting-die and the guiding relieving-plunger devices for changing the movement of this plunger relatively to that of the upsetting-ram; and as in all upsetting arrangements heretofore conducted with an upsetting plunger and dies the plunger has had the same, or, in some cases, even a less, cross-section than the upset, so that when this latter is long the plunger is too weak to sustain with safety the pressure to which it is subjected, and is liable to bend under it, and such bend must be straightened before the operation can be finished, which involves a great loss of time, as well as the heat in the bar operated upon.

Our improvement further consists in combining with the upsetting-die a movable piece, which shall be in contact with the bar to be upset and abut against the upsetting-plunger, thus enabling us to increase the thickness of the plunger to any desired extent, as hereinafter more fully set forth.

In the accompanying drawings, which make

part of this specification, Figure 1 is a cross-section of a rectangular bar, and Fig. 2 is a side view of same. Fig. 3 is a plan of one-half of the upsetting-die with receding side supports for such a bar. Fig. 4 is an end view of the two halves of this die, showing in section the bar in position for upsetting. Fig. 5 is a longitudinal vertical section of this die, showing the position of the bar in the die (previous to its being upset) and one end of the upsetting-plunger. Fig. 6 is a plan of an upsetting-die combined with a guiding relieving-plunger. Fig. 7 is a cross-section of Fig. 6 at the line *a a*, and Fig. 8 is a longitudinal vertical section of the same. Fig. 9 is a side elevation of the machine in which the dies shown in the drawings are constructed to operate, and Fig. 10 is a plan of the same.

The mechanism best adapted to the application of our improvement is shown and described in Patent No. 178,966, dated June 20, 1876, granted to Geo. H. Sellers for improvement in machines for welding, upsetting, and shaping iron, and in Patent No. 178,967, dated June 20, 1876, granted to William Sellers for improvement in hydraulic apparatus for holding bars of iron against the pressure required to upset them, and the dies we show in the drawings herein referred to are constructed so as to be operated in such a machine, which is also illustrated in the accompanying drawings by Figs. 9 and 10.

Within the top and bottom dies, D and D′, and at each side of the bar which is to be upset, we provide taper side supports, A A, Figs. 3 and 4, having their inner sides grooved in V shape to guide the bar G, Fig. 4. These side supports, before the insertion of the bar G, are pushed forward in the dies D and D′ until their narrow ends *b b* are in contact with the end of the upsetting-plunger B, Figs. 3 and 5, in which position the bar G, Fig. 4, will pass freely between the side supports, the sides of which, next the bar, will be parallel. The upper and the lower sides of these side supports, A A, are also parallel, and fitted to slide freely between the two halves D and D′ of the die when closed, as shown in Fig. 4; but the back of each side support is inclined to the face or V side, which guides the bar G, and they are fitted to a corresponding inclined surface in the die, the back edges of the side supports being slightly beveled, *a a a a*, Fig. 4, to facilitate their removal when the die is opened. The inclined surfaces of these side supports are such as to limit the upset to the width desired in the traverse required to compress the metal to the length required, while the thickness is limited by the dies themselves. The upsetting-plunger B has the same thickness as the side supports—that is, as the required thickness of the upset—and the face of the upsetting-plunger is broad enough to extend across the entire width of the narrow ends of the side supports, A A, when they are all the way in the die, as shown at *b b*, Fig. 3. As the plunger B advances in the die it will shove the side supports, A A, before it until it will at the end of its stroke occupy the position in relation to the side supports as shown by the dotted lines *b′ b′*, Fig. 3. The bar G while being upset will spread sidewise, and thus hold the side supports up to the inclined surfaces in the die, and the widening of the bar sidewise under compression will be in proportion to the incline, so that, the length and width of the finished upset being determined in advance, the length of bar required to produce this upset can be readily calculated. This will determine the traverse of the upsetting-plunger B and of the taper side supports, A. The taper of these side supports must, then, be such as will give the requisite width in the traverse required. To support the bar centrally in the die, we provide supports *c c* at the back end of the dies, Fig. 5, and these supports are beveled at *c′*, to make a beveled termination to the upset where it merges into the bar. The clamps or grips which hold the bar against the upsetting-pressure in this case are so arranged as to grip the bar on its upper and lower surfaces, so as to permit the side supports to pass out of the dies without obstruction. As thus arranged the upset is supported throughout the operation, so that bending cannot occur, and the sinuous foldings (heretofore a necessary consequence of thickening and spreading by upsetting in one operation) are avoided; but a change of guides or of dies and guides would be required for every change in the thickness of the upset.

In order to vary the thickness of the upset without making any changes in the dies, we adopt the method for supporting the upset shown in Figs. 6, 7, and 8, in which the lower die, D, is simply a thick plate fitted upon the lower clamping-ram of the upsetting-machine before referred to. The upper surface of the die D is grooved out its whole length to a width corresponding with that of the bar to be upset, and in this groove a bar, *d d*, is fitted. The upper half of the upsetting-die D′ rests upon and is supported by the lower half, and has cut in its under surface a groove conforming to the shape and size of the bar to be operated upon, and so that this bar will slide freely therein when at the requisite temperature. The upsetting-plunger B is more closely fitted to this groove, and its cross-section is such as to cover the end of the bar *d d*, and also that of the bar to be upset—that is to say, it is made so as to fill the opening formed by the grooves in the upper and the lower dies, when these dies are closed, ready for the operation of upsetting, so that in this operation the bar *d d* and the end of the one to be upset will be moved at the same time by the upsetting-plunger. The bar to be upset is prevented from moving by the grippers back of the dies, so that the portion within the dies will be upset as the plunger B moves forward, while the bar *d d*, being free to move endwise, will simply slide out of the dies under the vertical

pressure of the upset, and the increased thickness thus provided for in the plunger B will render it sufficiently stiff to resist the bending tendency produced by the upsetting-pressure. At a distance from the end of this die (at which the upsetting-plunger B enters) sufficient to contain the requisite length of bar to be upset, we provide a cross-opening having the diameter, if round, or, if rectangular, the width, required for the upset, and to this opening we fit the plunger E, the top of which plunger, and so much of the top of the die D′ as is equal to the width of the plunger E, are inclined to the surface of the lower die D on which the bar to be upset rests. Between this inclined surface and the upper clamping-ram of the upsetting-machine shown in Figs. 9 and 10 we provide the wedge-block F. Now, if this wedge is pushed outward by the upsetting-ram, the plunger E will be raised by the bar as it is upset, to this extent relieving the pressure on the bar, and this rising and relieving movement of the plunger E will be proportionate to the angle of the wedge and its traverse. If this rise of the plunger E is insufficient to provide room for the metal in the increased thickness, a portion will be forced out laterally, and thus increase the width of the upset. If the wedge-block F is pushed outward by the upsetting-ram directly, we prefer to make the plunger for pushing out the wedge-block as shown in Fig. 8, so that the wedge-block shall not commence to move until the groove in the die has been filled by the operation of the upsetting-plunger B, and it is desirable to observe this condition by whatever method the plunger E is relieved. To prevent any bending laterally of this upset, we provide a groove in the bottom of the plunger E, as shown in Fig. 7. This groove fills with metal as the bar is upset, so that the plunger E becomes a guiding as well as a relieving plunger. The thickness and width of the upset may be varied and proportioned at will by changing the speed of the wedge-block F relatively to that of the upsetting-ram. Thus, if this wedge-block is forced outward by the upsetting-ram directly, it will move at the same rate as the ram; but if it is forced outward by a lever operated by the upsetting-ram it is evident that its movement compared with that of the ram may be varied by altering the proportions of the lever. Such an arrangement is illustrated in Figs. 9 and 10, in which H is a bar, fixed, but adjustable longitudinally, upon the horizontal tension-bolts of the upsetting-machine. I is a similar bar fixed across the outer end of the upsetting-ram. J is a lever, one end of which is pivoted upon a sliding block, K, which can be secured to the bar H in any position by the set-screw S. The other end of the lever J is pivoted to a block which slides freely upon the bar I on the upsetting-ram. Upon the lever J another sliding block, L, is placed, which can be secured in any position thereon by the set-screw S′. On the under side of the block L we provide a pivot or post, about which vibrates the connecting-rod M, which connects the block L with the wedge-block F. As shown in the drawings, the wedge-block F would move less than half the distance of the upsetting-ram which operates it; but if the sliding block K is moved out to the extremity of the bar H, and the block L is secured upon the lever J opposite the wedge-block F, this latter would then move more than half the distance traversed by the upsetting-ram; and it is evident these proportions may be varied at will and to any extent that is desirable.

We also contemplate using a hydraulic cylinder and ram to control the movement of the plunger E, as a substitute for the wedge-block F, the movement of this hydraulic ram being regulated and determined by a plunger connected with this hydraulic cylinder and operated by the upsetting-ram shown in Figs. 9 and 10, with variable proportionate velocity, whereby an outward movement of the plunger will permit an amount of fluid to go out of the cylinder proportioned to the movement, and the plunger E to rise accordingly.

A modification of this die can easily be made that will effect any thickening and spreading designed in the construction, though it would not admit of proportioning this thickening to the widening, except by changing the dies and the wedge-block that affords the yielding support to the bar. Thus, if for the bar *d d* we substitute a wedge-block similar to F, having a width equal to that of the proposed upset, and in the upper and horizontal side of this block we provide a recess of the width of the bar to be upset and of a depth slight but sufficient to guide and support the bar laterally, the effect of upsetting a bar in such a die would be to increase the thickness as the wedge-block is pushed back by the upsetting-ram, and if the angle of inclination to this block is insufficient to provide room for the metal in the increased thickness the surplus metal would flow laterally over the edges of the recess in the top of the wedge-block until the requisite width is attained. The wedge-block in this case must be pushed back by the upsetting-ram, so that its speed cannot be varied from that of the ram, and consequently the proportion of thickness to width in the upset can only be changed by altering the angle of the wedge-block and its support in the lower die. It will be understood that the relieving-plunger E would not be required in this modification.

With dies constructed as shown in Figs. 6, 7, and 8, it is evident that the thickness and width of the upset may be varied at will without any change in the dies. It will also be evident that bars of the same width, but of varying thickness, may be upset in the same dies by changing only the bar *d d* to one having a thickness which, with the thickness of the bar to be upset, will equal the thickness of the plunger B. After the bar has been thus upset or thickened and spread, it is then reheated and transferred to the shaping-dies, in

which it is flattened to the desired outline by pressure, in the ordinary way.

By the means described we are enabled to upset the bar at one operation and at one heat, and without foldings or piling and welding, and this simultaneous thickening and spreading distinguishes our present improvement in the art of upsetting and shaping metal bars from that set forth in our Patent No. 276,291, already mentioned.

As the dies hereinbefore described, while they are especially devised for and adapted to this simultaneous thickening and spreading operation, are also available for either thickening or spreading separately, we do not confine ourselves to the use of them for both purposes at the same time. So, likewise, the enlargement and consequent stiffening of the upsetting-plunger, while especially designed for this simultaneous thickening and spreading operation, may, by the means described, be availed of when either operation is required independently of the other; and we therefore do not confine ourselves to the use of this device for both purposes at the same time.

Having thus described the nature and object of our invention, what we claim herein as new, and desire to secure by Letters Patent, is—

1. The improvement in the art of upsetting metal bars without piling and without folding, which consists in sustaining so much of the bar as is to be upset by supports, one or more of which, when pushed by the upsetting-ram, will recede laterally without ceasing to act as supports, and thickening and spreading the bar simultaneously by upsetting it while so supported, substantially as described.

2. The combination, with an upsetting-die, of supports, one or more of which, without ceasing to act as such, will recede, substantially as and for the purposes set forth.

3. The combination, with an upsetting-die, of a guiding relieving-plunger, substantially as and for the purposes set forth.

4. The combination, with the upsetting-die, the guiding relieving-plunger, the wedge-block, and the upsetting-ram, of devices for changing the rate of movement of the guiding relieving-plunger relatively to that of the ram, substantially as and for the purposes described.

5. The combination, with an upsetting-die, of the movable piece *d d*, substantially as and for the purposes set forth.

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