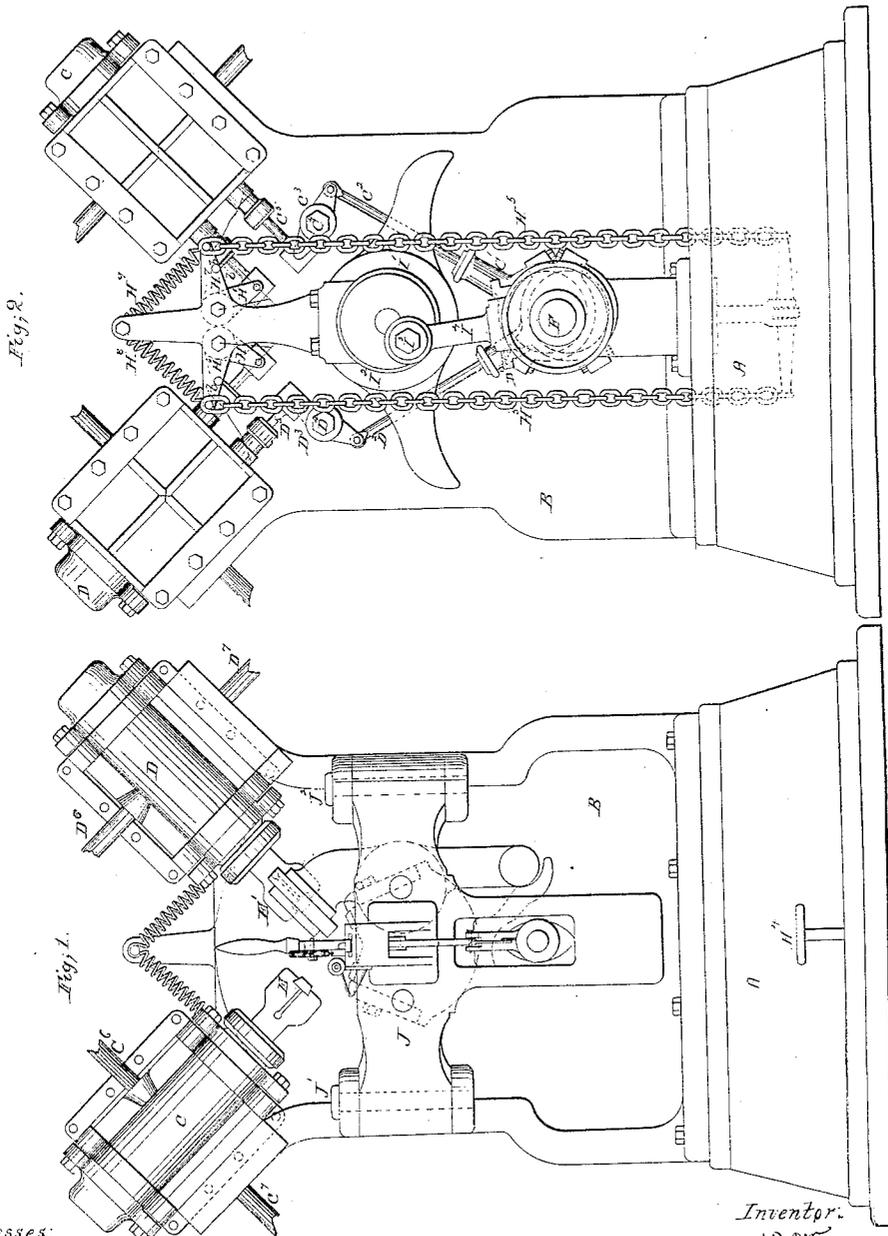


T. B. DE FOREST.  
FORGING APPARATUS.

No. 69,080.

Patented Sept. 24, 1867.



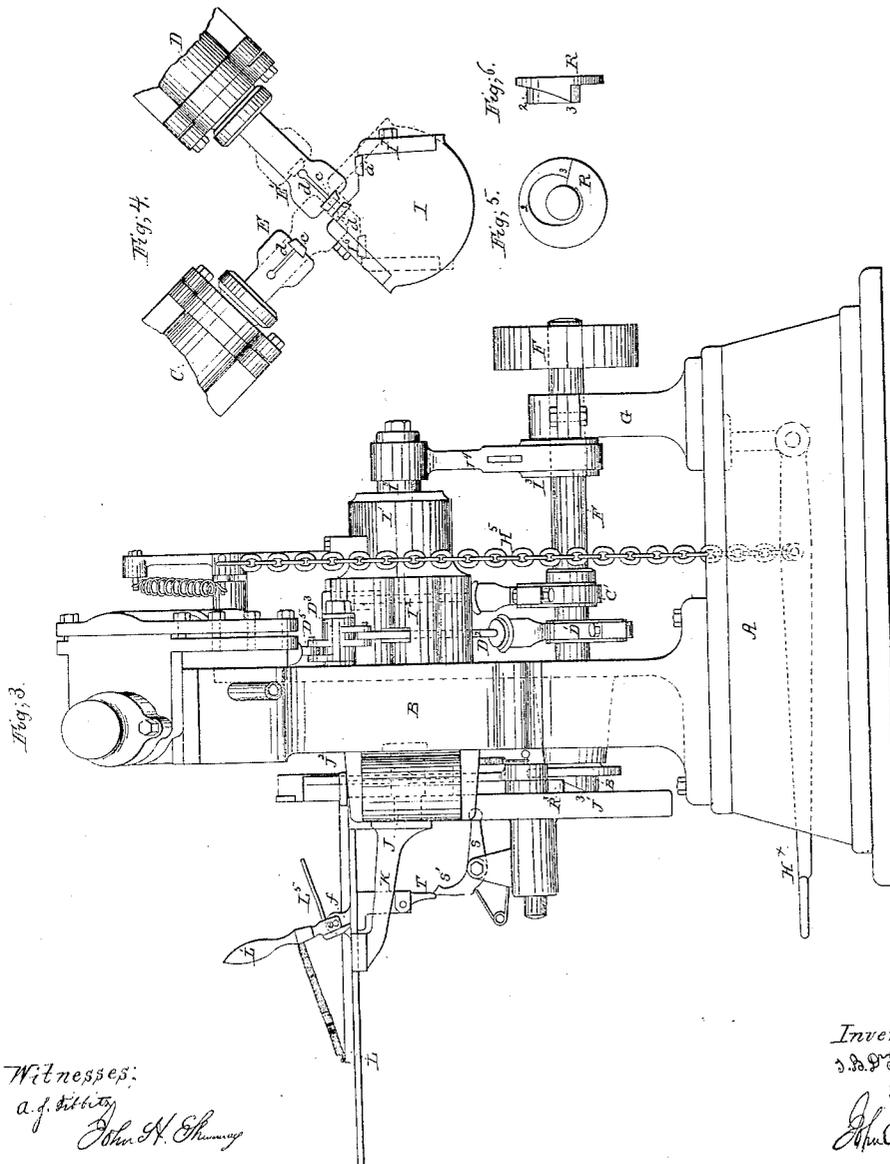
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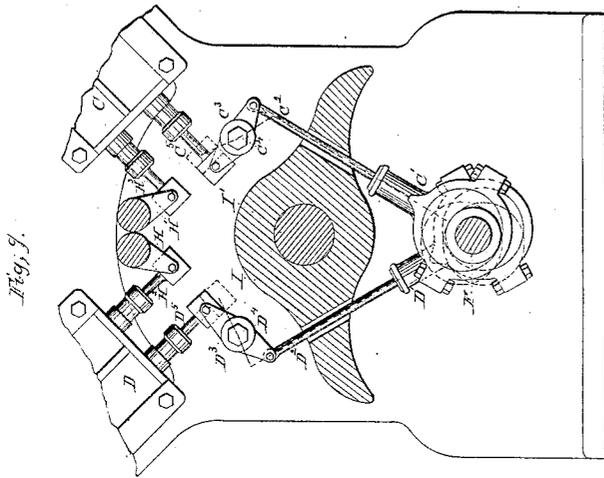


Fig. 9.

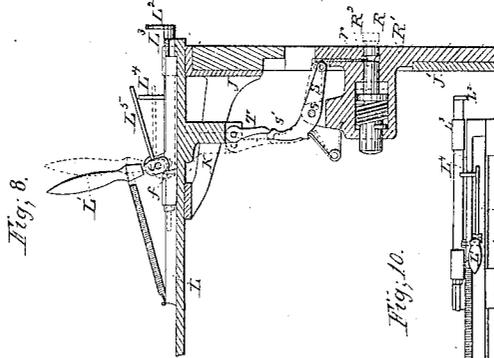


Fig. 8.

Fig. 10.

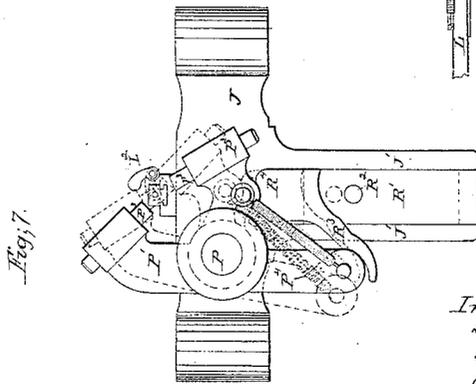


Fig. 7.

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# United States Patent Office.

THOMAS B. DE FOREST, OF BIRMINGHAM, CONNECTICUT.

Letters Patent No. 69,080, dated September 24, 1867.

## IMPROVED FORGING APPARATUS.

The Schedule referred to in these Letters Patent and making part of the same.

### TO ALL WHOM IT MAY CONCERN:

Be it known that I, THOMAS B. DE FOREST, of Birmingham, in the county of New Haven, and State of Connecticut, have invented a new Improvement in Forging Machine; and I do hereby declare the following, when taken in connection with the accompanying drawings and the letters of reference marked thereon, to be a full, clear, and exact description of the same, and which said drawings constitute part of this specification, and represent, in—

Figure 1, a front view

Figure 2, a rear view.

Figure 3, a side view; and in

Figures 4 to 10 inclusive, detached parts.

This invention relates to an improvement in machines for forging, in which steam is the power acting directly to operate the hammer, and designed more particularly for forging many successive like articles.

To enable others to construct and use my improvement, I will proceed to describe the same as illustrated in the accompanying drawings.

A is the bed-plate, upon which is placed the frame B, which supports the mechanism of the machine. C and D are two steam-cylinders, set at right angles to each other in a vertical plane, and arranged upon the face of the frame B, so that the axis of each cylinder lies at an angle of forty-five degrees from a perpendicular, as denoted in the several figures. Within each of the said cylinders is arranged a piston in the usual manner, to each of which is respectively attached a hammer-head, E and E', so that by the admission of steam to the cylinder below the piston, the piston will be raised, as denoted, in the cylinder C, fig. 4, and upon the reverse of the steam the hammer will fall or be forced down, as denoted at D in said fig. 4. The arrangement of the valves to thus operate the hammer is more clearly seen in fig. 9. F is a shaft supported in proper bearings G, and the said shaft caused to revolve by the application of power thereto through the pulley F', as seen in fig. 3. Upon the said shaft are arranged two eccentrics, C' and D', from which rods C<sup>2</sup> and D<sup>2</sup> extend up to levers C<sup>3</sup> and D<sup>3</sup>, working upon fulcrum C<sup>4</sup> and D<sup>4</sup>, and to the said levers the valve-rods C<sup>5</sup> and D<sup>5</sup> of the respective cylinders are attached, so that as the shaft F is caused to revolve, the valves of each cylinder are alternately worked, as denoted in diagram, fig. 9. Thus the valve motion which actuates or causes the movement of the hammer is entirely independent of the power which moves the hammer, steam being admitted to the steam-chest through pipes C<sup>6</sup> and D<sup>6</sup>, and exhausted through pipes C<sup>7</sup> and D<sup>7</sup>. The movement of the valves alternating according to the movement of their respective eccentrics, first one hammer is raised and then the other. The valve may if desired admit the steam above the piston to force down the hammer, as well as below to force it up. The anvil upon which each of the two hammers operates must be arranged so that its position be changed to present a face to each hammer. This may be done by two anvils arranged so that the one upon which the blow of one hammer has just been given recedes while the other advances to receive the blow of the second hammer, and so on, alternately receding or advancing, or the anvil may be arranged so as to vibrate and properly present a face to receive the blow of each hammer. This last method I prefer, and such I have shown, its operation being illustrated in fig. 4. I is the anvil, represented in fig. 4 detached, and shown in broken lines, fig. 1. It is arranged upon a shaft, I<sup>1</sup>, supported in a firm bearing, I<sup>2</sup>, so as to vibrate beneath the face of the hammers, as from the position in red to that in black, fig. 4, and *vice versa*, so that the descending hammer will strike squarely upon the face of the anvil, thus necessitating two faces, in each of which is placed a die, *a* and *a'*, so that the hammer E will strike upon the die *a*, as denoted in red, and the hammer D will in its turn strike upon the die *a'*, as denoted in black, and the anvil is caused thus to vibrate by the action of an eccentric, I<sup>3</sup>, on the shaft F through the rod I<sup>4</sup>, connected to the end of the shaft upon a crank-pin, I<sup>5</sup>, the motion of the said eccentric being only sufficient to give the required vibration to the anvil. Steam is admitted to the cylinder at the proper time by the operation of bell-crank levers H and H<sup>1</sup>, which by their movement operate the valve-rods H<sup>2</sup> and H<sup>3</sup>, to each of which is respectively attached a valve, so that by the movement of the rods steam will be admitted to the respective steam-chests, in which are operated the valves upon the rods C<sup>5</sup> and D<sup>5</sup> to admit steam to the cylinders for the operation of the hammers; and when both levers are at the same time depressed, as denoted in red, fig. 2, both valves are simultaneously opened, and at an equal distance, and the levers are thus operated by

a treadle,  $H^1$ , (see fig. 3,) passing under the bed-plate, from which a connection,  $H^5$ , extends to an arm,  $H^6$  and  $H^7$ , of each of the levers  $H$  and  $H^1$ , so that by depressing the treadle the valve of both cylinders is simultaneously and equally opened, and thus opening, and the shaft  $F$  revolving to operate the valves  $C^2$  and  $D^3$ , the hammers are made to alternately strike upon the anvil. If at any time it is desirable to begin or finish the work with either hammer, that is to say, if in any work to be performed it is necessary that the last blow or blows be struck by one hammer, the connection from the treadle to either of the levers  $H^6$  and  $H^7$ , as the case may be, should be changed so as to make the one shorter than the other, as to move the point of connection down to  $b$ . Therefore as the levers will be held up by their respective springs  $H^8$  and  $H^9$ , one of the connections will be shorter than the other; consequently the valve with the shorter connection will be open before the other, and thus cause the operation of the hammer in the cylinder to which steam is thus admitted before the other, and so, when the steam is cut off, it will be cut off first from that cylinder having the longest connection, and that cylinder being cut off its hammer will cease working, while the other will continue until its valve is permitted to close. The dies  $a$  and  $a'$  in the anvil are fitted into a dove-tailed seat in the anvil, as seen in fig. 4, and held by clamp-plates  $I^6$  and  $I^7$  in the securst possible manner, and by this arrangement, when it is required to remove or adjust the dies, it is simply required that the bolt which binds the clamp-plate be loosened, and thus forms a most convenient as well as practically durable arrangement. The dies  $c$  in each of the hammers are secured by cutting a slot,  $d$ , into each hammer, and forming a groove in the end of the hammer into which the dies are inserted, as seen in fig. 4, the said slot affording sufficient elasticity to bind the dies in place. The holding apparatus for presenting the work to the hammers is represented detached in fig. 8, and is attached to a swinging bar,  $J$ , hinged to the frame at  $J^1$ , and extending across the frame in front of the anvils, is secured upon the opposite side by a vertical bolt,  $J^2$ , so that when the said bolt  $J^2$  is removed, the said bar may be swung open as denoted in fig. 7. When in operation, this bar is closed as denoted in fig. 1, and opens for convenience of getting at the mechanism back of the said bar. To this bar is fixed a bracket,  $k$ , forming at its outer and inner end a guide for a sliding-plate,  $L$ . To the said sliding-plate  $L$ , at  $e$ , is pivoted a clamping lever,  $L^1$ , having upon its lower end a tooth or tongue,  $f$ , which, when the lever  $L^1$  is turned up, as denoted in red, will bind firmly upon a metal bar upon the said slide, or when drawn back, as denoted in black, permits the free movement of the bar on the said slide. The bar to be forged is placed upon the slide  $L$  and clamped with the lever  $L^1$ , the said lever serving as a handle by which to move forward the slide  $L$  on to the anvil. As it is necessary that a given length of bar be inserted for the work to be performed, it is necessary that a gauge be arranged to act in combination with the slide  $L$ .  $L^2$  is such a guide, arranged upon the internal end of a shaft,  $L^3$ , supported in bearings  $g$  upon the bracket  $k$ , and from which an arm,  $L^4$ , extends up beneath an arm,  $L^5$ , from the lever  $L^1$ , as seen in figs. 8 and 10, so that when the lever  $L^1$  is pressed forward, as denoted in red, the gauge  $L^2$  will be depressed, as denoted in blue, fig. 7, coming down in front of the slide  $L$ , so that when the bar held upon the slide is pressed forward, its end will strike the gauge  $L^2$ ; then, releasing the clamp upon the bar so as to permit the gauge  $L^2$  to rise sufficient to allow the bar to pass under, the slide is moved forward to carry the bar in on to the anvil for the operation of the hammers upon that portion of the bar allowed by such action of the gauge. After the operation of the hammers is completed the slide is drawn back and that part of the bar upon which the operation has been performed is cut off, as hereafter described, the bar re-entered as before for another operation, and so on so long as the bar retains the proper heat. The cutting-off apparatus is seen in fig. 1, but more clearly in fig. 7. Upon the inside of the bar  $J$ , at  $P$ , are pivoted two heads,  $P^1$  and  $P^2$ . When in a state of rest they are in the position denoted in black, each of the said two heads carrying a cutter,  $P^3$ , and are moved upon their bearing  $P$ , the one,  $P^2$ , up, and the one,  $P^1$ , downward, to the positions denoted in red; the two cutters  $P^3$  passing each other as a pair of shears, directly in front of the carrier, so that the two cutters cut off from the bar the forged or finished piece, and then return to their state of rest, and they are thus moved by the operation of a cam,  $R$ , on the shaft  $F$ , seen detached in figs. 5 and 6, and as seen in fig. 8, upon a slide,  $R^1$ , moving vertically in guides  $J^3$  on the bar  $J$ , the said slide having an arm,  $R^2$ , projecting to one side so as to bear against the lower arm  $P^4$  of the head  $P^1$ , so that by the upward movement of the slide to the position in red, the head is turned to the position in red, while another projection,  $R^4$ , upon the slide, strikes upon the head  $P^2$ , and at the same time raises that to the position denoted in red. A stud,  $R^3$ , fixed in the slide  $R^1$  resting upon the cam  $R$ , causes the slide to move with the operation of the cam. As this operation is required only at certain times, that is, only when the work is finished, it is necessary that the slide be disconnected from the cam until the proper time of cutting off the forged work, and at that time to present the stud by the action of the cam. This operation is illustrated in fig. 8. The stud  $R^3$  is constructed so that by a spring it is pressed forward to the position denoted in red. In this position the cam acts to raise the slide, but at that point in the cam when the slide has been raised, that is, to the point 2 in figs. 5 and 6, the face of the cam from that point to point 3 is inclined outward, so as to press against the end of the stud and force it back into the position denoted in black. In that position it is held by a catch-pin,  $r$ , falling into a notch or groove in the stud, as seen in fig. 8, to prevent its return on to the cam. To introduce the stud  $R^3$  at the proper time, which is when the work is finished, a lever,  $S$ , having its fulcrum at  $s$ , is attached, one arm to the catch-pin  $r$  and the other turned up as at  $S'$ , so that by turning the said lever to the position denoted in red, the catch-pin is raised and the stud thrown out. When the work is finished the slide  $L$  is drawn back. To the under side of the slide  $L$  is pivoted a finger,  $T$ , which when the slide is drawn back strikes the lever  $S$ , as denoted in black, and being drawn out a little further to the position in red, raises the lever  $S$  and escapes therefrom; then the work is held in a proper position for the cutters to operate and cut from the bar the finished piece, when the slide is returned or moved in, the tongue  $T$  turns upon its pivot, and passes freely over the lever  $S$ . This arrangement insures the operation of the cutters at the proper time.

Having thus fully described my invention, what I claim as new and useful, and desire to secure by Letters Patent, is—

1. The hammers E and E<sup>1</sup> projected from the pistons, and operated through the medium of the steam-cylinders C and D, arranged as described, in combination with a vibrating or receding anvil, constructed and arranged so as to present a face to each hammer, substantially in the manner herein set forth.

2. The arrangement described for operating the cut-off valve rods H<sup>2</sup> and H<sup>3</sup>, so as to adjust the operation of the hammer or hammers, substantially as set forth.

3. The bar J in combination with and carrying the feeding and cutting-off apparatus described, hinged to the frame so as to be turned from the anvil I, substantially as herein set forth.

4. The gauge L<sup>2</sup> in combination with the feeding device, all constructed and operated substantially as and for the purpose specified.

5. In combination with the slide L and clamping-lever L<sup>1</sup>, I claim the gauge L<sup>2</sup>, arranged so as to be operated by the movement of the lever L<sup>1</sup>, substantially as described.

6. The combination of the two cutter-heads P<sup>1</sup> and P<sup>2</sup>, with the slides R<sup>1</sup>, and the stud R<sup>2</sup>, and cam R, constructed and arranged so as to operate substantially as set forth.

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