

(No Model.)

9 Sheets—Sheet 1.

C. DE L. RICE.
FORGING MACHINE.

No. 575,790.

Patented Jan. 26, 1897.

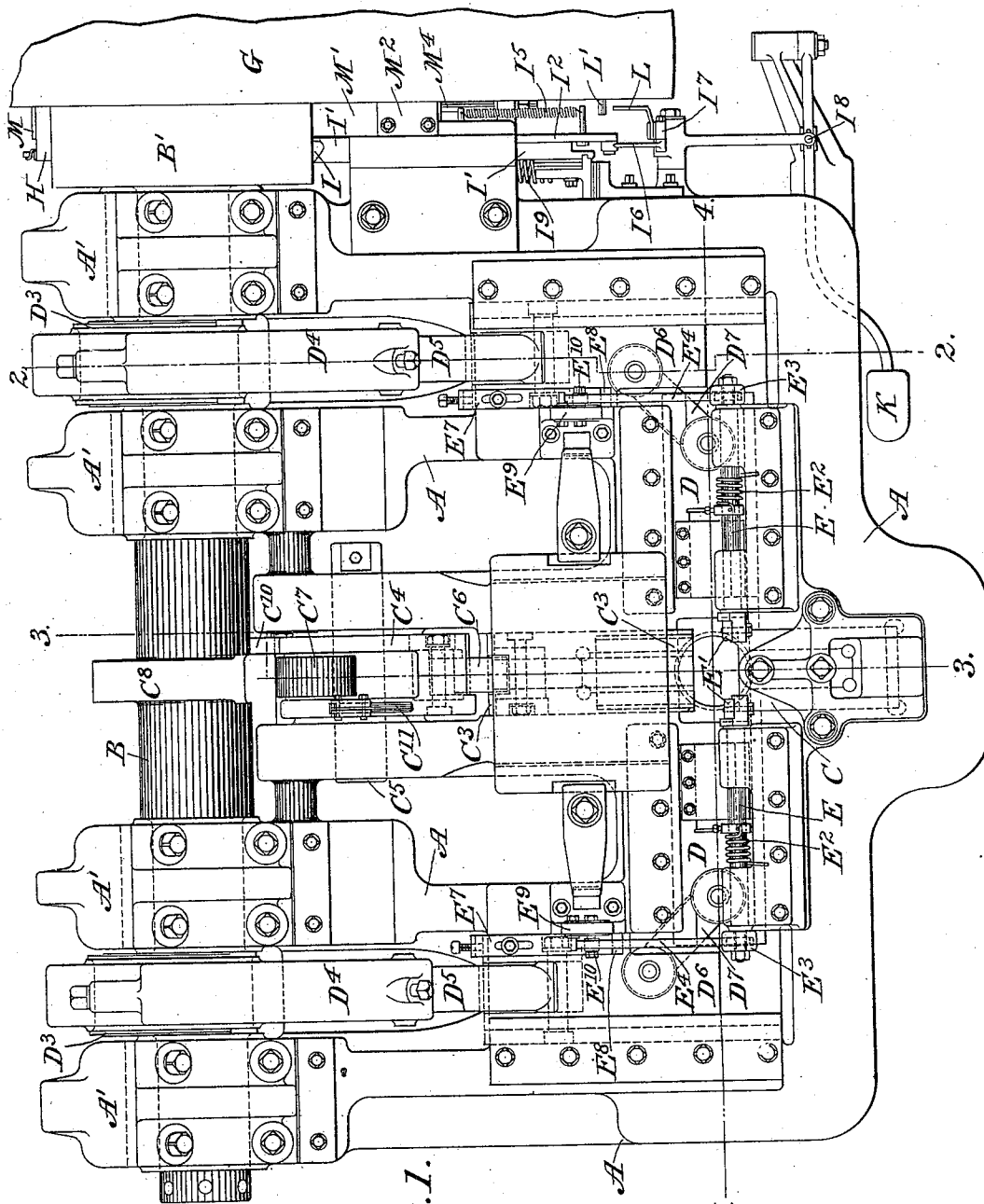


Fig. 1.

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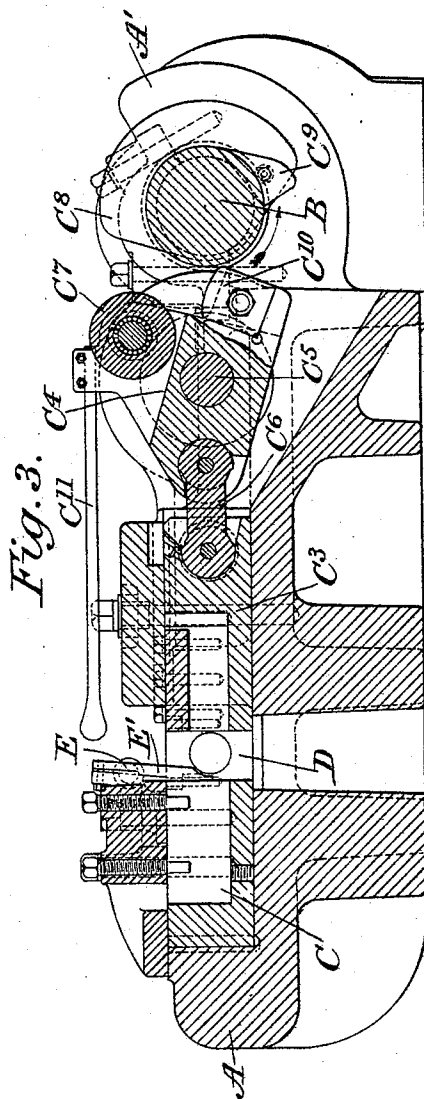
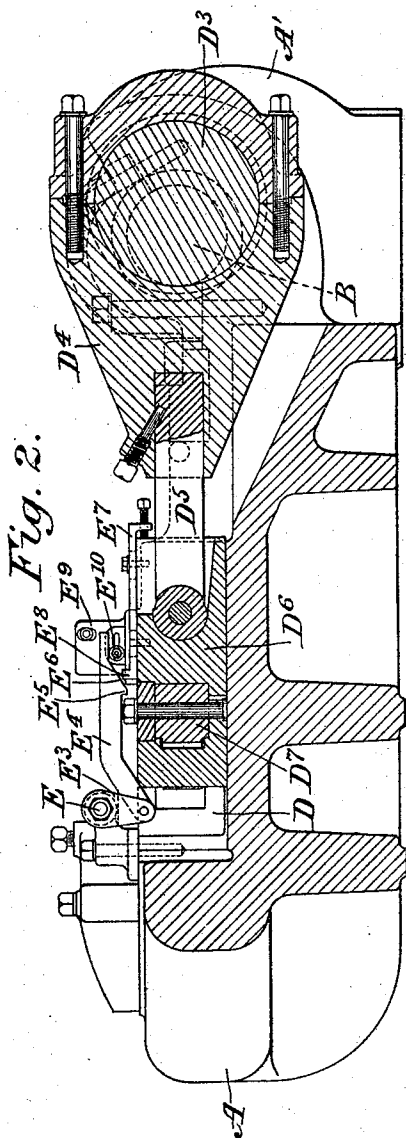
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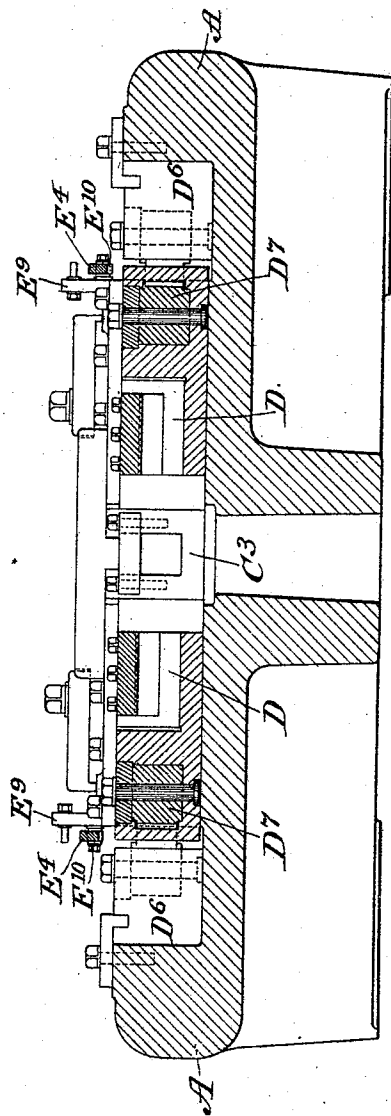
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Fig. 4.



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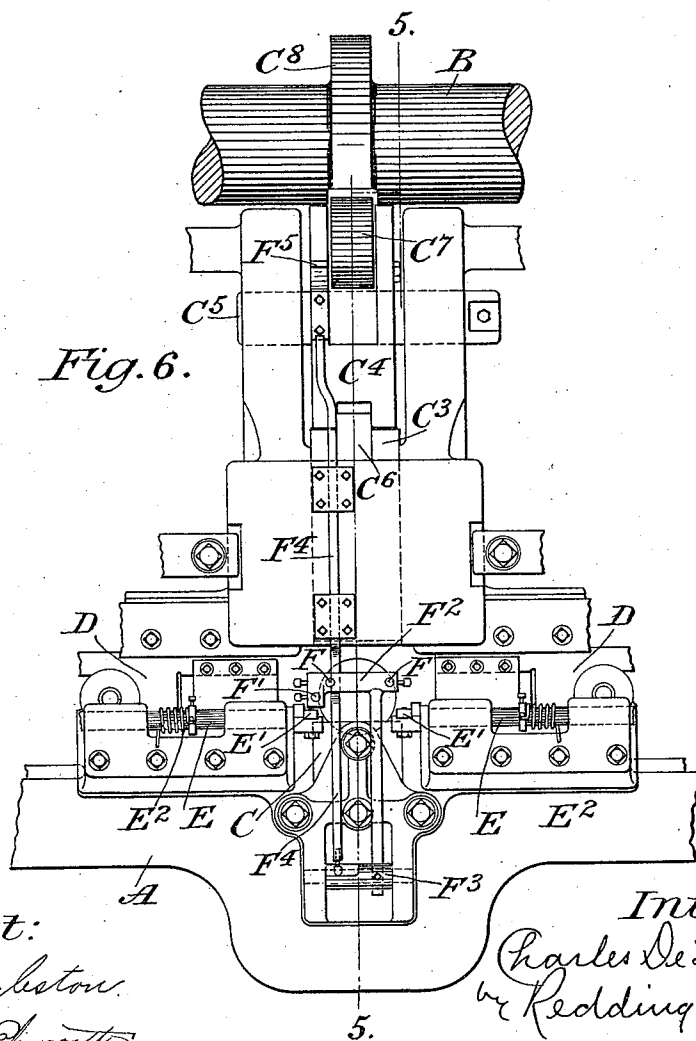
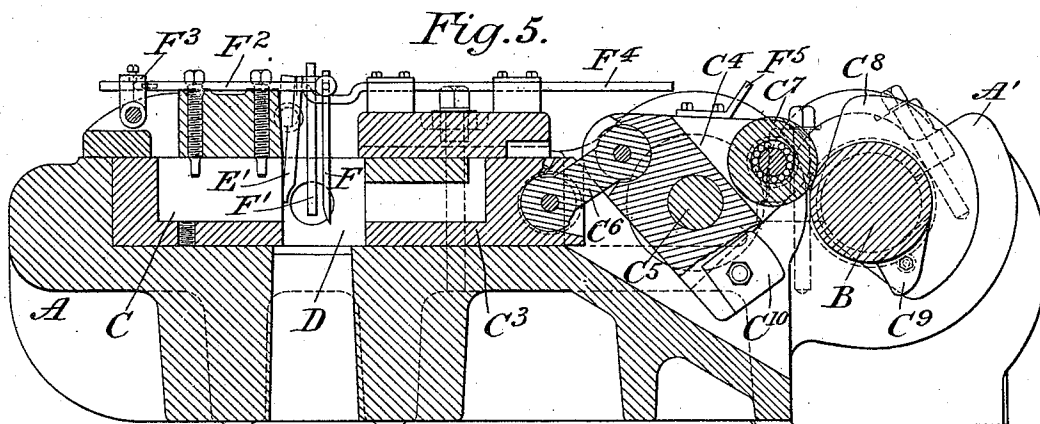
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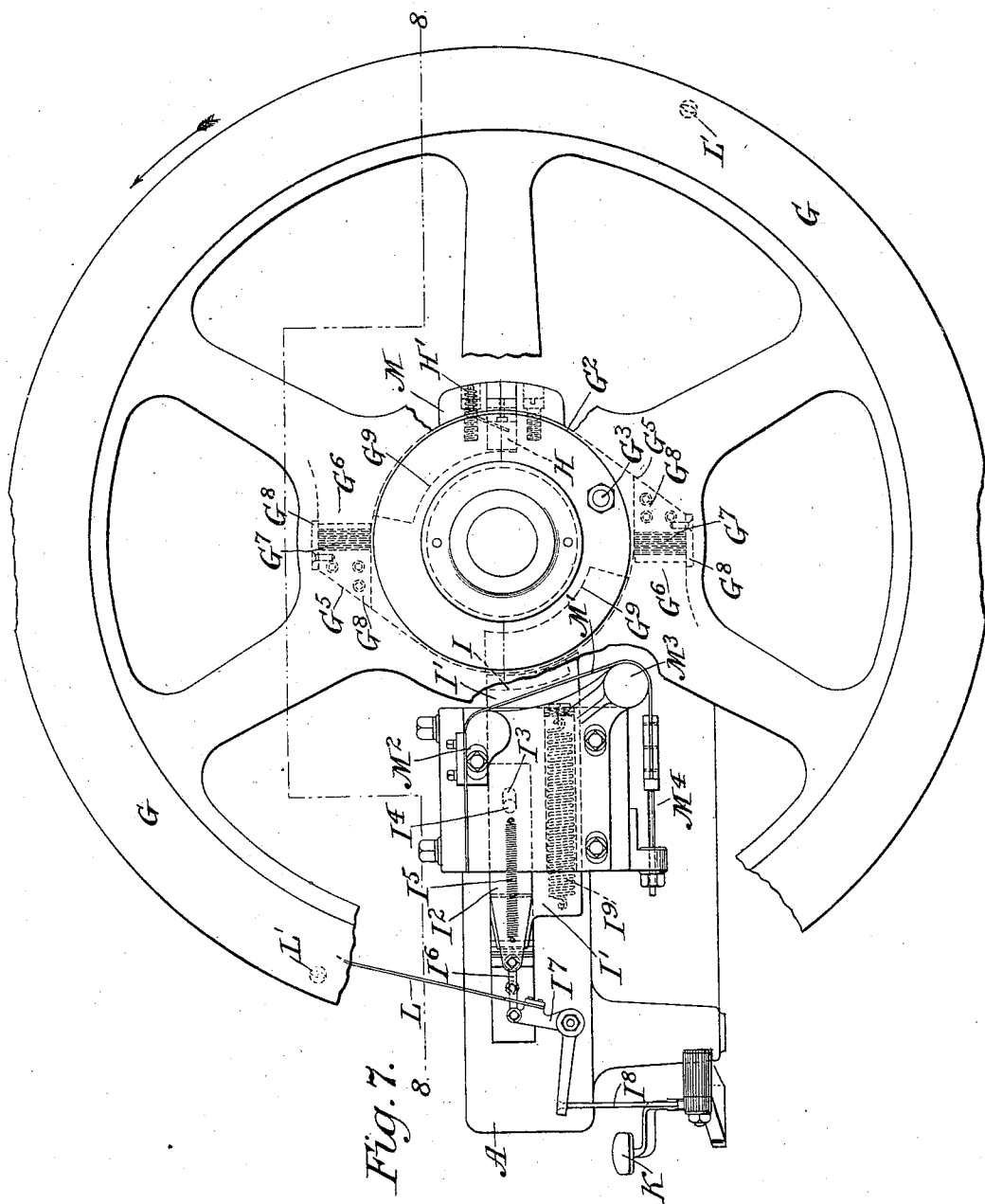


Fig. 7.

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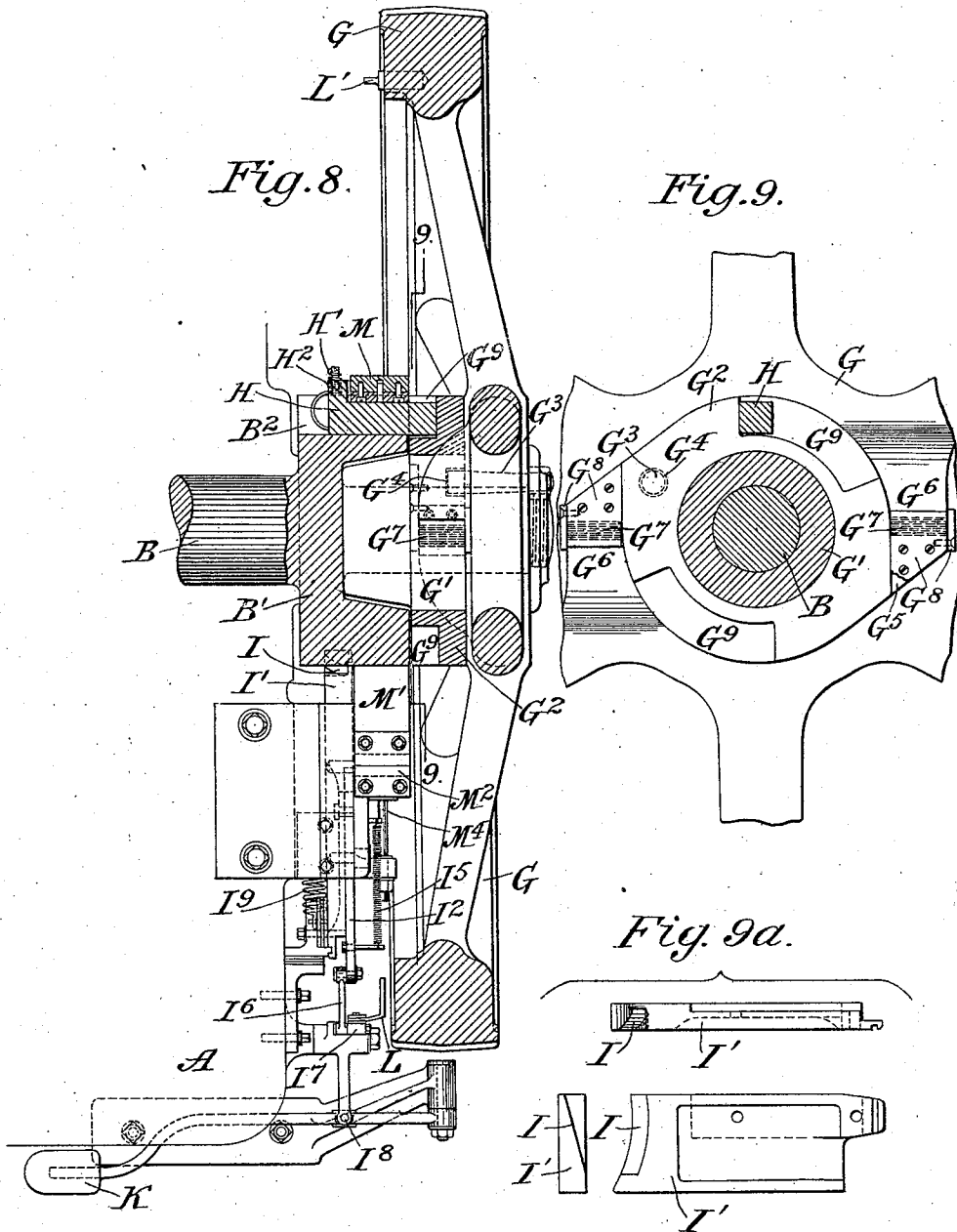
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Fig. 10.

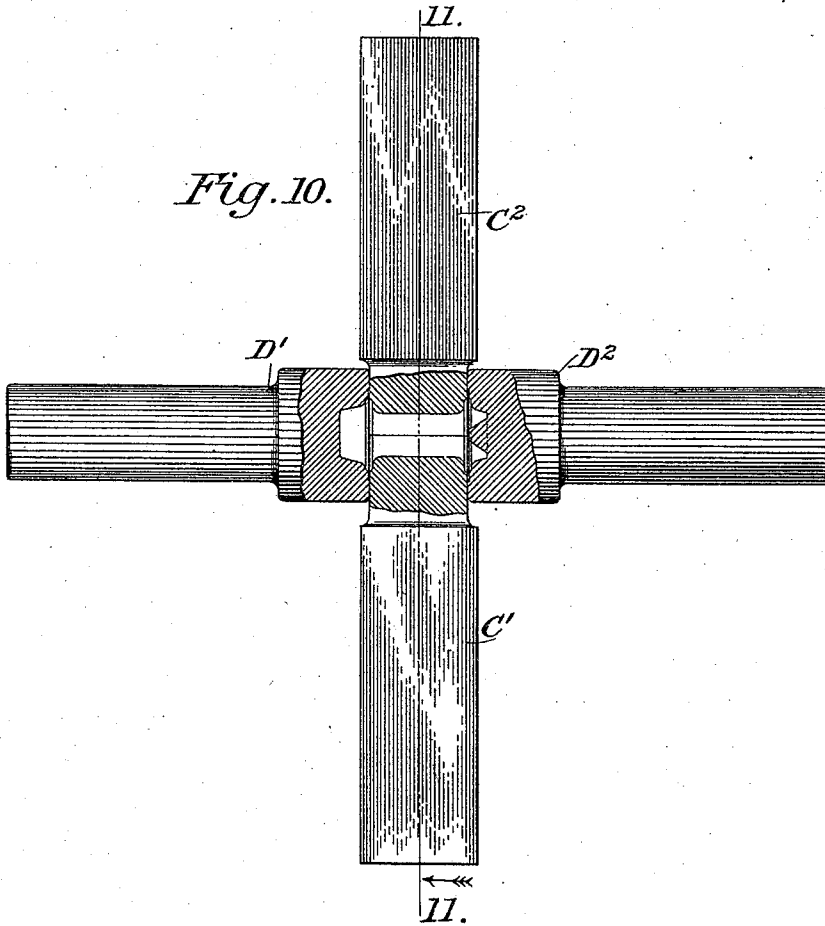
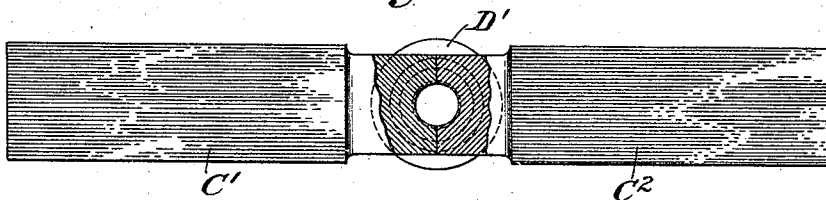


Fig. 11.



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Fig. 12.

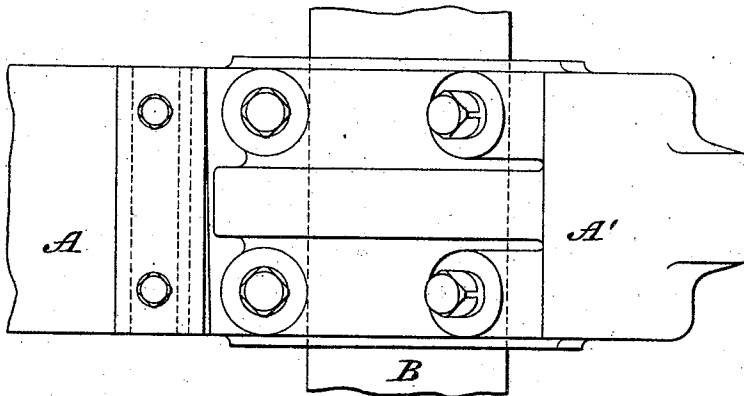
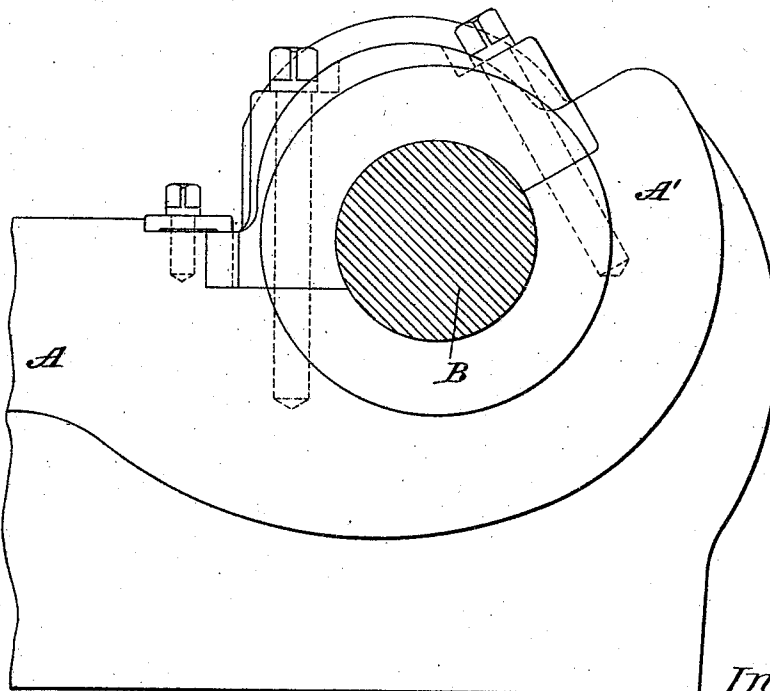


Fig. 13.



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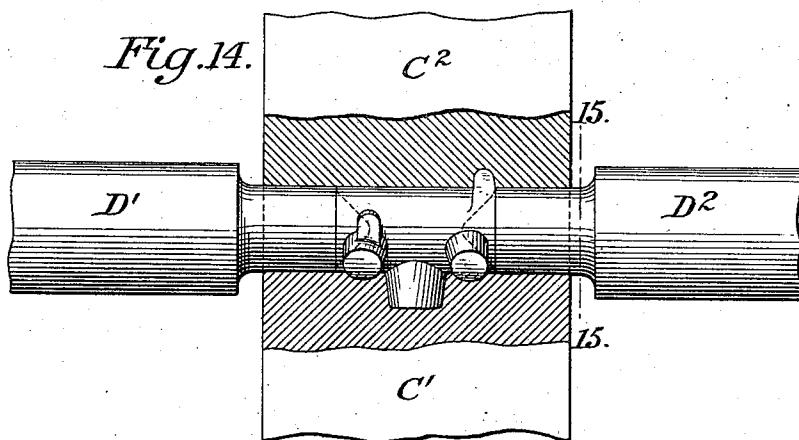


Fig. 15.

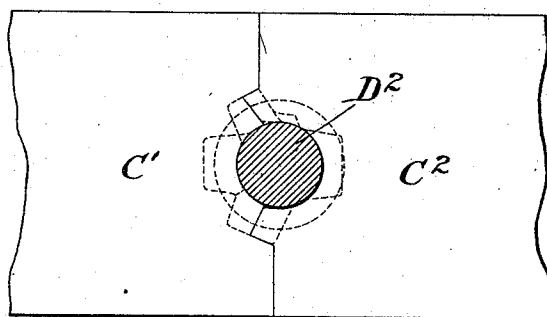


Fig. 16.

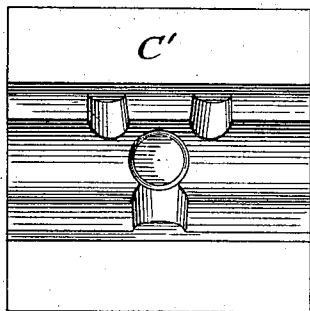
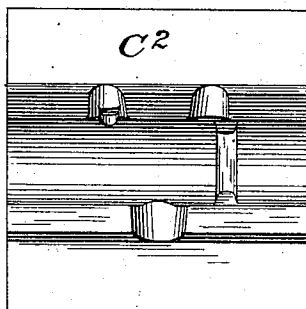


Fig. 17.



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UNITED STATES PATENT OFFICE.

CHARLES DE LOS RICE, OF HARTFORD, CONNECTICUT.

FORGING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 575,790, dated January 26, 1897.

Application filed December 11, 1895. Serial No. 571,760. (No model.)

To all whom it may concern:

Be it known that I, CHARLES DE LOS RICE, of the city and county of Hartford, State of Connecticut, have invented certain new and useful Improvements in Forging-Machines, &c., of which the following is a specification, reference being had to the accompanying drawings, forming part hereof.

This invention relates in general to the construction of metal-working machines for the production at a single operation of small forgings, &c., such as are usually produced by the usual methods of drop-forging.

The objects particularly in view are to render possible the machine-forging or forming of shapes hitherto impossible of production except by the use of the drop-hammer and of shapes which could not hitherto be produced economically by any of the ordinary machine-shop methods, to render possible the production of more perfect machine-forgings than has been ordinarily possible hitherto, to avoid material waste in flashes or overflows, to reduce the amount of machining usually required to produce the finished article after the forging has been completed and to reduce the waste of material usually occasioned by such machining, to provide for the rapid and automatic stripping of the forgings from the dies, and generally to increase the capacity and efficiency of machines of the class referred to. Hitherto, so far as I am aware, forging-machines, such, for example, as bolt-heading machines, have had at most three dies, two of the dies clamping between them the rod or blank and holding it for the action of the third or upsetting die. In such machines there is usually more or less longitudinal yielding of the stock between the gripping-dies when it is struck by the upsetting-die, which fact not only accounts for the production of imperfect articles, but makes it clearly impossible to produce forgings which require the metal to be forced into deep lateral recesses in the gripping-dies.

In accordance with my present invention I have provided for the use of four dies acting in pairs in opposite directions, two of the dies surrounding and retaining the billet or blank and leaving it exposed only at the ends and the other two dies acting against the exposed ends or portions of the billet and upsetting

the metal and forcing it into the recesses in the retaining-dies. As there is only the slightest possibility of the formation of flashes or of other escape of metal it is obviously necessary that the volume of the stock or billet should not exceed the volume of the completed article, but should be carefully predetermined in every case. The billet having then the required volume and the four dies closing together tightly to inclose a space which corresponds in form to the required article, it is obvious that the metal must be forced into all of the recesses of the dies and fill them completely, producing a perfectly-shaped article.

The improved machine having therefore the general characteristics here referred to, the invention further relates to the means for operating and controlling the dies and other movable parts, and it will be obvious as this description proceeds that the improved means may be employed in other machines of like character, but of different form and construction, and that such means might be used to advantage separately or with other devices than those herein described as well as collectively in the machine shown in the accompanying drawings.

In order that the description of the construction of the machine shown in the accompanying drawings and the relations of the parts thereof may be the more readily and clearly understood, the general arrangement of the machine and the operation thereof will first be described briefly.

As previously indicated, the machine has four dies arranged in pairs, two being retaining and forming dies and two being end or upsetting dies, the dies of each pair working in opposition to each other. One of the retaining and forming dies may be stationary while the other die of the pair is preferably arranged to be moved first by hand into position to hold in place the billet which has been introduced by the operator. Thereafter the movable retaining-die is forced home against the stationary die to form therewith a compound die of the shape which the article is desired to have, the faces of the two dies being suitably formed for this purpose. The movable die is forced home and there held during the operation of the upsetting-dies by the action of a cam which is secured

to the motor-shaft of the machine, the entire cycle of operations necessary to complete the forging taking place during a single rotation of this shaft. The two end or upsetting dies are supported to move in opposition to each other in a path at right angles to the direction of movement of the movable retaining-die and are actuated at the proper time, after the retaining-dies have closed upon the billet, by the action of eccentrics which are mounted upon the motor-shaft before referred to, suitable intermediate devices being provided to transmit movement from each eccentric to the corresponding upsetting-die.

The parts are so arranged that the upsetting-dies begin to retire before the movable retaining-die, and consequently the forging is held by the retaining-dies while the retiring upsetting-dies strip themselves. The movement of the upsetting-dies, however, is slow as compared with that of the movable retaining-die, so that after they have stripped themselves, but before their extreme ends have passed the extreme ends of the finished forging, the withdrawal of the movable gripping-die begins and is completed, whereby the upsetting or end dies act as strippers for the movable retaining-die. Automatic strippers are provided to kick the forging out of the fixed retaining-die, should it stick to the same, in cases where the finished forging extends beyond the confines of the retaining-dies. The motor-shaft is adapted to be driven by a continuously-rotating fly-wheel, which may be driven in any suitable manner, and is adapted to be engaged therewith by a clutch operated by means under the control of the operator. A brake is also provided to check the rotation of the shaft as soon as the clutch is disengaged, so that the parts operated by the shaft shall be brought to rest in their normal position. Centering and holding devices for the billet are also provided for use when required.

All of the parts of the machine have been designed with reference not only to the exertion of great force upon the billet, but especially to rapid operation, so that the period of contact of the hot metal with the dies may be as brief as possible in order to prolong the life of the dies. The fact that the movement of the dies must be stopped after each operation, although the moving parts are necessarily of great weight, renders the construction of the devices for effecting the required movements of the parts and of the devices for bringing them to rest of great importance.

In the accompanying drawings, wherein I have illustrated in detail mechanism which embodies my improvements in a desirable form and which is well adapted for the production of small forgings, Figure 1 is a plan view of the mechanism, the fly-wheel being broken away to save space. The retaining-die holders are shown in gripping position and the end or upsetting-die holders in their extreme outer position, the dies themselves being

omitted. Fig. 2 is a vertical cross-section on the line 2 2 of Fig. 1. Fig. 3 is a vertical cross-section on the line 3 3 of Fig. 1. Fig. 4 is a vertical longitudinal section on the line 4 4 of Fig. 1. Fig. 5 is a vertical cross-section on the line 5 5 of Fig. 6, similar to Fig. 3, but showing the parts in different positions and showing also centering and gaging devices hereinafter referred to, the hand-lever shown in Fig. 3 being omitted. Fig. 6 is a partial plan view of the central portion of the machine, as shown in Fig. 1, but with the parts shown in Fig. 5 added. Fig. 7 is an elevation of the right-hand end of the machine, as shown in Fig. 1, with portions of the fly-wheel broken out to show the clutch-controlling mechanism and the brake behind it. Fig. 8 is a horizontal section of the fly-wheel on the irregular plane indicated by the line 8 8 of Fig. 7, with the controlling mechanism and the hub of the fly-wheel in plan view and with the clutch members in central section. Fig. 9 is a detail view of a portion of the clutch mechanism, partly in section. Fig. 9^a shows in detail in edge, end, and plan views the cam and relief-bar. Fig. 10 is a detail plan view, partly in horizontal section, showing a set of dies. Fig. 11 is a side elevation of the two retaining or forming dies shown in Fig. 10, partly in section, on the line 11 11 of Fig. 10. Figs. 12 and 13 are detail views in plan and vertical cross-section, illustrating the construction of the bearings of the main shaft. Fig. 14 is a detail plan view similar to Fig. 10, showing a set of dies for the production of an article of different form. Fig. 15 is a side elevation of the two retaining or forming dies shown in Fig. 14, partly in section, on the line 15 15 of Fig. 14. Figs. 16 and 17 are face views of the retaining or forming dies shown in Figs. 14 and 15.

The frame or bed-plate of the machine is of sufficient strength and of proper construction to support the several working parts of the mechanism and to resist the strains to which it is subjected during operation. In suitable bearings A', at the rear of the frame or bed-plate A, is mounted the driving-shaft B, from which movement is imparted to the several working parts of the machine, as hereinafter described, and to which motion is imparted from a suitable driving-wheel through the medium of a clutch, so that the driving-wheel may have continuous rotation while the shaft comes to rest after each rotation.

At the front of the bed-plate A and in convenient position for the introduction of the billets or blanks to be operated upon is supported a stationary holder C for the stationary gripping or retaining and forming die, such as is shown, for example, at C' in Figs. 10, 11, 14, 15, and 16.

The movable gripping-die or retaining and forming die, such as is shown, for example, at C² in Figs. 10, 11, 14, 15, and 17, is adapted to cooperate with the stationary die to form a compound but practically rigid forming-die

inclosing a space which corresponds in form to the required article, and is carried by a movable-die holder C³, which is adapted to slide toward and from the stationary-die holder in a guideway formed on the bed-plate A, as shown in Figs. 1, 3, 4, 5, and 6.

In rear of the movable-die holder C³ a rocking frame C⁴ is mounted upon a shaft C⁵, a link C⁶ being interposed between the forward end of the rocking frame and the rear end of movable-die holder C³, so that the frame and link together constitute a toggle-lever by means of which the movable-die holder may be forced forward and held rigidly and afterward withdrawn. The frame C⁴ is provided above its axis of oscillation with a roller C⁷, which constitutes a bearing-point for a cam C⁸, which is secured to the driving-shaft B, so that the action of the cam upon said roller or bearing-point will rock the frame upon its axis (shaft C⁴) and will thrust the movable-die holder forward with great force.

The cam C⁸, as will be observed, is adapted to act quickly and has a long bearing-surface of equal radius, approximating one-half of a circle, whereby the frame C⁴ is held in its forward position without movement for an appreciable time in order to give the end or upsetting dies, hereinafter referred to, time to complete their forward movement and to be partially withdrawn before the movable retaining-die holder is withdrawn. At one side of the cam C⁸ and near the rear end of its operating-surface is secured a toe or projection C⁹, which is adapted to strike a projection C¹⁰, which is secured to the frame C⁴ substantially in line with the axis of the frame and the pivotal point of the link C⁶, and thereby, in the further rotation of the shaft B, to rock the frame C⁴ in the opposite direction and so withdraw the movable-die holder C³.

As shown in Figs. 1 and 3, a hand-lever C¹¹ may be secured to the frame C⁴, so that the operator may rock the frame by hand and so bring the movable retaining-die nearly to position, leaving the completion of its movement to be effected by the cam C⁸, as already described.

The billet or blank to be operated upon may be gripped firmly between the two dies C¹ and C², or it may be retained loosely between them, but in any case it is necessary that the movable die shall be held during the action of the end or upsetting dies with great force, so that the metal may not find its way out between the two dies C¹ and C². The arrangement of the die-operating mechanism just described permits this to be done, besides permitting both the forward and the backward movements of the die to be effected suddenly, with a long dwell between them.

The end or upsetting dies, such as are shown, for example, at D¹ and D² in Figs. 10 and 14, are arranged to move in opposite directions in a path substantially at right angles to the direction of the movement of the movable retaining-die and to act simultaneously upon

the billet which is in place between the two retaining-dies, the action of the upsetting-dies forcing the metal into every part of the mold formed by the retaining-dies.

The end or upsetting dies D¹ and D² are mounted, respectively, in end-die holders D D, which are adapted to slide to and fro in ways formed in the bed-plate A substantially parallel with the shaft B, the holders being disposed on opposite sides of the movable retaining-die holder.

The means for actuating the end-die holders are identical and a description of one set of devices or means will therefore suffice for both, and reference may be had particularly to Figs. 1, 2, and 4.

Near each end of the shaft B is mounted an eccentric D³, the strap D⁴ and rod D⁵ of which operate upon a cross-head D⁶, which is adapted to slide to and fro in a guideway formed in the bed-plate A. An obliquely-disposed link or toggle-lever D⁷ is interposed between the cross-head D⁶ and the corresponding die-holder D. At each rotation of the shaft B, therefore, the end dies D¹ D² are pressed toward each other slowly, (as compared with the movement of the retaining or forming die C²,) but with great force and act in opposite directions and simultaneously upon the billet, which is in place between the retaining-dies, forcing the metal into every part of the mold formed thereby. The end dies are preferably formed so as to engage the completed forging, as by being cupped to cover the end thereof, as shown in the die D¹ in Fig. 10, or by having a projection to form a corresponding depression in the forging, as shown in the case of the die D² in Fig. 10. I prefer to make use of the last-named device, particularly when the forging is to be drilled out subsequently, as a proportionate amount of raw material is thereby saved and the amount of machining necessary to finish the article is reduced correspondingly.

Immediately after the completion of the forward movement of the end dies the withdrawal of the same commences, but it progresses slowly (as compared with the movement of the retaining-die) because of the action of the eccentrics. This comparatively slow movement, however, is sufficient to withdraw the dies from contact with the forging before it is released by the opening of the gripping-dies. This movement of the last-named dies is effected rapidly by the action of the toe-cam C⁹ and takes place before the end dies are entirely withdrawn from the forging, whereby the end dies act as strippers for the movable retaining-die. If the end of the forging is given a taper, either internal or external, as indicated in Figs. 10 and 14, the two parts of the mold formed, respectively, in the faces of the two retaining-dies are so shaped or proportioned that the forging shall draw the more easily from the stationary retaining-die, whereby the first part of the movement of the movable retaining-die strips the forg-

ing from the stationary retaining-die and the movable retaining-die is thereafter stripped during its continued movement by the engagement of the end dies with the ends of the forging, the taper of the ends of the forgings permitting this action to take place. With some forms of forgings, however, it may be necessary or desirable to provide means for the stripping of the stationary die. Such means are shown in Figs. 1, 2, and 3.

In suitable bearings above each end die is mounted an oscillating shaft E, which is provided at its inner end with a stripping-finger E'. The end of the finger is extended downward in close proximity to the stationary retaining-die and in position to engage the end of the forging when thrown forward. A spring E², applied to the shaft E, holds the stripping-finger normally in the position represented in Fig. 3. At its outer end its shaft E is provided with a downwardly-projecting arm E³, to which is pivotally attached a latch E⁴, having on its under side a lip E⁵ and an incline E⁶. Upon each sliding block or cross-head D⁶ is mounted an adjustable strip E⁷, having an upwardly-projecting lip E⁸, and upon a stationary bracket E⁹, in close proximity to the cross-head D⁶, is mounted a pin E¹⁰ (having an antifriction-roller) for cooperation with the incline E⁶. As the cross-head D⁶ moves forward the lip E⁸ slips under the latch E⁴, and on the return movement of the cross-head the lip E⁸ engages the lip E⁵ of the latch and draws it backward, thereby rocking the shaft E and causing the finger E' to kick the forging out of the stationary die. As the latch continues its movement with the cross-head its incline E⁶ rides up on the roller of the pin E¹⁰ and effects a disengagement of the latch from the lip E⁸, the spring E² returning the latch E⁴ and finger E' to their normal positions.

When the article to be forged is greatly overbalanced at one end, it is preferable to use billets of a diameter slightly greater than that of the mold formed between the two retaining-dies, so that the billet may be gripped slightly by the retaining-dies and thereby held from displacement before the action of the end or upsetting dies. In order to locate such stock properly, I prefer to employ gaging and retaining fingers, which determine the position of the billet and retain it temporarily in position, but are themselves withdrawn in time to clear the moving parts as they come into action.

As clearly represented in Figs. 5 and 6, two beveled retaining-fingers F F and a straight gaging-finger F' are supported, normally, in the position represented in Fig. 5 by an L-shaped carrier F², Fig. 6, the long arm of which is secured to a part F³, which is pivotally mounted upon a fixed support and constitutes a hinge-like support for said carrier, so that if the part F³ be oscillated the fingers F and F' will be lifted from their normal position and out of the way of the moving parts

of the mechanism. For the purpose of lifting the fingers out of the way at the proper time I have mounted in suitable guides upon the fixed framework of the machine a rod F⁴, which abuts at one end against the upper edge of the hinged support F³ or against an ear or lug thereon and at its other end stands in the path of a lug F⁵, which is secured to the rocking frame C⁴, so that just before the latter completes its forward movement the lug F⁵ strikes the rod F⁴ and causes the fingers to be lifted out of the way of the dies and holders. In the operation of the machine provided with these retaining and gaging fingers the operator first places the billet in the fixed die, where it is held in place by the retaining-fingers F F. He then pushes the billet longitudinally into the position determined by the gaging-finger F'. The fingers remain in the position represented during the first part of the movement of the dies and are lifted just before the movable gripping or retaining die comes into place.

As hereinbefore indicated, it is highly desirable that the shaft B and the parts carried by it should be brought to rest after the completion of every cycle of operations, that is to say, at every rotation of the shaft, in order that the fresh billet to be operated upon may be properly placed in position. All of these parts are exceedingly ponderous, and the mechanism for starting and stopping their movement requires to be specially adapted for the purpose. One form of such starting and stopping or clutch mechanism is represented in Figs. 7, 8, and 9, although it will be evident that I am not restricted to the use of that particular clutch mechanism or of any other particular clutch mechanism, but that other forms of clutch mechanism may be substituted therefor and answer the requirements of the machine.

In the construction shown in the drawings I prefer to mount upon the shaft B, so as to rotate thereon, a ponderous driving and balance wheel G, which is preferably itself driven from a counter-shaft by a belt. The shaft B is formed or provided with an enlarged hub B', which forms one member of the clutch, while upon the hub G' of the wheel G is loosely mounted a cushioning-ring G², which rotates with the wheel and constitutes the other member of the clutch. The ring G² is not rigidly secured to the wheel G, but is loosely mounted on the hub thereof. A pin G³, which is firmly fixed in the wheel and enters a recess G⁴ in the face of the ring G², prevents backlash and consequently prevents the throwing out of the cushion-plates hereinafter referred to. The recess is larger in diameter than the engaging end of the pin, so that the ring may move to a limited extent with respect to the wheel. At opposite points the ring G² is provided with projecting brackets G⁵ for cooperation with corresponding lugs G⁶, which project on the inner face of the wheel in line with said brackets. Be-

tween each bracket G^5 and the corresponding lug G^6 are interposed several pieces G^7 of sheet metal, these pieces being held in position by retaining-plates G^8 . The play between the driving-pin G^3 and the wall of the recess G^4 permits some compression of these cushion-pieces between the lugs G^6 and brackets G^5 , and the ring is in fact driven from the wheel through them, and they thus reduce the shock when the clutch is engaged, as hereinafter described, and the machine started. The cushioning action of the sheets of metal is further increased by loading them with a heavy lubricant. In the hub B' is formed a guideway B^2 , parallel with the axis of the shaft, for the reception of a driving-dog H , which is adapted to engage a shoulder of the ring G^2 at one end of an arc-shaped recess G^9 , which is preferably about one-quarter of the circumference of the ring in length. The dog is pressed normally into engagement with the ring by a spring H' and is provided with a shoulder H^2 , by means of which it may be withdrawn from engagement with the ring and so release the shaft from the driving-wheel. The movement of the dog H is effected by the engagement therewith of a cam I , which has a thin entering edge and is formed upon or carried by a release-bar I' , which is mounted to slide toward and from the shaft in suitable ways attached to the fixed framework of the machine, so that the dog H may be withdrawn or permitted to remain in engagement with the ring G^2 at the will of the operator.

The mechanism for shifting the release-bar I' is so arranged that it may be brought into position easily by the operator and the actual work of shifting the bar be performed by the machine itself. For this purpose a supplementary bar I^2 is mounted upon the release-bar I' and is slotted, as at I^3 , to receive a pin I^4 , which is fixed in the release-bar I' . A spring I^5 normally pulls the supplementary bar I^2 toward the shaft and yet permits the supplementary bar to be moved outward easily until the rear end of the slot I^3 engages the pin I^4 . The supplementary bar I^2 is connected by a link I^6 to one arm of a bell-crank lever I^7 , the other arm of which is connected by a pull-rod I^8 to a treadle K . The operator therefore by placing his foot upon the treadle K draws the supplementary bar I^2 outward until it engages positively the release-bar I' . The further movement of the supplementary bar, which draws with it the release-bar and takes the cam I out of the path of the shoulder H^2 on the dog H , is effected by the continued movement of the wheel G . For this purpose there is affixed to the first-mentioned arm of the bell-crank lever I^7 a tripping-blade L , which stands in proximity to the rim of the wheel G , upon the side of which are secured tripping dogs or pins L' for cooperation with the tripping-blade. When the treadle is elevated, the tripping-blade is held in such position by the bell-crank lever I^7 that it is cleared

by the dogs or pins L' , but when the treadle is depressed by the foot of the operator the free end of the tripping-blade is swung outward, so that the blade is engaged by the pin or dog L' and by the forward movement thereof is shoved outwardly, rocking the bell-crank lever further and causing a further movement of the supplementary bar I^2 and an effective movement of the release-bar I' . As already indicated, the movement of the cam I outward prevents the disengagement of the dog H from the ring G^2 and permits the wheel and shaft to remain in connection. If the release-bar is not withdrawn, the cam will remain always in position to withdraw the dog at each rotation of the shaft. A heavy spring I^9 returns the release-bar to operative position. It will be evident that the wheel itself, acting through the dogs L' , effects the release of the driving-dog H at exactly the right time in relation to the movement of the shoulder of the clutch-ring G^2 , so that it has time to make a full engagement against its shoulder, preventing the upsetting of the edge and consequent injury to the ring. It also assists the operator greatly in tripping the heavy mechanism.

Fast to the hub B' is a brake-block M , which in the construction shown serves also as the cap to retain the dog H in position or is secured to said cap. A band or strap M' is secured at one end to a suitable casting M^2 , which is attached to the fixed frame of the machine and passes over a rounded casting M^3 , also secured to the fixed frame. The other end of the band is attached to an adjustable tightening-rod M^4 , whereby the tension of the band may be regulated. Between the castings M^2 and M^3 the band stands in the path of the brake-block M , so that by contact of the brake-block with the band the shaft is brought always to rest in the same position.

It will be understood that where it is practicable to do so, with regard to the shape of the article, it is desirable to so shape the retaining-dies as to cause the movable die to overcome the tendency of the forging to cling to the stationary die and consequently to strip the forging therefrom. Wherefore, as illustrated in Figs. 14, 15, 16, and 17, the two dies are unequally divided and a somewhat greater portion of the recess for the barrel of the forging is formed in the movable die, necessitating, of course, a slight departure from a perfect cylinder in order to prevent a hooking of the die over the barrel of the forging, but yet a less departure than would be employed under like circumstances with other mechanisms.

The operation of the machine as a whole will be clearly understood from the foregoing description of the construction and mode of operation of the several mechanisms which make up the complete machine and will therefore require no further explanation herein.

It will be seen that the mechanism is capable of use for swaging or stamping cold metal as well as for forging; the dies being properly shaped for the purpose, and it will be obvious,

moreover, that other forms and arrangements of the various parts of the machine than those shown and described herein are within the purview of my invention and that the said invention is not restricted to the single embodiment thereof which is herein shown and described.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a forging-machine, the combination of a sliding-die holder, a rocking frame supported upon an axis in line with said die-holder and having an eccentric bearing-point, a link intermediate said die-holder and rocking frame and constituting with said rocking frame a toggle-lever, a hand-lever connected to said rocking frame to shift the same, and a cam in line with said die-holder and the axis of said rocking frame and adapted to act upon the bearing-point of said rocking frame and to effect a further movement thereof after the action of a hand-lever, substantially as shown and described.

2. In a forging-machine, the combination of a sliding-die holder, a rocking frame supported upon an axis in line with said die-holder, a link intermediate said die-holder and rocking frame and constituting with said rocking frame a toggle-lever, a cam in line with said die-holder and the axis of said rocking frame and adapted to act upon said rocking frame, and a bearing-point on said rocking frame for said cam out of the line of the axes of the rocking frame and cam, substantially as shown and described.

3. In a forging-machine, the combination of a sliding-die holder, a rocking frame supported upon an axis in line with said die-holder and having an eccentric bearing-point, a link intermediate said die-holder and rocking frame and constituting with said rocking frame a toggle-lever, a shaft in line with said die-holder and the axis of said rocking frame, a cam on said shaft adapted to bear upon said eccentric bearing-point of said rocking frame out of line with the axes of said frame and shaft to thrust said die-holder forward, and a toe-cam on said shaft adapted to strike upon a projection from said rocking frame and to withdraw said die-holder, substantially as shown and described.

4. In a forging-machine, the combination of a stationary-die holder, a movable-die holder, means for actuating said movable-die holder, retaining-fingers standing normally in front of the stationary-die holder and adapted to hold an article temporarily in position between themselves and the stationary die, a movable carrier for said retaining-fingers and a device actuated by the operating means of the movable-die holder to shift said carrier and withdraw said fingers as the movable-die holder moves forward, substantially as shown and described.

5. In a forging-machine, the combination of a stationary-die holder, a movable-die holder, means for actuating said movable-die holder,

retaining-fingers adapted to hold an article temporarily in position, a carrier for said retaining-fingers, a hinged support to which said carrier is secured, and a rod adapted to be actuated by the operating means of the movable-die holder to swing said hinged support and withdraw the retaining-fingers, substantially as shown and described.

6. In a forging-machine, the combination of a stationary-die holder, a movable-die holder, means for actuating said movable-die holder, a stripper standing normally in front of the stationary-die holder and adapted to engage the forging and to eject it from the stationary die, a reciprocating part, a hooked rod to engage said reciprocating part, and intermediate means whereby said stripper is actuated by the movement of said hooked rod, substantially as shown and described.

7. In a forging-machine, the combination of a stationary-die holder, a movable-die holder, means for actuating said movable-die holder, a rock-shaft, a stripper secured to said rock-shaft and standing normally in front of the stationary-die holder and adapted to engage the forging to eject it from the stationary die, an arm secured to said rock-shaft, a reciprocating part, a hooked rod to engage said reciprocating part and connections from said hooked rod to said rock-shaft, substantially as shown and described.

8. In a forging-machine, the combination of a stationary-die holder, a movable-die holder, means for actuating said movable-die holder, a stripper-finger mounted to oscillate in front of the stationary-die holder and adapted to engage the forging and to eject it from the stationary die, a reciprocating part and a hooked rod connected to the stripper-finger to oscillate the same and adapted to engage a projection on said reciprocating part, substantially as shown and described.

9. In a forging-machine, the combination of a stationary-die holder, a movable-die holder, means for actuating said movable-die holder, a stripper adapted to engage the forging and to eject it from the stationary die, a reciprocating part and a hooked rod connected to the stripper to actuate the same and adapted to engage a projection on said reciprocating part and having also an incline to cooperate with a fixed pin whereby in the continued movement of the reciprocating part the hooked rod is disengaged therefrom, substantially as shown and described.

10. In a forging-machine, the combination of a stationary-die holder, a movable-die holder, means for actuating said movable-die holder, a stripper adapted to engage the forging and eject it from the stationary die, a reciprocating part, an adjustable bar mounted on said reciprocating part and having a lip, and a hooked rod connected to the stripper to actuate the same and adapted to engage the lip on said reciprocating part, substantially as shown and described.

11. The combination of a shaft, a clutch

member carried with said shaft, a driving-wheel, a ring mounted loosely on the hub of said driving-wheel and constituting the second member of said clutch, said ring and wheel having coöperating projections, and a cushion interposed between said coöperating projections, substantially as shown and described.

12. The combination of a shaft, a clutch member carried with said shaft, a driving-wheel, a ring mounted loosely on the hub of said driving-wheel and constituting the second member of said clutch, said ring and wheel having coöperating projections, a cushion interposed between said coöperating projections, and a driver carried by said wheel and engaging said ring but permitting movement of said ring with respect to said wheel to a limited extent, substantially as shown and described.

13. The combination with the two members of a clutch, of a dog carried by one member and adapted to engage the other member, a cam adapted normally to engage said dog in its revolution and to withdraw it from engagement with the second member of the clutch, a sliding bar carrying said cam, a lever connected to said sliding bar, a tripping-blade carried by said lever, a tripping-dog carried with the continuously-rotating member of the clutch, and means to shift said blade

into the path of said tripping-dog, whereby the continued movement of the tripping-dog will further shift said lever and withdraw said sliding bar and cam, substantially as shown and described.

14. The combination with two members of a clutch, of a dog carried by one member and adapted to engage the other member, a cam adapted normally to engage said dog in its revolution and to withdraw it from engagement with the second member of the clutch, a sliding bar carrying said cam, a supplementary bar mounted upon the first-named bar and having a loose connection therewith, a lever connected with said sliding bar, a tripping-blade carried by said lever, a tripping-dog carried with the continuously-rotating member of the clutch, and means to shift said lever and supplementary bar to bring the tripping-blade into the path of the tripping-dog, whereby the continued movement of the tripping-dog will further shift said lever and withdraw said sliding bar and cam, substantially as shown and described.

This specification signed and witnessed this 9th day of December, A. D. 1895.

CHARLES DE LOS RICE.

In presence of—

P. HANSLING, Jr.,
F. A. TICKNER.