No. 631,362. Patented Aug. 22, 1899.

S. P. WORMWOOD, Dec'd.

M. F. DICKINSON, Jr. & K. B. & L. H. WORMWOOD, Executors.

TOE CALK MACHINE.

(Application filed Nov. 18, 1898.)

(No Model.) 6 Sheets—Sheet 1.

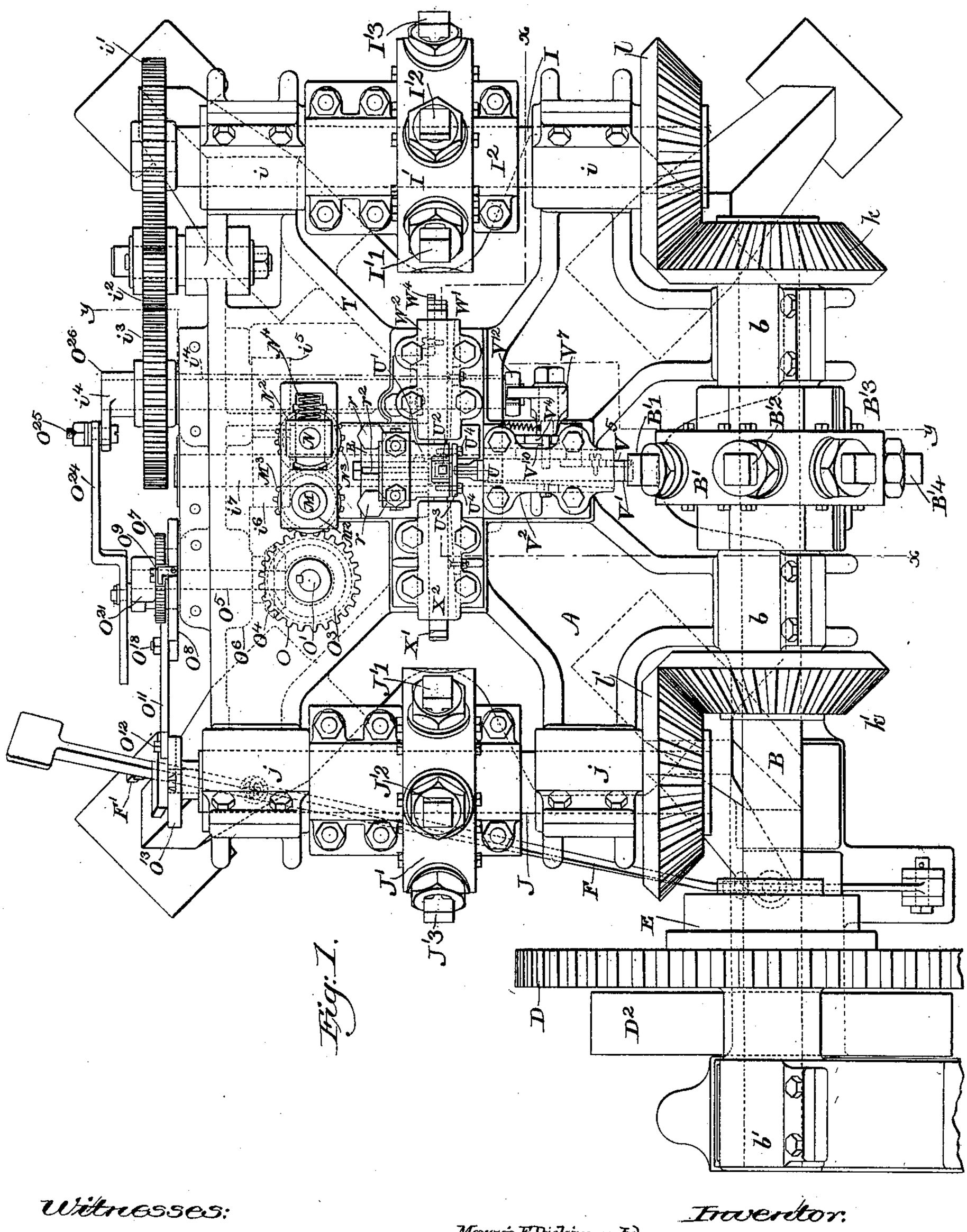

Fig. 1.

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(No Model.) 6 Sheets—Sheet 2.

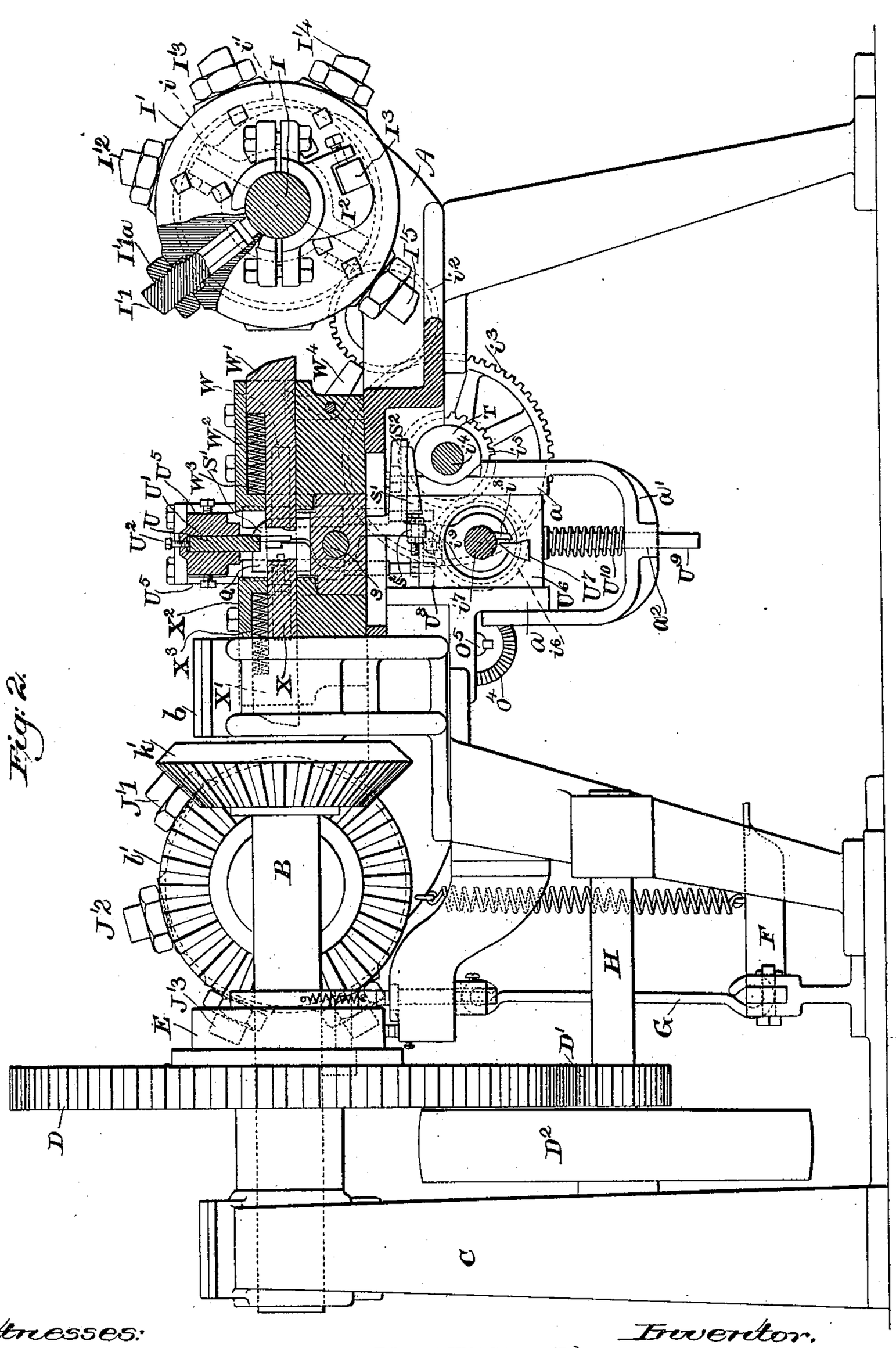

Fig. 2.

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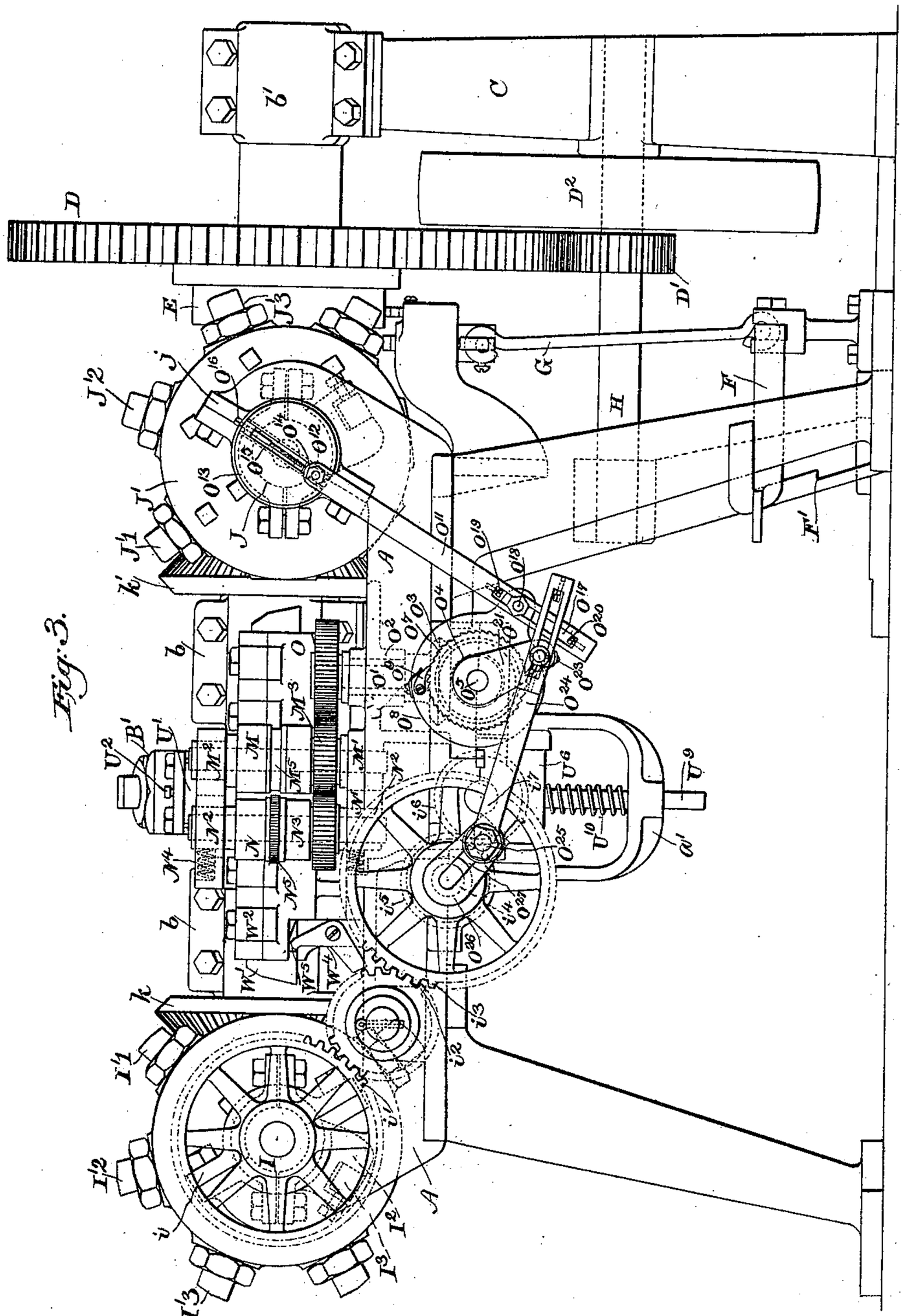
(No Model.) 6 Sheets—Sheet 3.

Fig. 3.



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(Application filed Nov. 18, 1898.)

(No Model.) 6 Sheets—Sheet 4.

Fig: 4.

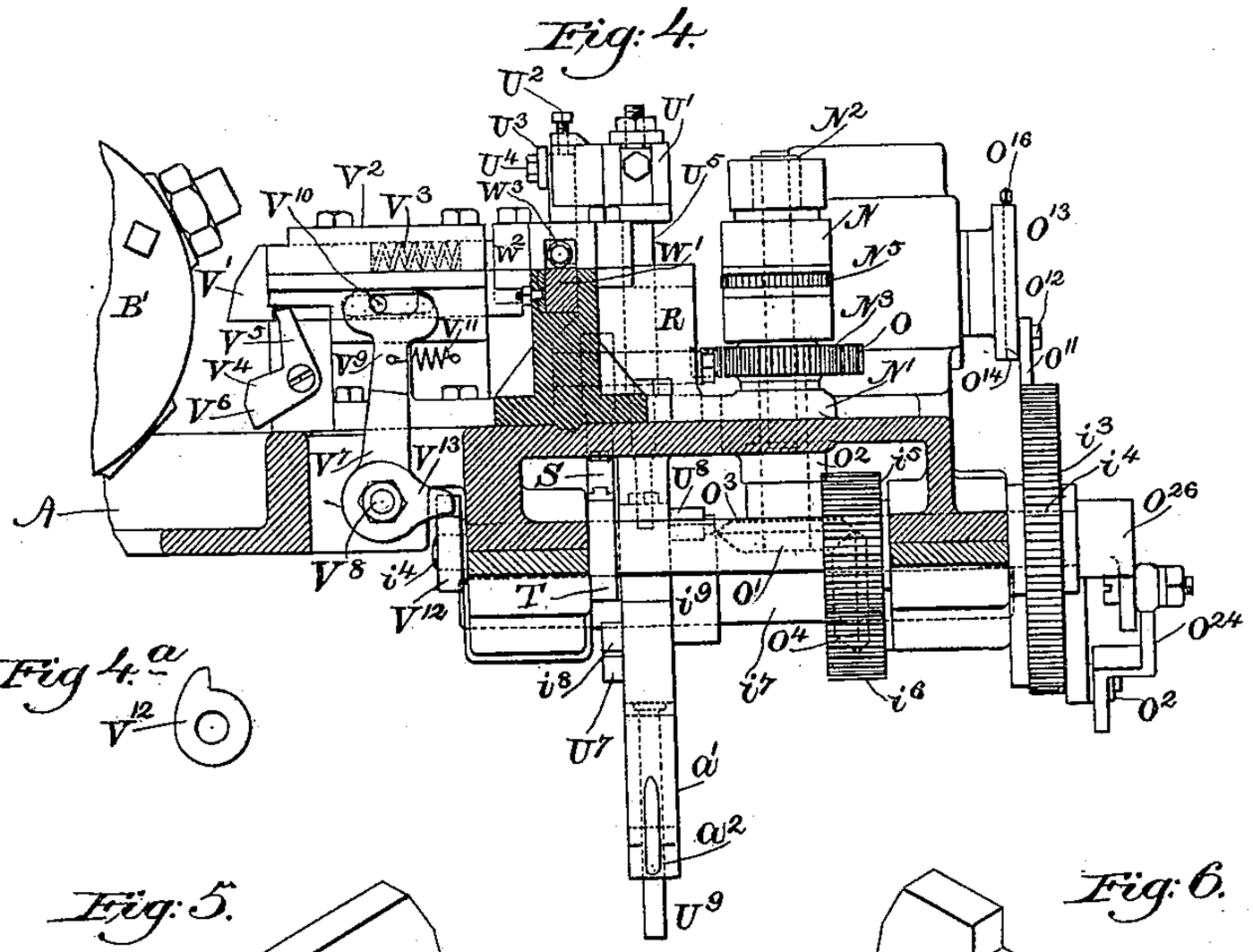


Fig 4.a

Fig: 5.

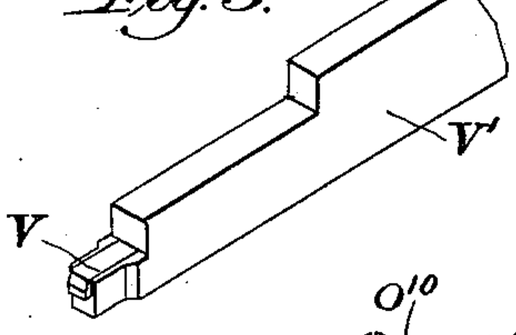


Fig: 6.

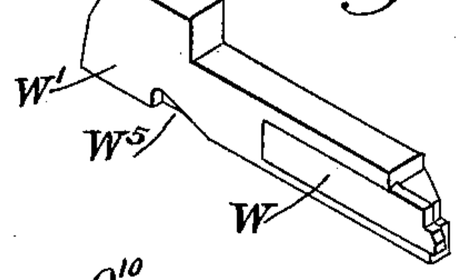


Fig: 7.

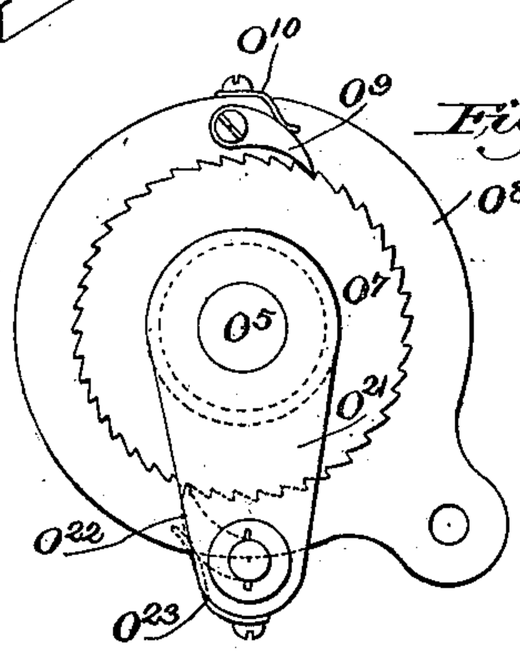
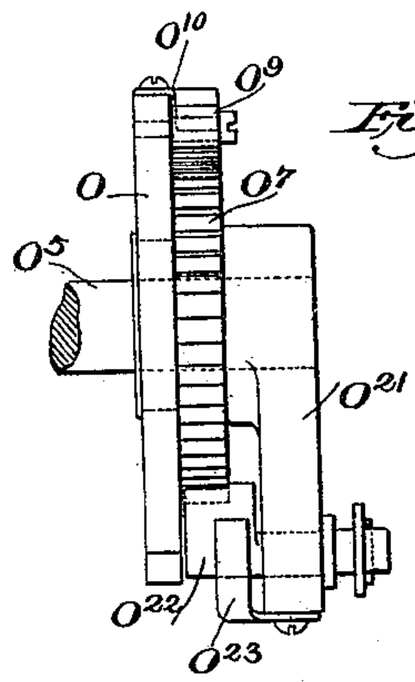


Fig: 8.



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TOE CALK MACHINE.

(Application filed Nov. 18, 1898.)

(No Model.) 6 Sheets—Sheet 5.

Fig: 9. (a.)

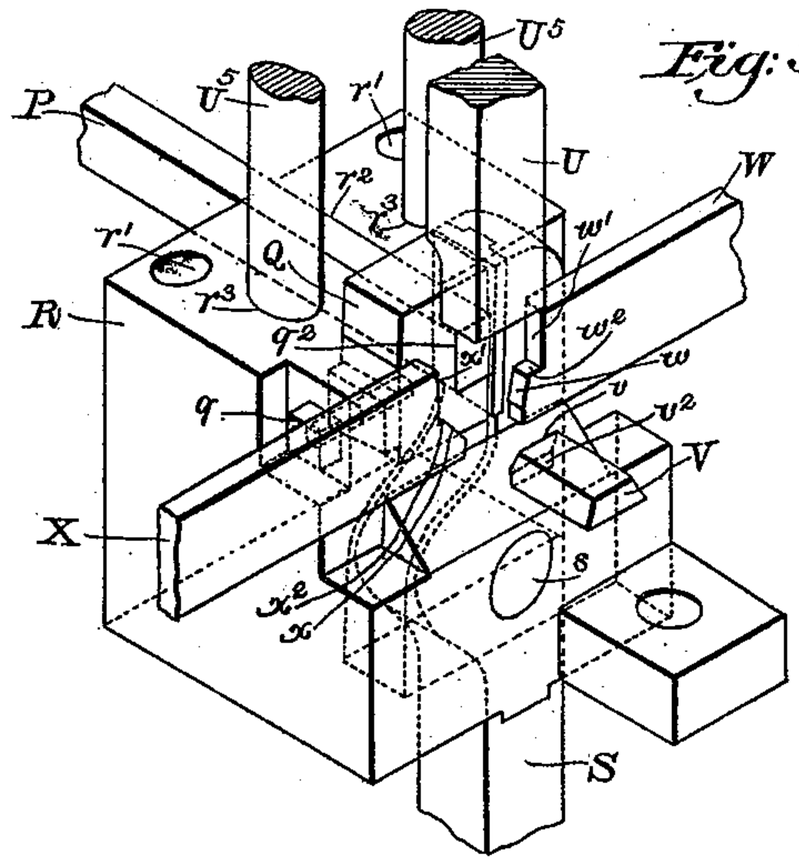

Fig: 9. (b.)

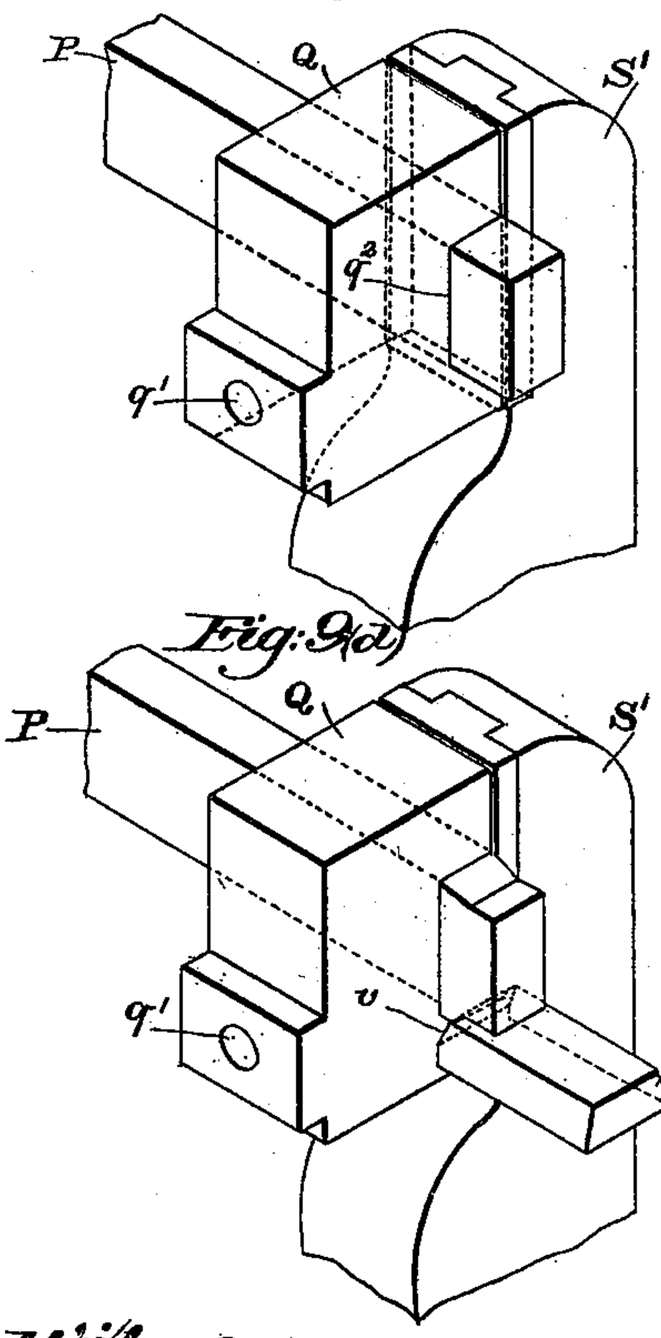

Fig: 9. (c.)

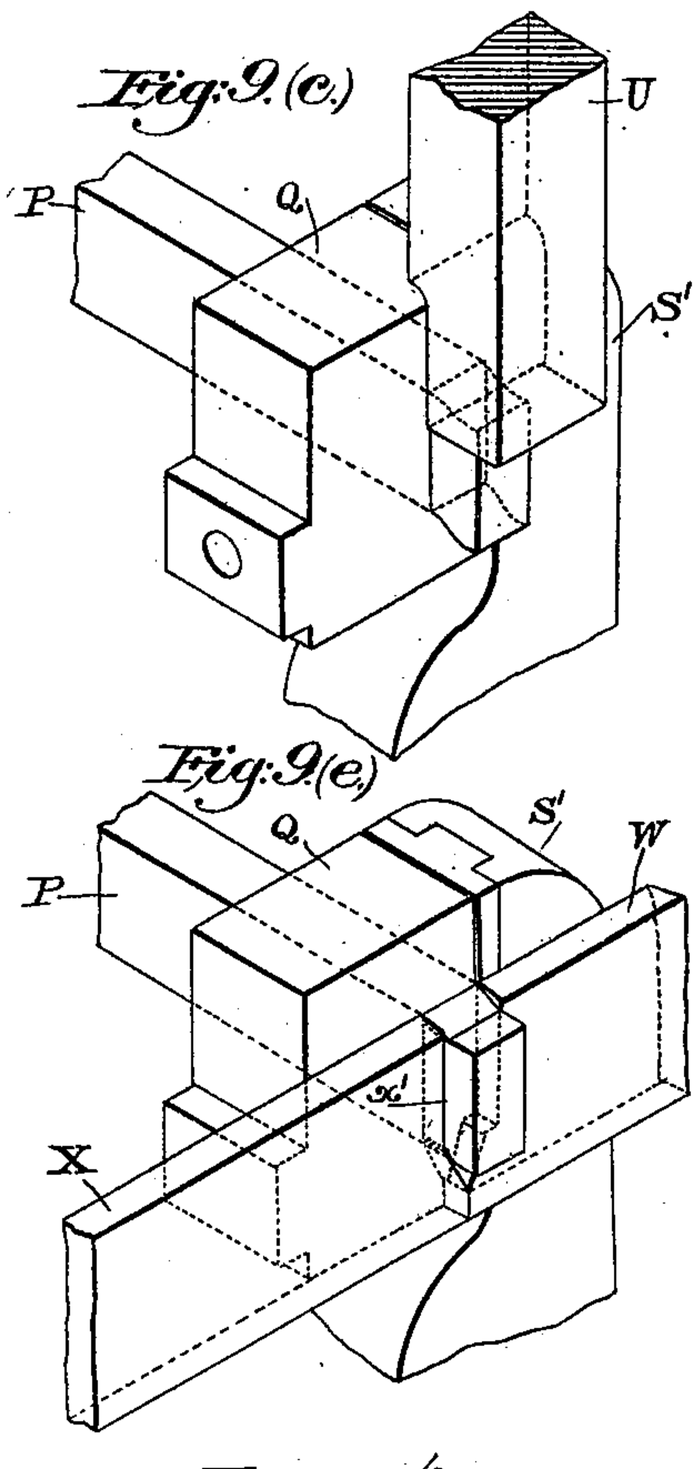

Fig: 9. (d.)

Fig: 9. (e.)

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No. 631,362. Patented Aug. 22, 1899.

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M. F. DICKINSON, Jr. & K. B. & L. H. WORMWOOD, Executors.

TOE CALK MACHINE.

(Application filed Nov. 18, 1898.)

(No Model.) 6 Sheets—Sheet 6.

Fig: 9. (f.)

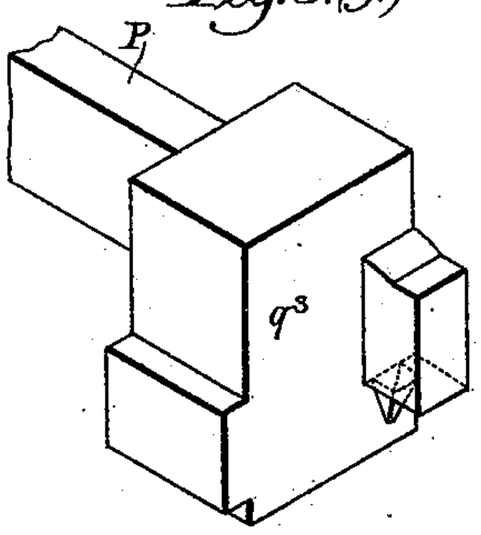


Fig: 9. (g.)

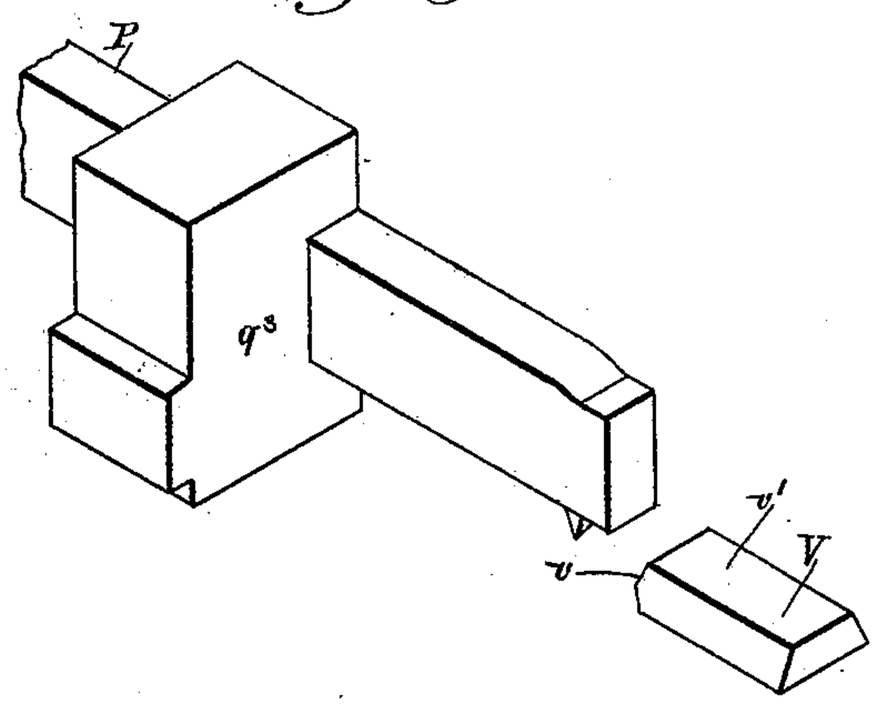


Fig: 9. (h.)

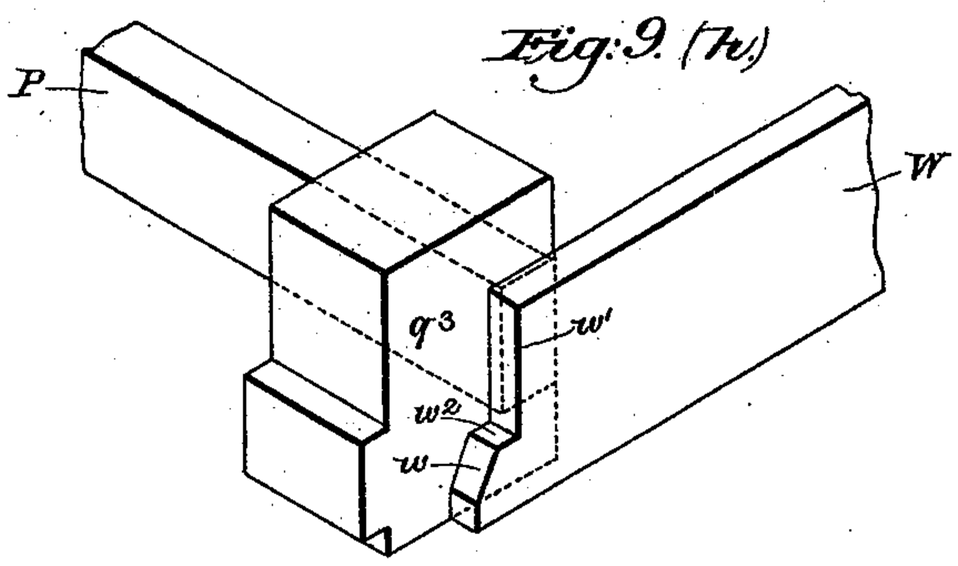
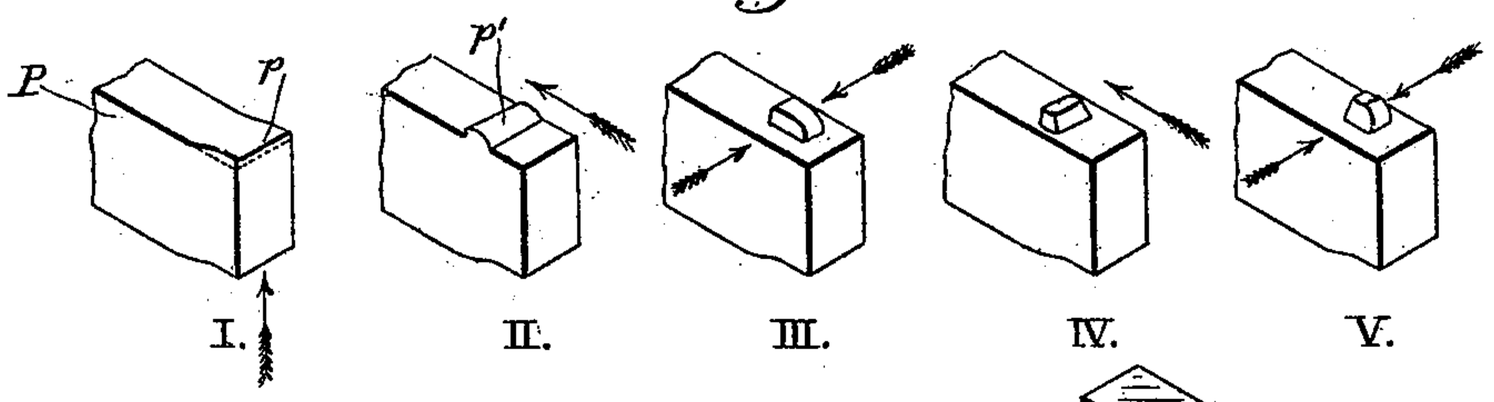


Fig: 10.



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Attys.

UNITED STATES PATENT OFFICE.

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TOE-CALK MACHINE.

SPECIFICATION forming part of Letters Patent No. 631,362, dated August 22, 1899.

Application filed November 18, 1898. Serial No. 696,789. (No model.)

To all whom it may concern:

Be it known that SAMUEL P. WORMWOOD, deceased, late of Newton, in the county of Middlesex, Commonwealth of Massachusetts, invented an Improvement in Toe-Calk Machines, of which the following description, in connection with the accompanying drawings, is a full, clear, and exact specification, such as will enable those skilled in the art to which it relates to make, construct, and use the same.

The invention relates to an improvement in toe-calk machines; and it consists in the combinations hereinafter described and more particularly pointed out in the claims.

This invention has for its object the production of an automatic machine into which is fed a bar or blank of steel, hereinafter called "stock," which by the operations of the various parts of the machine is transformed into toe-calks, each being provided with an integral spur.

Briefly stated, the operation of the machine is as follows: The stock is presented to the machine, the feeding mechanism moves it a short distance forward, a bringing-down hammer offsets the end of the stock, a clamp engages it and holds it in a fixed position in the anvil, and the end hammer alternately with a pair of side hammers delivers blows to the brought-down metal, transforming it into a spur, the clamp loosens, the stock is fed forward and is then cut off by one of the side hammers, and the cycle of operations continues as long as stock is presented to the machine.

It will be understood that the machine is especially adapted to operate upon stock which is continuously fed to it hot, so that a stopping of the machine for the purpose of reheating the bar or presenting another bar is not necessary, although feasible.

In the accompanying drawings, illustrating the preferred form of the invention, in which similar reference-letters refer to similar parts throughout, Figure 1 is a plan of the machine. Fig. 2 is a front elevation of the machine, parts being shown in cross-section on line *x x* of Fig. 1. Fig. 3 is a rear elevation. Fig. 4 is a sectional elevation of part of the machine, taken on line *y y* of Fig. 1. Fig. 4^a is a detail hereinafter to be described. Fig. 5 is an isometric view of the end hammer. Fig. 6 is an isometric view of the right-side hammer. Fig. 7 is a front elevation, and Fig. 8 is a side elevation, of the feed-ratchet and pawl mechanism for operating the feed-rollers. Figs. 9^a, 9^b, 9^c, 9^d, 9^e, 9^f, 9^g, and 9^h represent successive positions assumed by the toe-calk-forming parts of the machine in passing through one cycle of movements to form a toe-calk. Fig. 10 illustrates the successive stages through which the end of the stock passes as it is transformed by the machine into a toe-calk.

The frame or bed A of the machine is suitably mounted upon legs and supports the operative parts of the machine.

B is the main shaft of the machine, which is supported in suitable bearings *b*, projected from the front side of the bed A, and an auxiliary bearing *b'*, carried by an auxiliary frame C. The main shaft B is driven in any suitable manner from a source of power, and in the machine of the drawings by means of a gear-wheel D, loosely mounted upon the shaft and adapted to be clutched thereto by means of clutch E of any suitable form, by preference, however, a "one-revolution" clutch operated by a treadle F through a rod G. When the lever F is depressed and allowed immediately to return again to its original position, the gear-wheel D will be clutched to the shaft B until the said shaft shall have made one complete revolution, at the end of which time it will be automatically unclutched in the well-known manner. If, however, the lever F be depressed and caught under the projection F', thereby holding it permanently down, the gear-wheel D will be permanently clutched to the shaft B until the lever F is again released.

In the machine of the drawings the gear D is driven from the pinion D', keyed to the auxiliary shaft H, supported in suitable bearings in the auxiliary frame and a leg of the machine and in turn driven by a belt on the pulley D^2.

Upon the right-hand side of the machine is

a shaft I, supported in bearings *i*, projected from the side of the bed A, and upon the left-hand side of the machine is a similar shaft J, supported in bearings *j*, likewise projected from the side of the bed. These two shafts I and J are driven from the main shaft B by means of miter-gears, the former by gears *k l* and the latter by gears *k' l'*.

Upon the center of the shaft B is mounted the rotary hammer-head B', and similarly mounted upon the shaft I is the rotary hammer-head I' and on the shaft J the rotary hammer-head J'. These heads are all substantially alike except as to details hereinafter to be pointed out. They are loosely mounted upon their respective shafts and connected to them by means of dogs. Referring to Fig. 2, the dog I^2 is seen to be composed of two parts bolted together around the shaft. Projected from the side of the hammer-head I' is a lug I^3, which is embraced by a recess in the dog I^2, so that when motion is imparted to the shaft I it drives the dog I^2, which in turn engages the lug I^3 on the side of the hammer-head I' to drive it. These hammer-heads are provided with a number of strikers, which immediately engage the hammer-slides to force the hammers into engagement with the stock. The number, disposition, and work performed by the several strikers of the different hammer-heads will be described in connection with the description of the hammers themselves and their mode of operation.

Before proceeding to a description of the elements of the machine which act upon the heated stock to transform it into toe-calks it is more convenient to describe the mechanism for feeding said stock. Any suitable mechanism may be employed for this purpose which will engage the stock and give it a short feed and after an interval of time, during which the hammers shape the toe-calk spur, again feed it forward for the remainder of the length of the toe-calk to the position in which it is to be cut off; but the means which is preferred for this purpose is that illustrated in the drawings, in which two vertical feeding-rollers M N engage the heated stock and feed it forward at the proper times and to the desired extent. The roller M is supported in fixed bearings M M^2, and firmly secured thereto is a pinion M^3, by means of which motion is transmitted to the roller. The other roller N is mounted in yielding bearings N' N^2, which consist of boxes slidingly supported in housings and normally pressed in the direction of the stationary roller M by means of springs N^4. The roller N is provided with a pinion N^3, firmly secured thereto, which meshes with the pinion M^3 on the fixed roller and derives motion therefrom. The stock is adapted to be received in a groove M^5 in the side of the roller M, into which it is pressed by the corrugated collar N^5, projected from the surface of the roller N. Thus the groove M^5 directs the motion of the stock, and the corrugated collar N^5 engages the stock upon the opposite side, holds it in the groove, and feeds it forward at such times as rotative movement is imparted to the rollers by mechanism presently to be described. In the machine of the drawings this gearing for imparting motion to the feed-rollers consists of a gear-wheel O, mounted upon the upper end of a vertical shaft O', supported in a bearing O^2 in the frame A alongside of the bearings M' of the roller M. Upon the lower end of the shaft O' is mounted a miter-gear O^3, which meshes with a corresponding miter-gear O^4, mounted upon the end of the feed-shaft O^5, supported in a horizontal bearing O^6 underneath the rear end of the frame A. Upon the rear end of the shaft O^5 is mounted the ratchet-wheel O^7, which is fixedly secured thereto. Loosely mounted upon the shaft O^5 is the "short-feed" disk O^8, upon which is mounted the short-feed pawl O^9 and the spring O^{10} for pressing the pawl into engagement with the ratchet-wheel O^7. The feed-disk O^8 is given an oscillating movement to impart, through means of the pawl O^9, rotative movement to the feed-shaft O^5, which in turn, through the gearing before described, imparts motion to the feed-rollers. To impart this oscillating movement to the said feed-disk O^8, there is employed a lost-motion pitman O^{11}, which is pivoted to an adjustable-throw crank-pin O^{12}, projected from the face of a crank-disk O^{13}, fixedly secured upon the rear end of the shaft J. The crank-pin O^{12} is mounted upon a slide O^{14}, adapted to slide in a groove O^{15} in the face of the crank-disk O^{13} and to be adjustable therein by means of an adjusting-screw O^{16}, so that the throw of the crank-pin O^{12} may be varied to impart a greater or less oscillatory motion to the feed-disk O^8 to vary the length of the feed to be given the heated stock by the feed-rollers. The end of the pitman O^{11} is slotted at O^{17} and receives therein the feed-disk pin O^{18}, projected from the side of the feed-disk. In order to vary the amount of lost motion secured by the slot O^{17}, there are placed at its ends two adjusting-screws O^{19} and O^{20}. Loosely mounted upon the feed-shaft O^5 and on the other side of the ratchet-wheel O^7 from the feed-disk O^8 is the "long-feed" crank O^{21}, which carries the long-feed pawl O^{22}, normally pressed into contact with the ratchet-wheel O^7 by means of the pawl-spring O^{23}. This long-feed crank O^{21} is oscillated in a manner precisely similar to the manner in which the feed-disk O^8 is oscillated, which is by means of a lost-motion pitman O^{24}, pivoted to an adjustable-throw crank-pin O^{25}, mounted on an outboard crank O^{26}, secured upon the rear end of the shaft i^4 hereinafter referred to. The outboard crank O^{26} is provided with a slot O^{27}, in which the crank-pin O^{25} may be adjusted toward and from the center of the shaft i^4 to vary its throw. The other end of the pitman is provided with a slot and the adjusting-screws similar in all respects to the slot and the adjusting-screws in the end

of the pitman O^{11}. It will be seen that by means of these two mechanisms motion may be given to the feed-rollers at different times and to different amounts. The short-feed disk O^8 imparts a short feed to the heated stock, which projects it beyond the anvil after the previously-formed toe-calk has been cut off, thereby bringing it into position for the hammers to operate upon it, and the long-feed crank O^{21} imparts to the feed-rollers the motion which gives the heated stock its long feed after the toe-calk spur has been formed to bring the toe-calk into position to be cut off from the stock. The short feed plus the long feed equals the length of the toe-calk, and so the long feed may be described as being equal to the remainder of the toe-calk length after the short feed is subtracted therefrom.

Proceeding now to a description of the elements of the machine which act upon the heated stock to transform it into toe-calks and referring more particularly to Figs. 9^a to 9^h and assuming that the stock P has been heated and inserted between the feed-rollers and moved forward until its end is flush with the outer face of the anvil Q, as seen in Fig. 9^a, the machine will be set in motion and the successive operations will be performed upon the steel bar P to forge it into toe-calks. The anvil Q consists of a block of steel provided with a recess q^2 in its right side, which corresponds in size to the stock P, which is adapted to fit loosely therein. The anvil is mounted in an anvil-support R, firmly bolted to the frame A by means of bolts r, which pass down through holes r' and screw into the frame. The upper face of the anvil-support R has a longitudinal channel r^2 in line with the feed-rollers and the recess q^2 in the anvil, which is adapted to receive the heated stock P as it passes from the feeding-rollers M N to the anvil, which, as shown, is mounted in the front of the anvil-support R and into which the stock passes from the channel r^2 in the top of the anvil-support, and to which support the anvil is bolted by means of a bolt q, which enters a screw-threaded hole q' in the anvil Q. A clamping-jaw S', which consists of the upwardly-projecting end of a lever S, which is pivoted to the anvil-support at s, is adapted, when operated by means presently to be described, to engage the side of the stock P and to hold the same securely in the recess q^2 in the anvil, so that during the various operations of the hammers upon the stock P it shall be securely held from movement. Any suitable means may be employed for operating the clamping-lever S to cause it to clamp the stock P in the anvil; but it is preferred to actuate it by means of a cam T, which engages a bent end S^2 of the clamping-lever S. In order to provide for adjustment of the clamping-jaw S' so that it may securely clamp the stock P, there is preferably interposed between the bent end S^2 of the clamping-lever S and the cam T an adjustable gib s', which may be moved by means of nuts upon the projecting screw-threaded bar attached to the gib s' and passing through a boss s^2 on the clamping-lever S. The gib is tapered, so that when it is moved to the right, as seen in Fig. 2, it will interpose a greater thickness of metal between the cam T and the bent portion S^2 of the clamping-lever S and thereby move the clamping-jaw S' closer to the anvil and hold the stock P with greater pressure in the recess q^2 in the anvil side. This adjustment also serves to compensate for wear. The stock having been placed in the machine with its end flush with the face of the anvil will first be moved forward by a short feed of the feed-rollers M N, above described, for a short distance—say, approximately, three-eighths ($\frac{3}{8}$) of an inch—to the position shown in Fig. 9^b, and then the clamping-jaw S' will be operated by the means described to engage the stock and securely hold it with its end projecting beyond the face of the anvil. The stock being held in this position, the first operation thereon will be what may be termed a "bringing-down" operation, which offsets the end of the stock from the body thereof to displace laterally the whole end of the stock bodily with reference to the bar thereof held by the anvil. This operation of offsetting the end of the bar bodily with reference to the bar itself is an important step in the process of forming toe-calks with this machine, and for the reason that by a slight expenditure of power metal may be provided from which the toe-calk spur may be formed without upsetting the end of the bar or gouging the side of the end of the bar or seriously distorting it from its original shape. It is well known that in forging a large mass of metal may be moved bodily with a very much less expenditure of power than is required to move a similar mass of metal through a longer distance, for the reason that the number of molecules displaced with reference to each other is less in the former case than the latter. An important improvement in this case therefore consists in providing the metal from which the spur is to be formed by offsetting the end of the bar. Any suitable means may be employed to secure this bringing down of the end of the stock; but preferably this will be accomplished by the top hammer U, which descends upon the end of the stock and offsets the metal, as shown in Fig. 9^c. The top hammer U is supported and carried by a top-hammer block U', in which the top hammer U is secured in a vertical channel in the front face thereof, in which channel the top hammer may be vertically adjusted by means of an adjusting-bolt U^2. Having been adjusted to its desired position, it is securely clamped to the top-hammer block by means of a strap U^3, through which cap-bolts U^4 are screwed into the top-hammer block. The top-hammer block U' is mounted upon the upper ends of two vertical rods U^5, which pass down freely through vertical holes r^3 in the anvil-support

R, which thereby provides a support for the vertically-reciprocating top hammer. The lower ends of the rods U^5 are secured to a cross-head U^6, which slides in guides *a*, projected from the lower side of the bed A. The cross-head U^6 is provided in its center with a large opening, through which passes a shaft i^7, which carries two cams, which by striking projections thereon are adapted to raise and lower the top hammer. The cam i^8 first strikes the projection U^7 on the cross-head U^6 and forces the cross-head downwardly, carrying with it the top hammer and thereby securing the bringing down or offsetting of the end of the stock. After this cam i^8 has passed the projection U^7 the cam i^9 strikes a projection U^8 on the rear side of the cross-head U^6 and raises the top hammer again. It will be seen from the relative positions of these two cams and the projections with which they are adapted to engage that the bringing down of the top hammer is immediately followed by the motion which raises it again, so that the blow delivered is a quick blow and the hammer is immediately withdrawn from the stock. In order to guide the cross-head U^6, there is provided a U-shaped yoke a', the upper ends of which are attached to the downwardly-projected guides *a* in any convenient manner. From the bottom of the cross-head there is projected downwardly a guide-rod U^9, which is adapted to reciprocate in a hole a^2, provided in the lower end of the U-shaped yoke a'. This yoke also receives a thrust of a coiled spring U^{10}, surrounding the rod U^9, and which is interposed between the cross-head and the bottom of the yoke, so that it not only tends to raise the top hammer and to assist the cam i^9 in so doing, but also holds the top hammer in its raised position.

It is convenient at this point to describe the means for operating the clamping-jaw S′ and the means for operating the top hammer U, and while any suitable means might be provided for that purpose there is preferably employed the means illustrated in the drawings, which consists of shafts extending from the rear of the machine toward the front, supported in bearings fixed to the lower side of the bed A and driven from the shaft I on the right-hand side of the machine. Upon the rear end of the shaft I is fixed a gear-wheel i', which meshes with an intermediate gear i^2, which in turn engages the gear i^3, mounted upon the shaft i^4 before referred to, which is supported in suitable bearings, as described, and carries the cam T, which operates the clamping-lever S. Also mounted upon the shaft i^4 is a pinion i^5, which meshes with the pinion i^6, mounted upon a shaft i^7, supported in suitable bearings parallel to the shaft i^4, which shaft i^7, as before described, carries the cams i^8 and i^9, which operate the cross-head U^6 to actuate the top hammer U.

Recurring now to the stock after the same has been subjected to the bringing-down or offsetting operation of the top hammer U, it is acted upon by an end hammer V, as shown in Fig. 9^d, and then by the two side hammers W and X, W being the right-side hammer and X being the left-side hammer, as seen in Fig. 9^e, hammer V striking four blows alternately with four blows of the hammers W and X. First the operation of the hammers upon the metal will be described and then the hammers themselves and the means for giving them their motions.

In Fig. 10 the stock P is shown upside down and at nine different stages in the operation. In stage I the stock is seen after it has been subjected to the action of the top hammer, the direction of the blow of which is indicated by the arrow 1, and the brought-down metal is clearly seen on the lower side of the stock. In stage II the brought-down metal p' is seen after the first blow of the end hammer V (the direction of the blow being indicated by the arrow 2) to press and force the brought-down metal in the direction of the face q^3 of the anvil, whereby the stock is provided upon its under side with a laterally-disposed ridge or projection p'. Then the two side hammers W and X operate simultaneously from opposite sides of the blank in the direction of the arrows 3 and 4, respectively, to press the end portions of the laterally-disposed ridge or projection p' in toward the center of the blank, as shown in stage III. At stage IV the blow of the end hammer is repeated, and at stage V the blow of the two side hammers is repeated, so, also, at stages VI and VII and VIII and IX, by which time the brought-down metal will have been brought to the shape of the finished form of spur, as shown in stage IX and Fig. 9^f. Then the stock P will be given its long feed for the remainder of a toe-calk length, carrying it to the position shown in Fig. 9^g, and the side hammer W will be given its cutting-off stroke, as seen in Fig. 9^h, and a completed toe-calk (shown at stage IX) will be severed from the stock and fall down into a receptacle placed under the machine to receive it. It will thus be observed that in the process of making a toe-calk the end hammer V and the side hammers W and X alternately strike blows to gradually and progressively bring the brought-down metal to the shape of a finished spur, which spur is projected from the surface of the bottom of the toe-calk and lies at a distance from the end and from one side of the same.

The end hammer V consists of a piece of air-hardened steel supported in its slide V′, (shown in perspective in Fig. 5), which is slidingly mounted in a suitable guide V^2 upon the frame A of the machine, so that the slide may be reciprocated therein. A spring V^3 acts normally to hold the hammer-slide and hammer withdrawn from the work; but inasmuch as such spring is not always sufficient for the purpose the bell-crank lever V^4 is provided, which is mounted upon the base of the guide V^2 and has its ends, the one, V^5, pro-

jected into a recess in the under side of the hammer-slide V′, and the other, V⁶, projected into the path of the strikers when the hammer-slide has been driven inward thereby, so that a striker, as B′¹, after forcing the hammer against the work will engage the end of the bell-crank lever and actuate the same to positively withdraw the hammer from engagement with the work. When the formation of a toe-calk has been completed and just before it is given its long feed, it is necessary that the end hammer V be withdrawn from the space into which the toe-calk is to be projected, and for this purpose there is provided a lever V⁷, pivoted at V⁸ to the frame A of the machine, having an upwardly-extending arm V⁹, forked at its end and receiving between its forks a pin V¹⁰, projected from the side of the end-hammer slide V′ out through a slot in the side of the guide V². The distance between the forks permits the ordinary reciprocation of the hammer-slide without thereby imparting any movements to the lever V⁷. A light spring V¹¹ holds the upper end V⁹ of the lever V⁷ in the position shown in Fig. 4, from which position it is moved to the left to withdraw the hammer-slide from proximity to the toe-calk by means of a cam V¹², (shown in elevation in Fig. 4ª,) mounted upon the front end of the shaft *i*⁴, which cam V¹² engages the projection V¹³ on the side of the lever V⁷ to actuate the same. It is to be noted in this connection that the gear *i*′ on the shaft I and gear *i*³ on the shaft *i*⁴ are of the same size, the one being driven from the other by means of the intermediate gear *i*², which transmits motion from the one to the other, and as a consequence that the cam V¹² operates to withdraw the hammer once for each revolution of the shaft I, and remembering that the shaft I revolves once for each toe-calk formed it is seen that the cam V¹², being properly timed with respect to the making of the toe-calk, will operate to withdraw the end hammer V when the toe-calk is given its long feed for the remainder of a toe-calk length to bring it to the position in which it is cut off.

The right-side hammer W consists of a piece of air-hardened steel supported in its slide W′, (shown in perspective in Fig. 6,) which is slidingly mounted in a suitable guide W² upon the frame A of the machine at right angles to the end-hammer guide V², so that the slide W′ may be reciprocated in said guide W². A spring W³ acts normally to hold the hammer withdrawn from the work, which corresponds in function to the spring V³ before described. So, also, there is provided for this slide W′ the bell-crank lever W⁴, which, like lever V⁴, is to positively withdraw the hammer from the work after its blow has been struck. The lever W⁴ engages the recess W⁵ in the lower side of the hammer-slide W′.

The left-side hammer X, its slide X′, guide X², and spring X³ correspond to the similar parts appurtenant to the hammer W; but hammer X is not provided with the positive retracting bell-crank lever of the end hammer V and side hammer W, as the same has been found unnecessary when the toe-calk spur is quite close to this side of the stock.

The faces of the several hammers V, W, and X are shaped to adapt them to the work to be performed. This face *v* of the hammer V is beveled to correspond to the desired inclination of the face 5 of the toe-calk spur which it forms. The face *w* of the hammer W is projected forward beyond the cutting-face *w*′, so that the spur-forming face *w* passes under the lower surface of the body of the toe-calk and forms the side face 6 of the toe-calk spur. The face *x* of the hammer X is like the face *w* of the hammer W, but is not projected so far beyond the face *x*′ of the hammer X, so that the spur shall be nearer the left side of the toe-calk than the right. Thus it is seen that there is but a short face *x*² of the side hammer X under the lower side of the toe-calk, while the face *w*² of the right-side hammer and the face *v*² of the end hammer V extend much larger distances under the lower side of the toe-calk. This fact accounts for the sufficiency of the spring X³ to retract the hammer X, while in addition to the springs to retract the hammers V and W there are needed the bell-crank levers V⁴ and W⁴ to positively withdraw the right-side and end hammers. If, therefore, the spur should be placed equidistant from the sides of the toe-calk, the same retracting means would be required on both sides. In this connection it should be observed that the faces *v*², *w*′, *w*², *x*′, and *x*² act upon the stock P to preserve it from distortion by the blows of the spur-forming faces *v*, *w*, and *x* as well as to restore the stock P to its proper shape after the distortion due to the action of the bringing-down hammer U.

The hammers V, W, and X may be actuated by any suitable means to operate them in the manner above set forth; but the preferred means consists of the hammer-heads B′, I′, and J′ above referred to, which actuate, respectively, the hammers V, W, and X by means of the strikers with which the hammer-heads are respectively provided. As we have seen, the hammer V strikes four blows against the work to form the face 5 of the toe-calk spur, so that hammer-head B′ is provided with four strikers B′¹, B′², B′³, and B′⁴ to deliver the desired blows. They are spaced at intervals of one-seventh of a circumference around the periphery of the hammer-head B′, so that the four blows are struck during three-sevenths of a revolution, leaving four-sevenths for the long feed cutting off and the short feed of the stock. The hammer-head I′ is similarly provided with four strikers I′¹ I′² I′³ I′⁴ to impart the four forming blows to the hammer W, similarly arranged in three-sevenths of the circumfer-

once, but so timed with relation to the strikers of the head B′ as to deliver its blows between the blows of the head B′. After striker I′⁴ delivers its blow an interval of two-sevenths of a circumference intervenes, during which the stock P is given its long feed for the remainder of a toe-calk length, and then the striker I′⁵, which, as clearly shown in Fig. 2, is projected much farther out from the head than the other strikers, strikes the hammer-slide W² a blow which moves its hammer W to the position shown in Fig. 9ʰ, thereby forcing the cutting-face *w′* of the hammer past the face of the anvil Q and shearing off the completed toe-calk. Between the striker I′⁵ and striker I′¹ there intervenes a space of another two-sevenths of a circumference which allows for the short feed of the stock after cutting off the completed toe-calk. The hammer-head J′ is provided with four strikers J′¹, J′², J′³, and J′⁴, which correspond each to each with the strikers I′¹, I′², I′³, and I′⁴ of the head I′, being so timed as to deliver their blows simultaneously therewith and arranged in the circumference in the same way, and there being but four strikers they leave four-sevenths of a circumference for the long feed cutting off and short feed of the stock P like the hammer-head B′. In giving the angles between the strikers it is stated in angles between their center lines. These hammer-heads are all substantially alike and the method of attaching their strikers to them is the same, so that in Fig. 2 is illustrated a partial section through the striker I′¹ and the hammer-head body. Each striker consists of a piece of round tool-steel having flattened sides inserted in round holes in the body of the hammer-head. Through the sides of the hammer-head body pass set-screws to engage the flattened sides of the striker to hold it from accidental rotation. The striker is screw-threaded on its outwardly-projecting end and receives thereon an adjusting-nut I′¹ᵃ, by means of which it may be adjusted toward and from the center of the hammer-head to vary the length of the stroke to be imparted by it to the hammer-slide. The extreme outer end of the striker is preferably square in section, so that it may strike fairly on the projecting end of the hammer-slide. The faces of the strikers of the hammer-head I′ are beveled, because the stroke of the hammer-slide W′ is comparatively long, while the faces of the strikers of the hammer-heads B′ and J′ are substantially flat, as they do not have to impart a long stroke to their hammer-slides. This beveling of the projecting end of the striker divides the bevel between the end of the hammer-slide and the end of the striker.

To recapitulate briefly the operation of the machine set forth throughout the above description of the construction and organization thereof, hot-steel stock is inserted between the feed-rollers and moved forward until its end is flush with the face of the anvil. At this time the stock P rests loosely in the recess q^2 in the side of the anvil Q, the clamp S′ being retracted. The first step consists in feeding the stock a short distance toward the front of the machine or in giving it its short feed to the position shown in Fig. 9ᵇ. Then the clamp S is operated by the cam T to grip and tightly clamp the stock P in the recess q^2 of the anvil Q. The bringing-down hammer U is now forced down upon the projecting end of the stock P, and the end thereof is brought down or offset from the body of the bar, bringing the stock to the shape shown in stage I, Fig. 10, the position of the bringing-down hammer with reference to the anvil being shown in Fig. 9ᶜ. The bringing-down hammer U is immediately raised and the end hammer V and the two side hammers W and X deliver four blows alternately to the brought-down metal *p*, transforming it into the spur of the toe-calk, carrying it through the successive stages II, III, IV, V, VI, VII, VIII, and IX to the completed article. In Fig. 9ᵈ the end hammer V is shown in the position of delivering one of its blows to the spur, and in Fig. 9ᵉ the two side hammers W and X are shown in the position of delivering their blows. The cam T will at this time release the clamp S′, and the stock P, provided with a finished spur, as shown in Fig. 9ᶠ, will be given its long feed for the remainder of a toe-calk length, carrying it from the position shown in that figure to the position shown in Fig. 9ᵍ, the end hammer V having been just previously withdrawn from in front of the stock by means of the cam V¹² and lever V⁷ to the position shown in said Fig. 9ᵍ. Then while the stock P is still loosely held in the recess q^2 of the anvil Q the right-side hammer W will be given its cutting-off movement to the position shown in Fig. 9ʰ by the high striker I′⁵, which will shear off the completed toe-calk from the stock. The cycle of operation will then be repeated without interruption as long as heated bars one after another are fed into the machine.

By the expression "spur-forming hammers," wherever the same is used in the claims, is meant those hammers or their equivalents which operate upon the metal of the stock to form the spur upon the lower side of the same. By the expression "toe-calk-forming hammers" is meant those hammers which operate upon the stock to transform it into the completed toe-calk, thus including both the spur-forming hammers and the bringing-down hammer or their equivalents. By the expression "short feed" is meant the feed which projects a short piece of stock beyond the face of the anvil into position to be operated upon by the toe-calk-forming hammers. By the expression "long feed" is meant the feed of the stock for the remainder of a toe-calk length after the same has previously been given its short feed.

Having fully described the invention, what is claimed, and desired to be secured by Letters Patent of the United States, is—

1. In a toe-calk machine, the combination with means for holding the stock, of means for offsetting the end of the same to provide material to form a spur, spur-forming hammers for forming a spur from the offset material and connected mechanism operating automatically to actuate the said elements, substantially as described.

2. In a toe-calk machine, the combination with means for holding the stock, of means for offsetting the end of the same to provide material to form a spur, spur-forming hammers for forming a spur from the offset material, means for cutting off the completed toe-calk, and connected mechanism operating automatically to actuate said elements, substantially as described.

3. In a toe-calk machine, the combination with means for holding the stock, of toe-calk-forming hammers and connected mechanism operating automatically to feed a short length of the stock, to actuate said hammers to form a spur on said stock, to feed a long length of the stock and to actuate one of said hammers to cut off the completed toe-calk, substantially as described.

4. In a toe-calk machine, the combination with means for feeding a short length of the stock, of means for holding the same, means to offset the end of the same to provide material to form a spur, spur-forming hammers for forming a spur from the offset material, means for feeding a long length of the stock, and connected mechanism operating automatically to actuate said elements and to actuate one of said spur-forming hammers after the completion of the long feed of the stock to cut off the completed toe-calk, substantially as described.

5. In a toe-calk machine, the combination with means for holding the stock, of means for offsetting the end of the same to provide material to form a spur, spur-forming hammers for forming a spur from the offset material, means to positively withdraw said hammers after having struck their blows, and connected mechanism operating automatically to actuate said elements, substantially as described.

6. In a toe-calk machine, the combination with means for holding the stock, of a bringing-down hammer to offset the end of the stock, spur-forming hammers for forming a spur from the offset material, and means for actuating the said elements, substantially as described.

7. In a toe-calk machine, the combination with feeding mechanism to feed the stock a short feed, of means for holding the stock, a bringing-down hammer to offset the end of the stock to provide material to form a spur, means for actuating the bringing-down hammer, spur-forming hammers and means for actuating them to form a spur from the offset material, substantially as described.

In witness whereof we affix our signatures in presence of two witnesses.

MARQUIS F. DICKINSON, JR.,
KATE B. WORMWOOD,
LUTHER H. WORMWOOD,
Executors of Samuel P. Wormwood, deceased.

Witnesses:
T. HART ANDERSON,
HORACE VAN EVEREN.