J. R. BLAKESLEE.

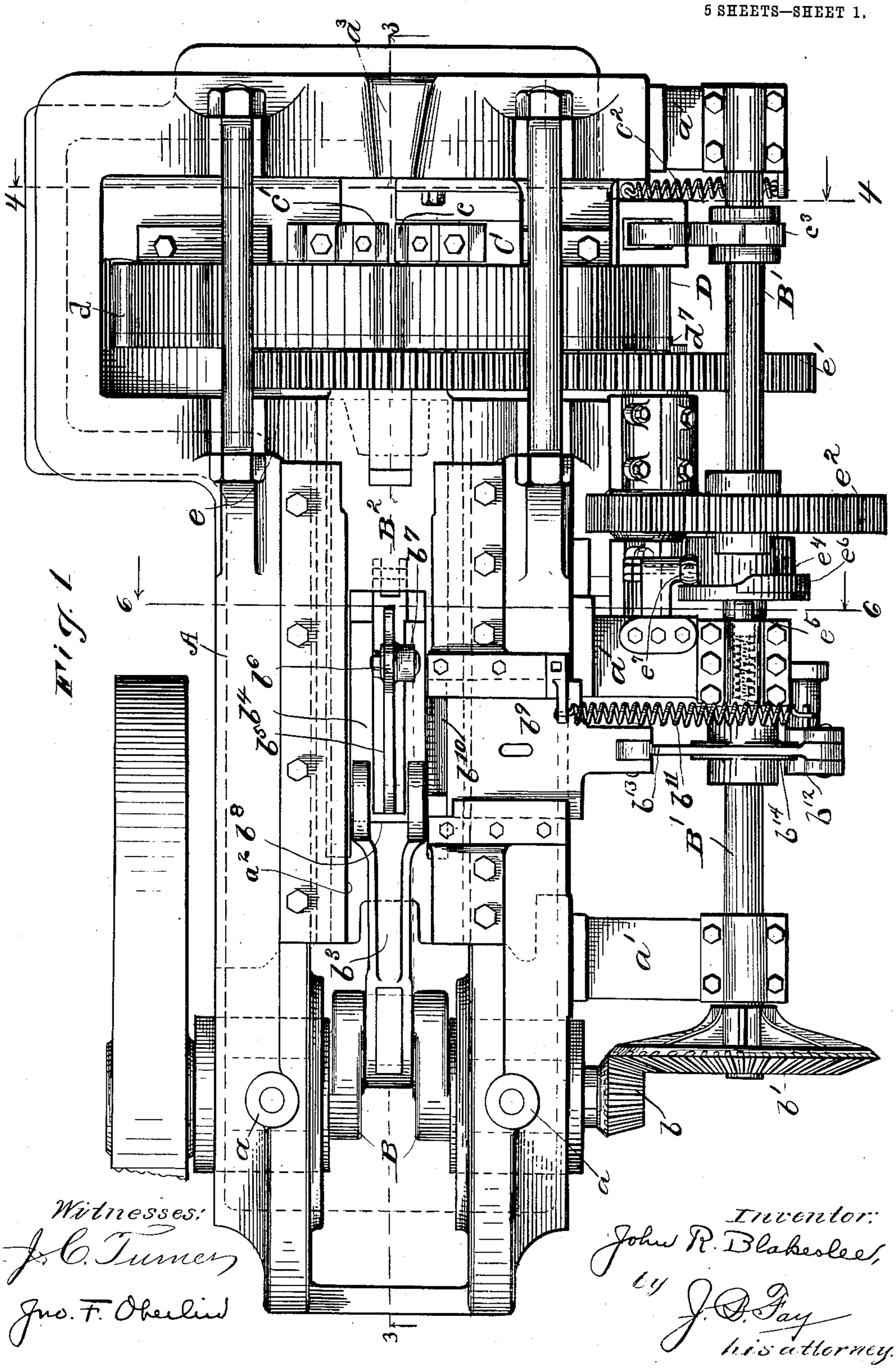
BOLT HEADER.

APPLICATION FILED AUG. 15, 1907.

943,335.

Patented Dec. 14, 1909.

5 SHEETS—SHEET 1.



Witnesses:

J. C. Turner

Jno. F. Oberlin

Inventor:

John R. Blakeslee,

by J. B. Fay

his attorney.

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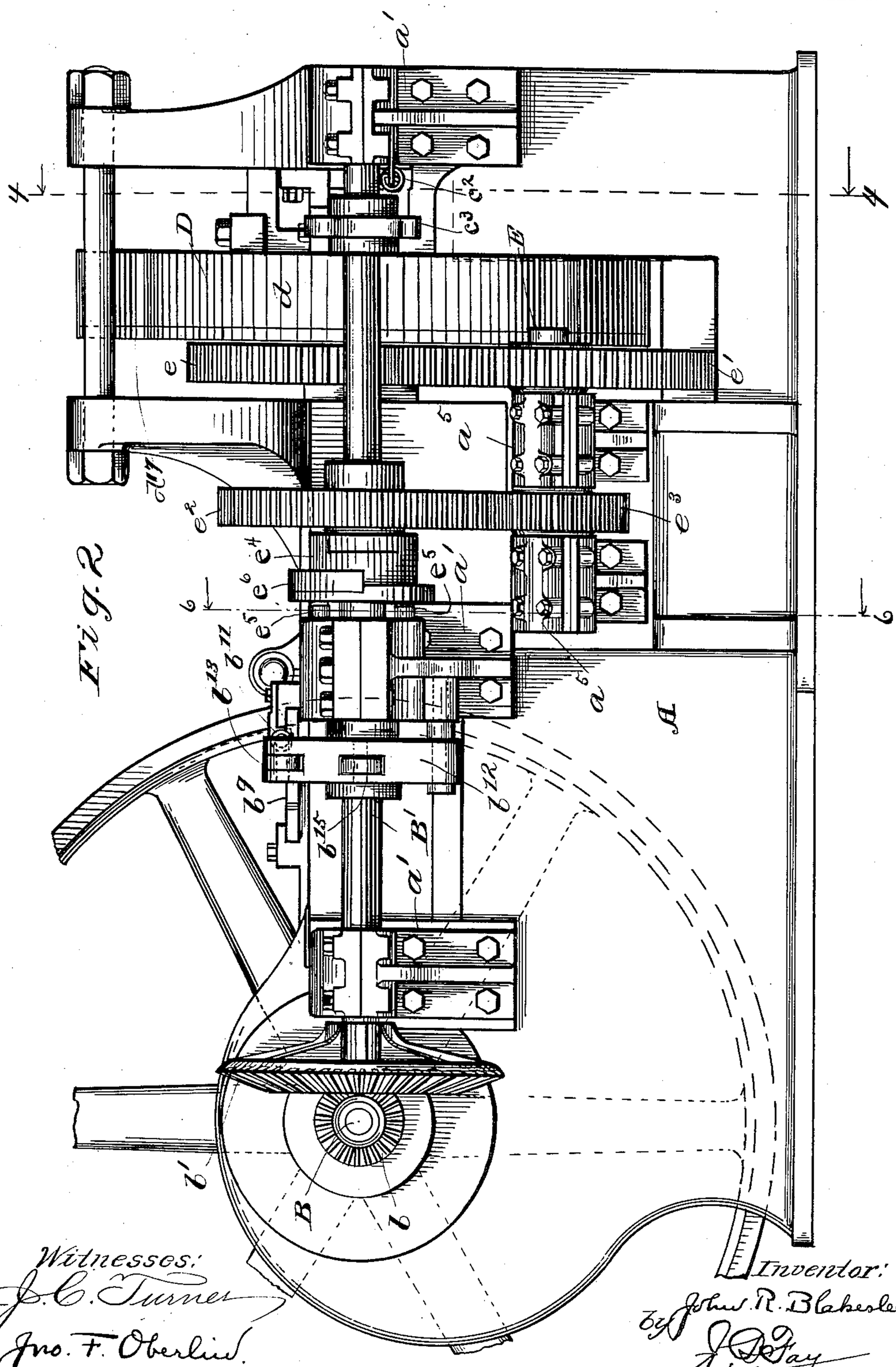

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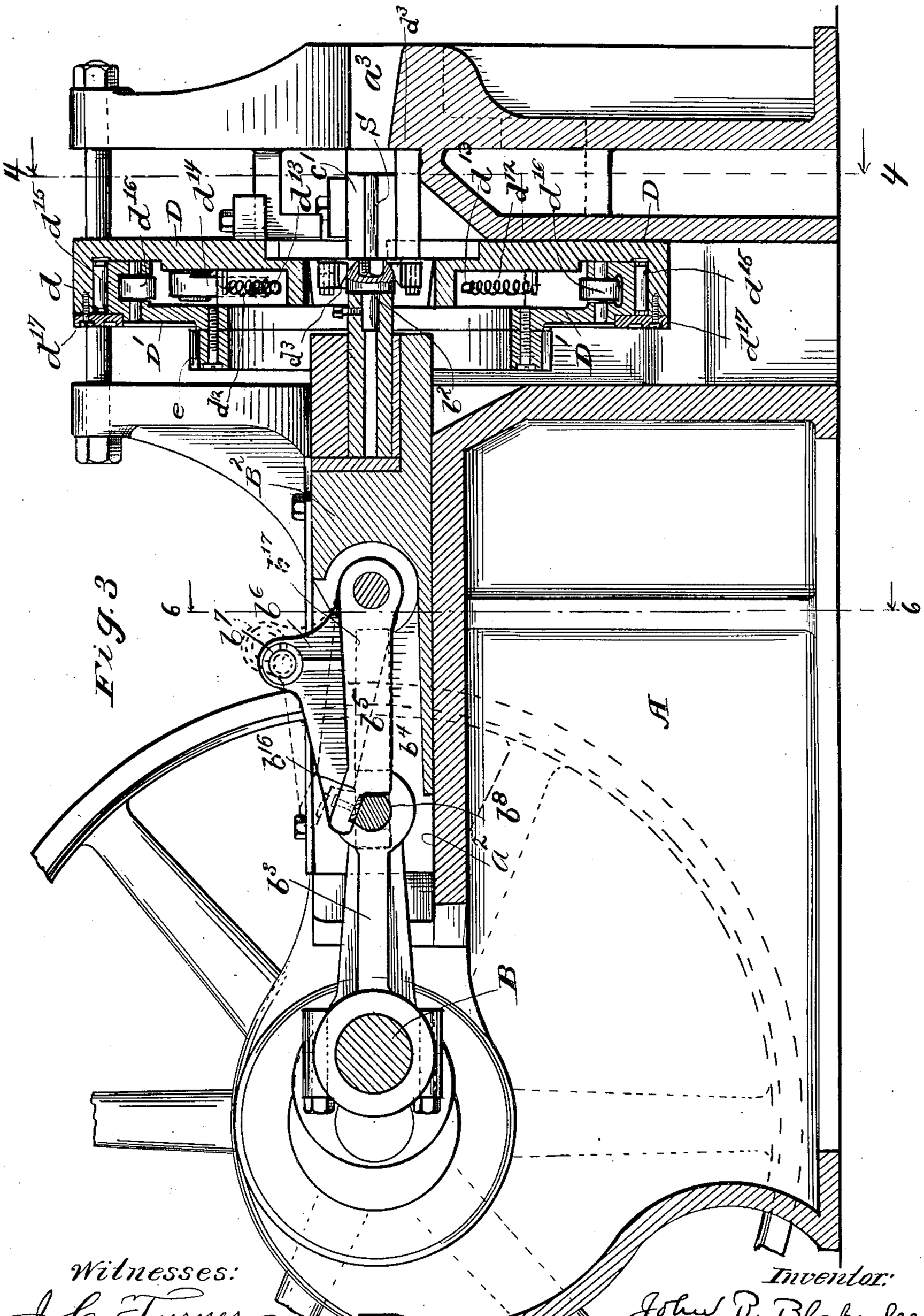

Fig. 3

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Fig. 4

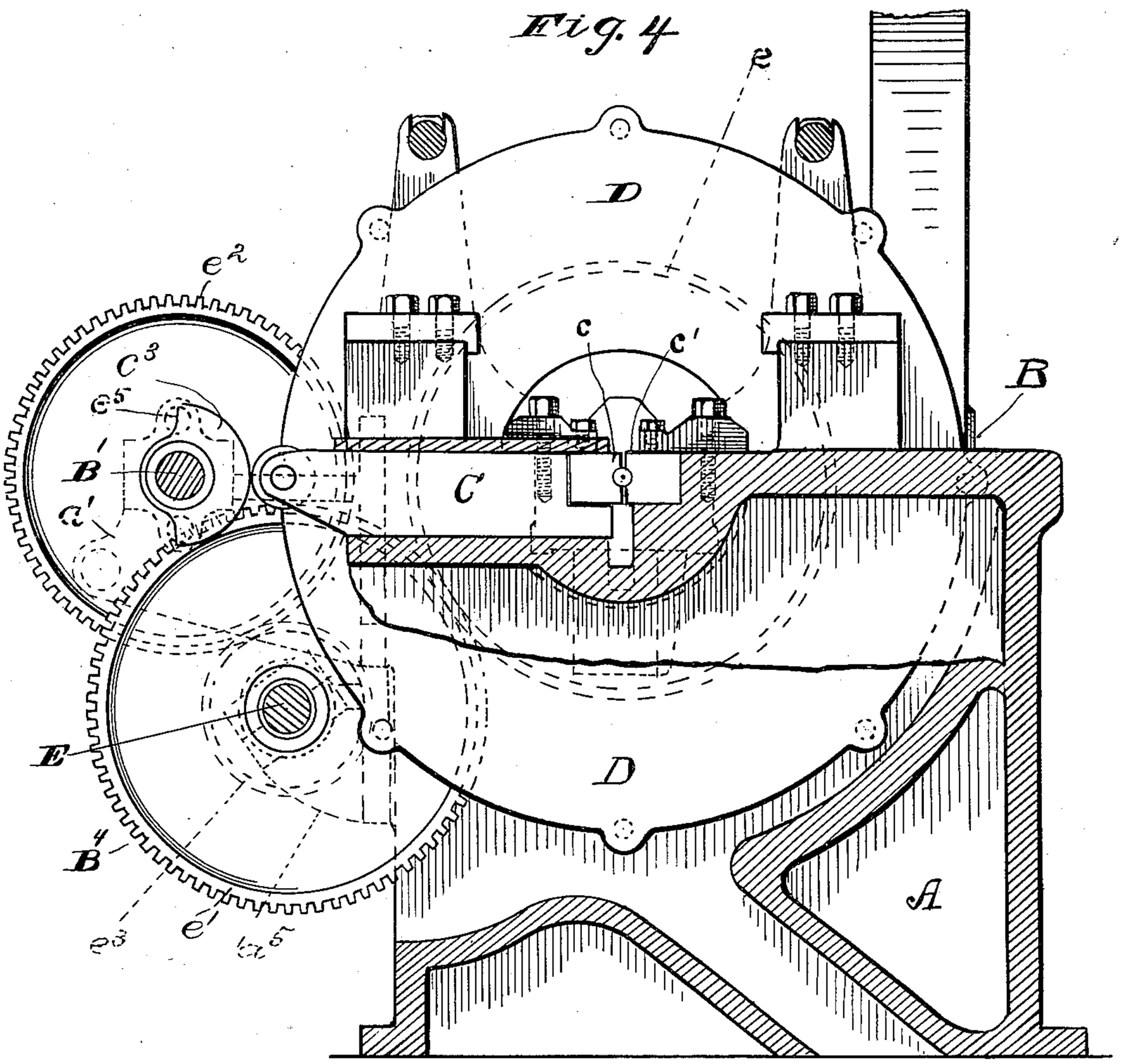
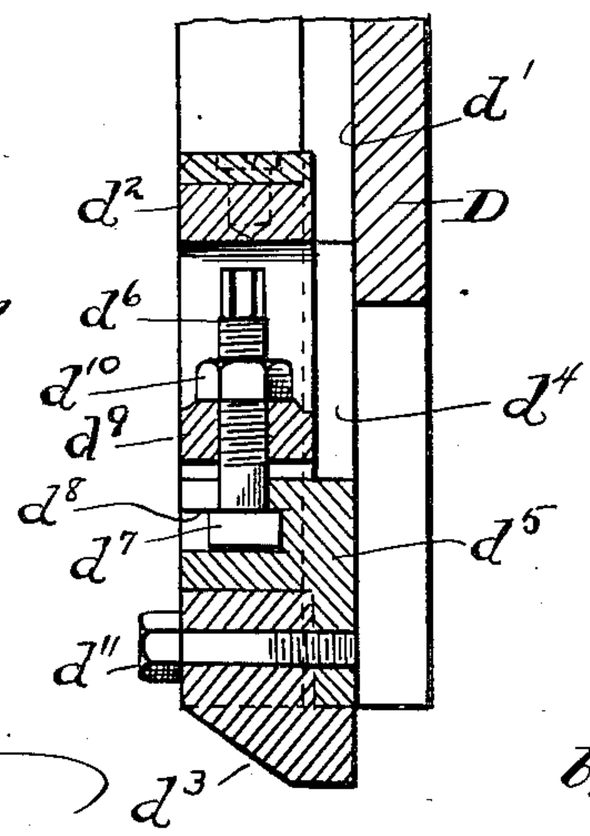


Fig. 7



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5 SHEETS—SHEET 5.

Fig 5

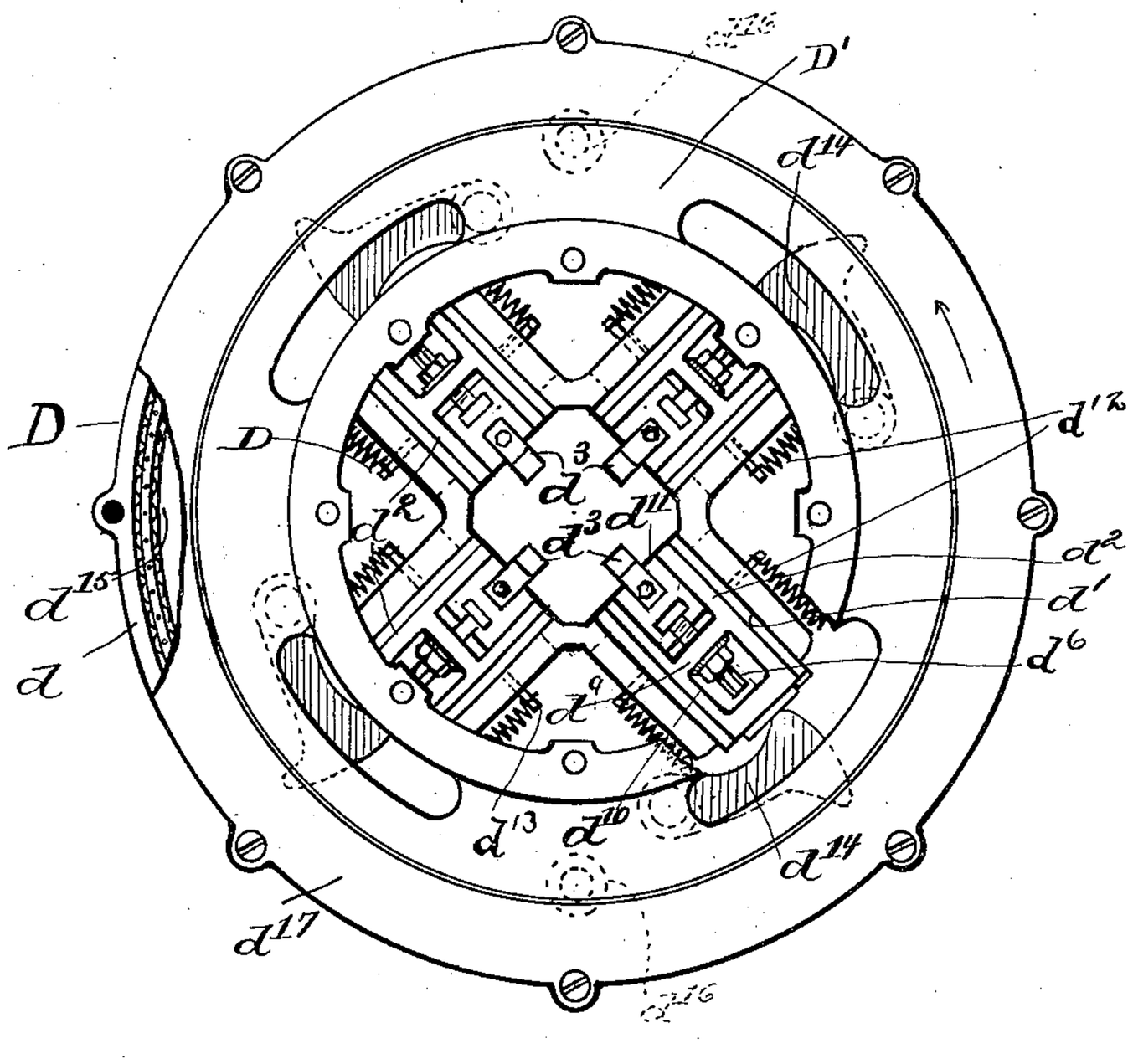
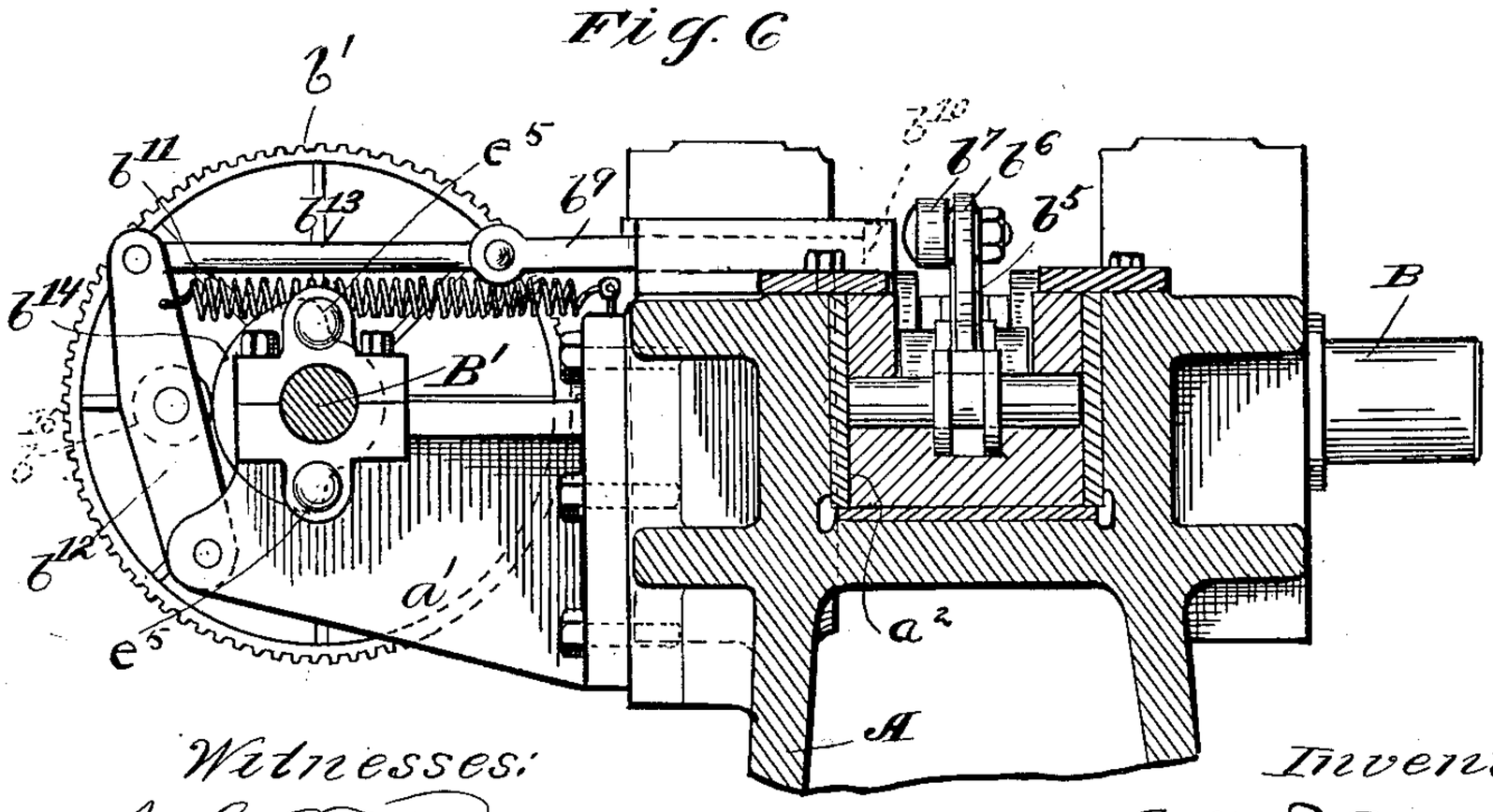


Fig. 6



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UNITED STATES PATENT OFFICE.

JOHN R. BLAKESLEE, OF CLEVELAND, OHIO, ASSIGNOR TO THE AJAX MANUFACTURING COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

BOLT-HEADER.

943,335. Specification of Letters Patent. Patented Dec. 14, 1909.

Application filed August 15, 1907. Serial No. 388,610.

To all whom it may concern:

Be it known that I, JOHN R. BLAKESLEE, citizen of the United States, resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Bolt-Headers, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

This my present invention relates to forging machines, particularly to that type of forging machine used in heading bolts and for this reason ordinarily termed bolt-header or bolt heading machine.

As is well understood, the method of heading bolts by hot forging is accomplished by upsetting the end of the rod or blank forming the body of the bolt and thereupon forging such upset end into the form of head desired, whether square, hexagonal or round. The initial upsetting operation is performed by an upsetting die striking the inserted end of the bolt blank, such blank being held between a pair of gripping dies in the meanwhile. Upon retraction of the upsetting die oppositely disposed pairs of dies, transversely reciprocable with respect to the direction of movement of the upsetting die, are caused to strike the sides of the bolt head and shape the same as just stated.

The object of the present invention is to provide means for coördinating the aforesaid operations more perfectly than has been the case in machines heretofore devised, as also to render the performance of such operations entirely automatic, thus obviating to a large measure the expensive element of personal supervision now necessary and at the same time resulting in a large increase in the capacity or output of the machine.

To the accomplishment of the above and related ends, said invention then consists of the means hereinafter fully described and particularly pointed out in the claims.

The annexed drawings and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but one of various mechanical forms in which the principle of the invention may be used.

In said annexed drawings: Figure 1 is a plan view of a bolt heading machine embodying in approved form my several improvements; Fig. 2 is a side elevation of the same; Fig. 3 is a longitudinal vertical section taken on the line 3—3 of Fig. 1; Fig. 4 is a transverse vertical section taken on the line 4—4, Figs. 1, 2 and 3; Fig. 5 is a front elevation of the header-dies and the mounting therefor removed from the remainder of the machine; Fig. 6 is a transverse cross section of the machine on the line 6—6, Figs. 1, 2 and 3; and Fig. 7 is a detail view of one of the header-die slides, forming a feature of the invention.

The various operative elements, the more particular description of which is to follow, are suitably mounted upon a frame A preferably consisting of a single integral casting, as is usually the case. Operation of such element is derived from a crank shaft B mounted in suitable journals *a* transversely disposed of said frame A at one end thereof. Such crank shaft B is driven through suitable gearing or by means of a belt from any source of power, whether by an engine or motor directly coupled or from a power shaft is of course a matter of indifference. Mounted in suitable brackets *a'* provided along one side of the machine frame A is a secondary shaft B' disposed longitudinally of the frame and extending practically the entire length thereof. Bevel gears *b b'* having in the case of the particular machine under consideration a ratio of 4 to 1, are mounted upon the contiguous ends of shafts B and B' and communicate motion from the former to the latter. Actuation of the upsetting die is had directly from crank shaft B, while actuation of the gripping die, header dies and of a device for controlling the operation of the upsetting die is had in each case from said secondary shaft B'.

Taking up first of all the upsetting die, this die b^2 will be seen to be mounted in a slide B^2 reciprocable longitudinally of the frame in a suitably constructed slide-way a^2, such reciprocation being effected through the medium of an operating pitman b^3 journaled upon the crank shaft B, Figs. 1 and 3. Header slide B^2 is formed with a central opening b^4, Fig. 3, at one end of which is journaled the inner extremity of a movable locking member b^5 formed with an upwardly projecting arm b^6 that bears laterally of its

extremity a roller b^7. The outer or free end of member b^5 normally rests upon a pin b^8 to which the inner end of the pitman b^3 is journaled. The upper surface of the pin which receives the member b^5 is beveled to receive the flat contact face of said member while the inner or extreme portion of the pin is of concave form to receive a bearing of convex form that is provided upon the end of the movable member b^5. The respective ends of pin b^8 are journaled in slide-blocks b^{16} mounted in slots b^{17} that form guide-ways in the slide B^2 and in each side of the opening b^4 therein. The lengths of the member b^5, pitman b^3 and such slide-blocks are made such as to cause the blocks to contact the outer ends of the guides when the pitman and movable member are in engagement with each other as shown in Fig. 3. The construction of the connection between the pitman and upsetting-die slide just described, it should be stated, forms *per se* no part of the present invention being fully set forth and claimed U. S. Letters Patent No. 737,065 issued to J. R. Blakeslee, August 25, 1903. When member b^5 is thus in engagement with the pitman b^3 rotation of the crank shaft B will obviously effect reciprocation of the slide B^2. To release member b^2 from this engagement, and thereby render the operation of the crank shaft and pitman ineffective so far as such reciprocation is concerned, a plate b^9 is mounted so as to be transversely reciprocable with respect to such slide B^2, the inner end of said plate lying adjacent to the path of movement of roller b^7 borne upon the upper end of arm b^6 wherewith member b^5 is provided. Such inner contiguous end of slide plate b^9 is beveled so as to form an inclined cam-way b^{10} alined with the path of movement of such roller. Inward movement of plate b^9, so as to interpose cam-way b^{10} in the path of the roller, it will be evident will be effective to raise member b^5 out of engagement with the pin b^8 to which is connected the inner end of the pitman (this position of the member is shown in dotted outline in Fig. 3) and as long as this state of affairs continues slide B^2 and with the upsetting die will remain idle. Operation of plate b^9 inwardly is had by means of a tension spring b^{11} connected with a lever b^{12} fulcrumed in one of the brackets a' referred to previously as supporting secondary shaft B′, the upper end of such lever being joined to the plate by suitable connecting rod b^{13}. Outward actuation of the slide is had by means of a cam b^{14} mounted upon shaft B′ and co-acting with a roller b^{15} mounted in said lever. As shown, cam b^{14} is so formed as to render the upsetting-die alternately operative and inoperative during successive half-rotations of secondary shaft B′. In other words, in view of the ratio of gears b b' taken in connection with this construction, the upsetting-die slide is advanced and retracted only twice to four revolutions of the crank-shaft.

The stock or bolt blank S, Fig. 3, is designed to be placed in position to be operated upon by the upsetting die borne by slide B^2 through a feed opening a^3 in the front end of the machine. To securely hold the stock, once it is thus placed in proper position, a gripping-die c transversely reciprocable of the direction of movement of said upsetting-die b^2 and coöperative with a corresponding fixed die c' is provided in the same end of the machine adjacent to feed opening a^3. Such gripping-die is mounted upon a suitable slide C of the usual construction and normally retained by a spring c^2 in its outermost position. Inward actuation thereof is had by means of a cam c^3 mounted upon secondary shaft B′ as will be clearly evident from an inspection of Fig. 4. This cam c^3, like the cam b^{14} of the upsetting-die controlling device, just described, is formed so as to render gripping-die c alternately operative and inoperative during successive half-rotations of the shaft B′. The angular relation of the two cams to each other, furthermore, is such that the stock is gripped by die c just before the advance of slide B^2 brings upsetting-die b^2 into contact therewith, and continues to be thus held until after the second blow has been struck by said up-setting-die. After each retraction of the latter the bolt end is left free to be acted upon by the header-dies.

The header-dies whereby proper form is given to the end of the bolt after being thus upset by upsetting die B^2 are mounted in a disk-like frame D rigidly supported in the machine frame A adjacent to the slideway in which the gripping-die slide C operates. Disk D, Figs. 1, 3, 4 and 5, is of general annular form and is provided with a deep flange d about its entire periphery. The flat portion of the disk is furthermore provided with two pairs of diametrically opposed, radially extending, slide-ways d' in which are mounted the slides d^2 that bear the heading dies or hammers d^3, the latter being adjustably mounted in the slides as shown in Fig. 5, or better still in the detail view of a single slide appearing in Fig. 7. Having reference more especially to the last named figure reference letter d^2 designates the slide proper, which is in turn provided with a slide-way d^4 of its own. In the latter is adjustably mounted a block d^5 that constitutes a holder for the header-die or hammer d^3. The block d^5 is securely held in place by means of an adjusting screw d^6 provided with a head d^7 designed to register in a slot d^8 therefor provided near the outer end of the hammer-holder. This screw is threaded in a transverse web or partition d^9 formed in the slideway provided in slide d^2, a lock-nut

d^{10} preventing rotation once it is properly positioned. To facilitate rotation of the screw, when adjusting the holder, the outer end of the same is made of angular cross-section so as to receive a wrench or similar tool. The die, or hammer, d^3, being designed in the case in hand to assist in the formation of a square headed bolt is formed simply with a flat striking face, the portion not actually utilized in the operation being cut away so as to afford ample clearance for the movement of the upsetting die b^2. Such hammer fits in a suitable recess in the forward end of the carrier and is solidly held in place by a set screw d^{11}.

Normally the slides d^2 and the heading dies d^3 borne thereby are maintained in their outer or retracted positions by means of tension springs d^{12} connected with the frame D at their outer ends and at their inner ends with pins d^{13} projecting laterally from slides d^2. Actuation of the dies inwardly is had by means of dogs d^{14} that are pivotally attached at one end to disk frame D adjacent to the outer ends of the respective slideways d'. The inturned face of the free end of each dog d^{14} is thus brought to bear substantially centrally upon the outer end of the corresponding slide d^2, while the outwardly directed face of such end is formed with a rounded projection, Fig. 5. Such projections lie in the path of two diametrically oppositely disposed rollers d^{16} that are mounted in an annular frame D′ rotatably secured to disk D and held in place by means of a cover ring d^{17} attached to the rear face of the flange d of the fixed disk D. A roller bearing d^{15} is furthermore preferably interposed between such flange and the revoluble frame as shown, in order to render movement of the latter as nearly frictionless as possible. Rotation of revoluble frame D′ is had by means of gearing now to be described that operatively connects the same with secondary shaft B′. This gearing, see Figs. 2 and 4 particularly, consists of a spur gear e rigidly secured to the rear face of the frame in question and meshing with a gear e' of the same size that is mounted upon a third, or intermediate shaft E, the latter being journaled, Fig. 1, in brackets a^5 just below secondary shaft B′. Such third shaft E is driven in turn through gears e^2 e^3 having a ratio of 2 to 1 and mounted respectively on shaft B′ and such shaft E.

Rotation of the connecting gears just described, and consequent actuation of the header-die mechanism, is designed to be intermittent as will appear. To this end gear e^2 is loosely mounted upon the shaft B′ and its operative connection therewith controlled by a clutch and clutch-shifting means actuated directly by the shaft. The preferred arrangement illustrated consists simply of a clutch-collar e^4 splined upon the shaft and normally held in engagement with the gear by means of spring-pressed plungers e^5 mounted in the adjacent shaft-supporting bracket a'. Such collar e^4 is provided with peripheral cam e^6 disposed to co-act with a fixed roller e^7 mounted upon the same bracket a as plungers e^5. The conformation of the face of cam e^6 is such that as the shaft B′ rotates carrying with it collar e^4, the latter is alternately withdrawn from its engagement with gear e^2 and then allowed under the impulsion of plungers e^5 to enter such engagement again. This engagement obviously will occur once for every rotation of shaft B′ and is so timed, having regard to the angular disposition of the header-die actuating dogs d^{14} and the initial positions of rollers d^{16} with respect thereto, as to impart approximately a half turn to revoluble disk D′ immediately following each of the retractive movements of upsetting-die slide B^2. The effect of each such half turn of disk D′ is successively to force each pair of header-slides d^2 inwardly, the second blow of the upsetting die being struck intermediate between the two rounds of blows from the header dies.

Having thus described it is thought with sufficient detail the several elements of my improved bolt-heading machine, considered both structurally and from the stand-point of their individual operation, it only remains to indicate more fully than has before been possible the manner in which such elements and their respective operations are correlated. Assuming, then, gripping die slide C to be retracted and upsetting die slide B^2 both retracted and inoperative by reason of the disengagement of locking member b^5, the heated blank S is introduced in the manner previously indicated through feed opening a^3. The general sequence of operations, following in cyclical order, then is as follows: Cam c^3 closes gripping die c upon the blank and securely holds the same while upsetting die b^2, thrown into operation by the withdrawal of slide-plate b^9, is twice advanced and retracted, both pairs of header-dies or hammers being driven inwardly to laterally form the head after each such retraction of the upsetting-die. As the upsetting-die is thus retracted the second time, and simultaneously with the concluding round of blows by the heading-hammers, plate b^9 is again advanced into the path of the roller b^7 and upsetting-die slide B^2 disengaged from the actuating pitman. As such final round of blows by the heading hammers is concluded, gripping-die slide C is withdrawn, the finished blank S either removed or else allowed to drop through the machine frame to the floor, and another blank inserted in its stead. After a brief interval the last named die again closes and

the same series of operations is repeated. This interval is, however, quite ample to permit the introduction of another blank so that the operation of the machine is in effect continuous. It will be furthermore seen that this operation is wholly automatic from the initial gripping of the stock to the final stroke of the header dies, there being no trips or levers to distract the operator's attention and waste his time. The adaptability of my improved machine to use with automatic blank feeding mechanism will hence be obvious. As to the advantageous results attained by the several operative elements of the machine, especial attention need be called to the header-die mechanism only. Not only is a more effective and hammer-like stroke secured by the die slide actuating means shown than where cams or cranks are employed for this purpose, but wear of the slides and slideways is minimized by the employment of the dags that rest centrally against the slides and transmit movement to the latter in line with the direction in which they respectively lie.

By way of conclusion it should be stated that no limitation of the invention to the employment of the exact ratios of gearing and other connections, heretofore described, is intended. Obviously, if instead of two blows of the upsetting dies and corresponding rounds of blows from the header-dies but one such blow were required in handling any particular kind of stock, the necessary changes to effect this result would be readily apparent; similarly to increase the number of blows.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. In a machine of the class described, the combination of a reciprocable upsetting-die; a transversely reciprocable die for gripping the stock; transversely reciprocable header-dies; a transversely disposed rotatable shaft; means connecting the transverse shaft with the upsetting-die; a longitudinally disposed rotatable shaft; means borne by the longitudinal shaft adapted to reciprocate the gripping die; means connecting the longitudinal shaft with the header-dies; and means operated by the rotation of the longitudinal shaft and adapted to interrupt connection between said shaft and the header-dies.

2. In a machine of the class described, the combination of a reciprocable upsetting-die; a transversely reciprocable die for gripping the stock; transversely reciprocable header-dies; a transversely disposed rotatable shaft; means connecting the transverse shaft with the upsetting-die; a longitudinally disposed rotatable shaft; means borne by the longitudinal shaft and respectively adapted to reciprocate the gripping die and to interrupt the connection between the transverse shaft and the upsetting-die; means connecting the longitudinal shaft with the header-dies; and means operated by the rotation of the longitudinal shaft and adapted periodically to interrupt connection between said shaft and the header-dies.

3. In a machine of the class described, the combination of a reciprocable upsetting-die; a transversely reciprocable die for gripping the stock; transversely reciprocable opposed header-dies; a transversely disposed rotatable shaft; means connecting the transverse shaft with the upsetting-die; a longitudinally disposed rotatable shaft; cams borne by the longitudinal shaft and respectively adapted periodically to reciprocate the gripping die and to interrupt the connection between the transverse shaft and the upsetting-die; means connecting the longitudinal shaft with the header-dies; and means operated by the rotation of the longitudinal shaft and adapted periodically to interrupt connection between said shaft and the header-dies.

4. In a machine of the class described, the combination of a reciprocable upsetting-die; a transversely reciprocable die for gripping the stock; transversely reciprocable opposed header-dies; a transversely disposed rotatable shaft; means connecting the transverse shaft with the upsetting-die; a longitudinally disposed shaft geared to the transverse shaft; cams borne by the longitudinal shaft and respectively adapted periodically to reciprocate the gripping-die and to interrupt the connection between the transverse shaft and the upsetting-die; means connecting the longitudinal shaft with the header-dies; and a cam controlled clutch borne by the longitudinal shaft and adapted periodically to interrupt connection between said shaft and the header-dies.

5. In a machine of the class described, the combination of a transversely rotatable shaft; a longitudinal shaft geared to the transverse shaft; a transversely reciprocable gripping-die; a cam on the longitudinal shaft and adapted periodically to close the gripping-die; a longitudinally reciprocable upsetting-die; means connecting the transverse shaft with the upsetting-die and adapted to reciprocate said die subsequently to the closing of the gripping-die; a cam on the longitudinal shaft and adapted to periodically interrupt the connection between the transverse shaft and the upsetting-die; transversely reciprocable opposed header dies; means connecting the longitu-

dinal shaft with the header-dies; and means operated by the rotation of the longitudinal shaft and adapted to interrupt connection between said shaft and the header-dies during the reciprocation of the gripping-die and the upsetting-die.

6. In a machine of the class described, the combination of a transverse rotatable shaft; a longitudinal shaft geared to the transverse shaft; a transversely reciprocable gripping-die; a cam on the longitudinal shaft and adapted positively and periodically to close the gripping-die; a longitudinally reciprocable upsetting-die; means connecting the transverse shaft with the upsetting-die and adapted to reciprocate said die subsequently to the closing of the gripping-die; a cam on the longitudinal shaft and adapted to periodically interrupt the connection between the transverse shaft and the upsetting-die; transversely reciprocable opposed header-dies; means connecting the longitudinal shaft with the header dies; a reciprocable clutch borne by the longitudinal shaft and controlling the means connecting the longitudinal shaft with the header dies, the clutch normally engaging said means; and means adapted to withdraw the clutch incidentally to its rotation with the shaft and during the reciprocation of the gripping-die and the upsetting-die.

7. In a machine of the class described, the combination of a transverse rotatable shaft; a longitudinal shaft geared to the transverse shaft; a transversely reciprocable gripping-die; a cam on the longitudinal shaft and adapted positively and periodically to close the gripping-die; a longitudinally reciprocable upsetting-die; means connecting the transverse shaft with the upsetting-die and adapted to reciprocate said die subsequently to the closing of the gripping-die; a cam on the longitudinal shaft and adapted periodically to interrupt the connection between the transverse shaft and the upsetting-die; transversely reciprocable opposed header-dies; a gear loosely mounted on the longitudinal shaft and connected to operate the header-dies; a reciprocable sleeve keyed to said shaft and adapted to have a clutch engagement with said gear, resilient means normally retaining the sleeve in such engagement; and an externally fixed member engaging said sleeve, the engaging face of the latter being of cam conformation, whereby it is periodically withdrawn from engagement with said gear, incidentally to rotation of said shaft and during the reciprocation of the gripping-die and the upsetting-die.

8. In a machine of the class described, the combination of a transverse rotatable shaft; a longitudinal shaft geared to the transverse shaft; a transversely reciprocable gripping-die; a cam on the longitudinal shaft and adapted positively and periodically to close the gripping-die; a longitudinally reciprocable upsetting-die; means connecting the transverse shaft with the upsetting-die and adapted to reciprocate said die subsequently to the closing of the gripping-die; a longitudinally reciprocable upsetting-die; means connecting the transverse shaft with the upsetting-die and adapted to reciprocate said die subsequently to the closing of the gripping-die; a cam on the longitudinal shaft and adapted to periodically interrupt the connection between the transverse shaft and the upsetting-die; a transversely disposed stationary frame provided with oppositely disposed radially extending slide ways, dies mounted in such slide ways, resilient means normally retracting said dies, dogs pivotally attached to said frame and loosely contacting with the outer ends of said dies, a revoluble frame secured to said stationary frame, and members borne by said second frame and adapted upon the latter's rotation to engage said dogs and force said dies inwardly; means connecting the longitudinal shaft with said revoluble frame; a reciprocable clutch borne by the longitudinal shaft, and controlling the means connecting the longitudinal shaft with the revoluble frame, the clutch normally engaging said means; and means adapted to withdraw the clutch incidentally to its rotation with the shaft and during the reciprocation of the gripping-die and the upsetting-die.

9. In a machine of the class described, the combination of a transverse rotatable shaft; a longitudinal shaft geared to the transverse shaft; a transversely reciprocable gripping-die; a cam on the longitudinal shaft and adapted positively and periodically to close the gripping-die; a longitudinally reciprocable upsetting-die; a member pivoted to said upsetting-die, a pitman connected with the transverse shaft and adapted to actuate said pivoted member and thereby to reciprocate said upsetting-die subsequently to the closing of the gripping-die; a plate provided with an inclined face and transversely reciprocable into and out of the reciprocatory path of said pivoted member, and adapted to engage the latter and thereby disconnect it from said pitman, a spring normally advancing said plate, and a cam on the longitudinal shaft and adapted periodically to retract said plate; a transversely disposed stationary frame provided with oppositely disposed radially extending slide ways, dies mounted in such slide-ways, resilient means normally retracting said dies, dogs pivotally attached to said frame and loosely contacting with the outer ends of said dies, a revoluble frame secured to said stationary frame, and members borne by said revoluble frame and adapted upon the latter's rotation to engage said dogs and force said dies inwardly; means connecting the longitudinal shaft with said revoluble frame; a reciprocable clutch borne by the longitudinal shaft and controlling the means

connecting the longitudinal shaft with the revoluble frame, the clutch normally engaging said means; and means adapted to withdraw the clutch incidentally to its rotation with the shaft and during the reciprocation of the gripping-die and the upsetting-die.

Signed by me this 13th day of August, 1907.

JOHN R. BLAKESLEE.

Attested by—
E. R. RODD,
JNO. F. OBERLIN.