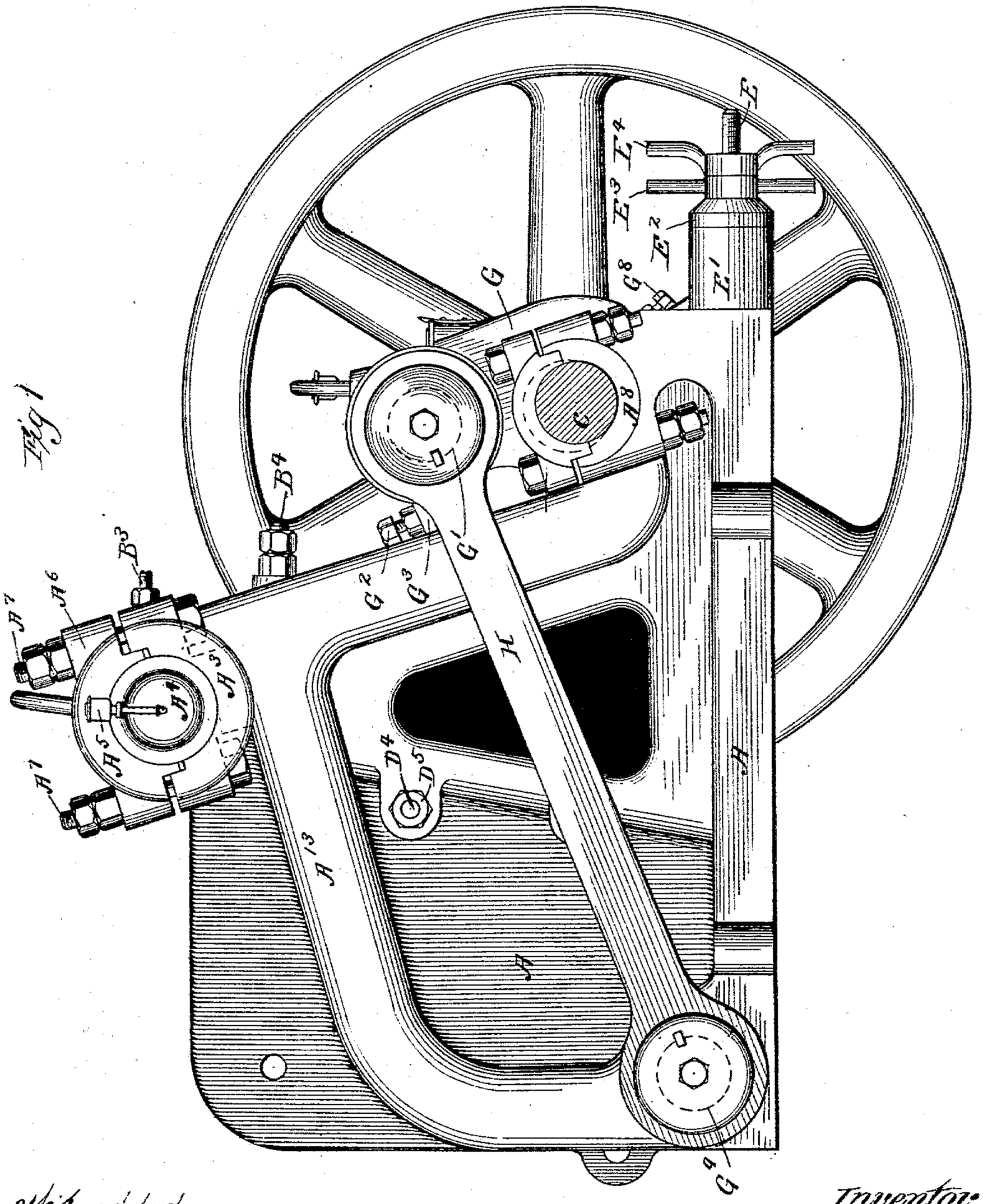
(No Model.) 7 Sheets—Sheet 1.

C. L. CARMAN.

JAW STONE CRUSHER.

No. 551,304. Patented Dec. 10, 1895.



Witnesses:
John L. Tunison.
Cassell Severance.

Inventor:
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Mann Hemwick Lawrence

(No Model.)

7 Sheets—Sheet 2.

C. L. CARMAN.

JAW STONE CRUSHER.

No. 551,304. Patented Dec. 10, 1895.

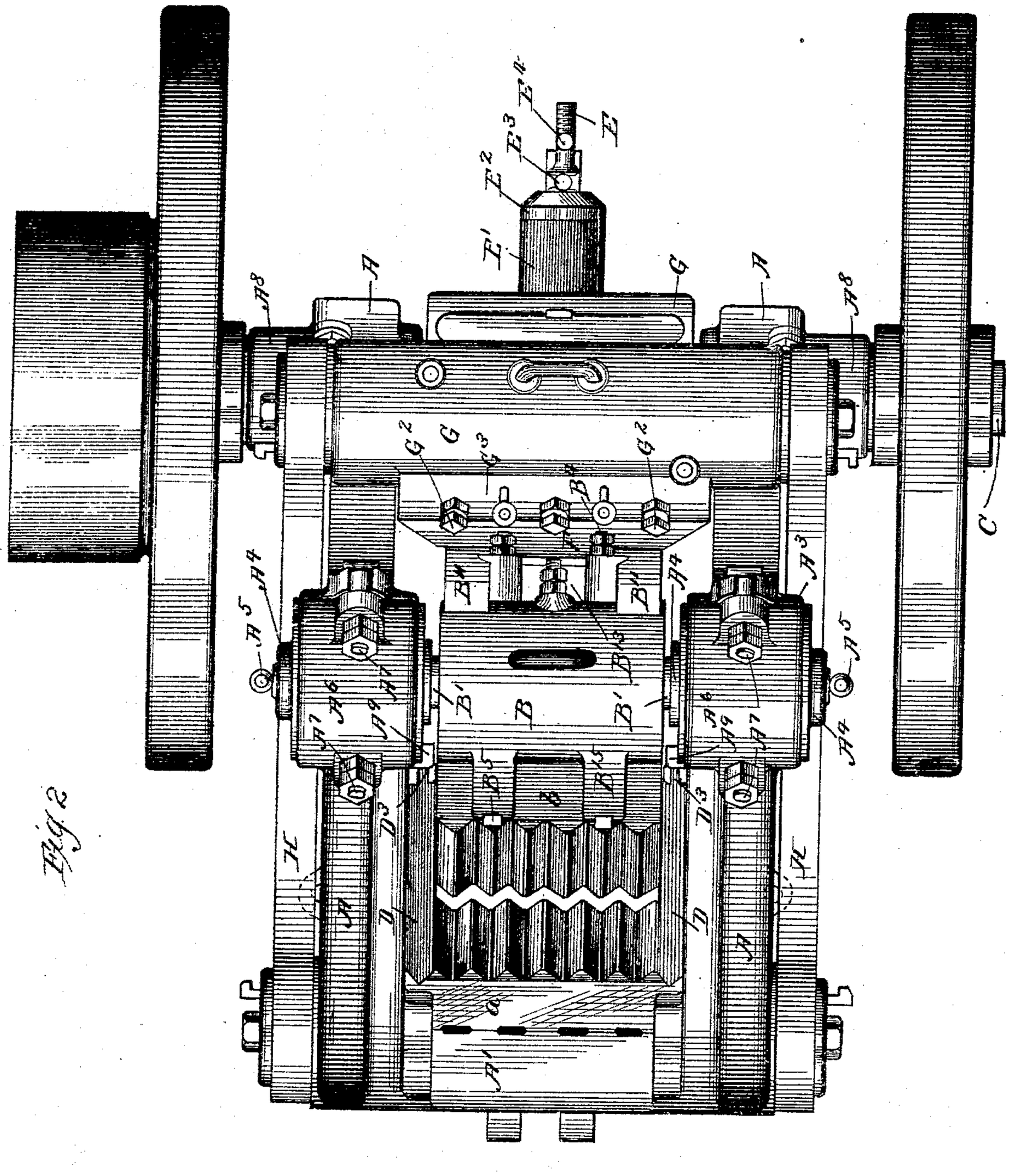

Fig. 2.

Witnesses:
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(No Model.) 7 Sheets—Sheet 3.

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JAW STONE CRUSHER.

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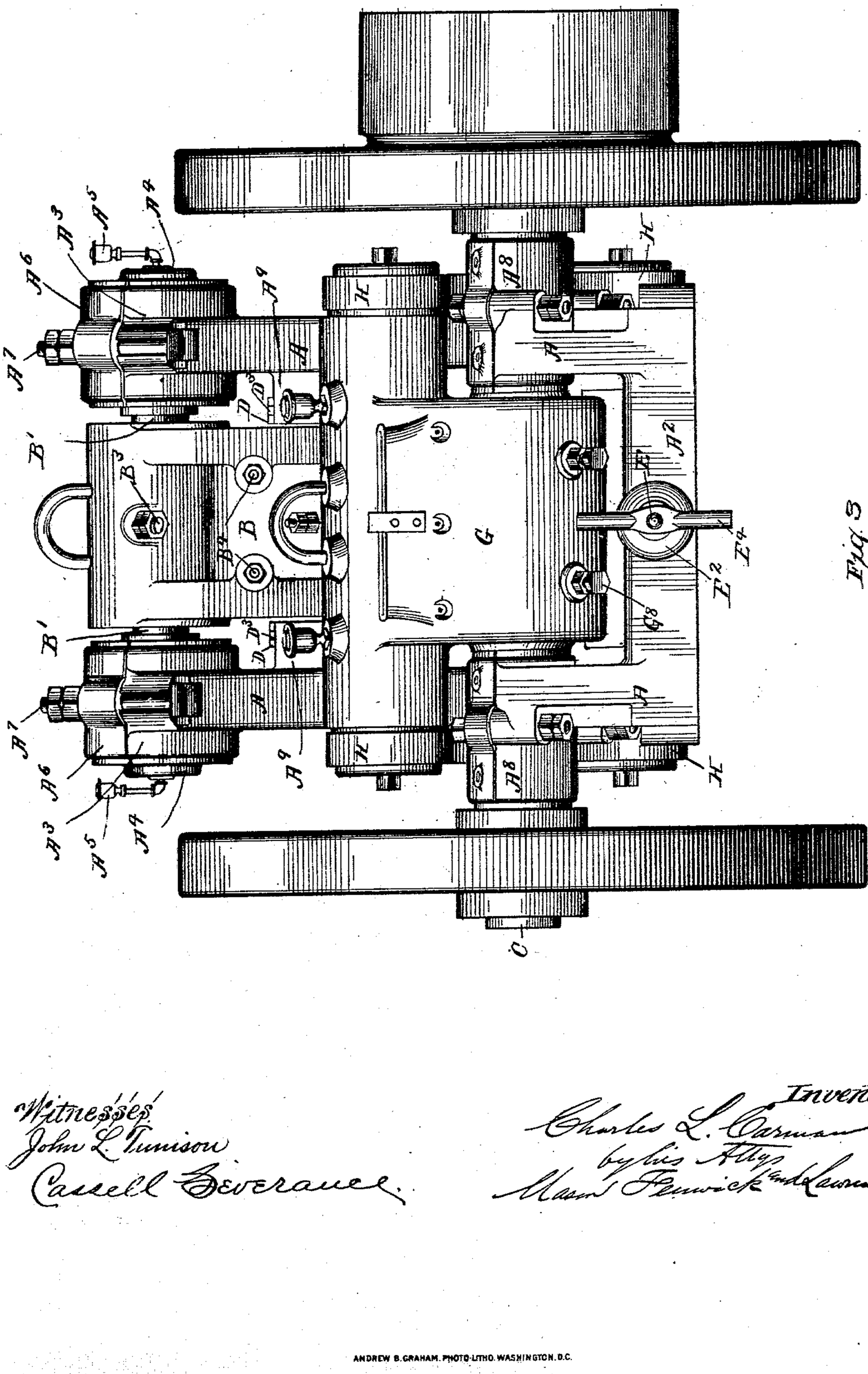

Fig. 3

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(No Model.) 7 Sheets—Sheet 4.

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JAW STONE CRUSHER.

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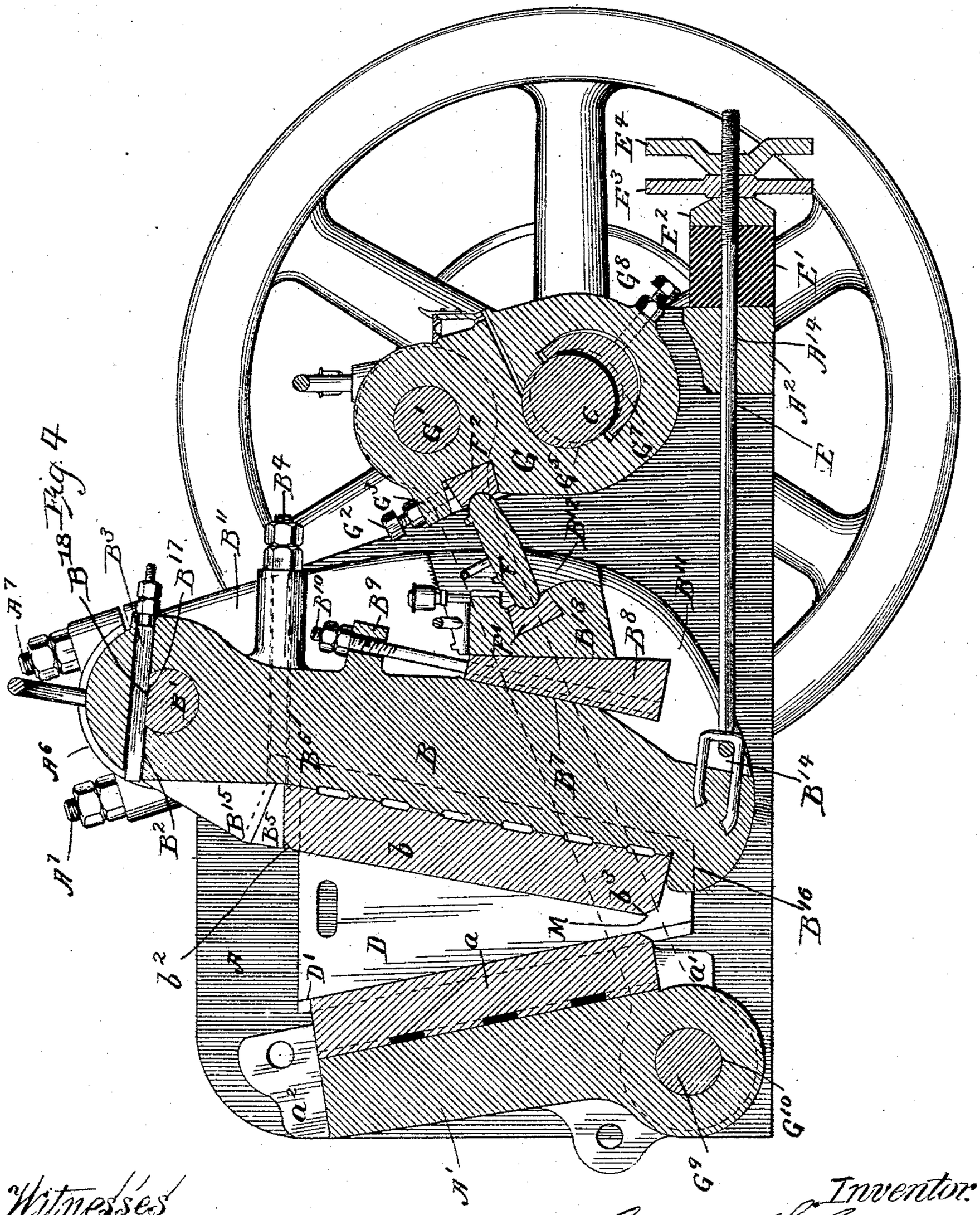

Fig. 4

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(No Model.)

7 Sheets—Sheet 5.

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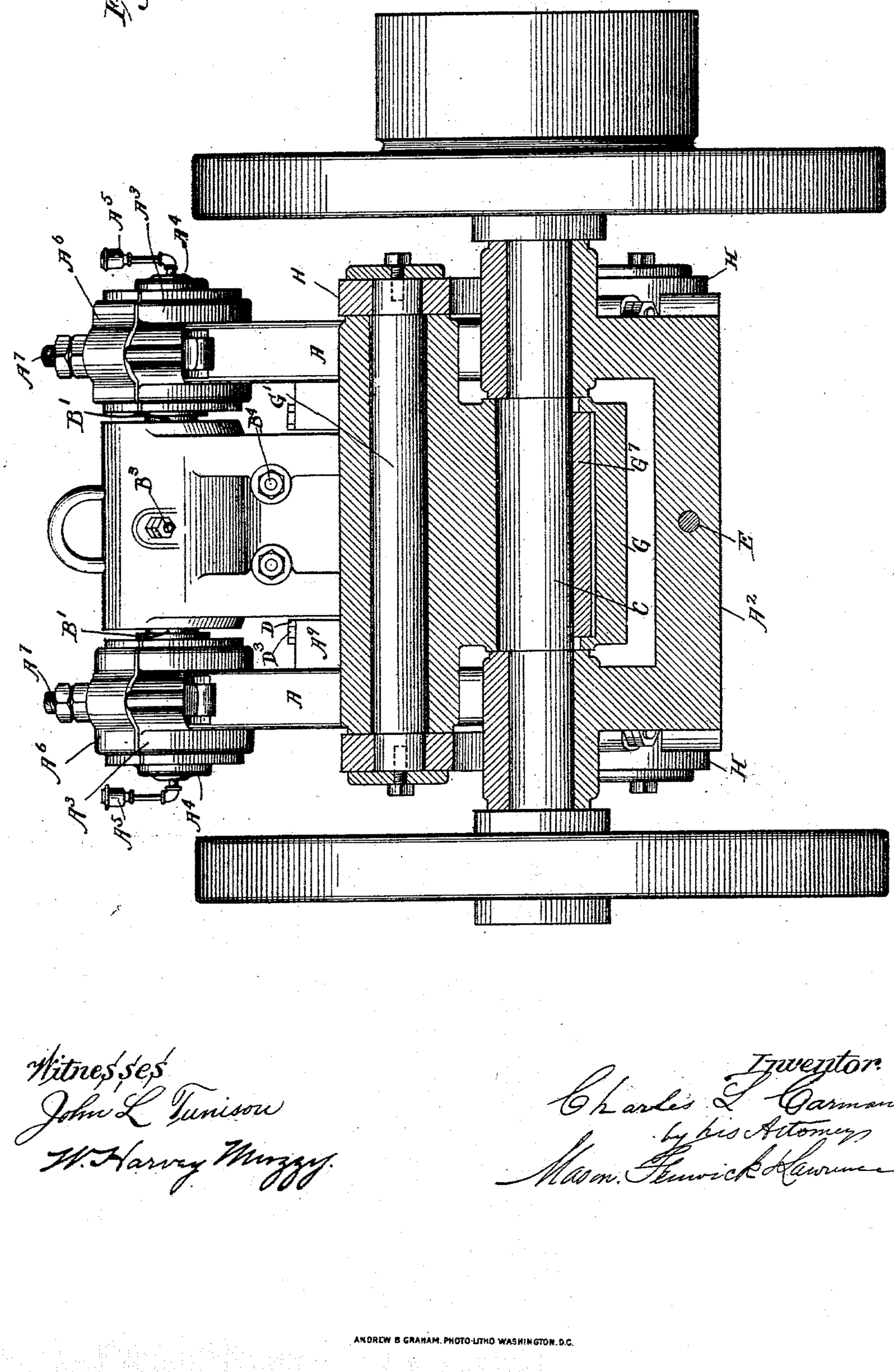
No. 551,304. Patented Dec. 10, 1895.

Fig. 5



Witnesses
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7 Sheets—Sheet 6.

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JAW STONE CRUSHER.

No. 551,304. Patented Dec. 10, 1895.

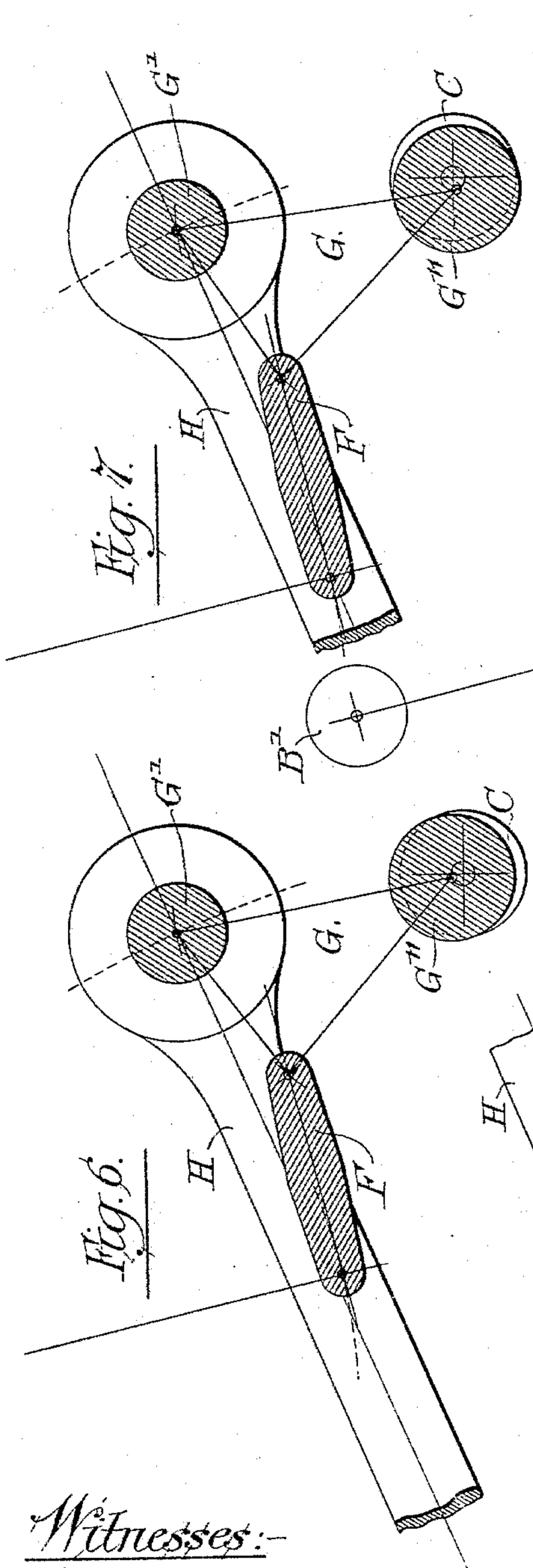

Fig. 4.

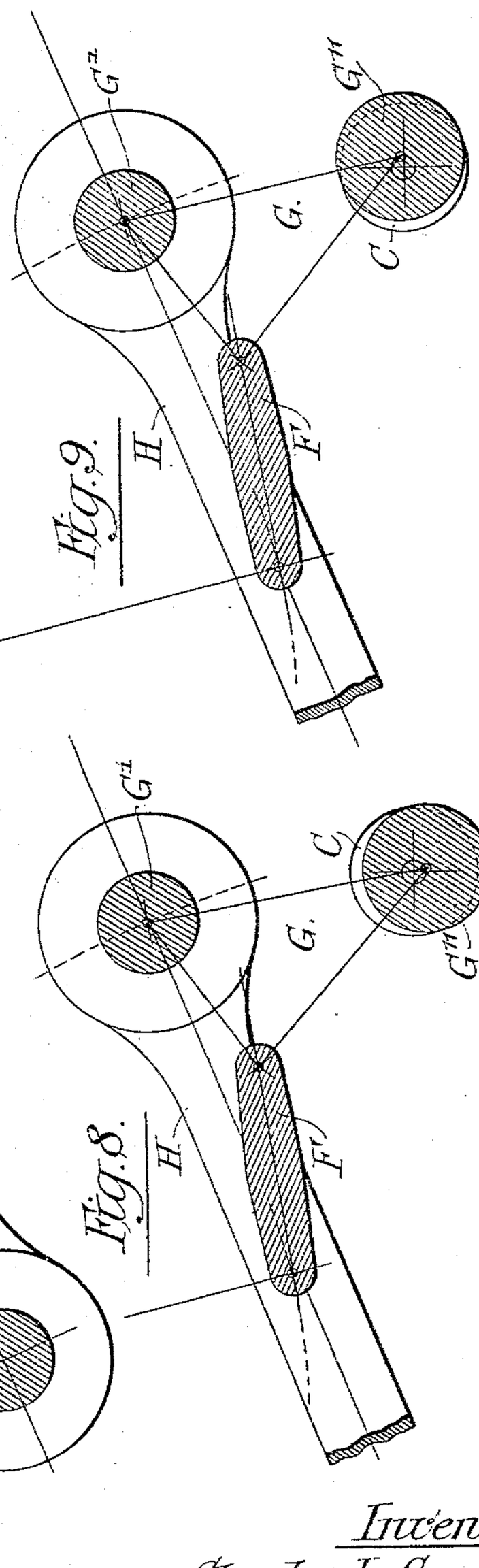

Fig. 9.

Fig. 6.

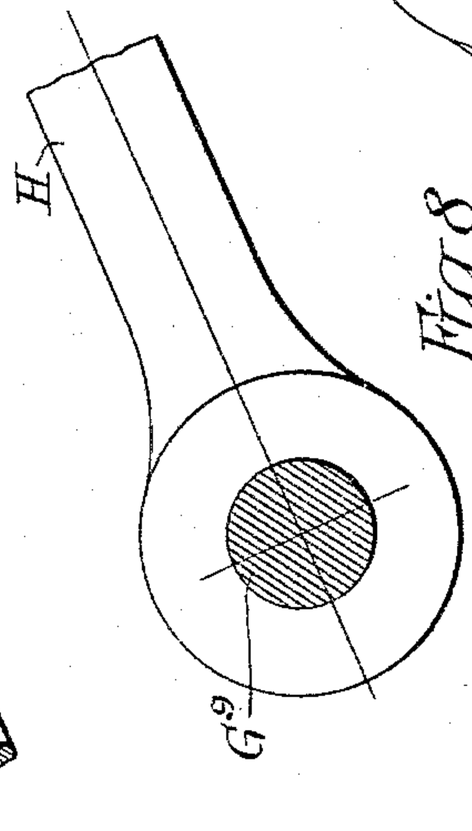

Fig. 7.

Fig. 8.

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His Attorneys.

(No Model.)

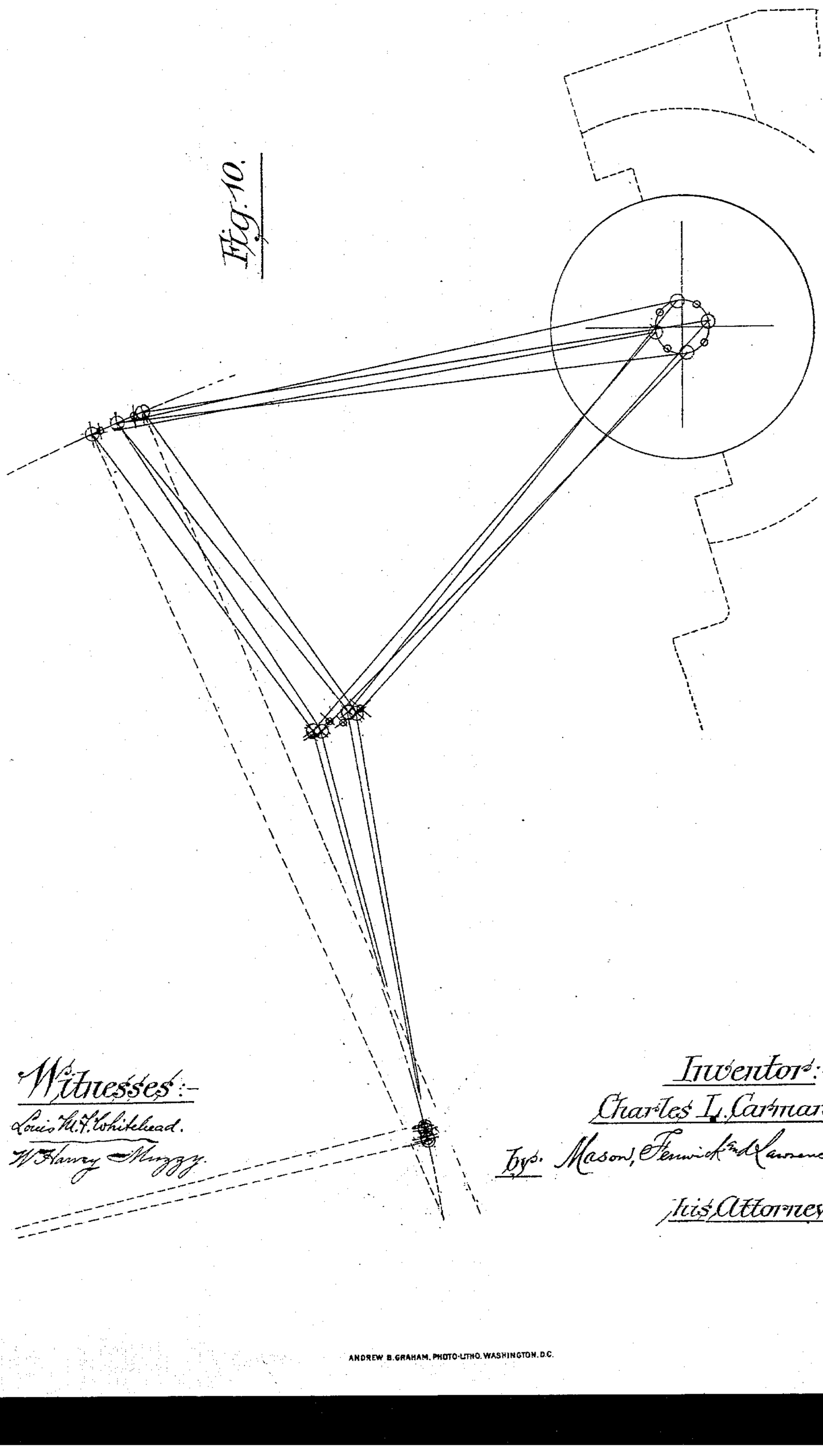
7 Sheets—Sheet 7.

C. L. CARMAN.

JAW STONE CRUSHER.

No. 551,304. Patented Dec. 10, 1895.

Fig. 10.



Witnesses:-
Louis M. T. Whitehead.
W. Harry Mungay.

Inventor:-
Charles L. Carman.
by: Mason, Fenwick and Lawrence
his Attorneys.

UNITED STATES PATENT OFFICE.

CHARLES LEWIS CARMAN, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE GATES IRON WORKS, OF SAME PLACE.

JAW STONE-CRUSHER.

SPECIFICATION forming part of Letters Patent No. 551,304, dated December 10, 1895.

Application filed May 15, 1894. Serial No. 511,346. (No model.)

To all whom it may concern:

Be it known that I, CHARLES LEWIS CARMAN, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Jaw Stone-Crushers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to that class of rock or ore breakers in which there is one stationary jaw, forming a portion of the main frame, and one swinging or vibrating jaw pivoted in the main frame and caused to approach and recede from the stationary jaw to crush the material between them and to allow it to escape when crushed to the desired degree of fineness, the faces of the jaws presenting to each other a suitable angle, the distance between them being considerably less at the bottom than at the top, as is the common form of construction for such crushers.

The present improvements have relation to the mechanism employed to actuate the swinging jaw and to details of construction, whereby the stress incidental to the crushing of the material between the jaws is prevented from coming upon the main frame directly, as in most cases, and the machine may be made more compact and be more cheaply constructed.

Reference is had to the accompanying drawings, in which—

Figure 1 is a side elevation of the crusher with one fly-wheel removed and constructed according to my invention. Fig. 2 is a top plan view of the same. Fig. 3 is a rear elevation. Fig. 4 is a vertical longitudinal section of the machine. Fig. 5 is a transverse vertical section on the line $x\ x$ of Figs. 1 and 4. Fig. 6 is a diagrammatical view illustrating the three-membered toggle when the crank is at the upward limit of its movement. Fig. 7 is the same at one-quarter revolution of the crank to the front. Fig. 8 is when the crank is at its lowest point. Fig. 9 is when it is a quarter of a revolution to the rear. Fig. 10 is a diagrammatical view showing the path of the toggle end in connection with the rest of the three-membered toggle.

The main frame A is formed as shown with the stationary jaw A′ integral therewith, by which the two side portions are connected and held in position. The side portions of the main frame are also connected at the rear end at the bottom by cross-bar A^2, the specific purpose of which will hereinafter be more clearly set forth. Near the center of the main frame, at or near its top, are provided two bearings A^3 for the pivoted shaft B′ of the swinging jaw B. These bearings A^3 are provided with bushings A^4, having means A^5 for oiling, substantially as shown. These bushings A^4 have their outer ends made solid, and the ends of the shaft B′ bear against the inner faces of the respective solid ends of the bushings, preventing lateral movement of the shaft, and as the bushings A^4 are held rigidly by the bearing-caps A^6, secured by bolts A^7, the shaft B′ is free to oscillate or rock with the swinging jaw B, but is prevented from acquiring a vertical motion which is incidental to the rolling action of the round portion of the material to be crushed between the jaws.

At the rear of the main frame A and somewhat above the cross-bar A^2 are formed two bearings A^8 for the crank C. These are ordinary bearings provided with suitable caps, bolts, and lubricating devices, in the usual manner. The front portion A′ of the main frame A is provided on its inner side with a liner or crushing-plate *a*, of suitable material, to resist the abrading action of the material being crushed, and is supported by lugs *a*′ and prevented from rising by lugs a^2 and held firmly against the face of jaw A′ by the wearing-plates D, which are wedge-shaped and placed on each side of the main frame A, on the inside, and their front edges D′ bear against the plate *a* and their rear inner edges against strips A^9, formed on the inner side of the main frame A and projecting inwardly, and suitably located to form an abutment or bearing for the wearing-plates D.

The wearing-plates D have their front edges D′ beveled to conform to the end corrugations on the face of the liner *a*, where they come in

contact therewith, and are thus held in contact with the inner faces of the main frame A. The rear edges of the wearing-plates D have strips D^3, of about one-third of the thickness of the plates, extending midway their entire length, respectively. These strips D^3 form the bearings of the plates D, respectively, against the strips A^9, formed on the main frame A, and form, also, seats for the gib-headed bolts D^4 (see Fig. 1) that pass through the main frame A and hold the rear of the wearing-plates D in contact with the main frame A. By slightly loosening the nuts D^5 on the bolts D^4 the wearing-plates D may be removed or forced down to more firmly seat the liners *a*.

In the lower portion of the stationary jaw A′ is formed an eye G^{10} for the reception of the shaft G^9, as will be hereinafter more clearly set forth.

Swinging jaw B is provided at its upper end with an eye, in which the pivot-shaft B′ is inserted, and also an opening B″, in which the key B^3 is placed and engages with the shaft B′ at a point about midway of its length, where a transverse groove B^{18} is cut in the shaft B′ to receive it. This key prevents the swinging jaw B from swinging or oscillating on the shaft B′ and causes said shaft to move with the swinging jaw and to swing and oscillate in the bushing A^4. This key B^3 also prevents any transverse motion of the swinging jaw in the frame A. The swinging jaw B is also provided with a liner or crusher-face *b*, which is supported by an extension or lug B^{16}, whose upper surface is slightly inclined downward and to the rear, forming a dovetail to receive the liner *b*, whose lower edge is formed with a suitable angle to fit the lug B^{16}.

The liner *b* is held down and against the front face of the swinging jaw B by two bolts B^4, having wedge-shaped heads B^5, that pass through the swinging jaw B in holes B^6, and whose wedge-shaped heads B^5 bear against two suitable lugs B^{15} of said jaw B, thus firmly securing liner *b*, being slightly angular in relation to the face of the swinging jaw B, as it is intended to be reversed so as to present a new corner b^2 in place of b^3, as the greatest wear takes place at the lower end of the liner *b*, where it is in the closest proximity to liner *a*.

The swinging jaw B is formed with a flat surface on the side opposite to that upon which the liner *b* is placed, and this surface is located somewhat below the center of the crushing-face of the liner *b*, and forms the seat for the adjusting-wedge B^8, the use of which will be hereinafter more fully described. Somewhat above this surface and extending rearwardly is the lug B^9, through which an opening is made adapted to receive the bolt B^{10}, whose function is the raising or lowering of the wedge B^8 for the adjustment of the distance between the swinging jaw B and the sliding wedge-block B^{13}, and thereby change the distance between the liners *b* and *a*.

At its outer edge the swinging jaw B is provided with ribs or flanges B^{11}, extending rearwardly, as shown, and having slightly-inclined grooves or recesses B^{12} in each, on the inside, to receive and support the wedge-block B^{13}.

Near the lower end of the swinging jaw B is a loop or eye B^{14}, into which the rod E is hooked or otherwise secured. This rod E extends rearwardly and passes through an opening A^{14}, provided for it in the center of the cross-bar A^2, and has mounted upon it a spring E′, preferably of rubber, and a follower-washer E^2, and has finally mounted upon its extremity two winged nuts E^3 and E^4 for producing a tension on spring E′ sufficient to return the swinging jaw B when the forward movement has been accomplished and also retain the toggle-plate F of the actuating mechanism in its seat, this being the best method of accomplishing this end.

The mechanism for actuating the swinging jaw B is composed of a three-membered toggle, formed of the toggle-plate F, the pitman G and the tension-bars H. The toggle-plate F has its ends in the form of semicircles, which are hardened to prevent wear, and operate in the toggle-seats F′ and F^2, which are of suitable material provided for them in the wedge-block B^{13} and pitman G respectively.

The pitman G has an eye or hole in its upper end for the reception of the shaft G′, and is provided with a semidovetail recess, into which the toggle-seat F^2 is fitted and is held by set-screws G^2, as shown in the drawings, and the lower end of the pitman has an opening through which passes the crank-shaft C, the upper portion G^5 of this opening G^4 forming the upper half of the bearing for the crank-shaft C. The lower portion is enlarged and incloses a movable half-box G^7, which forms the lower portion of the bearing for the crank C.

The half-box G^7 is held in position by set-screws G^8, and is adjustable. This crank-shaft G, as shown in Fig. 5, has its crank portion G^{11} passed through the pitman, so that as the shaft revolves the pitman is raised and lowered by the said crank portion. The part of the pitman G that is in a straight line between the center of the shaft G′ and the toggle-seat F^2 forms one member of the toggle combination, the toggle-plate forms the second, and the tension-bars form the third, as shown and specified hereinbefore, the latter connecting the shaft G′ to the shaft G^9 that passes through the opening G^{10} in the front of the main frame A, as shown. These tension-bars H are securely keyed at both ends to the shafts G′ and G^9, respectively.

By the use of the three-membered toggle a short frame may be constructed upon which no tensile strain may fall, as that is carried by the tension-bars H. The wedge-block and

jaw are preferably located as shown in the drawings, but they can be located on the front face of the pitman G to receive the toggle seat F^2, or they may be located on the front end of the machine on the lower portion of the stationary jaw on the wedge-block formed to receive and form a journal-bearing for the shaft G^9; but in the latter case the adjustment made would change the inclination of the pitman relatively to the rest of the toggle mechanism and thereby change the throw. The objection to placing it on the front of the pitman would be that it would increase the distance between the center of the shaft G' and the toggle-seat F^2, thereby changing the relation of the parts and the angularity of the toggle-plate F, and thus change the amount of throw at every adjustment.

The rotation of the crank-shaft C is continuous, and the pitman and its associated mechanism are actuated thereby, and from the highest point to which it may be raised, viz., that shown by Fig. 4 and diagrammatical view, Fig. 6, it is lowered the full throw of the cranked portion G^{11} of the crank-shaft C, as will be seen by reference to diagrammatical view, Fig. 8. At this point it begins to rise until it has again obtained the position delineated in Figs. 4, 6, and 10, and so on continually as long as the crank-shaft may be rotated, passing through the positions shown in diagrammatical views, Figs. 7 and 9, in its rotation.

The end of the pitman being journaled on the shaft G', which is secured to the tension bars H, it vibrates through the arc of a circle whose radii are coincident with the length of the tension-bars H, from the center of the shaft G' to the center of the shaft G^9. The lower end of the pitman, of course, follows the crank portion G^{11} of the crank-shaft C throughout the cycle of its revolution. Any other point on the pitman partakes of either one or the other of these two motions, or a combination of both, corresponding to its location in relation to either of the two points named. The more closely it is located to either the more closely it describes the same path.

It will be noted that the toggle-seat F^2 is located on the pitman somewhat below a straight line drawn from center to center of the shafts G' and G^9 coincident with the center of the tension-bars H.

It will be observed that the crank-shaft C causes the lower end of the pitman to vibrate forward and backward as it revolves, which movement results in the movement of the toggle-seat F^2 in the arc of a circle whose radius is struck from the center of the shaft G'. Owing to the fact that the crank-shaft swings the pitman to the position shown by diagrammatical views, Figs. 7 and 9, this vibratory motion is in addition to and acts simultaneously and in combination with the vertical vibration of the shaft G', and the path described by the center of the toggle-seat F^2 will be understood by reference to diagrammatical view, Fig. 10.

It will be noted that when the pitman is at its highest point, as shown by Figs. 4 and 6, the movable jaw B and its connections are being swung toward the stationary jaw and the adjacent faces of the two are in the greatest proximity that they will attain without further adjustment of the wedge-block. This forward swinging movement of the movable jaw B is accomplished by the upward movement of the pitman by means of the crank, thereby nearly straightening the three-membered toggle or bringing nearly into coincidence the center lines of the tension-bars H from the center of the shaft G' to the center of the shaft G^9 and the center line of the toggle-plate F. If it were considered desirable the above center line could be made by changing the location of the toggle-seat on the pitman and wedge to exactly coincide or "come onto the center," as it is commonly called, with the other members of the three-membered toggle just described. The reason for not so locating the toggle-seat is this: that it would require a crank of greater throw to actuate the swinging jaw sufficiently. This not being considered the most desirable method of accomplishing this end, a slight angle is introduced between the members of the toggle in order to impart the requisite amount of motion to the swinging jaw B without unduly increasing the size and throw of the shaft. By reference to diagrammatical view, Fig. 10, the motion and composition of the three-membered toggle will be readily understood, the center line between the center of the toggle-seat F^2 and the center of the shaft G being indicated by the letter x, all other parts having the same letters as in the main drawings.

When the forward motion of the swinging jaw B is completed by the toggle and the pitman, the latter descends, as shown in Figs. 7, 8, 9, and 10, and the parts all present to each other a greater angle and thereby decrease the distance between the center of the toggle-seat F' and the center of the shaft G', this allowing the spring E^2, by means of the rod E, to withdraw the swinging jaw B and its wedge-block B^{13} and wedge B^8 as fast as this angularity of the toggle takes place, and it is this constant backward pressure of the swinging jaw, maintained by the spring and rod against that end of the toggle-plate F that is in contact with toggle-seat F', that keeps it seated in its two seats and increases the space between the adjacent faces of the swinging jaw B and the stationary jaw A'.

It will be readily seen that the great resistance to the crushing of the material between the jaws is not brought upon the main frame A, but is taken almost wholly by the tension-bars H, thus allowing a much lighter frame to be used. The strain due to the initial break of the large pieces of material placed

between the top of the jaws falls to a certain degree upon the frame at the top between the top of the plate *a* and the pivot-bearing A^3, so that, therefore, a large rib is formed on the frame at these points to sustain the strain, but this rib may be eliminated and the common method of passing a bolt through suitably-cored holes in the frame substituted to receive the tensile stress.

The sliding wedge-block B^{13} is adapted to be moved to or from the seat of the wedge B^8, by sliding in the groove B^{12} in the flanges B^{11} of the swinging jaw B, by the interposition of more or less of the wedge B^8, as the case may be, thus changing the distance between the crushing-faces of the jaws *a* and *b*. The crank-shaft is journaled in the main frame A in the ordinary manner, and has mounted upon it a suitable fly-wheel and driving-pulley by which it may be rotated from any power.

I have described in detail the several parts of the machine, but all, except the mechanism for operating and adjusting the swinging jaw, may be substituted by any analogous devices which would accomplish substantially the same object.

It will be observed that the toggle-block and adjusting-wedge are mounted on the back of the swinging jaw. This I regard a great advantage, as by it I am enabled to shorten the main frame of the machine about one-half over existing constructions, which of course greatly cheapens the machine. The difference between the weights of the main frames of the two constructions would be about four thousand five hundred pounds to my advantage.

What I claim as my invention is—

1. The combination in a rock and ore breaker, having a movable and stationary crushing jaw, of a movable crushing jaw, and an adjustable wedge, an adjustable wedge block upon the rear face of which is formed a toggle seat, all mounted and adjustably secured to the rear surface of the said movable crushing jaw, substantially as and for the purpose set forth.

2. The combination in a rock and ore breaker having a movable and a stationary crushing jaw, of a movable crushing jaw carrying upon its rear surface an adjustable wedge and wedge block, and a three membered toggle, composed of outside tension bars having respectively one of their ends pivoted in a bearing in the front of the main frame and extending rearwardly to, and having their other ends suitably journaled in a pitman adapted to be actuated by a rotary crank, and having a toggle seat upon its face adjacent to the movable crushing jaw, and that portion of the pitman lying between the said journal for tension bars and said toggle seat, and a toggle plate having one of its ends seated in the toggle seat on the pitman, and the other seated in the toggle seat in the wedge block, substantially as and for the purpose set forth.

3. The combination in a rock and ore breaker having a movable and a stationary crushing jaw, of a three membered toggle composed of outside tension bars pivoted to the front of the main frame and extending to the rear where they are journaled in the actuating pitman, that portion of the actuating pitman lying between the said journal for the tension bars and a toggle seat formed on that face of the pitman adjacent to the movable crushing jaw, and a toggle plate having one of its ends seated in said toggle seat on the front of the actuating pitman and the other end seated in the wedge block at the rear of the movable crushing jaw, and a movable crushing jaw adapted to be vibrated by the action of the said three membered toggle and located and pivoted in the main frame of the machine, between the pivot of the tension bars in front and the actuating pitman in the rear, substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

CHARLES LEWIS CARMAN.

Witnesses:
JOHN J. BREWIS,
W. R. TALBOT.