No. 632,635. Patented Sept. 5, 1899.

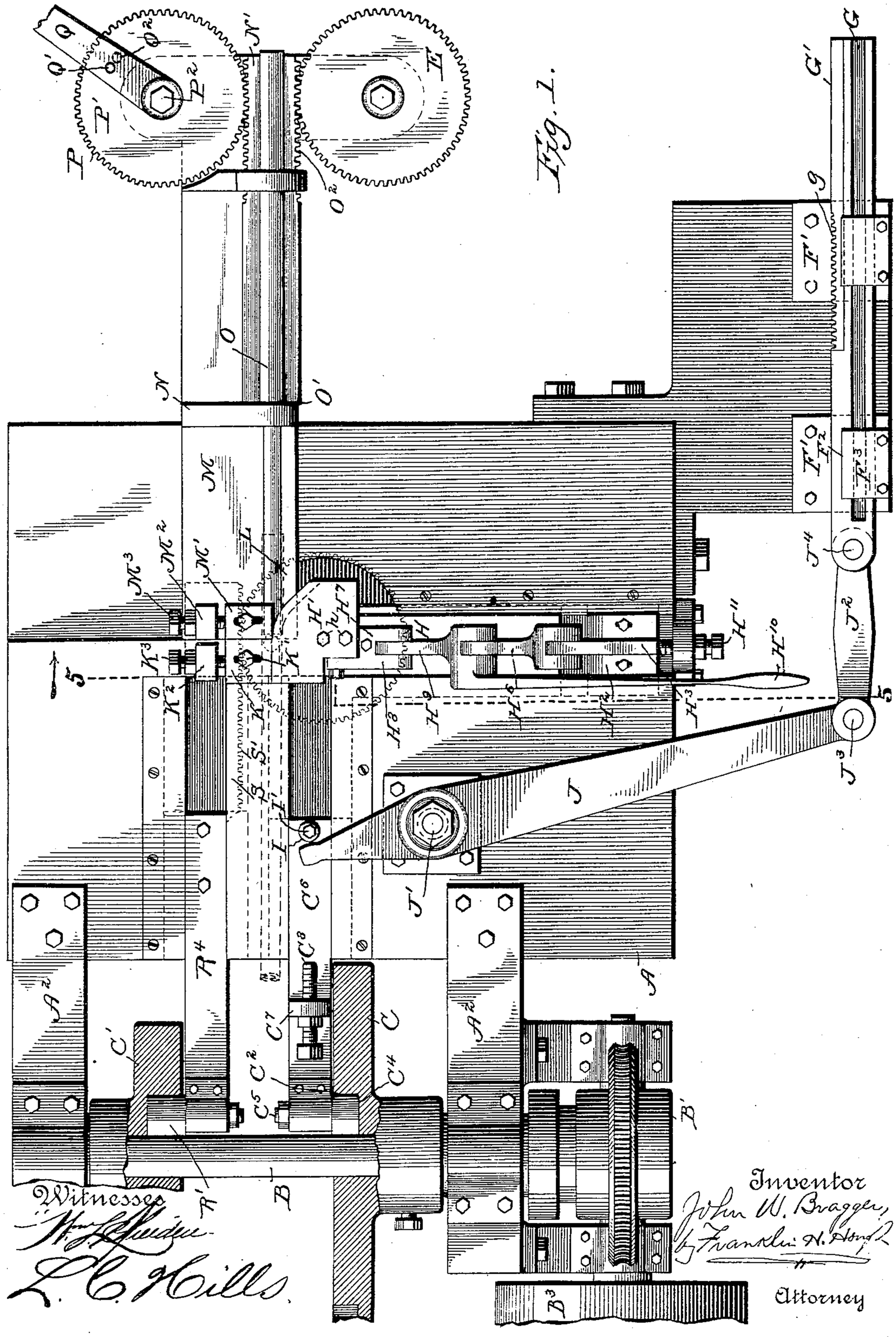
J. W. BRAGGER.

PIPE BENDING MACHINE.

(Application filed Dec. 15, 1898.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



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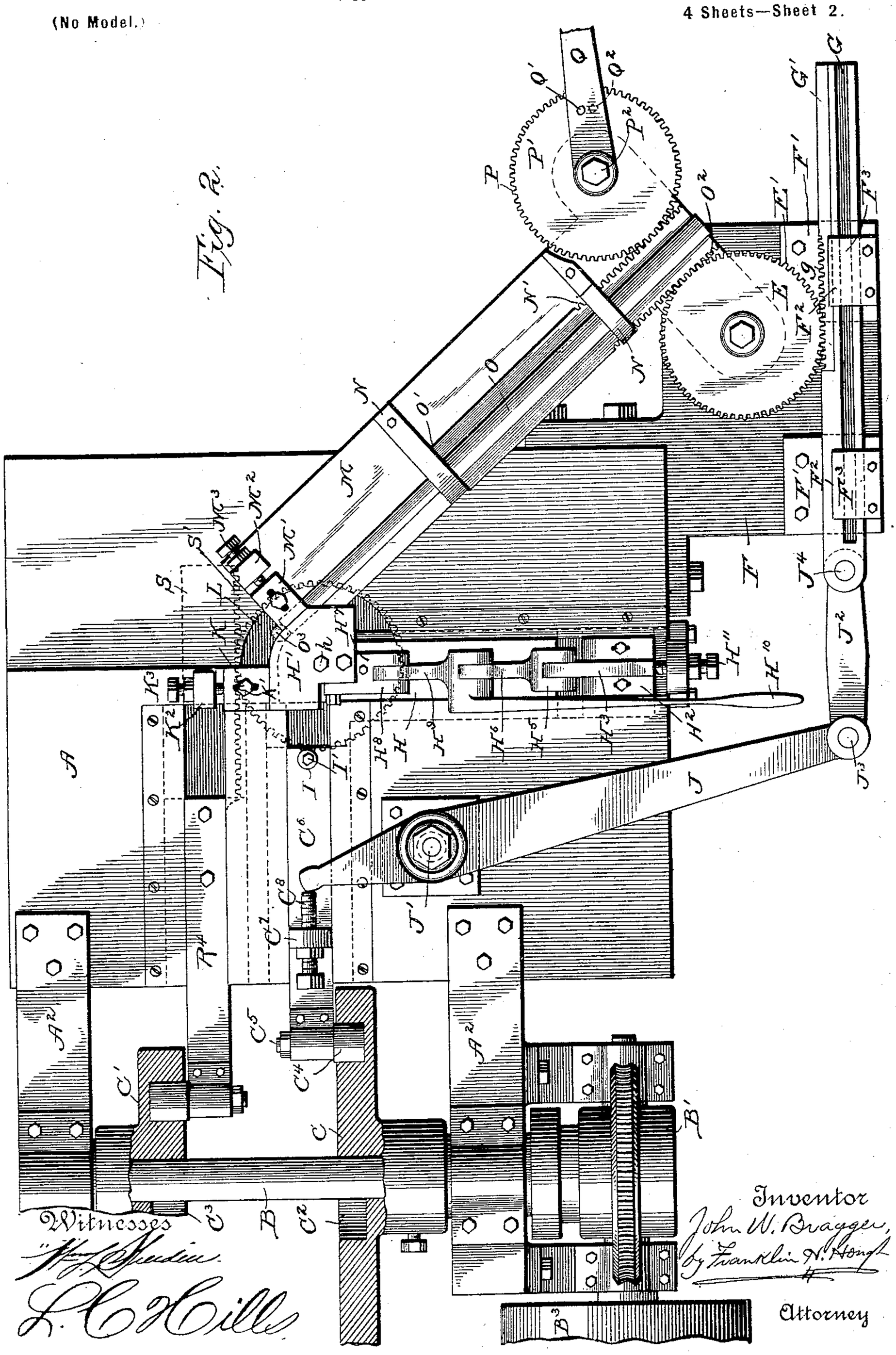
(No Model.) 4 Sheets—Sheet 2.

Fig. 2.



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(Application filed Dec. 15, 1898.)

(No Model.) 4 Sheets—Sheet 3.

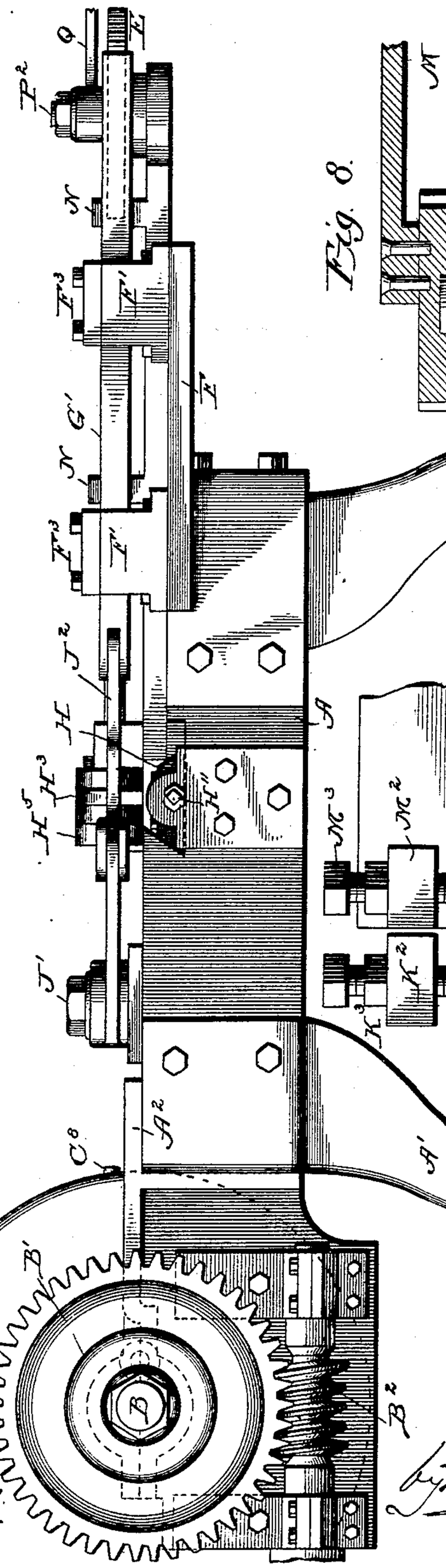

Fig. 3.

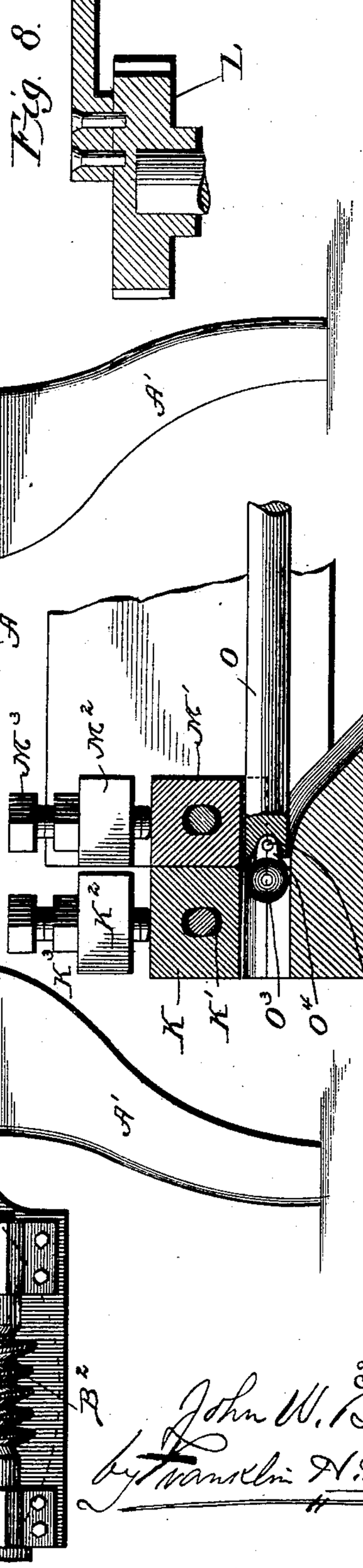

Fig. 8.

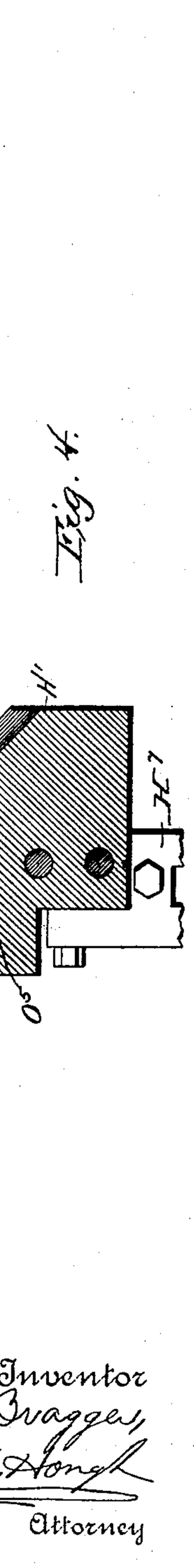

Fig. 4.

Witnesses
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(Application filed Dec. 15, 1898.)

(No Model.) 4 Sheets—Sheet 4.

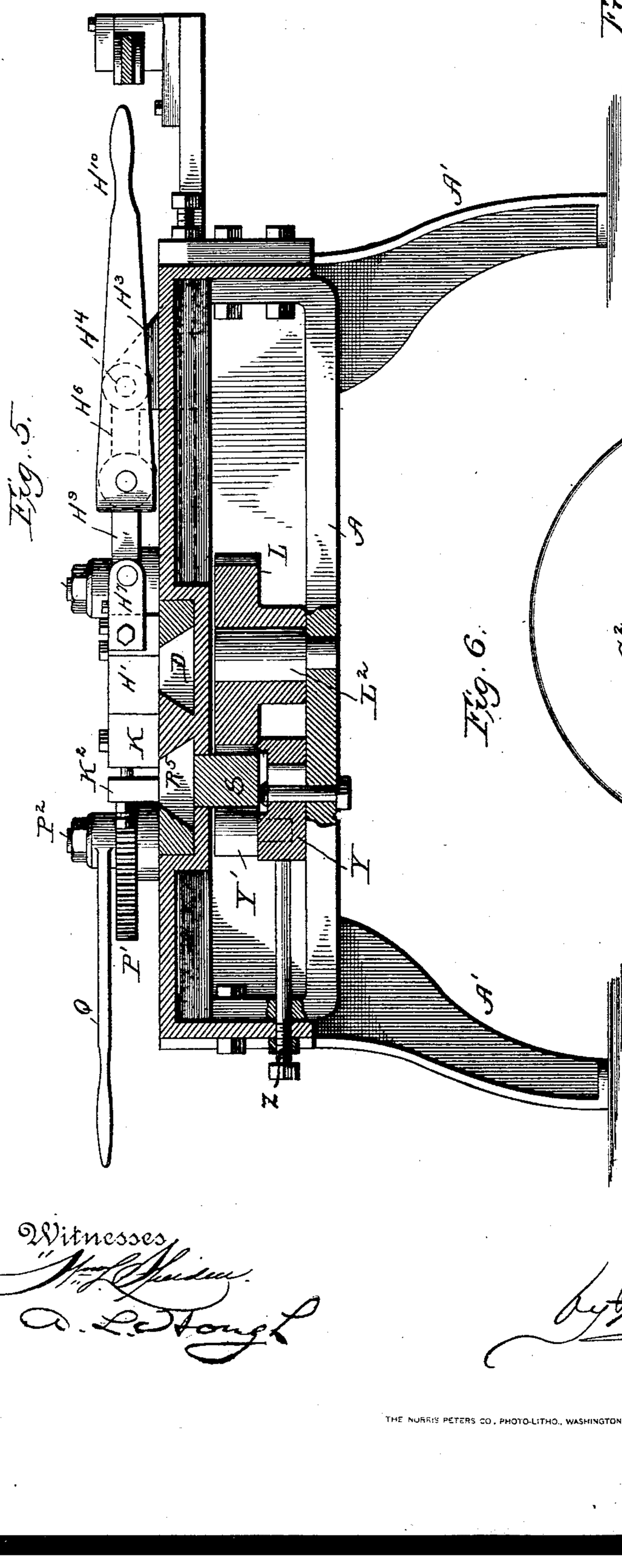

Fig. 5.

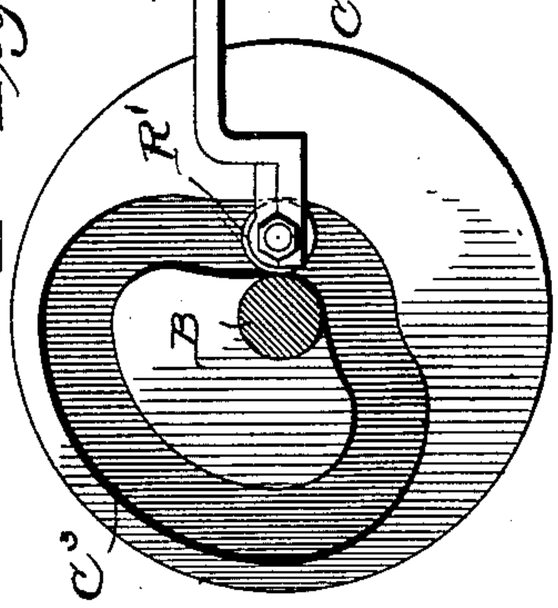

Fig. 7.

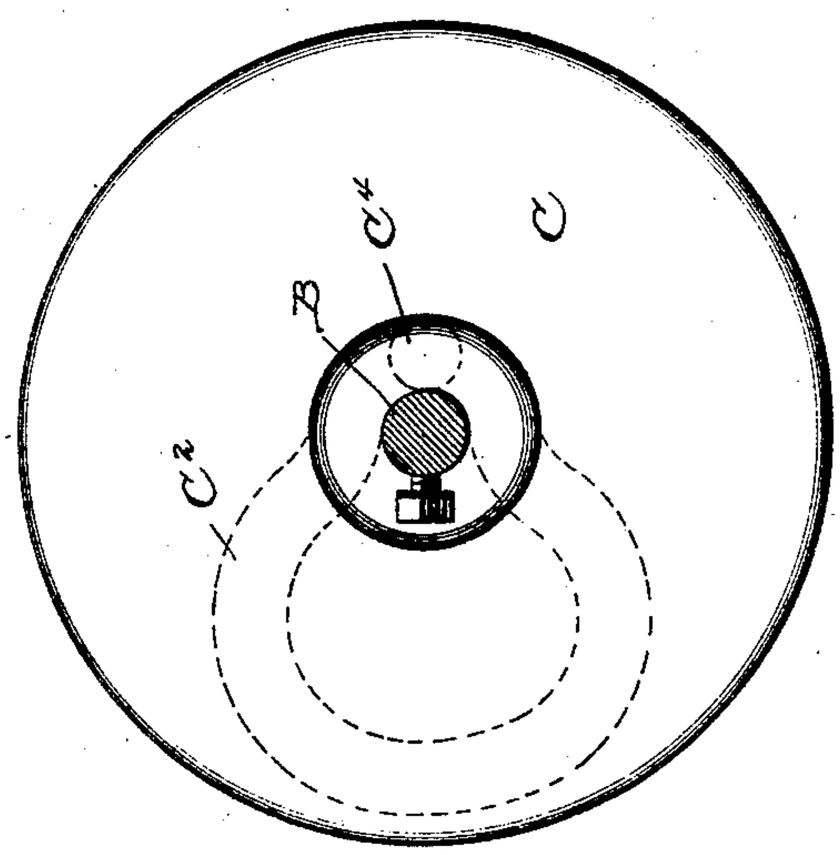

Fig. 6.

Witnesses
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UNITED STATES PATENT OFFICE.

JOHN W. BRAGGER, OF WATERTOWN, NEW YORK, ASSIGNOR TO THE JEFFERSON BRASS WORKS, OF SAME PLACE.

PIPE-BENDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 632,635, dated September 5, 1899.

Application filed December 15, 1898. Serial No. 699,297. (No model.)

To all whom it may concern:

Be it known that I, JOHN W. BRAGGER, a citizen of the United States, residing at Watertown, in the county of Jefferson and State of New York, have invented certain new and useful Improvements in Pipe-Bending Machines; and I do 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, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in machines for bending tubes; and it consists in mechanism whereby one end or a portion of the tube to be bent is held stationary while a mandrel connected to a ball is drawn longitudinally within the pipe during the swinging movement of the mandrel as the pipe is bent about a suitable former and means for withdrawing the mandrel and ball from the pipe after the latter is bent to the desired angle.

A further part of this invention resides in the provision of mechanism in a pipe-bending machine whereby a geared wheel carried at the swinging end of the mandrel-carrying block normally meshes with a rack-bar on the mandrel and is caused to mesh with a rack-bar connected to an operating-lever for the purpose of withdrawing the mandrel when said mandrel-carrying block is swung to its farthest forward limit.

Another feature of the present invention consists of the provision of a lever which is pivoted to the frame of the machine and having one end disposed in the path of a set-screw mounted to travel on a sliding plate which is actuated by a cam-wheel, while the other end of said lever is connected to a sliding rack-bar adapted to mesh with a gear-wheel for withdrawing a mandrel from the pipe which it has bent as it is automatically swung from its starting position to its farthest forward limit.

Further parts of this invention reside in various details of construction and arrangement of the machine, as will hereinafter be set forth, and specifically defined in the appended claims.

The invention is clearly illustrated in the accompanying drawings, which, with the letters of reference marked thereon, form a part of this application, and in which drawings similar letters of reference indicate like parts throughout the several views, in which—

Figure 1 is a top plan view of my machine, showing the relative arrangement of the various parts of the machine in its starting position. Fig. 2 is a top plan view of the machine, showing the relative positions of the various parts of the machine after the pipe has been bent. Fig. 3 is a side elevation of the machine, showing the geared wheel whereby power is applied to the operating-shaft. Fig. 4 is a horizontal section through the jaws which clamp the pipe and hold same while it is being bent, said view showing the end of the mandrel and the ball connected thereto. Fig. 5 is a vertical section through the machine, taken on line 5 5 of Fig. 1. Fig. 6 is an elevation of one of the cam-wheels mounted on the operating-shaft of the machine. Fig. 7 is a similar view of a second cam-wheel having a groove of a distinct shape and also mounted on the main operating-shaft. Fig. 8 is a sectional view showing the manner of attachment of the plate M to the geared wheel L.

Reference now being had to the details of the drawings by letter, A designates the framework of the machine, which is mounted on suitable legs A′, and on brackets A^2, secured to said frame, is the operating-shaft B, which shaft is provided with a gear-wheel B′, the teeth of which mesh with the worm B^2, to which power is transmitted from a pulley B^3, which may be driven from any source of supply of power.

Keyed to the main operating-shaft are the cam-wheels C and C′, which wheels are of different diameters, as shown, and have distinctive cam-grooves C^2 and C^3, respectively, preferably of the shapes shown in Figs. 6 and 7 of the drawings. Mounted to travel in the groove C^2 in said cam-wheel C is an antifriction-roller C^4, which is mounted on a stub-shaft C^5, carried at the end of the slide C^6, which slide is adapted to reciprocate in a dovetailed groove D. (Shown clearly in the cross-section in Fig. 5.) C^7 is an integral lug or projection on said slide and carries an adjusting-screw C^8.

Mounted on the bed of the frame and slid-

ing in a suitable guideway or dovetailed groove is the plate H, which plate carries at one end the jaw H′, which is bolted or otherwise held to said plate, as at *h*. This jaw has one of its forward corners rounded, as shown clearly in Figs. 1 and 2 of the drawings, which show a top plan view of the same, and has its longitudinal edge, which merges into the curved corner, and one end concaved, forming a suitable member to grip about a portion of the circumference of the pipe to be bent. Opposite the concaved end of said jaw is mounted a longitudinally-adjustable block K, which is held to the frame by means of the bolt K′. This block has an elongated aperture, through which passes the bolt K′, said bolt being rigidly held to the frame and adapted to hold the said block in an adjusted position. Mounted on the lug K^2, integral with the frame, is an adjusting-screw K^3, which is adapted to bear against the rear or outer end of said adjusting-block K to hold the same rigidly. Between the concaved ends of said jaw H′ and block K the pipe to be bent is designed to be securely held during the bending operation. The plate H is moved backward and forward by means of a toggle-joint, comprising the links H^9 and A^6, which are pivoted together and secured, respectively, to the plates H^7 and H^2, a lever H^{10} being secured to the link H^9, as illustrated. This block H^2 has an upwardly-projecting lug H^3, which is apertured to receive a bolt H^4, (shown in Fig. 5 of the drawings,) which forms a pivot for the forked end H^5 of the link H^6. At the forward end of said plate H is bolted or otherwise secured a plate H^7, which has integral lugs H^8, which are apertured to receive a bolt, forming a pivotal connection between said lug and the link H^9, which latter is pivoted to the end of the link H^6 and has an operating-handle H^{10}, thus completing the mechanism forming the toggle-joint. Secured to the side of the frame adjacent to the block H^2 is an adjusting-bolt H^{11}, the inner end of which is adapted to bear against the end of said block H^2 in order to hold it in a fixed position.

Pivoted to a stationary axis and in a horizontal position directly underneath the clamping-jaws is a geared wheel L. Mounted on a stud L^2 and securely bolted or otherwise fastened to said wheel L is a block M, and adjustably mounted on said block at its inner end is a plate or block M′, the forward or inner end of which is concaved to conform to the circumference of the pipe against which it is to be held while the pipe is being bent. Immediately behind said block M′ and integral with the plate M is a lug M^2, which carries an adjusting-screw M^3, which is adapted to bear against the rear end of the adjusting-block M′ to hold the same in a fixed position. This block or plate M, which is bolted to the geared wheel L, is designed to turn with said wheel and assume a position at an angle to its starting position, as shown in Fig. 2 of the drawings, in which position said plate is shown at its farthest forward limit. Mounted on said plate M are the lugs N, which are apertured to receive the mandrel O, and a series of cog-teeth N′ are provided on one edge of the said mandrel, which teeth are designed to mesh with the teeth P of the geared wheel P′. Pivoted to one end of the said mandrel is a ball O^3, which has an ear O^4, through which passes the pivot O^5, carried in the end of said mandrel. This geared wheel P′ is mounted on a stub-shaft P^2, carried by the plate M, and loosely journaled on the said stud is an operating-handle Q, which has a lug Q′, adapted to strike against a similar lug Q^2, which is carried by the geared wheel P′, for the purpose of rotating said gear-wheel in the act of imparting a longitudinal movement to the mandrel. Said mandrel has a shoulder O′, which strikes against the inner lug N, carrying said mandrel, and limits its inward throw, said mandrel having a slight longitudinal movement through the lugs supporting same. Mounted in a cam-groove C^3 in the wheel C′, which is keyed to the main operating-shaft, is an antifriction-roller R′, which roller is carried by the sliding plate R^4, which plate R^4 is mounted in dovetailed groove R^5, as shown in Fig. 5 of the drawings, and bolted or otherwise fastened to said sliding plate is a rack-bar S, having a series of teeth S′ on one edge, which are designed to mesh with the teeth of the geared wheel L, as shown clearly in Figs. 1 and 2 of the drawings. In order to rigidly hold and guide said rack-bar, I provide a block Y, which carries an antifriction-roller Y′, mounted on a stub-shaft carried by said block Y, which roller is adapted to contact with the back face of the said rack-bar, said antifriction-roller Y′ being located, preferably, opposite the contact-point of the rack and gear. The block may be adjusted by means of a set-screw Z, as shown clearly in Fig. 5 of the drawings.

Mounted in an extension of the plate M is a geared wheel E, the teeth of which geared wheel E are adapted to normally mesh with the teeth O^2, formed in the edge of the mandrel. Secured to or integral with the frame is a shelf F, which carries the plates F′, which have bolted or otherwise secured thereto the guide-blocks F^2, which have ribs F^3 on their under faces, (shown in dotted lines in Fig. 2 of the drawings,) said ribs being designed to engage in the longitudinal slot G in the sliding bar G′, which has a longitudinal movement on said shelf. This bar G′ has a series of cog-teeth *g*, which are designed to mesh with the teeth of the geared wheel E when the mandrel-carrying plate is swung forward to its farthest limit in the position shown in Fig. 2 of the drawings.

Pivoted on a stud J′ on the frame of the machine is a lever J, which is pivoted at its outer end to a link J^2, as at J^3, the other end of said link being pivoted to the bar G′ at J^4. The free end of said lever J extends over a portion of the sliding plate C^6 and is adapted

to be struck by the set-screw C^8 on the forward movement of said slide C^6 for the purpose of tilting said lever J, which withdraws the mandrel from the pipe which has been bent, which withdrawal of the said mandrel is caused by the longitudinal movement imparted to the bar G', which communicates motion through the geared wheel E to the series of teeth on the mandrel, with which teeth the geared wheel is always in mesh. On the return movement of the sliding plate C^6 as the cam-wheel actuating the same completes its revolution an eccentric I, mounted on a stud I', contacts with the free end of the lever J and causes the latter to tilt on its pivot, which imparts a longitudinal movement to said bar G' in an opposite direction from that imparted to said bar in the withdrawing of the mandrel, which motion in a reverse direction causes the mandrel to be returned to its normal position. This eccentric I is provided so that it may be slightly rotated on its axis in order to cause the said lever J to tilt at the right angle to allow the teeth *g* to mesh with the teeth on the geared wheel E when the mandrel-carrying plate is swung to its farthest forward position.

The operation of the machine is as follows: The tube to be bent is first inserted between the clamping members, and the toggle-joint lever H^{10} depressed, which forces forward the jaw H', which securely grips the pipe, after which the mandrel is inserted in the pipe and occupies the position shown in Fig. 1 of the drawings in readiness to bend the pipe. When the pipe and mandrel are thus adjusted, the operator causes the main operating-shaft to be rotated, and as said shaft begins its rotary movement the slide R^4 begins to be driven forward and with it the rack-bar S, the teeth of which mesh with the teeth of the geared wheel L, causing the latter to rotate on its axis, and as said wheel L rotates the plate M, fastened thereto, will begin to swing and carry with it the mandrel. This mandrel, it will be observed, which carries the ball at its end, will bend the pipe against the grooved or concaved portion of the jaw H', which acts as a former, and the mandrel being held in a fixed position with reference to the swinging plate M by reason of the shoulder O' bearing against the lug N, as the said plate swings will be drawn through the pipe slightly during the bending operation, and the ball is drawn over the portion being bent to prevent the pipe from collapsing during the bending operation. The cam-wheels and grooves contained therein, in which travel the antifriction-rollers connected to the slides R^4 and C^6, are so arranged that at the moment the slide R^4 has caused the plate M to assume the position shown in Fig. 2 of the drawings, in which position said plate is at its farthest forward throw, the cam-wheel C, which is preferably of larger diameter than the cam-wheel C', forces the plate C^6 forward, and the adjusting-screw C^8, carried thereby, striking against the end of said lever J will cause the latter to tilt and with it cause a longitudinal movement to be imparted to the bar G', which when the plate M has been thrown forward to its farthest limit causes the teeth of the wheel E^2 to be in mesh with the teeth *g* on said bar G'. As said lever J tilts by the forward movement of the plate C^6 the gear-wheel E will cause the mandrel O to be drawn out of the pipe which it has bent after said plate has been swung from its normal position to that shown in Fig. 2 of the drawings. After the plate C^6 has finished its farthest forward limit and the mandrel withdrawn from the pipe the cam-groove and antifriction-roller C^4, carried thereby, will cause the said plate C^6 to resume its normal or starting position, and as the plate C^6 returns the eccentric or stop I carried at its forward end will strike against the free end of the lever J and tilt the latter on its pivot and return the sliding rack-bar G' to its normal or starting position. Immediately after the slide C^6 begins its return movement the slide R^4 starts to return to its normal position and the teeth of the rack-bar S, which are constantly in mesh with the teeth of the geared wheel L, will cause the latter to rotate on its stud and the plate M will be swung back to its starting position, as shown in Fig. 1 of the drawings.

While I have shown and described a mechanism for making forty-five-degree bends, it is my purpose to adapt the machine for bending pipes of less degree, which may be accomplished by fastening suitable geared wheels to the shelf carrying the sliding rack-bar, with which wheels in their adjusted positions motion may be imparted to the geared wheel carried by the swinging plate carrying the mandrel as it is swung forward in the bending operation. It is my purpose to have a distinct set of the geared wheels which I can apply to the shelf, which are geared with the sliding rack-bar for each angle for which it is desired to bend the pipes.

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

1. A machine for bending pipes, in which the pipe to be bent is held by suitable clamping members, combined with a mandrel, and ball connected to the end thereof, a swinging plate carrying the mandrel, means for operating the same, and geared mechanism for drawing the mandrel and ball from the pipe after it is bent, as set forth.

2. A machine for bending pipes, in which the pipe to be bent is held by suitable clamping members, combined with a mandrel and ball connected thereto, a swinging plate carrying said mandrel and means for operating the same, a geared wheel which is mounted on said swinging plate and geared to the teeth

on the mandrel, and designed to be thrown into mesh with mechanism for rotating said wheel, when the plate carrying the latter reaches the limit of its forward throw, as set forth.

3. In combination with the swinging mandrel-carrying plate, the mandrel and ball connected thereto, the geared wheel meshing with teeth on said mandrel, mechanism with which said wheel is designed to mesh after the plate reaches its forward limit, and a trip-lever and means for actuating said geared mechanism, as set forth.

4. In a pipe-bending machine, the combination with the swinging plate and means for operating the same, the mandrel mounted thereon, the wheel carried by said plate and geared to the teeth of the mandrel, a sliding rack-bar mounted to mesh with said gear-wheel after the plate carrying the latter has swung to its forward limit, and means for reciprocating the said rack-bar, as set forth.

5. In a pipe-bending machine, the combination with the swinging plate and means for operating the same, of the mandrel carried thereby, the gear-wheel meshing with the teeth of said mandrel, the sliding rack-bar with the teeth of which the gear-wheel is adapted to mesh, when the plate carrying the latter is swung to its forward limit, the lever pivoted to the frame, and having one end connected to said sliding rack-bar, and means for tripping its free end, as set forth.

6. In a pipe-bending machine, the combination with the swinging mandrel-carrying plate and means for operating the same, the mandrel having teeth formed thereon, a wheel carried by said plate and geared to the mandrel-teeth, a sliding rack-bar and guides therefor, a lever pivoted to the frame, a link connecting one end of the same with said rack-bar, a slide and adjusting-screw carried thereby for tripping the free end of said lever, and means for actuating the slide and for returning the lever to its normal position, as set forth.

7. In combination in a pipe-bending machine, the lever, the sliding rack-bar and the mandrel-carrying plate and the gear-wheel carried thereby, the sliding plate and means for operating the same, the set-screw mounted on the latter, and the eccentric mounted on the plate, the free end of said lever being disposed in the path of said screw and eccentric, as the slide carrying same is reciprocated, as and for the purpose set forth.

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

JOHN W. BRAGGER.

Witnesses:

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FRANKLIN H. HOUGH.