No. 771,611. PATENTED OCT. 4, 1904.

L. D. DAVIS.

SWAGING MILL.

APPLICATION FILED DEC. 12, 1901.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 2.

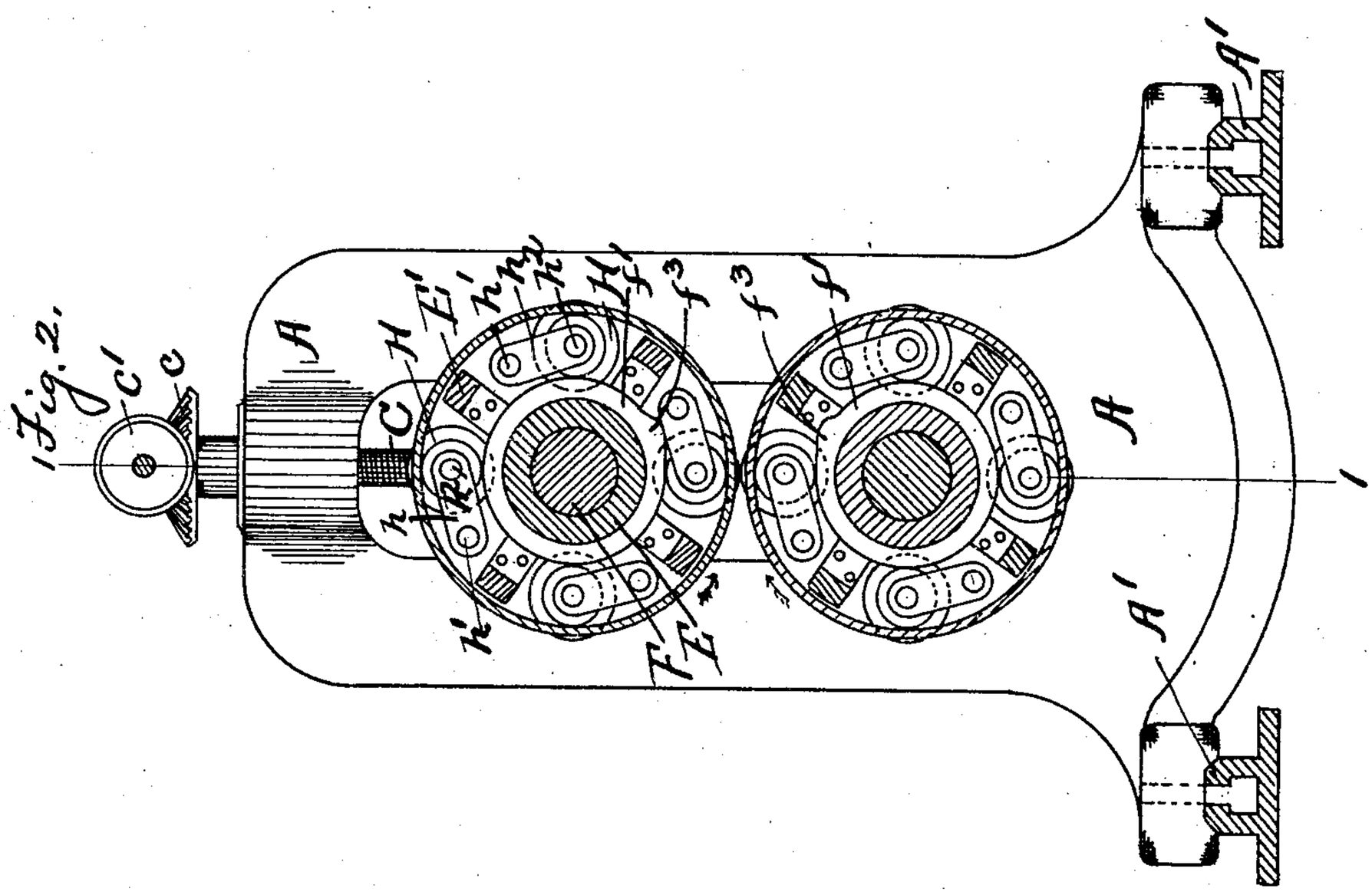
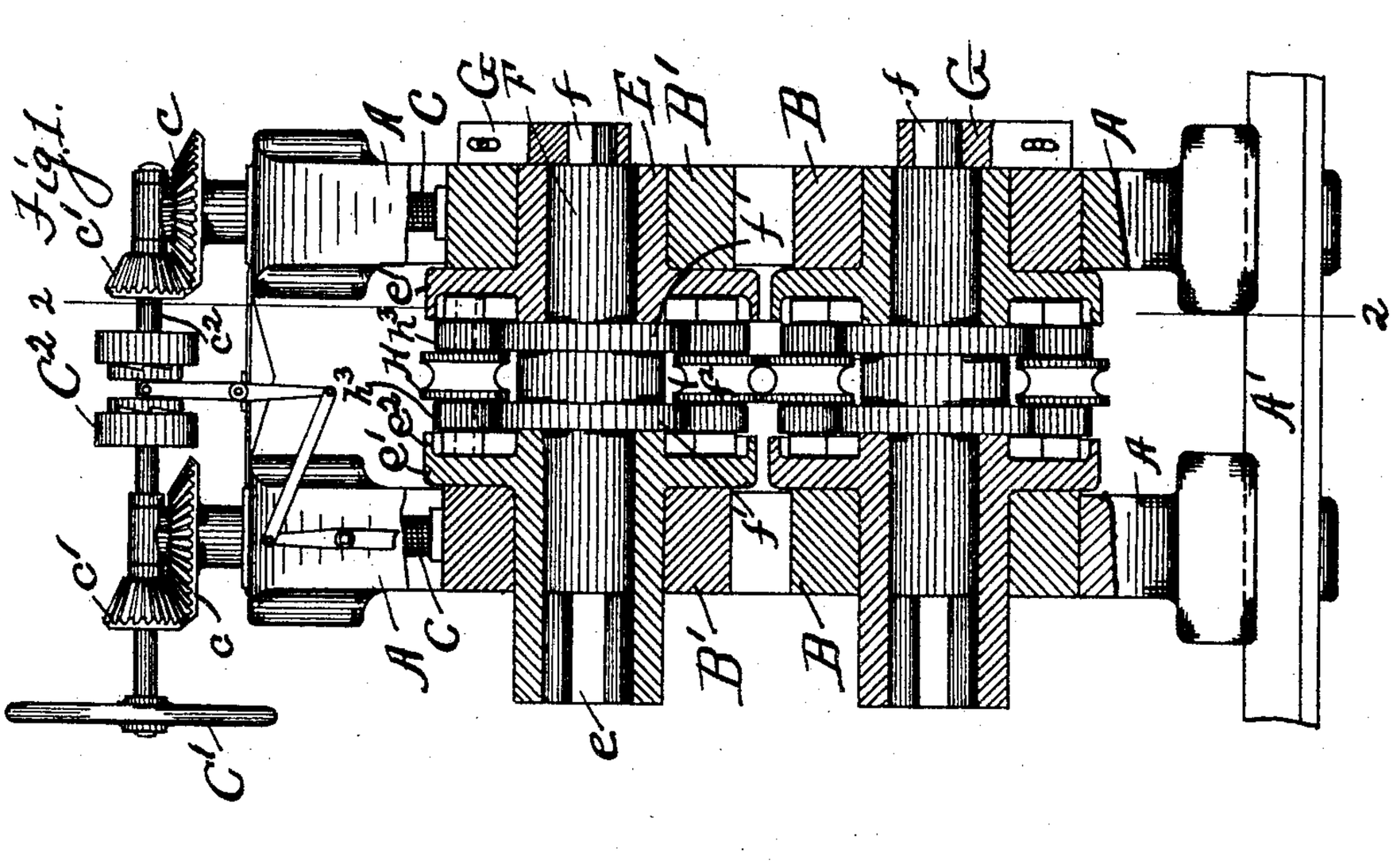


Fig. 1.



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NO MODEL. 4 SHEETS—SHEET 2.

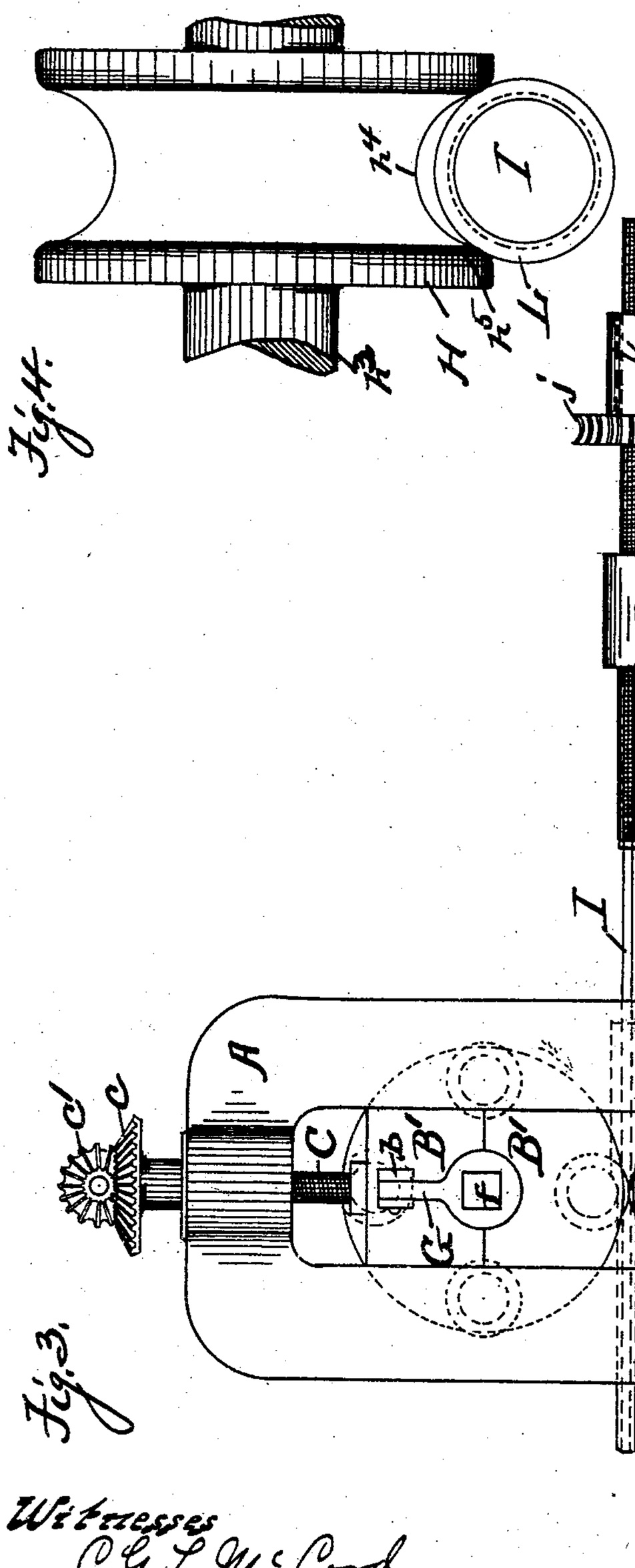

Fig. 3.

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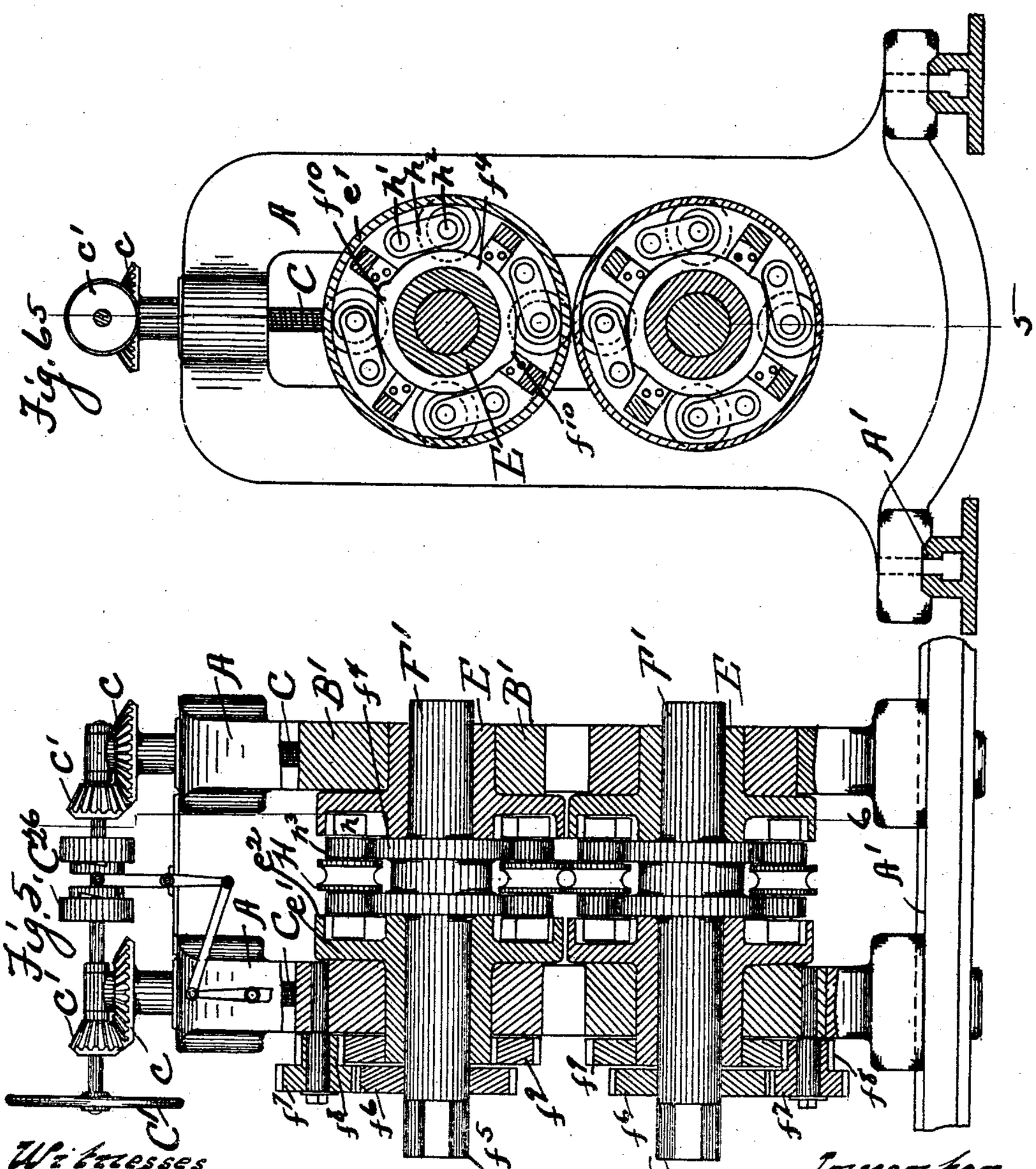
NO MODEL. 4 SHEETS—SHEET 3.



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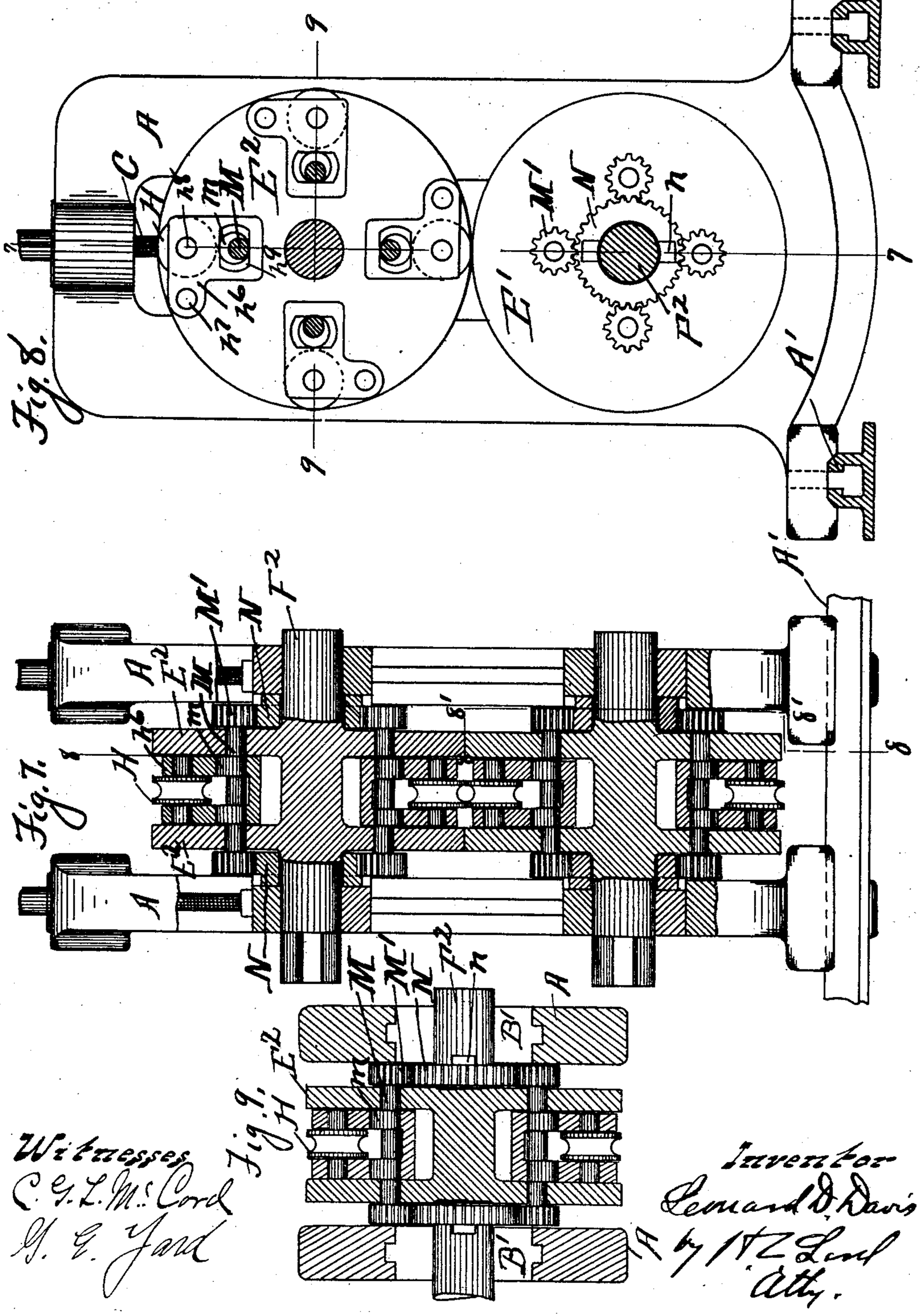
NO MODEL. 4 SHEETS—SHEET 4.



Witnesses
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No. 771,611. Patented October 4, 1904.

UNITED STATES PATENT OFFICE.

LEONARD D. DAVIS, OF ERIE, PENNSYLVANIA, ASSIGNOR TO NATIONAL TUBE COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF NEW JERSEY.

SWAGING-MILL.

SPECIFICATION forming part of Letters Patent No. 771,611, dated October 4, 1904.

Application filed December 12, 1901. Serial No. 85,656. (No model.)

To all whom it may concern:

Be it known that I, LEONARD D. DAVIS, a citizen of the United States, residing at Erie, in the county of Erie and State of Pennsylvania, have invented certain new and useful Improvements in Swaging-Mills; 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.

This invention relates to swaging-mills; and it consists in certain improvements in the construction thereof, as will be hereinafter fully described, and pointed out in the claims.

In the usual method of swaging now employed two rolls with eccentric or bell-mouth grooves are arranged to operate upon a hollow ingot or rod. With this method the billet is usually reciprocated, being fed forward slightly with each reciprocation. The objection to this method is the necessary limitation as to speed both because of the reciprocation and the small amount of feed possible with this arrangement. To make the operation a success, comparatively large rolls are required, and these by reason of a slight degree of curvature grip a considerable length of metal in the pass. This by reason of the length of the metal engaged prevents the metal flowing freely, and this with the time required for the reciprocation of the ingot, as aforesaid, necessarily limits the rapidity with which the reduction can be made. As it is desirable that a complete reduction be effected with a single heating, the rapidity with which the ingot may be reduced becomes a very important feature.

The object of this invention is, broadly speaking, to obviate the difficulties above stated and to provide a mechanism for rapidly and effectively reducing hollow metallic ingots to the form of tubes.

The invention is illustrated in the accompanying drawings, as follows:

Figure 1 shows a swaging-mill in section on the line 1 1 in Fig. 2. Fig. 2 shows a section of the same mill on the line 2 2 in Fig. 1. Fig. 3 shows a side elevation of the mill with a feeding mechanism. Fig. 4 shows an enlarged view of the roll-swage. Fig. 5 shows an alternative construction of the mill in section on the line 5 5 in Fig. 6. Fig. 6 shows a view of the same mill on the line 6 6 in Fig. 5. Fig. 7 shows a view of another alternative construction in section on the line 7 7 in Fig. 8. Fig. 8 shows a section on the lines 8 8 and 8′ 8′, the upper part of Fig. 8 being on the line 8 8 and the lower part on the line 8′ 8′. Fig. 9 shows a section on the line 9 9 in Fig. 8.

In the preferred construction (shown in Figs. 1, 2, 3, and 4) A marks the housings. These are mounted on the shoe-plates A′ in the usual manner. Mounted in the housings are the stationary boxes B B. Also mounted in the housings are the movable upper boxes B′ B′. Arranged to operate upon the upper boxes are the screws C C. The gears c c are arranged on the upper ends of these screws and are made to operate simultaneously through the gears c' c' on the shaft c^2. A hand-wheel C′ is arranged to operate the shaft c^2, or, if desired, the shaft may be operated by a power mechanism C^2. By the operation of these gears and the screws C the boxes B′ may be raised or lowered, as desired. Journaled in the boxes B B′ are the swage-carriers E. These are provided with the ordinary coupling mechanism e, by which the carriers may be driven. Extending from the carriers are the webs e' e', on which are the flanges e^2. Roll-swages H are mounted on the carriers between the webs e' e' and are free to move toward and from the axis of the carriers. As shown, they are mounted on the swinging supports comprising the swinging arms h, which are journaled on the pins h', extending between the webs e' e'. The swages are carried by the pins h^2, mounted in the swinging arms h. Journaled in the carriers E are the shafts F. The ends of these shafts are squared at f. The bars G are arranged on these squared ends and secured to the boxes B B′ by the lugs b, thus preventing the shafts F from rotating. At the center of these shafts are the guide-shoulders f', forming the groove f^2 between them. The roll-swages H are disposed in the groove f^2.

At each side of the swages are the shoulders h^3, which roll on the shoulders f'. The roll-swages are prevented from swinging outwardly by the flange e^2, which engages the ends of the arms h. The two parts of the carrier E are secured together by the bridge-pieces E', so that the parts on both sides of the shoulders f' operate as one. The cams f^3 are arranged on the guide-shoulders f' adjacent to the pass. These cams swing the swage-rolls positively and bodily away from the axis of the carrier, so that they move for a distance in a line substantially parallel to the axis of the pass or the axis of the billet in the pass. In other words, the rolls are given a movement out of the circular path of the parts of the carrier. In Fig. 3 is shown the mandrel I, on which the ingot is ordinarily placed as it is fed into the mill. A feed-screw J is connected with this mandrel and passes through the blocks k. These blocks are mounted on the frame K. Secured to this screw is the worm-gear j, and arranged to operate upon this worm-gear is a worm j'. By operating the worm the screw J is actuated, and the mandrel I, with the billet, is moved forward. With this mechanism very small swages may be used, so that a very small amount of metal in the ingot is engaged by a swage. The metal therefore flows freely in front of a swage as the swage is moved in its work. After the reduction is made by a swage the swage moves along a reduced ingot or tube preferably some distance. The ingot between each operation of the swage is turned, preferably, about forty-five degrees, so that any fin that may be produced by the rolling of the preceding swage may be rolled out of the swage as it passes along the reduced billet. The length of the cams f^3, therefore, should be preferably such as to carry the swages along the tubes a sufficient distance to roll out the fins produced by the preceding swages. The distance of course will be dependent to some extend upon the feed or movement which is given to the ingot.

By the mechanism described the ingot is not reciprocated, but is simply fed forward step by step and turned between each feeding movement. The swage-rolls being small in diameter and engaging a small portion of metal permit it to flow freely along the mandrel. The roll then continuing along the pass rolls out the fins produced by the preceding swages. The action of the carrier is rotary and continuous, so that the opposing inertia forces are slight. This continuous movement permits of a very rapid reduction of the ingot not only by reason of the fact that the swages are brought into action with greater frequency, but also by reason of the fact that the roll-swages are of less diameter than those in common use, so that a larger feed for each swage is permissible.

In Fig. 4 an enlarged view of a roll-swage is shown. The annular groove in its face should have the inner surfaces h^4 of a curve in cross-section of the radius of the finished tube. The edges of the grooves are flared at h^5, preferably to a width equal to the diameter of the ingot.

In Figs. 5 and 6 I show an alternative construction. In these figures the carriers and roll-swages are practically the same as those in the preceding structures. The boxes and adjusting mechanisms are the same. The carriers E are also of similar construction and have the web e' and flanges e^2 for the same purpose. Instead of the shafts F there are journaled in the carrier the shafts F'. These are similar to the shafts F, excepting that there are two cams f^{10} on each shaft. In this construction the shafts F' are driven by the driving mechanisms connected at f^5. Fixed on the shafts F' are the gears f^6. Driven by these gears are the gears f^7. Fixed with the gears f^7 are the gears f^8 of smaller diameter than the gears f^7. The gears f^8 drive the gears f^9, which are fixed on the carriers E. The proportions of the gears f^6, f^7, f^8, and f^9 are such that while the carriers are driven in the same direction as the shafts F' they are driven at only half the speed. The cams f^{10} are so adjusted that one of them on each shaft arrives at the pass just as one of the rolls H arrives at the pass. The action of these cams moves the rolls H positively and bodily relatively to and from the axis of the carrier, so that they have a direction out of the circular path along the pass for the purpose described in relation to Figs. 1 and 2. It will be noted in this construction that the action of the shoulder f^4 tends to turn the rolls H, and thus eliminate the friction on the shoulder h^2. The work is fed to this mill as in Figs. 1 and 2.

In Figs. 7 and 8 I show another alternative construction. In these figures the shafts F^2 have the webs E^2 secured direct to the shaft. These webs E^2 form practically the carriers. The rolls H are carried by the pins h^8, and these are carried by the rock-arms h^6. The arms h^6 are mounted on the shafts h^7, carried by the webs E^2. The arms h^6 have an inward projection in which there is a slot h^9. Eccentrics m work in this slot. The eccentrics are mounted on the shafts M, which are journaled in the webs E^2. Gears M' are secured to the ends of the shafts M. They mesh the stationary gears N. The gears N are locked with the housings A by means of the lugs n. As the shafts F^2 are rotated the eccentrics m are turned and rock the arms h^6, thus moving the roll-swages H toward and from the axis of the carriers or shafts F^2. The eccentrics and carriers are so arranged that the rolls H^2 are made to move along the pass in a direction substantially parallel to the axis of the pass for the purpose described in relation to Figs.

1 and 2. The housings, boxes, and adjusting mechanism are similar to those shown in Figs. 1 and 2.

What I claim as new is—

1. In a swaging-mill, the combination of a rotative carrier, a swage mounted in said carrier so as to rotate relatively thereto and having movement bodily toward and from the axis of the carrier, and means for moving said swage bodily away from the axis of the carrier along the pass.

2. In a swaging-mill, the combination of a rotative carrier, a rotative swage carried thereby and movable radially thereto, and means for moving the swage away from the axis of the carrier along the pass.

3. In a swaging-mill, the combination of a rotative carrier, a swage mounted in said carrier so as to rotate relatively thereto and having a working face concentric with its own axis, and means for moving said swage away from the axis of said carrier during a portion of its orbital movement.

4. In a swaging-mill, the combination of a rotative carrier, a rotative swage having a working face concentric to its axis and mounted in said carrier to have movement toward and from the axis of said carrier, and means for moving said swage away from the axis of the carrier along the pass.

5. In a swaging-mill, the combination of a rotative carrier, a swage mounted in said carrier so as to rotate relatively thereto, and having movement bodily toward and from the axis of the carrier, and means for moving said swage at the pass away from the axis of the carrier and substantially parallel to the axis of the pass.

6. In a swaging-mill, the combination of a rotative carrier, a swage mounted in said carrier to have movement bodily toward and from the axis thereof, and means for moving said swage at the pass away from the axis of the carrier and substantially parallel to the axis of the pass.

7. In a swaging-mill, the combination of a rotative carrier, a rotative swage having a working face concentric with its axis and mounted in said carrier to have movement toward and from the axis of the carrier and to rotate relatively thereto, and means for moving said swage at the pass away from the axis of the carrier and substantially parallel to the axis of the pass.

8. In a swaging-mill, the combination of a rotative carrier, a swage mounted in said carrier so as to rotate relatively thereto and having movement toward and from the axis of the carrier, and a cam arranged to move said swage away from the axis of the carrier along the pass.

9. In a swaging-mill, the combination of a rotative carrier; a shaft journaled in said carrier; a swage carried by said carrier; and a cam on said shaft arranged to actuate the swage to move it relatively to the axis of the carrier along the pass.

10. In a swaging-mill, the combination of a rotative carrier; a shaft journaled in said carrier; a roll-swage carried by said carrier, said swage having extensions; a cam on said shaft arranged relatively to said extensions to form a guide for said extensions and to move the swage relatively to the axis of the carrier.

11. In a swaging-mill, the combination of a rotative carrier; a shaft journaled in said carrier; a roll-swage carried by said carrier, said swage having extensions; a cam on said shaft arranged relatively to said extensions to form a guide for said extensions and to move the swage relatively to the axis of the carrier and in a direction substantially parallel to the direction of the pass along the pass.

12. In a swaging-mill, the combination of a rotative carrier; a swage; a swinging support for said swage mounted upon said carrier; and means for positively moving said swinging support and swage relatively to the axis of the carrier along the pass.

13. In a swaging-mill, the combination of a rotative carrier having the webs e'; a swage; a swinging support for said swage mounted between said webs; a shaft journaled in said carrier and having guide-shoulders thereon; and a cam forming a part of said shoulder for swinging said swage relatively to the axis of the carrier.

14. In a swaging-mill, the combination of a rotative carrier, a plurality of swages mounted in said carrier so as to rotate relatively thereto and having movement toward and from the axis of the carrier, and means for moving said swages away from the axis of the carrier at the pass.

15. In a swaging-mill, the combination of a rotative carrier, a plurality of swages mounted in said carrier so as to rotate relatively thereto and having movement toward and from the axis of the carrier, and means for moving said swages at the pass away from the axis of the carrier and substantially parallel to the axis of the pass.

16. In a swaging-mill, the combination of a carrier E, having the webs e' with flanges e^2, thereon; the shaft F, journaled in the carrier E, and having the shoulders f' thereon, forming a groove f^2, and having the cams f^3, on the shoulders; the swage H, disposed in the groove f^2; a swinging support h, for the roll H, mounted in the web e'; an extension h^3, arranged to operate upon the shoulders f'.

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

LEONARD D. DAVIS.

Witnesses:
JUSTIN P. SLOCUM,
GRACE E. YARD.