(No Model.) 2 Sheets—Sheet 1.

G. J. CAPEWELL.

APPARATUS FOR PERFORATING BILLETS OR INGOTS.

No. 575,104. Patented Jan. 12, 1897.

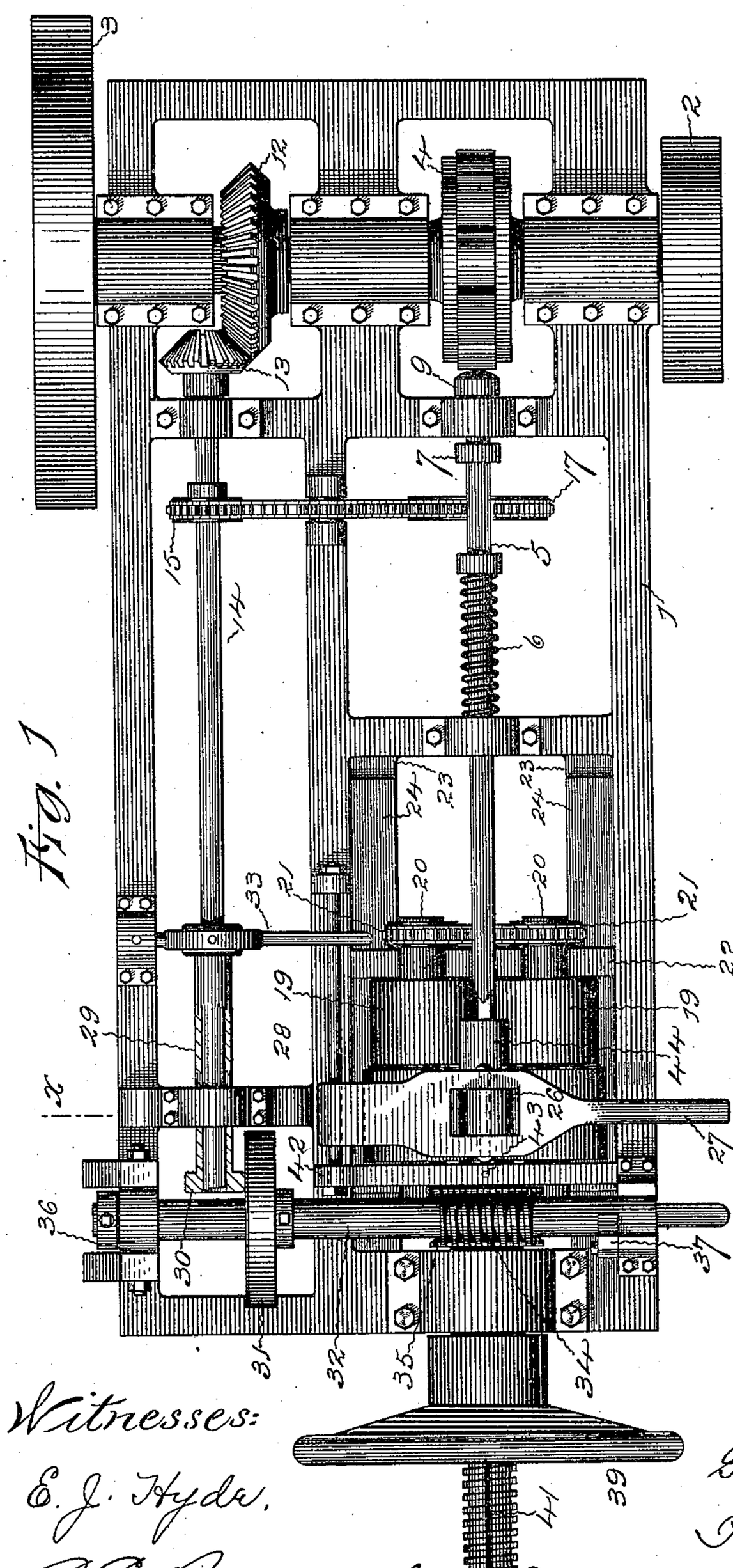

Fig. 1

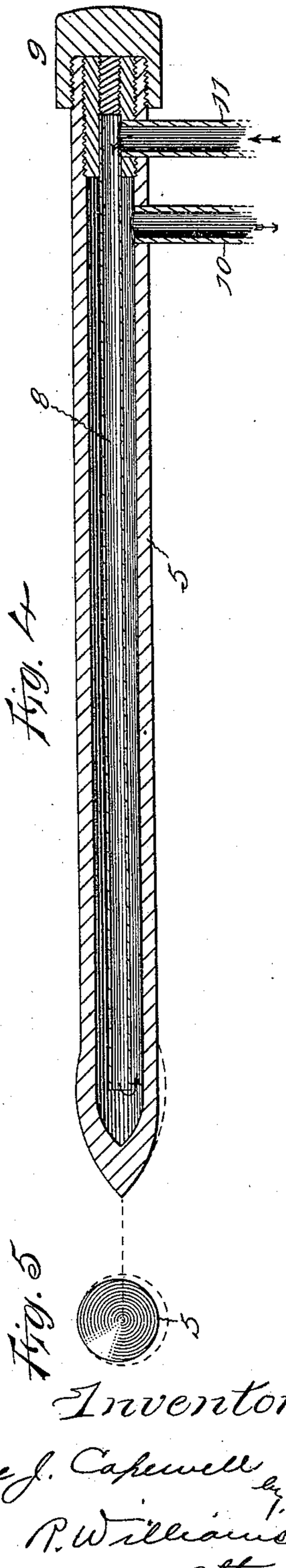

Fig. 4

Fig. 5

Witnesses:

E. J. Hyde.

C. E. Buckland.

Inventor:

George J. Capewell by

Harry P. Williams.

atty.

(No Model.) 2 Sheets—Sheet 2.

G. J. CAPEWELL.

APPARATUS FOR PERFORATING BILLETS OR INGOTS.

No. 575,104. Patented Jan. 12, 1897.

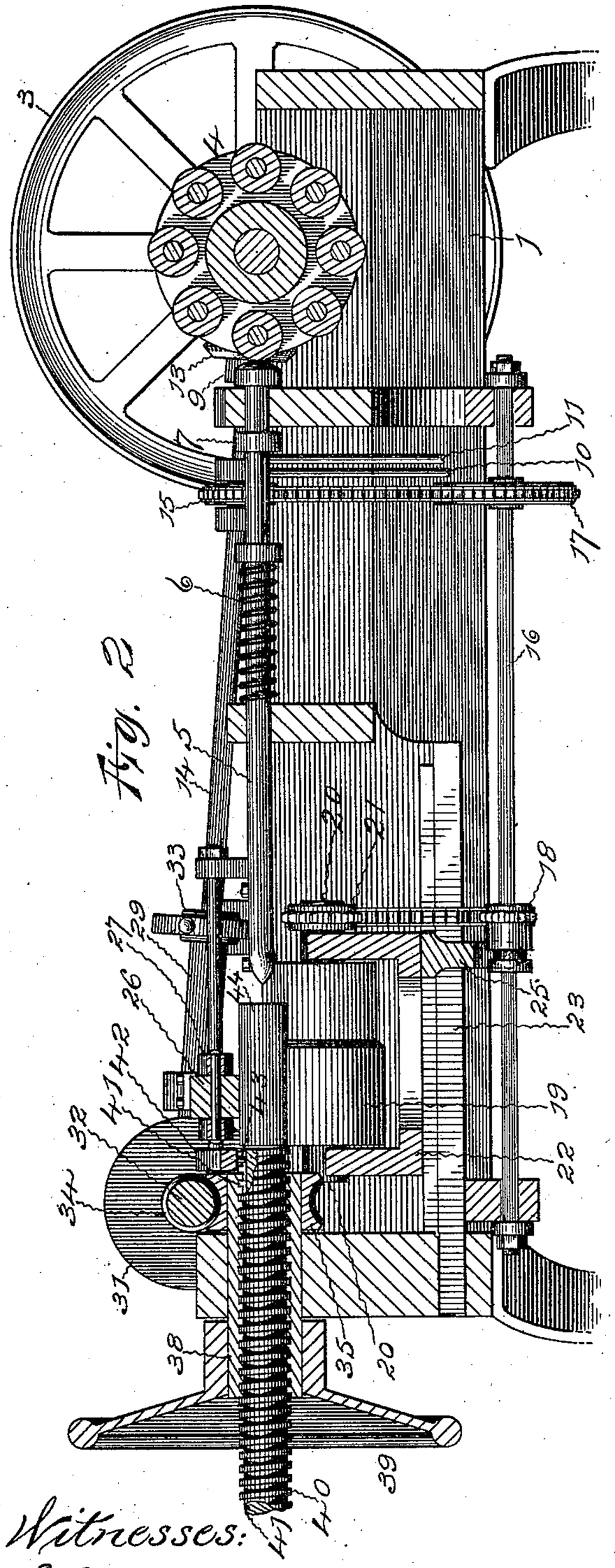

Fig. 2.

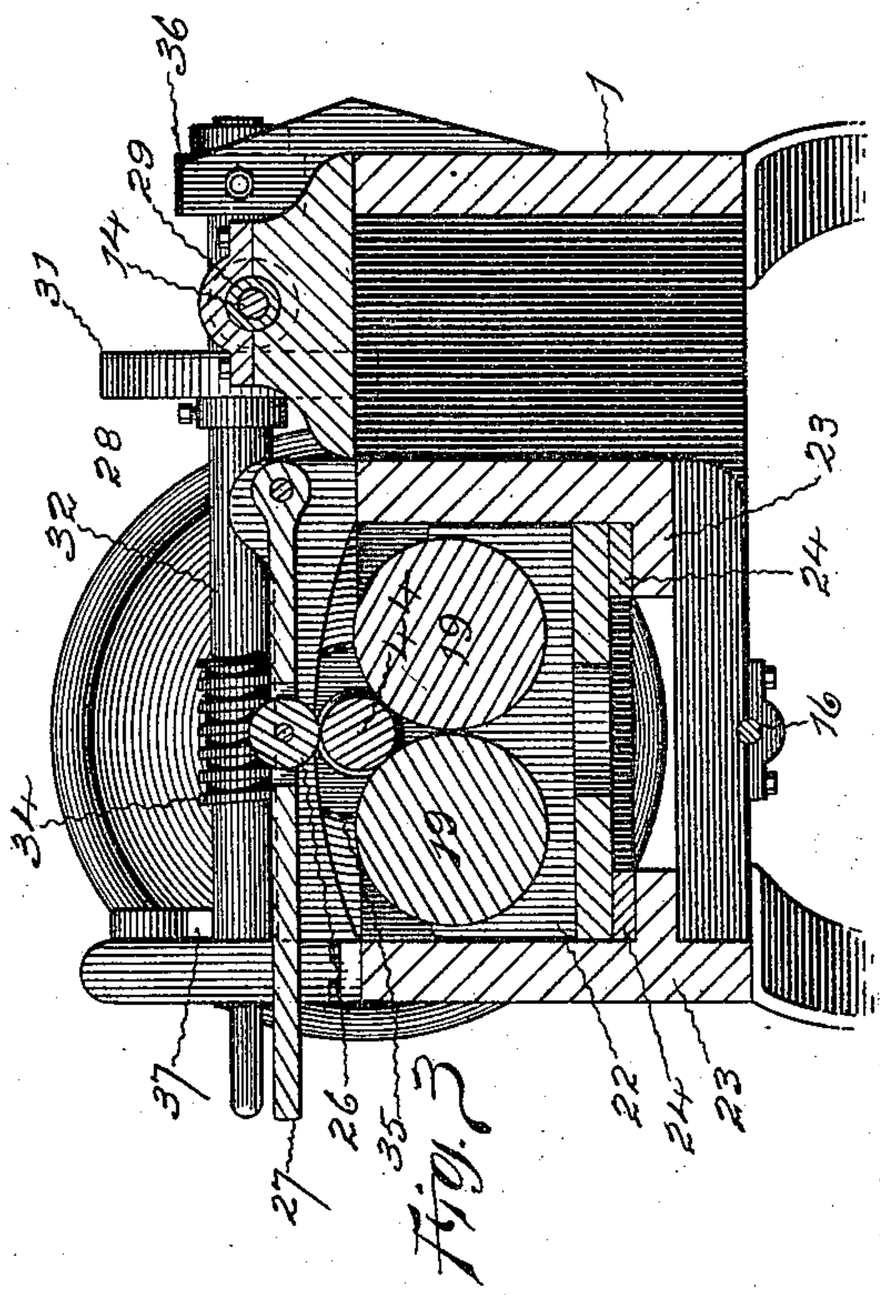

Fig. 3.

Witnesses:
E. J. Hyde.
C. E. Buckland.

Inventor:
George J. Capewell by
Harry R. Williams
atty.

UNITED STATES PATENT OFFICE.

GEORGE J. CAPEWELL, OF HARTFORD, CONNECTICUT.

APPARATUS FOR PERFORATING BILLETS OR INGOTS.

SPECIFICATION forming part of Letters Patent No. 575,104, dated January 12, 1897.

Application filed April 11, 1896. Serial No. 587,099. (No model.)

To all whom it may concern:

Be it known that I, GEORGE J. CAPEWELL, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Apparatus for Perforating Billets or Ingots, of which the following is a specification.

The invention relates to the class of apparatus constructed for perforating billets or ingots of steel or other metal to form tube-blanks.

The object of the invention is to provide a comparatively simple, cheap, strong, and durable apparatus by means of which ingots or billets of various sizes can be perforated quickly and uniformly in a manner and by a process that leaves the texture of the material forming the blanks in a very desirable condition for being drawn into tubing.

In the apparatus shown and described the heated billet or ingot is revolved by rolls and at the same time fed forward against a peculiarly-shaped tool that is being very rapidly and forcibly vibrated longitudinally in line with the axis of the rotating billet that is fed against it.

Referring to the accompanying drawings, Figure 1 is a plan of the apparatus, showing the perforating-tool about to enter a billet. Fig. 2 is a longitudinal sectional view of the apparatus, taken on the plane passing through the perforating-tool and its vibrator and the billet and billet feeding and rotating mechanisms. Fig. 3 is a transverse sectional view taken on a plane cutting the billet supporting and revolving rolls, as shown by the dotted line X X of Fig. 1. Fig. 4 is a central longitudinal section, on enlarged scale, of the perforating-tool used with the apparatus; and Fig. 5 is an end view of the perforating-tool.

In the views, 1 indicates the bed or frame of the apparatus, which may or may not, as desired, be supported on legs. Held by heavy bearings mounted on the frame near one end is the driving-shaft that bears the driving-pulley 2 and the fly-wheel 3.

Borne by the driving-shaft or connected so as to rotate therewith is the perforating-tool vibrating or percussive wheel 4. This wheel is shown as formed of a pair of disks arranged on the shaft side by side a little distance apart or as a drum with a groove turned in its periphery, leaving a pair of peripheral flanges, and supported between the disks or flanges are a number of rollers. These rollers are preferably held by journal-pins circumferentially, with their peripheries extending slightly beyond the peripheries of the disks or flanges in such manner that they will make percussive contact with the end of the shank of the perforating-tool 5 as the wheel is revolved.

The perforating-tool 5 is loosely supported in bearings formed on the frame, and a spring 6, that thrusts between a part of the frame and a collar on the shank of the tool, is provided to normally force the shank of the tool backward, so that its end will extend into the path of revolution of the rollers of the percussive wheel, a collar 7 preferably being placed on the shank to limit the backward movement of the tool under the impulse of the spring.

The perforating-tool is provided with a hollow shank, and in this is located a tube 8, the opening in the shank extending nearly to the working point of the tool and the inner tube extending almost as far. The tube is preferably supported by a plug screwed into the end of the shank, and over this end is placed a strong hard cap 9, that receives the blows of the rollers of the percussive wheel. Opening into the interior of the hollow shank is a pipe 10 and leading into the inner tube is a pipe 11. The pipe 10 is intended to be connected with any outlet or escape duct, and the pipe 11 is to be connected with a pump or other source of water-supply, so that cold water may be forced through the inner tube directly to the point and allowed to flow out in contact with the walls of the shank, thus maintaining a rapid complete circulation, which will keep the temperature of the tool so reduced that the point will remain in its normal working condition for a long period.

The operating end or the working point of the tool is slightly enlarged on one side, so that the hole the tool makes in the rotating billet will be somewhat larger in diameter than the size of the part of the operating end of the tool that makes the hole, which insures a

smoothly-forged perforation and permits of an easy withdrawal of the tool from the billet when the perforation is completed.

The end of the tool is preferably shaped by forming on the shank a circular enlargement the center of which diametrically will be coincident with the axis of the tool and tapering the enlargement to a point which will lie in the longitudinal axis of the tool. The enlargement is then ground off on one side, so that the diametrical center of the enlarged part will not be coincident with, but will be eccentric to, the axis of the tool, as shown in Figs. 4 and 5. This produces a tool that will work straight into the end of the heated billet and at first crowd out the material in all directions equally, forming a round opening of the same diameter as the end of the tool; but as the billet is forced more and more upon the tool and the hole gradually becomes enlarged to the full size the metal will be forged back, by the cam action of the eccentric enlargement as the billet rotates, until the perforation becomes enlarged beyond the real diameter of the end of the tool to the full diameter of the enlargement before one side was ground off, as described, and this operation forges a perforation that is round, smooth, and true and that is so much larger than the end of the tool that the end can be easily withdrawn when desired.

On the driving-shaft is a bevel-gear 12, and in mesh with this gear is a bevel-pinion 13, borne by a shaft 14, that is supported by bearings on the top of the frame longitudinally of the apparatus.

On the shaft 14 is a sprocket-wheel 15, and on a shaft 16, that is held by bearings supported by the frame below the perforating-tool, is a sprocket-wheel 17, which sprocket-wheels are connected by an ordinary sprocket-chain, so that they rotate together. On this shaft 16 is another sprocket-wheel 18, and this sprocket-wheel is preferably keyed so that while it will rotate with it may be moved longitudinally along the shaft.

The billet-supporting rolls 19 are provided with journals 20, and on these journals are sprocket-wheels 21, around which and the sprocket-wheel 18 on the shaft 16 passes an ordinary sprocket-chain. These billet-supporting rolls consist of a pair of heavy cylinders, preferably of steel, formed with one section smaller than the other, as shown, to allow for a slight increase of diameter of the billet as it expands when being forced upon the perforating-tool. The rolls are arranged side by side and their journals rest in bearings provided in a bed 22, that is supported upon ways 23, projecting from a part of the frame. This bed 22 can be moved along the ways as desired, according to the length of the billet, and can, by inserting between the bed and the ways or removing from between the bed and the ways plates or bars 24, of varying thickness, be lifted or lowered, if necessary, so that the axes of billets of different sizes that may be placed upon the rolls may be made to coincide with the point of the perforating-tool. These plates 24 may be made tapering or the ways may be inclined if the billet is tapering, so that as the bed is moved along the axis of the billet that is larger at one end than the other will remain coincident with the point of the perforating-tool. A bracket 25 may be so attached to the bed as to make contact with the sleeve of the sprocket-wheel 18 on the shaft 16, and through this when the bed is moved on the ways the sprocket-wheel will also be moved.

The billet is preferably held down onto the heavy supporting-rolls by a top roll 26; that is carried by a bar 27, hinged on a rod 28, supported by bearings on the top of the frame. When this bar with the roll is turned up, a billet can be placed on or removed from the supporting-rolls; but when the bar is down a billet that is inserted between the rolls will be so held as to be given a rotation as the rolls are rotated. This bar can be moved along its hinge-rod and made to follow the bed bearing the supporting-rolls and billet as they are moved toward the perforating-tool.

Keyed on the shaft 14 is a sleeve 29, that bears a wheel 30, adapted to make frictional contact with the face of a disk 31 on a shaft 32. This sleeve can be moved along the shaft by a lever 33, that is pivoted to a standard rising from the back of the frame, so that the wheel can be made to make contact with the face of the friction-disk more or less distant from the center, to regulate and vary the relative rates of rotation of the shafts 14 and 32.

Of course, if desired, instead of rotating the shaft 32 by means of a wheel and friction-disk a pulley can be mounted on the main shaft in place of the bevel-gear 12, and this pulley and the disk 31 or a pulley mounted in place of the disk 31 may be belted together, without departing from the invention.

The shaft 32 bears a worm 34 in mesh with a worm-wheel 35. This shaft is preferably held at one end in a bearing in a block 36, that can be oscillated, while the other end, which is provided with a handle, may be held down so the worm will engage with the worm-wheel by a latch 37, or may be held up, with the worm and worm-wheel out of engagement, by the same latch, the oscillating bearing-block for this shaft permitting of this raising or lowering of the shaft and the latch being simply a bar with a lug adapted to project over the shaft to hold it down or project under the shaft to hold it up.

The worm-wheel 35 is connected with a sleeve 38, on which is mounted a balancing-wheel 39. The inner walls of this sleeve are provided with a thread and in this thread is fitted a feed-screw 40. This feed-screw is provided with a groove 41, and projecting into this groove from a bar 42, attached to the frame, is a pin 43. As this pin prevents the screw from rotating, when the sleeve is rotated the screw will be fed forward or backward,

according to the direction of rotation of the sleeve. The center of this feed-screw is in line with the center of the perforating-tool, and consequently will be directly in line with the billet, so that when the screw is moved in one direction the billet 44 on the supporting-rolls will be forced toward the perforating-tool. This feed-screw may, of course, be so arranged as to feed forward only the billet, or it may be arranged to move the billet and the supporting-rolls together, as shown in Fig. 2.

The heated billet is placed upon the supporting-rolls, which previously have been adjusted vertically so that the axis of the billet will be in line with the center of the perforating-tool, and adjusted horizontally according to the length of the billet, and the top bar turned down, so that the billet will be held between the top and the supporting-rolls.

When the driving-pulley is rotated, the percussive wheel is rotated and the revolving rollers, by making contact with the capped end of the shank, give to the perforating-tool a very rapid and forcible longitudinal vibration of very short travel and minute interval. At the same time the driving-shaft, through the bevel gear and pinion, rotates the shaft bearing the wheel that engages the friction-disk on the shaft with the worm, and this, through the worm-wheel and threaded sleeve, moves the screw in such manner as to feed the heated billet on the supporting-rolls forcibly against the end of the rapidly-vibrating perforating-tool. As above stated, the rapidity of feed of the billet is regulated by adjusting the relative rates of rotation of the friction-wheel and the friction-disk. Of course, at the same time, the rotation of the shafts, through the medium of the sprocket wheels and chains, rotates the supporting-rolls in such manner as to rotate the billet they hold as it is being forced forward by the feed-screw against the percussive blows of the perforating-tool. When the heated billet, rotated in this manner between the rolls, is forced forward strongly against the rapidly and forcibly vibrating tool having the perforating-head described, the tool enters the billet centrally but slightly each blow, but the large number of powerful blows of short length and quick interval so act upon the metal that the billet will advance very quickly onto the tool, and as the billet is revolving a round straight hole a little larger in diameter than the head of the tool is formed. The peculiar shape of the tool, as previously described, so crowds the metal out from the center that the inner wall of the billet is forged by this tool, leaving a clean, round, and true perforation, while at the same time the outside of the billet is also forged to an extent by the rotating holding-rolls. This process of perforating billets provides blanks for tubes having a texture that is very desirable for drawing, and by its use billets of varying sizes can be quickly and truly perforated. With a large-size apparatus heavy ingots can be treated and perforated in this manner to provide tubes for use in gun and ordnance building, which tubes will have very desirable characteristics for these purposes.

The apparatus is comparatively simple in construction and operation and the billets resulting from its use are perforated truly and perfectly in a very rapid manner, for while at each blow the metal is forced outward but little and the billet is advanced but slightly to the perforating-tool the large number of blows capable of being given by this tool arranged in this manner in a short space of time will advance the perforation rapidly.

I claim as my invention—

1. In a billet-perforating apparatus, in combination, a perforating-tool having a hollow eccentrically-enlarged head, mechanism for rapidly vibrating the tool longitudinally, billet-supporting means, and mechanism for feeding the billet against the vibrating tool, substantially as specified.

2. In a billet-perforating apparatus, in combination, a perforating-tool having a hollow eccentrically-enlarged head, mechanism for rapidly vibrating the tool longitudinally, billet-supporting means, mechanism for rotating the billet, and mechanism for feeding the rotating billet against the vibrating tool, substantially as specified.

3. In a billet-perforating apparatus, in combination, a perforating-tool having a hollow eccentrically-enlarged head, mechanism for rapidly vibrating the tool longitudinally, rotary billet-supporting means, and mechanism for feeding the rotating billet-supporting means toward the vibrating tool, substantially as specified.

4. In a billet-perforating apparatus, in combination, a perforating-tool having an eccentrically-enlarged head, rotary billet-supporting means, and mechanism for feeding the rotary billet-supporting means toward the enlarged head of the perforating-tool, substantially as specified.

5. In a billet-perforating apparatus, in combination, a perforating-tool, a rotary percussive wheel arranged to rapidly vibrate the tool longitudinally, rolls adapted to support the billet, mechanism for rotating the rolls, and mechanism for feeding the billet against the vibrating tool, substantially as specified.

6. In a billet-perforating apparatus, in combination, a perforating-tool, a rotary wheel having peripheral rollers arranged to percussively engage the end of the tool, rolls for supporting the billet, a roll for holding the billet to the supporting-rolls, mechanism for rotating the supporting-rolls, and mechanism for feeding the billet against the tool, substantially as specified.

7. In a billet-perforating apparatus, in combination, a perforating-tool, a rotary wheel having peripheral rollers arranged to percussively engage the end of the tool, a spring normally holding the tool with its end in the path of the rollers, rolls for supporting the

billet, mechanism for rotating the supporting-rolls, mechanism for feeding the billet against the tool, and adjusting means whereby the rate of speed of the billet feed mechanism may be changed, substantially as specified.

8. In a billet-perforating apparatus, in combination, a hollow perforating-tool having two chambers that are connected near the working end of the tool, water-ducts opening into both chambers, mechanism for rotating the billet, and mechanism for feeding the billet against the perforating-tool, substantially as specified.

9. In a billet-perforating apparatus, in combination, a perforating-tool, mechanism for rapidly vibrating the tool longitudinally, a pair of billet-supporting rolls held by a longitudinally-movable bed, mechanism for rotating the supporting-rolls, a roll for holding the billet to the supporting-rolls, and mechanism for feeding the billet and the supporting-rolls toward the perforating-tool, substantially as specified.

10. In a billet-perforating apparatus, in combination, a hollow perforating-tool having an eccentrically-enlarged head, a rotary wheel having peripheral rollers arranged to percussively engage the end of the tool, a pair of billet-supporting rolls held by a longitudinally-movable and vertically-adjustable bed, mechanism for rotating the supporting-rolls, a top roll held by a swinging plate for keeping the billet to the supporting-rolls, mechanism for feeding the billet-supporting rolls toward the rapidly-vibrating tool, and an adjustable friction-wheel for imparting motion to the feeding mechanism, substantially as specified.

11. In a billet-perforating apparatus, in combination, a perforating-tool having an eccentrically-enlarged head, billet-supporting means, and mechanism for feeding the billet and the perforating-tool together, one part having a rotary motion and the other a longitudinal vibration, substantially as specified.

12. A billet-perforating tool consisting of a shank with an eccentrically-enlarged head or working end, substantially as specified.

GEORGE J. CAPEWELL.

Witnesses:
H. R. WILLIAMS,
E. J. HYDE.