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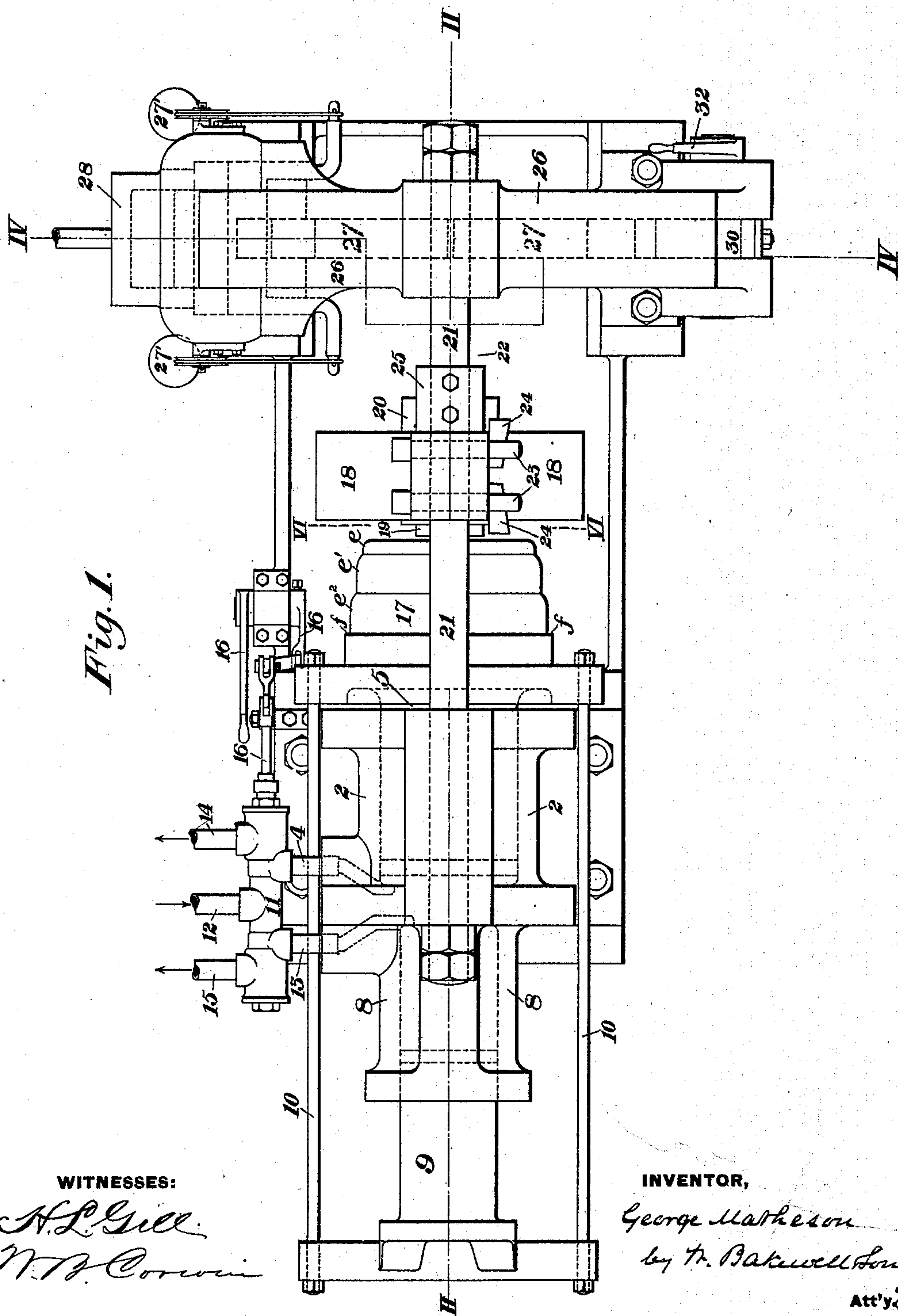
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G. MATHESON.

MACHINE FOR EXPANDING THE ENDS OF PIPES.

No. 410,000.

Patented Aug. 27, 1889.





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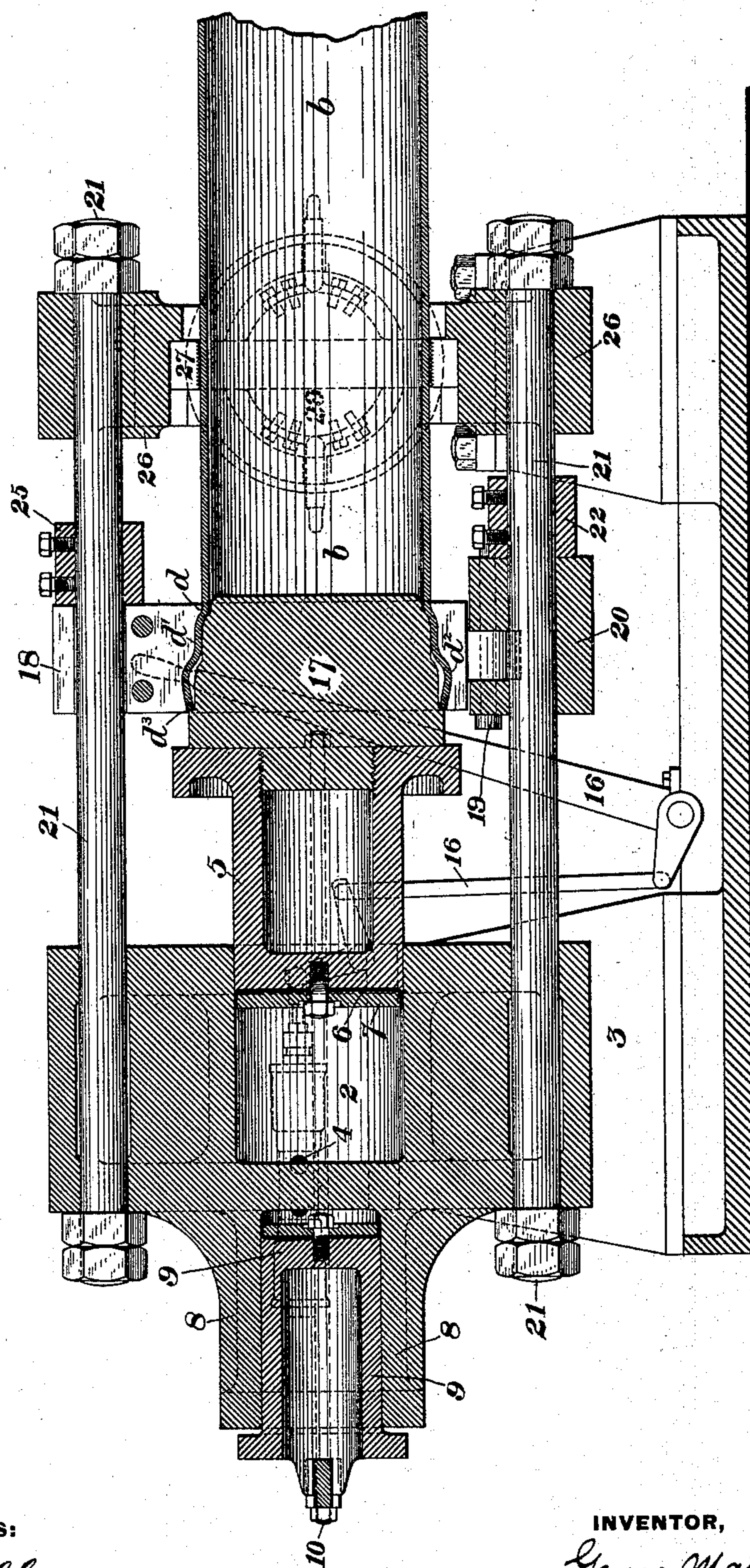
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Fig. 2.



WITNESSES:

*N. L. Gill*  
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Att'ys.



(No Model.)

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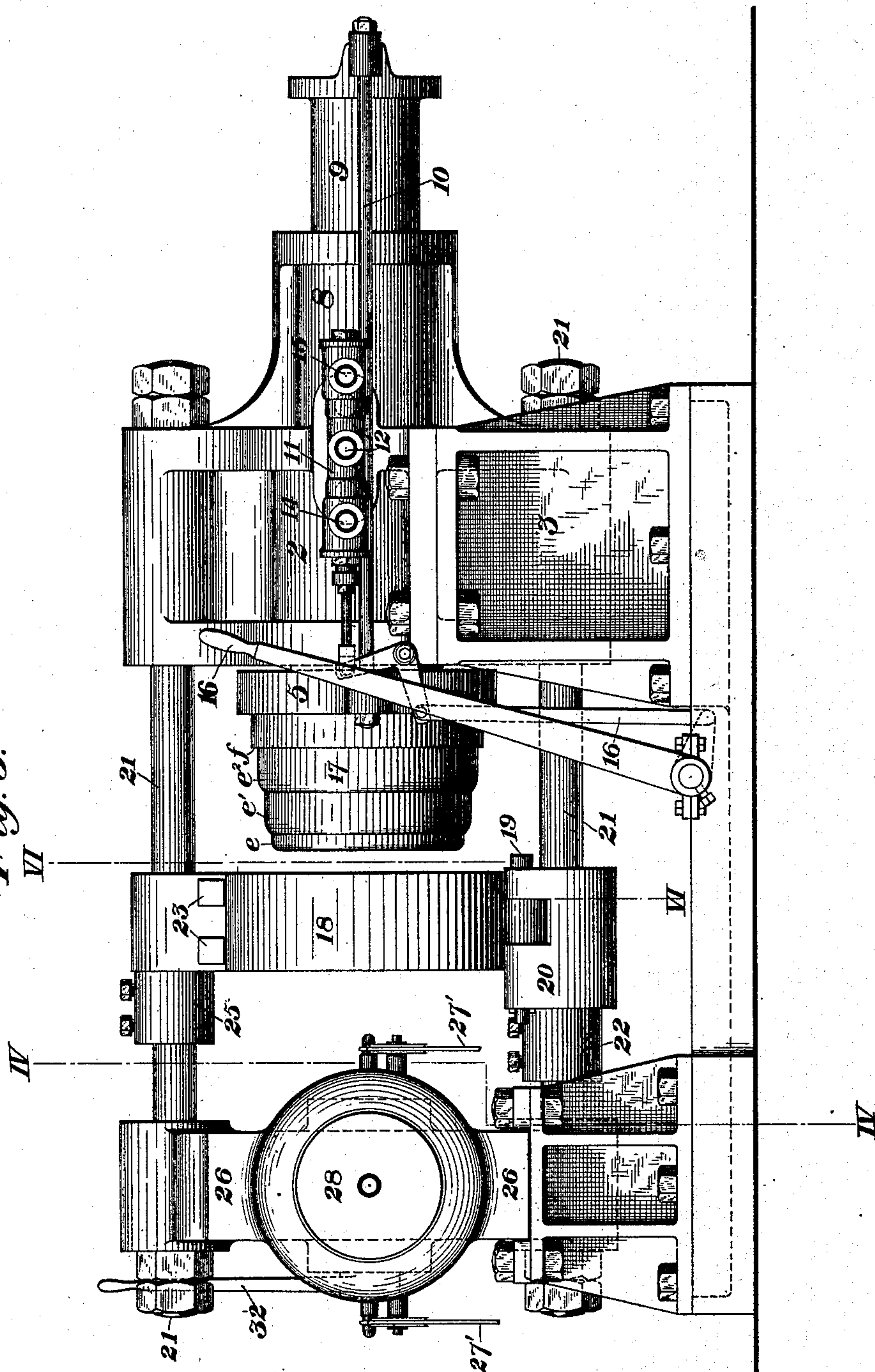
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Fig. 3.



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(No Model.)

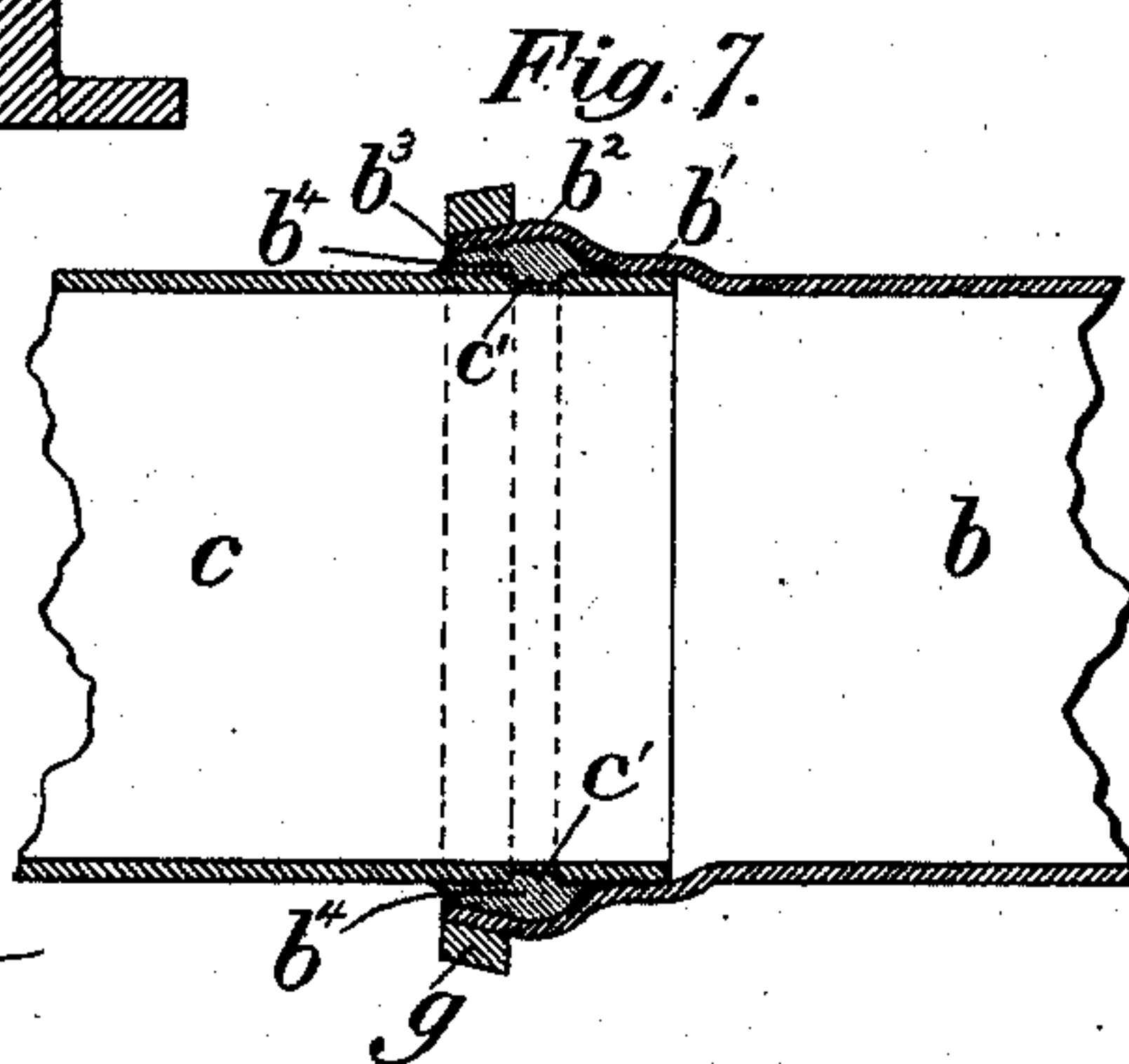
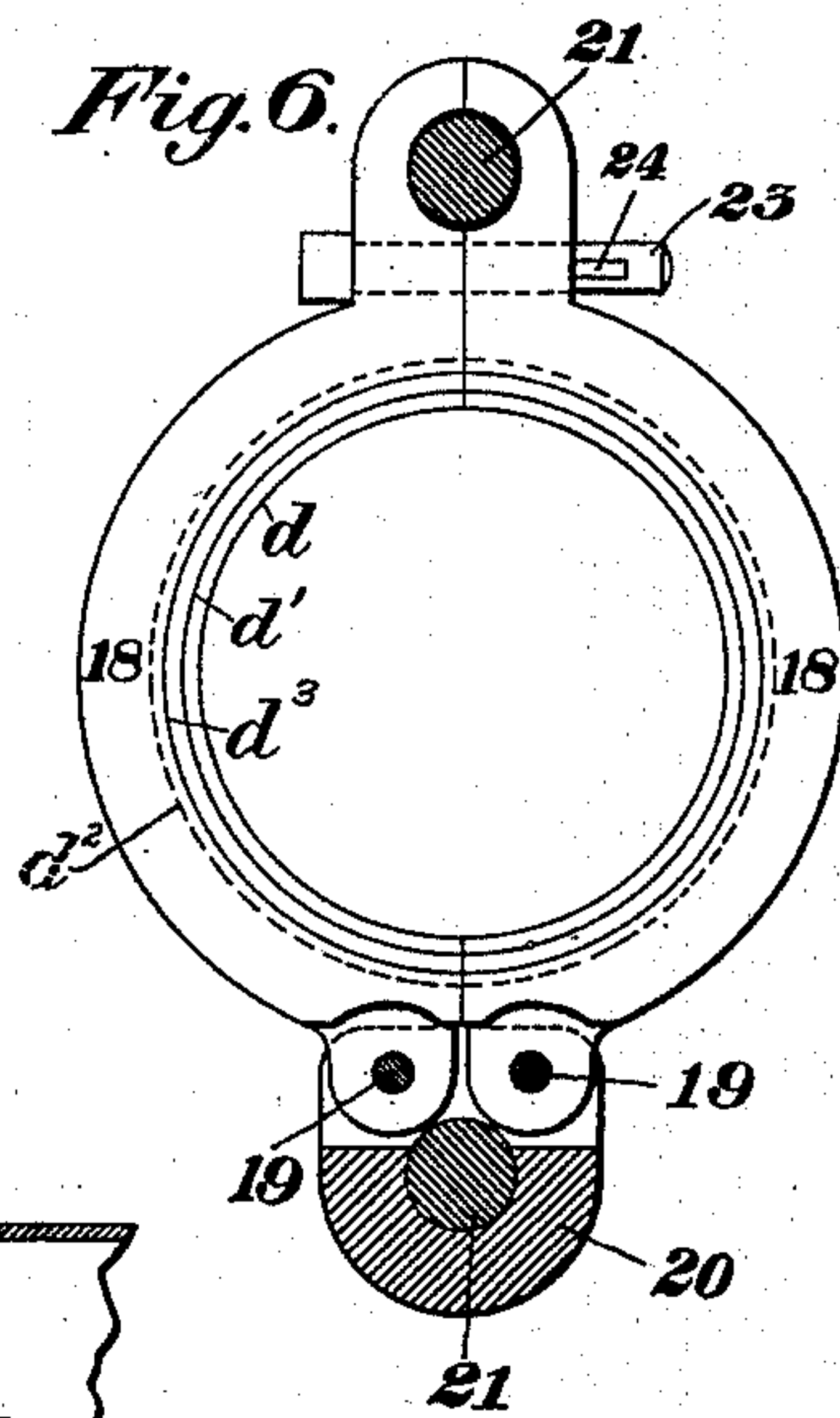
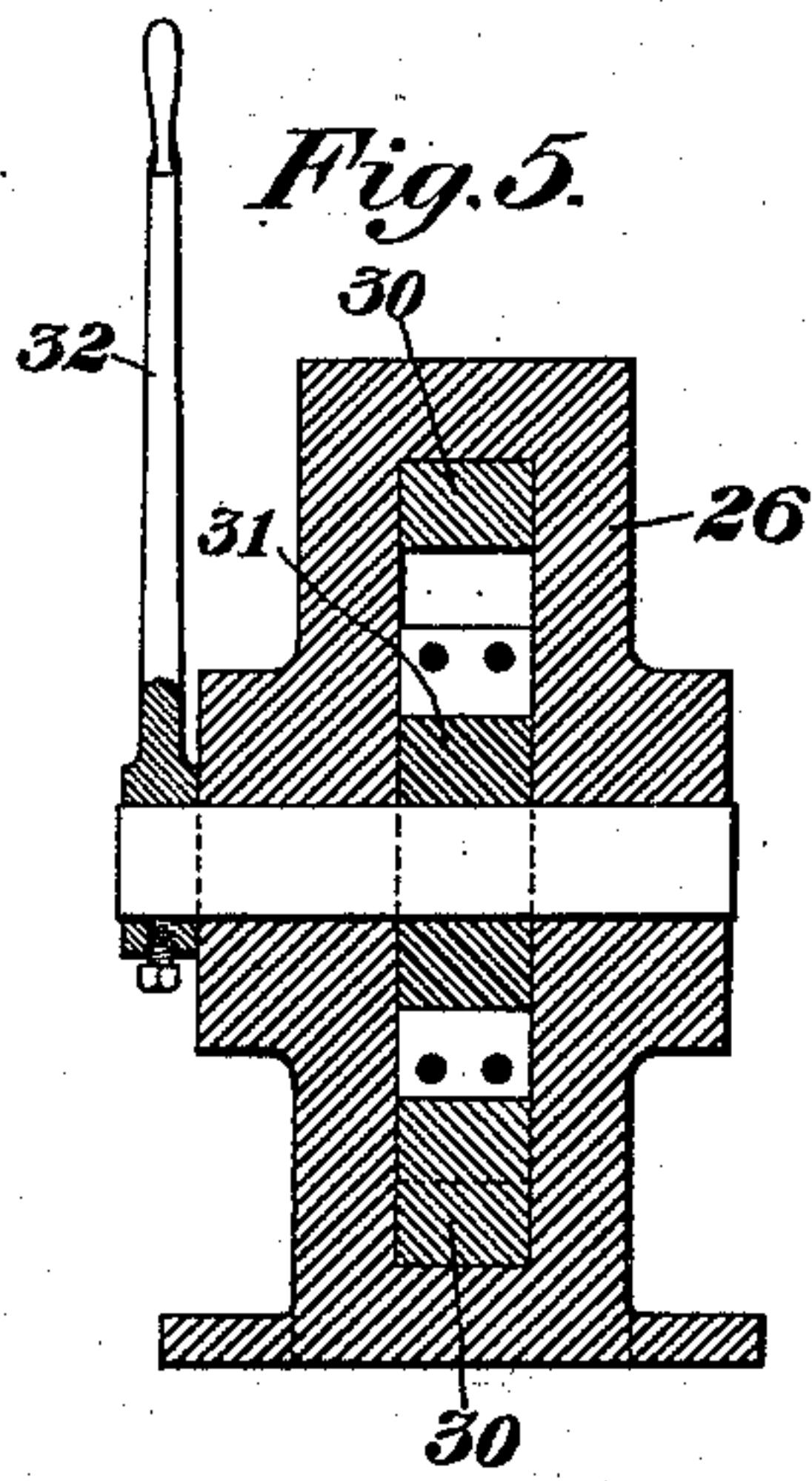
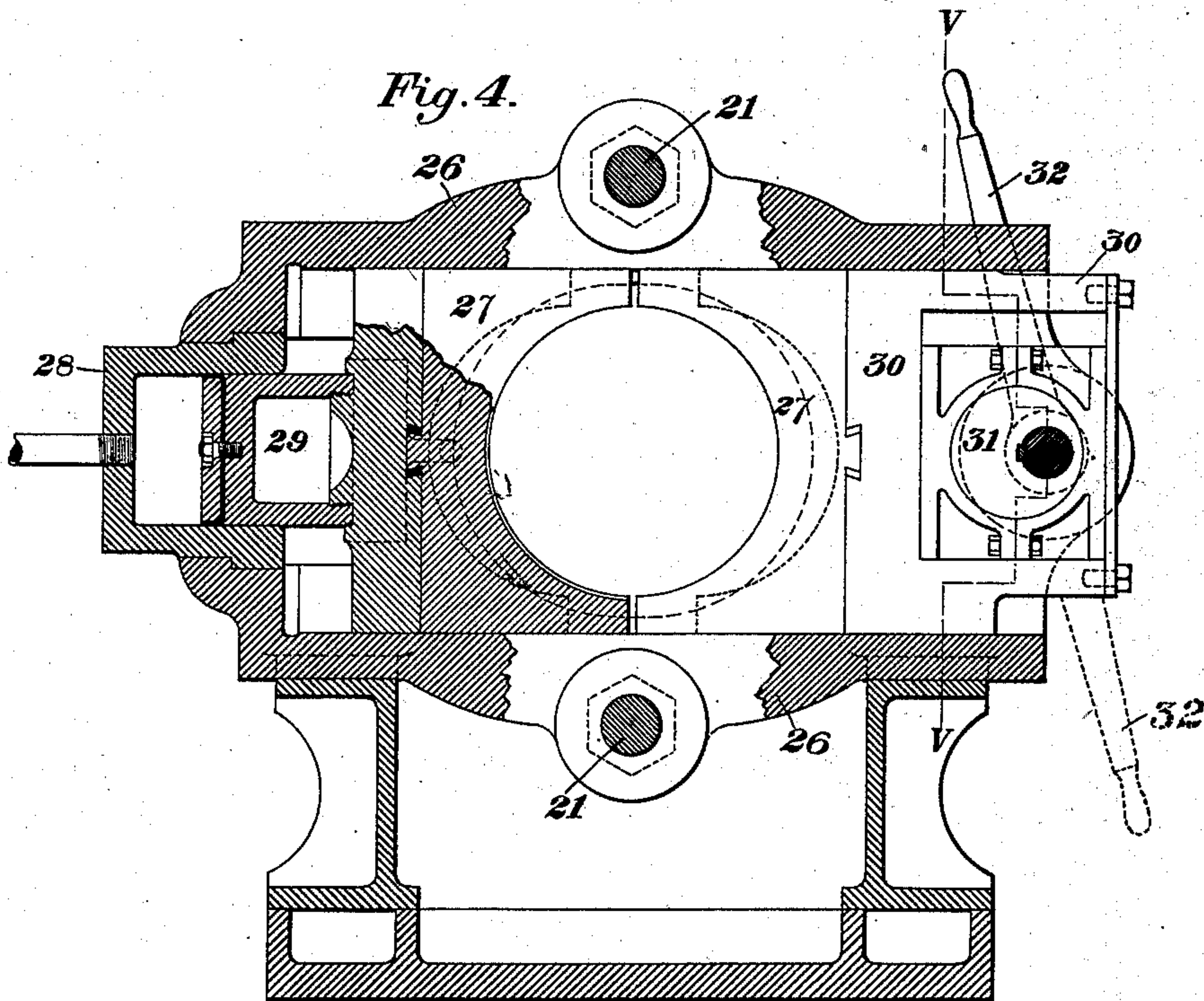
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G. MATHESON.

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# UNITED STATES PATENT OFFICE.

GEORGE MATHESON, OF BROOKLYN, NEW YORK.

## MACHINE FOR EXPANDING THE ENDS OF PIPES.

SPECIFICATION forming part of Letters Patent No. 410,000, dated August 27, 1889.

Application filed June 20, 1889. Serial No. 314,952. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE MATHESON, of Brooklyn, in the county of Kings and State of New York, have invented a new and useful  
5 Improvement in Machines for Expanding the Ends of Pipes, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

10 Figure 1 is a plan view of my improved machine. Fig. 2 is a vertical longitudinal section on the line II II of Fig. 1. Fig. 3 is a side elevation of the machine. Fig. 4 is a vertical cross-section on the lines IV IV of Figs. 1 and 3. Fig. 5 is a vertical cross-section on the line V V of Fig. 4. Fig. 6 is a vertical cross-section on the lines VI VI of Figs. 1 and 3. Fig. 7 is an axial longitudinal section of a pipe-joint, showing a pipe the  
15 end of which has been shaped by the machine.

Like symbols of reference indicate like parts in each.

I have shown Fig. 7 for the purpose of making clear the description of the construction  
25 and operation of the machine, and not for the purpose of limiting the application of the machine to any particular use. Referring to this figure,  $b$  and  $c$  represent pipes which are joined together at their abutting ends, the  
30 spigot end of the pipe  $c$  fitting within the flared or bell-shaped end of the pipe  $b$ , so as to form an annular space within the bowl of the pipe  $b$  and around the pipe  $c$ , in which calking material—such as molten lead—is  
35 poured for the purpose of sealing the joint.

I shall now describe the shape of the flared end of the pipe  $b$ . At the rear or inner portion of the flared end there is an annular portion  $b'$  of the pipe, which is expanded somewhat relatively to the cylindrical part  $b$  of the pipe, the inner end of the portion  $b'$  forming an annular shoulder or stop against which the end of the pipe  $c$  abuts, as shown in the drawings. Next to the portion  $b'$  of the pipe  
40 there is an annular portion  $b^2$ , which is expanded to a greater diameter than the portion  $b'$ , and next to and outside of the portion  $b^2$  the end  $b^3$  of the pipe is expanded to a diameter greater than that of the portion  $b'$ , but  
50 somewhat less than that of the portion  $b^2$ . There is thus formed within the pipe, opposite to the flared portion  $b^2$ , an annular recess

$b^4$ , which is limited on one side by the annular portion  $b'$  and on the other by the end portion  $b^3$ . An annular groove  $c'$  is cut around  
55 the pipe  $c$ , opposite to the annular recess  $b^4$  of the pipe  $b$ , and this recess  $b^4$ , in conjunction with the groove  $c'$ , affords means for holding the lead or other calking material in place when it has been poured around the joint in-  
60 side of the bell end of the pipe  $b$ .

The pipe-joint which is thus produced possesses many advantages. It is strong as regards the construction of the pipe, because the joint is not weakened by tapping of  
65 screw-threads, nor is it weakened by producing the recess  $b^4$  by cutting into the material of the pipe  $b$ , and the joint being thus of proper strength the body of the pipe can be made of comparatively lighter material and  
70 with correspondingly less cost than if the joint were weakened by tapping, as before indicated. While this joint is in these respects a good one, the fact that the recess  $b^4$  is made by expanding an annular portion in the in-  
75 terior of the pipe would cause it to be quite difficult to manufacture with the imperfect appliances heretofore known in the art. I have therefore devised my present machine, which is so constructed as to expand and  
80 shape the end of a pipe with great rapidity, saving of labor, and with uniformity and regularity in the product of the machine.

Referring now to the drawings, 2 represents a hydraulic cylinder mounted on a suitable  
85 pedestal or support 3, which forms part of the machine-frame and is provided with the usual water-pipe 4, through which, by the action of the controlling-valve, motive fluid—such as water—is admitted to and discharged  
90 therefrom. The piston or plunger 5 of the cylinder is preferably made of a single casting, and has at its inner end a packing ring or disk 6, which is held to the plunger by means of a follower 7.

In the operation of the machine the plunger is advanced by means of fluid-power in the cylinder 2, and to retract the plunger I employ an auxiliary motor consisting of a cylinder 8, situate at the rear of the cylinder 2,  
100 and preferably cast in a single piece therewith, and provided with a piston 9, preferably constructed and arranged similarly to the plunger 6 and connected therewith by tie-



rods 10, extending on the outside of the cylinders and secured to cross-heads on the plungers. The plungers are controlled by a suitable valve 11, having a supply-pipe 12, pipes 4 and 13 leading to the cylinders, and exhaust-pipes 14 and 15. The valve is of the usual construction and is provided with the usual stem and operating-lever 16, by which the valve-plunger may be put into position to admit water from the supply 12 into the main cylinder and to exhaust it from the auxiliary cylinder, or to admit it to the auxiliary cylinder and exhaust it from the main cylinder, or to cut off the supply to both cylinders at once, as will be readily understood.

The mandrel 17, which acts to expand the pipe, consists of a block of metal of substantially cone-shape, which is fixed to the forward end of the plunger 5, the preferable mode of attachment being to make the plunger hollow and to screw the end of the mandrel therein.

In advance of and opposite to the face of the mandrel 17 is the annular die, within which the end of the pipe is set during the expanding operation. This die is made of two sections 18, hinged by pins 19 to a block 20, which is mounted on one of the braces 21 of the machine and is held in position thereon by means of a set-block 22. The sections 18 are movable pivotally on the pins 19, and when brought together, as shown in Fig. 6, they present a central annular die-cavity directly opposite to and concentric with the axis of the mandrel. When thus brought together, the die-sections are confined in position by bolts 23 and keys 24, which pass through suitable slots in the bolts, and the upper ends of the conjoined sections are braced and steadied by means of a collar 25 on the upper brace 21, and by means of a strut or distance-piece interposed between the collar and the frame 26 at the end of the machine. In this frame 26, at the ends of the braces 21, is a clamp or gripper consisting of two sections 27, mounted in horizontal guide-ways in the frame and each provided with a nearly-semicircular face. These sections are adapted to be moved toward and away from each other by the following mechanism. 28 is a hydraulic cylinder set in and secured to the frame 26, the plunger 29 of which cylinder is fixed to one of the sections 27, which is also suitably counterbalanced by means of weights 27', or otherwise, so that when pressure is not exerted on the plunger 29 it shall automatically move within the cylinder toward the rear thereof. The other section 27 is keyed to a cam box or yoke 30, which is set in slideways in the frame of the machine and is provided with an eccentric or cam 31 and an operating-lever 32, journaled as shown in Fig. 5.

I shall now describe the shape of the mandrel and the cavity of the annular die. At the outer end of the latter cavity is an annular portion  $d$ , which is about the same in di-

ameter as the outside diameter of the pipe to be shaped. In advance of this is an annular portion  $d'$ , of somewhat greater diameter than the portion  $d$ . In advance of this is an annular portion  $d^2$ , of greater diameter than the portion  $d'$ , and at the inner end of the cavity, next to the portion  $d^2$ , is an annular portion  $d^3$ , of greater diameter than the portion  $d'$  and of somewhat less diameter than the portion  $d^2$ .

As before stated, the mandrel is in the form of a stepped cone, having a series of annular portions or zones of increasing diameter from the forward end rearwardly. The outer zone  $e$  is the same in diameter as the portion  $d$  of the die less the thickness of the pipe to be shaped. The zone  $e'$  bears the same relation to the annular portion  $d'$  of the die, and the zone  $e^2$  bears the same relation to the portion  $d^2$  of the die.

The operation of the machine is as follows: In order to flare and shape the end of the pipe, as mentioned in the former part of this specification, its end is brought to a welding heat in a suitable furnace, and is then placed on a supporting-roller in front of the machine, and is moved longitudinally thereon between the separated clamp-sections 27 and between the sections of the annular die. The clamp-sections are then brought together by moving the lever 32 from the position shown in dotted lines to the position shown in full lines, thereby moving its clamp-section to the middle of the machine, and by advancing the other section by means of its hydraulic motor, so as to tightly grasp the interposed pipe. The plunger 5 is then projected by the admission of water into the main cylinder 2, thereby advancing the mandrel 17, which enters the end of the pipe. The zone  $e$  at the end of the mandrel being of the same external diameter as the interior of the pipe, enters the pipe without expanding it. The zone  $e'$ , being somewhat larger, expands the pipe as it enters, as does also the zone  $e^2$ , which is of still greater diameter. When the zone  $e^2$  has entered the end of the pipe, the zone  $e$  at the end of the mandrel will be within the annular portion  $d$  of the die-cavity, and as the mandrel continues to advance the circular stop or shoulder  $f$  at the rear of the zone  $e^2$  engages the end of the pipe and tends to force it inward. All the portions of the pipe will then have been expanded into contact with the circumference of the die, which limits its further expansion, except at the annular portion  $d^2$  of the die, and the effect of the inward pushing exerted on the pipe by the shoulder  $f$  therefore swells out the hot material of the pipe into the annular portion  $d^2$ , which is the one cavity remaining for its expansion, thus producing an annular outward flare or bulge of the pipe at this place, which flare is of greater diameter than that of the portion  $e^2$  of the mandrel which is opposite thereto. The form of the flare thus produced is clearly shown in Fig. 7, the unflared portion



*b* of the pipe being at the end of the operation in the annular portion *d* of the die; the portion *b'* of the pipe being in the portion *d'* of the die; the flared or bulged portion *b*<sup>2</sup> of the pipe being in the portion *d*<sup>2</sup> of the die, and the end portion *b*<sup>3</sup> of the pipe being in the portion *d*<sup>3</sup> of the die. When the pipe end has been thus expanded, the sections of the annular die are opened to release the pipe, the mandrel is stripped therefrom by retracting the plunger by means of the auxiliary cylinder, and the clamps 27 are opened by retracting the hydraulic plunger 29 of one clamp-section and reversing the eccentric 31 of the other. The pipe may then be removed from the machine.

I have found in practice that it makes the mandrel somewhat easier to disengage and prevents its corrosion or burning to coat it with lubricating-oil before the beginning of the operation of expanding the pipe end.

The action of the machine in expanding the pipe is very rapid and the labor of handling the pipe is small, so that I am enabled to form the joints above described with very little cost.

In order to strengthen the joint after the pipe has been expanded, I prefer to shrink on the end of the pipe a ring *g*, as shown in Fig. 7.

Of course the die, mandrel, and clamp must be exchanged for corresponding parts of different size when the size of the pipe to be operated on in the machine is changed; but from the construction and relative arrangement of these parts it is clear that their removal and readjustment is easy.

I do not claim herein specifically the construction of the mandrel and annular die, since they have been included as the subject-matter of another application for Letters Patent, Serial No. 292,466.

I claim—

1. The combination of an expanding mandrel and die, a hydraulic motor comprising a cylinder and plunger by which the mandrel is projected, and an auxiliary cylinder and plunger by which it may be retracted and stripped from the pipe, substantially as and for the purposes described.

2. The combination of an expanding man-

drel and die, a hydraulic motor comprising a cylinder and plunger by which the mandrel is projected, and an auxiliary cylinder and plunger by which it may be retracted and stripped from the pipe, said cylinders being situate in substantially the same axial line and formed of an integral piece of metal, substantially as and for the purposes described.

3. The combination of an expanding mandrel and die, a hydraulic motor comprising a cylinder and plunger by which the mandrel is projected, an auxiliary cylinder and plunger by which it may be retracted and stripped from the pipe, and a common valve controlling the cylinders, substantially as and for the purposes described.

4. The combination, with an expanding-mandrel, of a clamp for holding the pipe, said clamp consisting of separable sections, and a hydraulic motor by which one at least of the sections is moved, substantially as and for the purposes described.

5. The combination, with an expanding-mandrel, of a clamp for holding the pipe, said clamp consisting of separable sections, a hydraulic motor by which one of the sections is moved, and an eccentric by which the other section is moved, substantially as and for the purposes described.

6. The combination, with an expanding-mandrel, of a clamp for holding the pipe, said clamp consisting of separable sections, an eccentric, and an eccentric-box set in a recess or slideway in the machine-frame and connected with the clamp-section, substantially as and for the purposes described.

7. The combination of the machine-frame, a hydraulic motor and mandrel at one end thereof, a gripper or clamp and its actuating mechanism at the other end, and braces or rods connecting the ends of said machine-frame, substantially as and for the purposes described.

In testimony whereof I have hereunto set my hand this 27th day of May, A. D. 1889.

GEO. MATHESON.

Witnesses:

A. M. LALLY,  
JAS. H. MATHESON.