

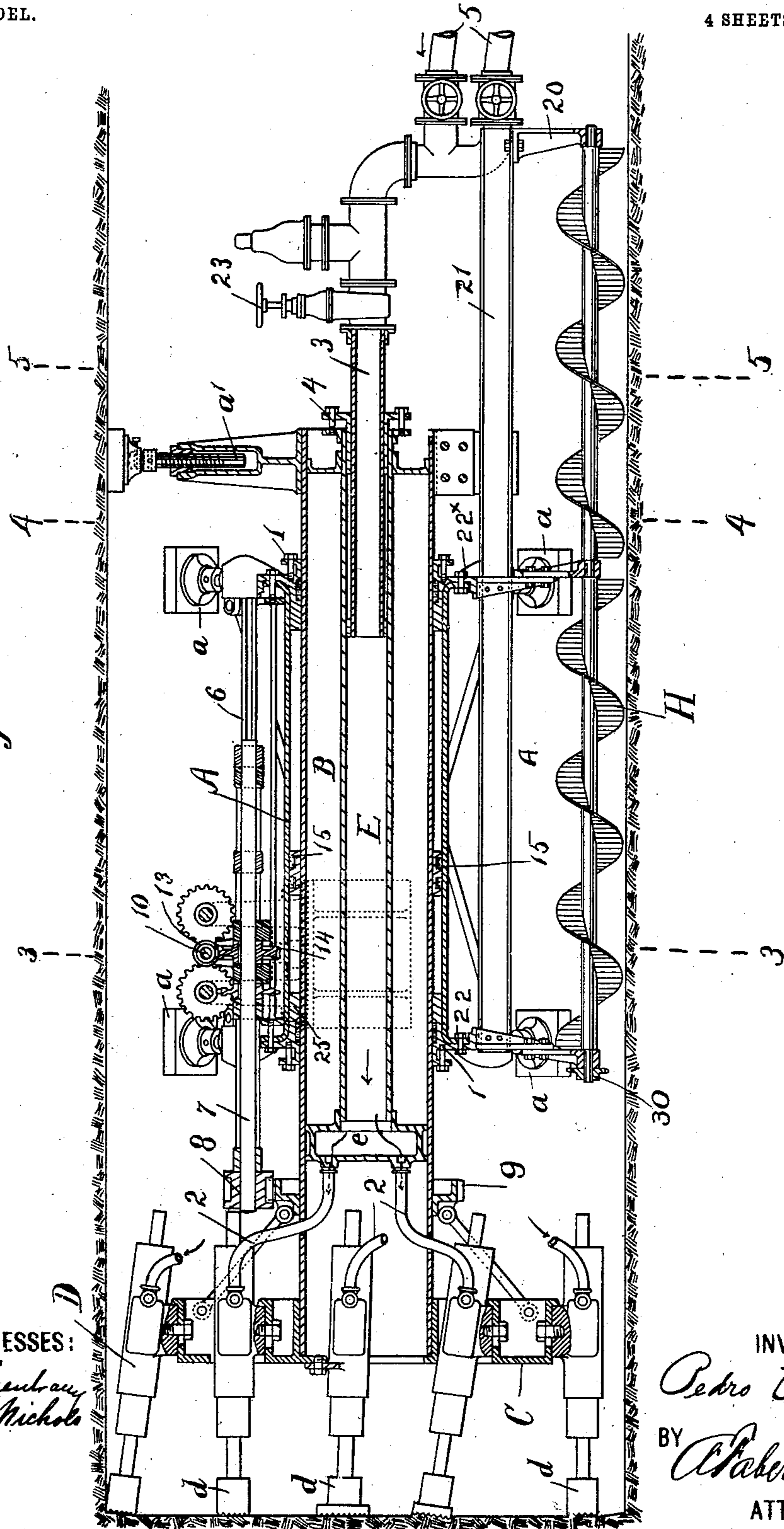
P. UNANUE.
TUNNELING MACHINE.

APPLICATION FILED DEC. 23, 1901.

NO MODEL.

4 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:
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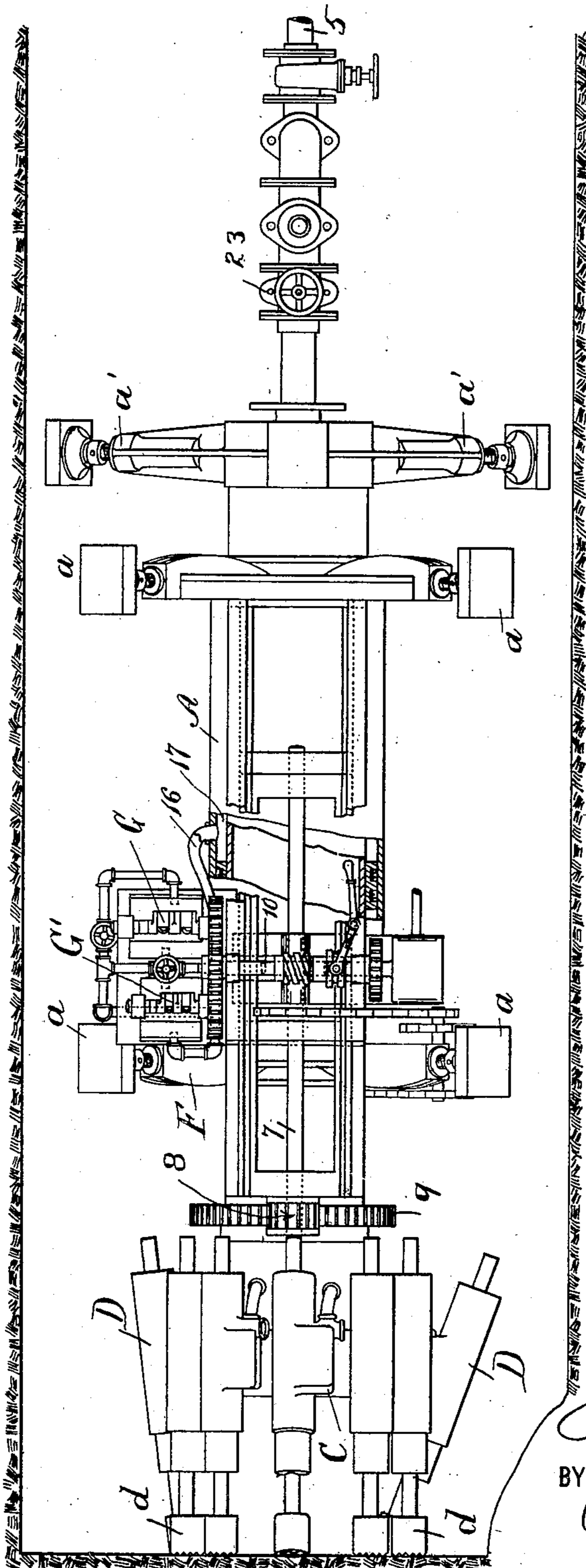
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NO MODEL.

4 SHEETS—SHEET 2.

Fig. 2.



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No. 732,326.

PATENTED JUNE 30, 1903.

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TUNNELING MACHINE.

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NO. MODEL.

4 SHEETS—SHEET 3.

Fig. 3.

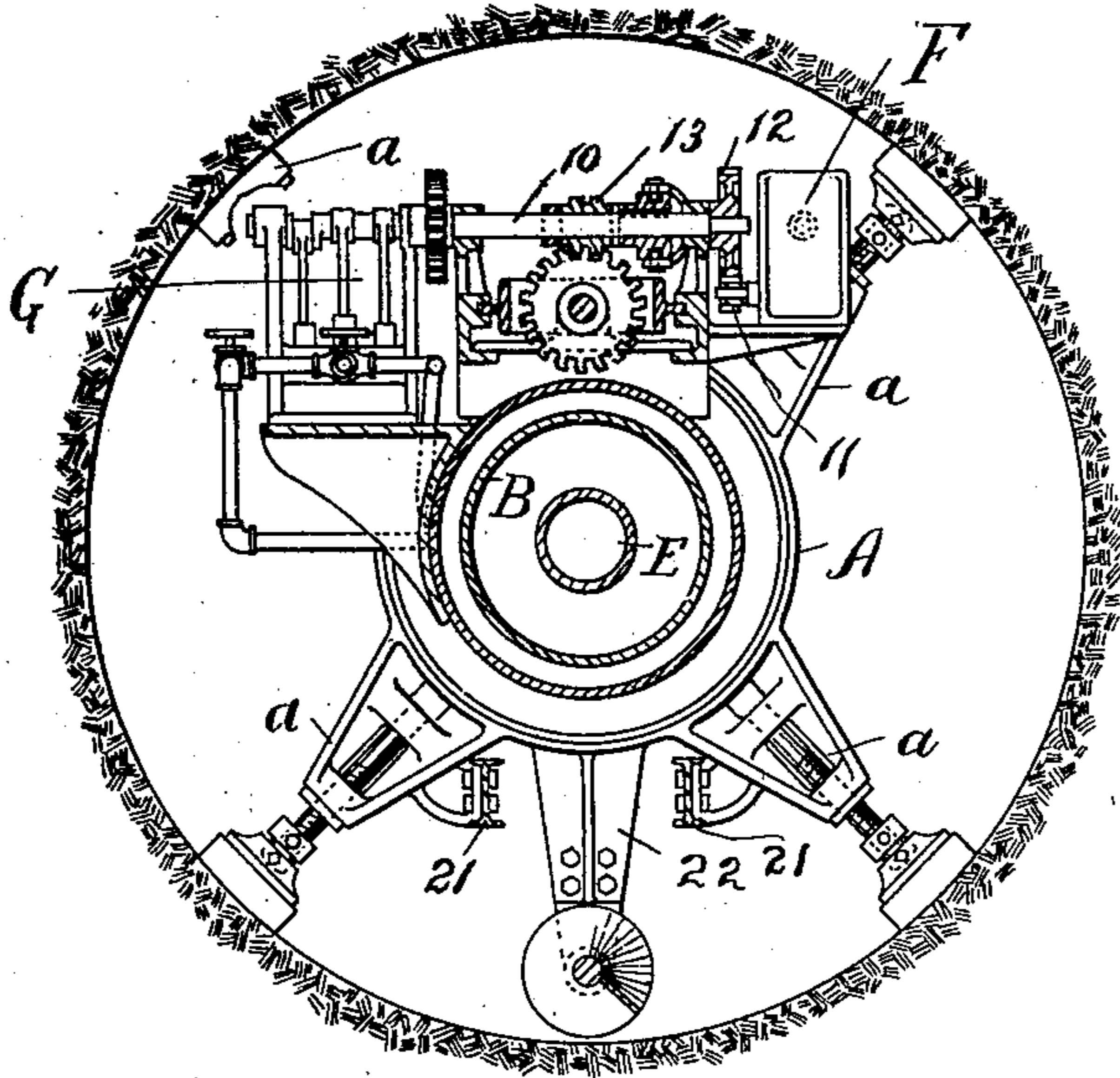
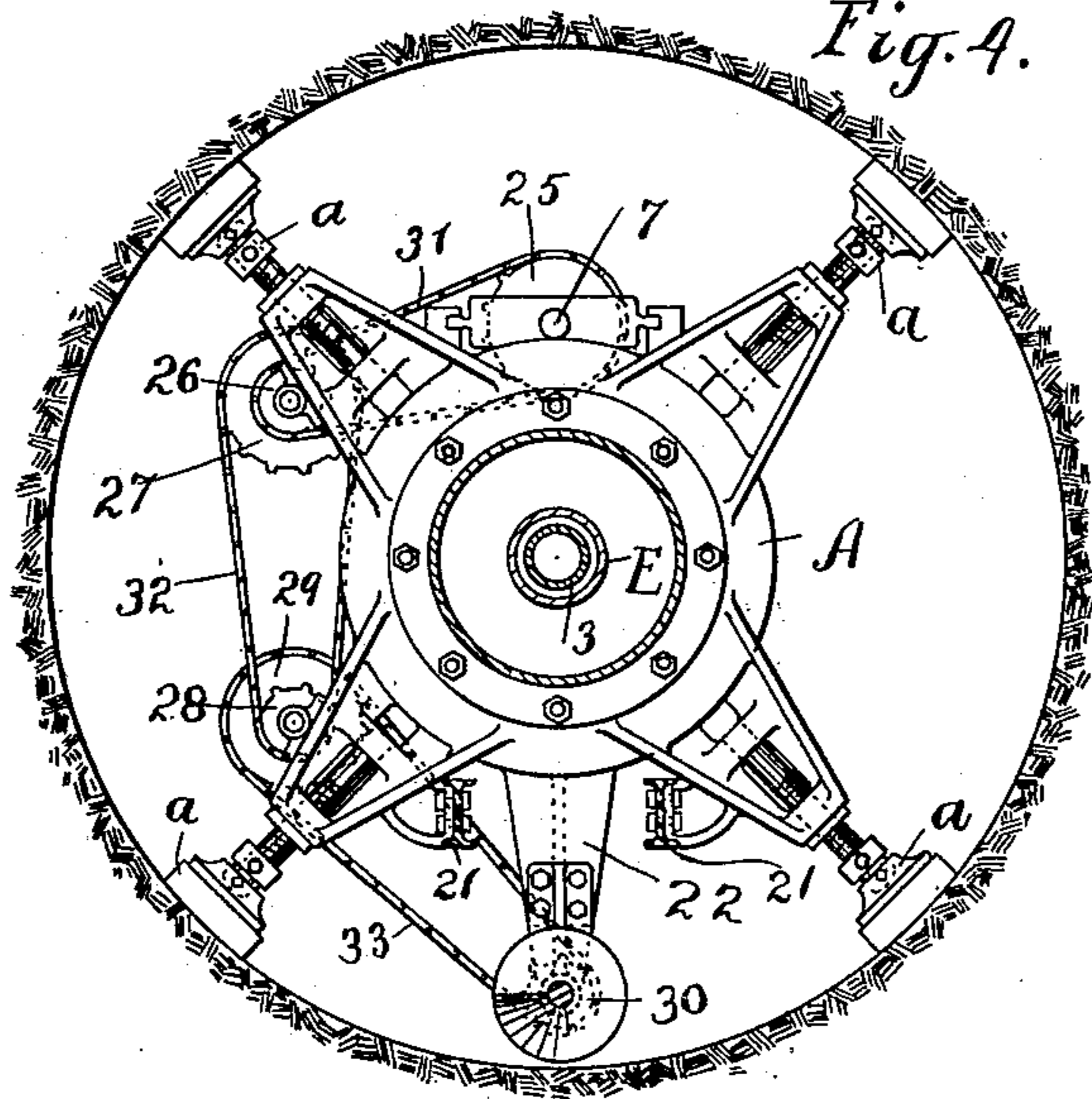


Fig. 4.



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4 SHEETS—SHEET 4.

Fig. 7.

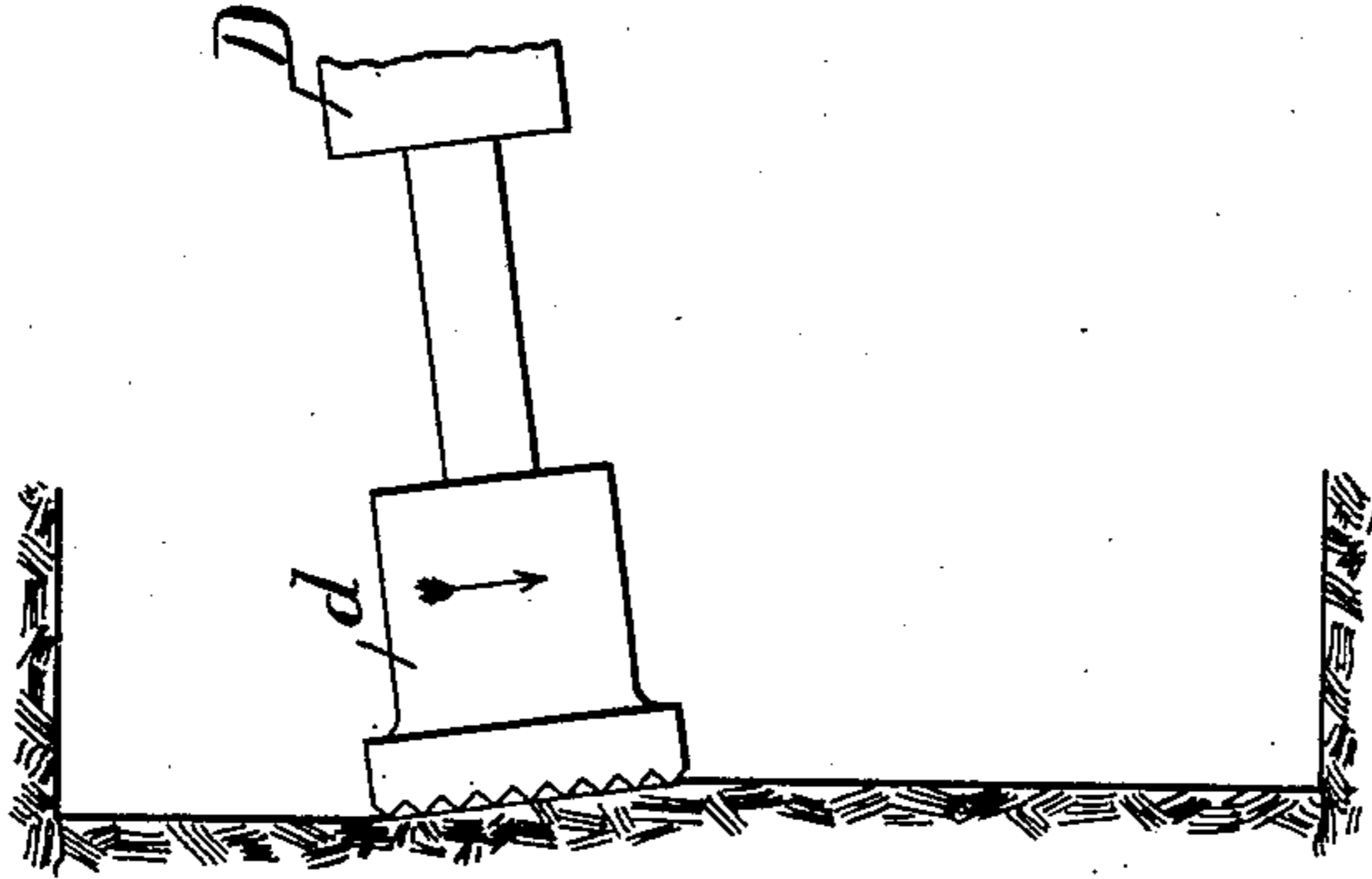


Fig. 5.

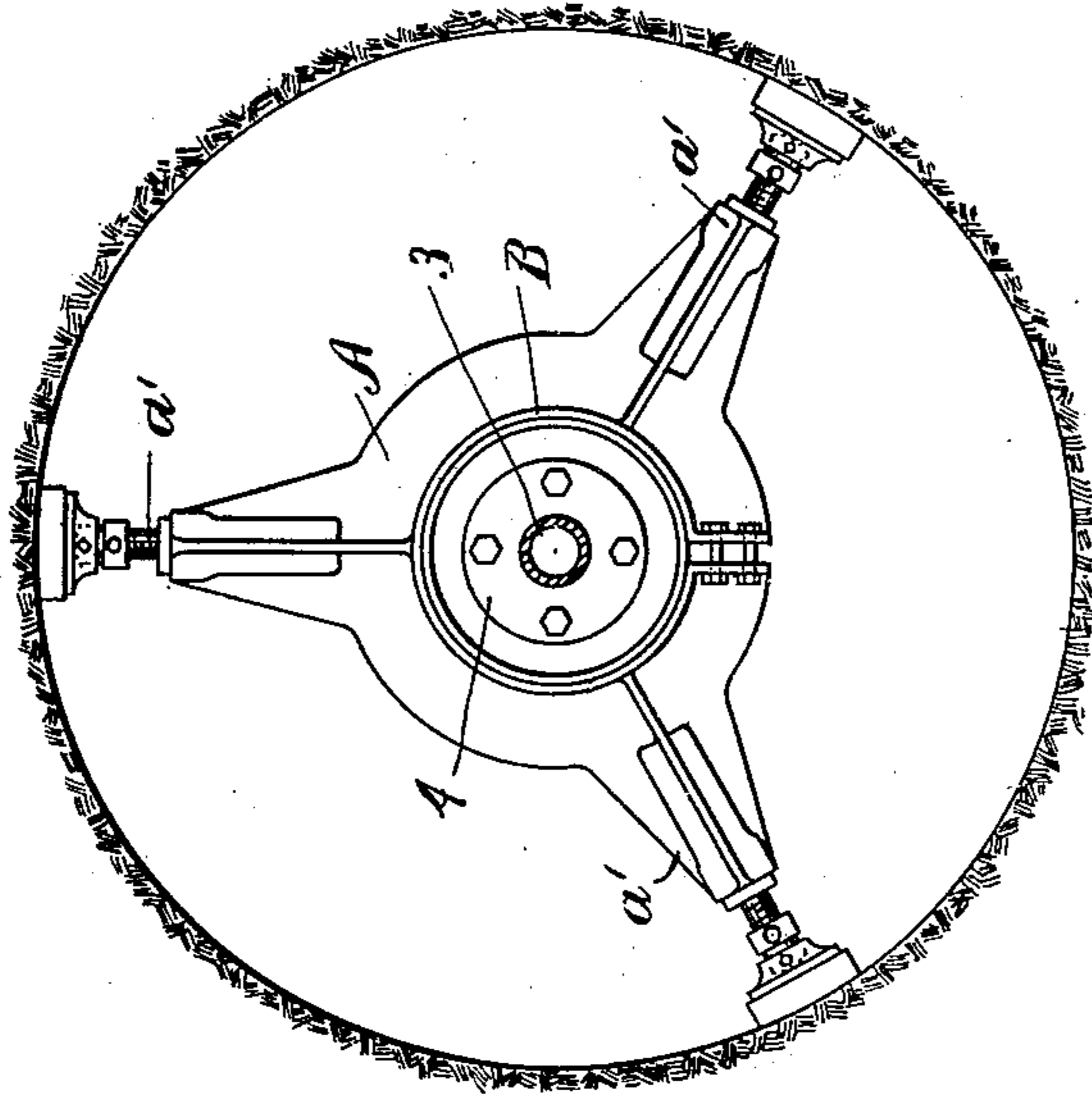
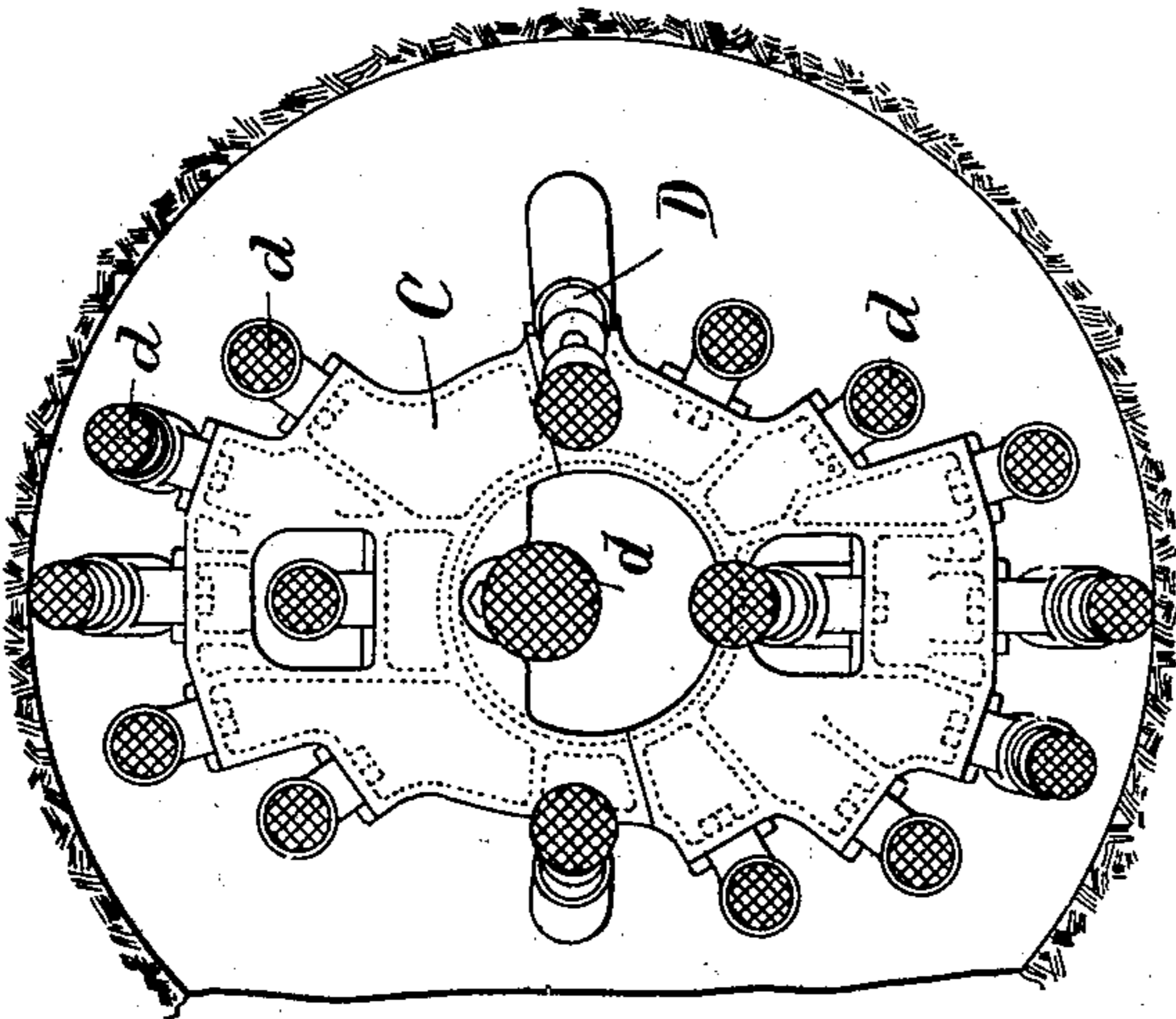


Fig. 6.



WITNESSES:

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INVENTOR:

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UNITED STATES PATENT OFFICE.

PEDRO UNANUE, OF MEXICO, MEXICO.

TUNNELING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 732,326, dated June 30, 1903.

Application filed December 23, 1901. Serial No. 86,902. (No model.)

To all whom it may concern:

Be it known that I, PEDRO UNANUE, a subject of the King of Spain, residing at the city of Mexico, in the State and Republic of Mexico, have invented certain new and useful Improvements in Tunneling-Machines, of which the following is a specification.

My invention has reference to improvements in tunneling-machines, and has for its objects, first, to provide a rapidly and smoothly acting automatic feeding apparatus, and, secondly, to secure better working and cutting away of the rock by so arranging or directing the rams or cutters as to insure blows squarely directed on the surface and not only on part of said surface, as is the case in ordinary tunneling-machines, thereby avoiding strains both on the rams or cutters and the apparatus supporting and operating the same.

To this end my invention consists, essentially, in a tunneling-machine comprising a series of cutters and means for revolving and feeding the same forward, said cutters being set at an angle to the direction of their revolution.

My invention, furthermore, consists in certain novel means for the feeding and withdrawal of the cutter-head in its longitudinal direction, all of which is more fully pointed out in connection with the accompanying drawings, in which—

Figure 1 represents a longitudinal central section of a machine embodying my invention, part being in elevation. Fig. 2 is a plan or top view. Fig. 3 is a vertical section on the line 3 3, Fig. 1. Fig. 4 is a similar section on the line 4 4, Fig. 1. Fig. 5 is a similar section on the line 5 5, Fig. 1. Fig. 6 is a face view of the ram-head and its attached rams. Fig. 7 is an enlarged elevation of one of the cutters, illustrating its position relative to the work.

Similar letters and numerals of reference designate corresponding parts throughout the several views of the drawings.

Referring now to the drawings, the letter A designates the casing of the tunneling-machine, which said casing is preferably made cylindrical and is adapted to be secured in and to the wall of the tunnel by

means of suitable radial jacks *a*. These jacks are made adjustable, as usual, by means of a threaded connection between its parts, so as to enable the casing A to be securely held or to have a forward movement imparted after loosening the jacks. The opposite ends of the cylinder A are closed by suitable heads I, provided with stuffing-boxes surrounding tubular plunger B, carrying at its forward end the ram-head C, upon which latter is mounted a series of rams D. These rams may be in the form of ordinary rock-drills provided with suitable cutters *d* at the ends of their rods and adapted to be operated either by steam or pneumatic pressure. The rams are so distributed on the ram-head that the cutters are located at different radial distances from the center, but in overlapping peripheral paths, thus insuring the entire removal of the material without the necessity of blasting.

Within the plunger B is placed a tube E, having at its inner end a head *e* fitted to and guided in the bore of the plunger B, and pipes 2 are conducted from this head to the respective valve-chambers of the rams D. Compressed air is supplied to the pipe E by means of a supply-pipe 3, extending through a suitable stuffing-box 4, carried by the plunger B and telescoping with the pipe E. The supply-pipe 3 is in communication with the main supply-pipes 5 through suitable fittings. Valves are interposed between the main supply-pipes 5 and the telescopic supply-pipe 3, as usual, for controlling the supply of air according to circumstances or for entirely shutting off such supply or for shutting off one of the main supply-pipes 5.

The casing A is provided on its exterior with longitudinal guideways 6, to which is fitted a slide-bar 7, adapted to move with the plunger B and provided at its forward end with a pinion 8, engaging with a gear-wheel 9, rigidly mounted upon the said plunger. An air or other suitable motor F, mounted on suitable standards connected with the casing, drives a transverse shaft 10 through suitable intermediate gearing 11 and 12, which said shaft is provided with a worm 13, engaging with a gear 14, mounted on the slide-bar 7 for the purpose of turning the latter.

For the purpose of advancing or feeding the ram-head C, I provide the plunger B with a piston 15, fitted to the bore of the casing A, and make use of suitable means for effecting
 5 a circulation of liquid—such, for instance, as oil. The means herein shown consist of a circulating-pump G, driven from the shaft 10 of the motor F and connected by pipes 16 and 17 with the interior of the casing A on
 10 opposite sides of the piston 15. The function of this pump, as is well understood in practice, is to remove the oil or other liquid from the casing on one side of the piston and to introduce it into the casing at the other side
 15 of the piston, thus causing a feed of the ram-head or plunger corresponding to the speed of the pump. In practice I make use of two circulating-pumps of different capacities, the small pump G being used for feeding the
 20 plunger while the machine is in operation and the other pump, G', when the casing is to be advanced for a readjustment of the machine, as will be subsequently described.

For the purpose of removing the slime from
 25 the machine I make use of a screw conveyer or a series of screw conveyers H, having its shaft mounted in suitable bearings in hangers 20, respectively attached to the rails 21 and the hangers 22 of the casing A. From
 30 the plunger B depend guides 22^x, engaging the rail. The conveyer H is rotated from the shaft 7 by means of suitable chain-wheels 25, 26, 27, 28, 29, and 30 and chains 31, 32, and 33, all arranged for the purpose of obtaining
 35 an accelerated rotation of said conveyer.

The operation of the machine is as follows: In the position of the parts shown in Fig. 1 the machine is toward the end of its feed. The circulating-pump G' is drawing liquid
 40 from the forward end of the cylinder A and introducing it into said cylinder back of the piston, so as to cause a gradual forward feed of the ram-head. The motor F through the intermediate mechanism described rotates
 45 the plunger B and ram-head C, while the conveyer H is rotated for the purpose of removing the slime. In this operative position of the machine the jacks *a* are tightened against the wall of the tunnel and hold the casing
 50 firmly in position, while the jacks *a'*, attached to the plunger B, are in a position to clear the wall of the tunnel. When the plunger B is at the end of its feed or stroke, the supply of air is closed off at the supply-
 55 pipe or at valve 23 and the jacks *a'* are caused to engage with and to immovably hold the plunger against longitudinal movement. The jacks *a* on the casing are then screwed down to clear the walls of the tunnel, and the casing
 60 is moved forward, together with its attached parts, to place the machine in operative position for the next drilling operation.

Heretofore the surfaces of the cutters on the rams have been arranged to strike in a plane
 65 parallel to the surface of the material acted upon or in a plane parallel to the plane of revolution of the ram-head, and consequently

the cutters after the first blow would not strike squarely, but would impinge on the uncut material, and consequently tend to pro-
 70 duce a bending movement on the rammer-rods. This objection I avoid by setting the several rams at an inclination to the direction of their revolution, so that the cutters always strike the material squarely—that is to say,
 75 this angle is so taken as to correspond to the feed during revolution for producing the proper effect. In Fig. 7 I have shown the position in which the rammer-rod is set. The rammers D are preferably adjustably mount-
 80 ed, so that the angle to which they can be set may be varied.

Before the casing A is moved forward the plunger is blocked up in a usual manner, so as to prevent undue strain on the conveyer
 85 and other pendent parts and permit an easy forward movement of the cylinder. This forward movement of the cylinder is effected either by reversing the circulating-pump or by throwing the larger pump G' into opera-
 90 tion, so as to accelerate the movement.

What I claim as new is—

1. In a tunneling-machine, the combination of a ram-head provided with a series of rammers having their rods inclined to the ram-
 95 head in and toward the direction of revolution of the ram-head together with an inclination from the axis of revolution of the ram-head, and means for rotating and feeding said ram-head, substantially as described. 100

2. In a tunneling-machine, the combination of a ram-head provided with a series of rammers having their rods inclined to the ram-
 105 head in or toward the direction of revolution of the ram-head together with an inclination from the axis of revolution of the ram-head, and said rammers being adjustably mounted relative to said ram-head, and means for rotating and feeding said ram-head, substan-
 110 tially as described.

3. In a tunneling-machine, the combination of a ram-head provided with a series of rammers having their rods inclined to the ram-
 115 head in and toward the direction of revolution of the ram-head together with an inclination from the axis of revolution of the ram-head, and said rammers being arranged at different radial distances so as to travel in different overlapping paths, and means for rotating and feeding said ram-head substantially as de-
 120 scribed.

4. A tunneling-machine comprising in its structure a casing provided with means for securing the same in the tunnel, a plunger
 125 slidable within said casing and provided with a piston fitted to said casing, a circulating-pump connected with a cylinder for moving the plunger in either direction by liquid means, a ram-head at one end of said plunger provided with a series of rammers arranged
 130 at an inclination to the direction of their revolution, means for rotating the plunger, and means for securing the casing and plunger in the tunnel substantially as described.

5. A tunneling-machine comprising in its structure a casing provided with means for securing the same in the tunnel, a plunger slidable within said casing, a ram-head on said plunger provided with a series of rammers, two circulating-pumps of different capacities connected with said casing for longitudinally moving the plunger in opposite directions, means for rotating the plunger, and means

for securing the casing and the plunger in the tunnel substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

PEDRO UNANUE.

Witnesses:

A. FABER DU FAUR, Jr.,
WM. J. FARRELL.