

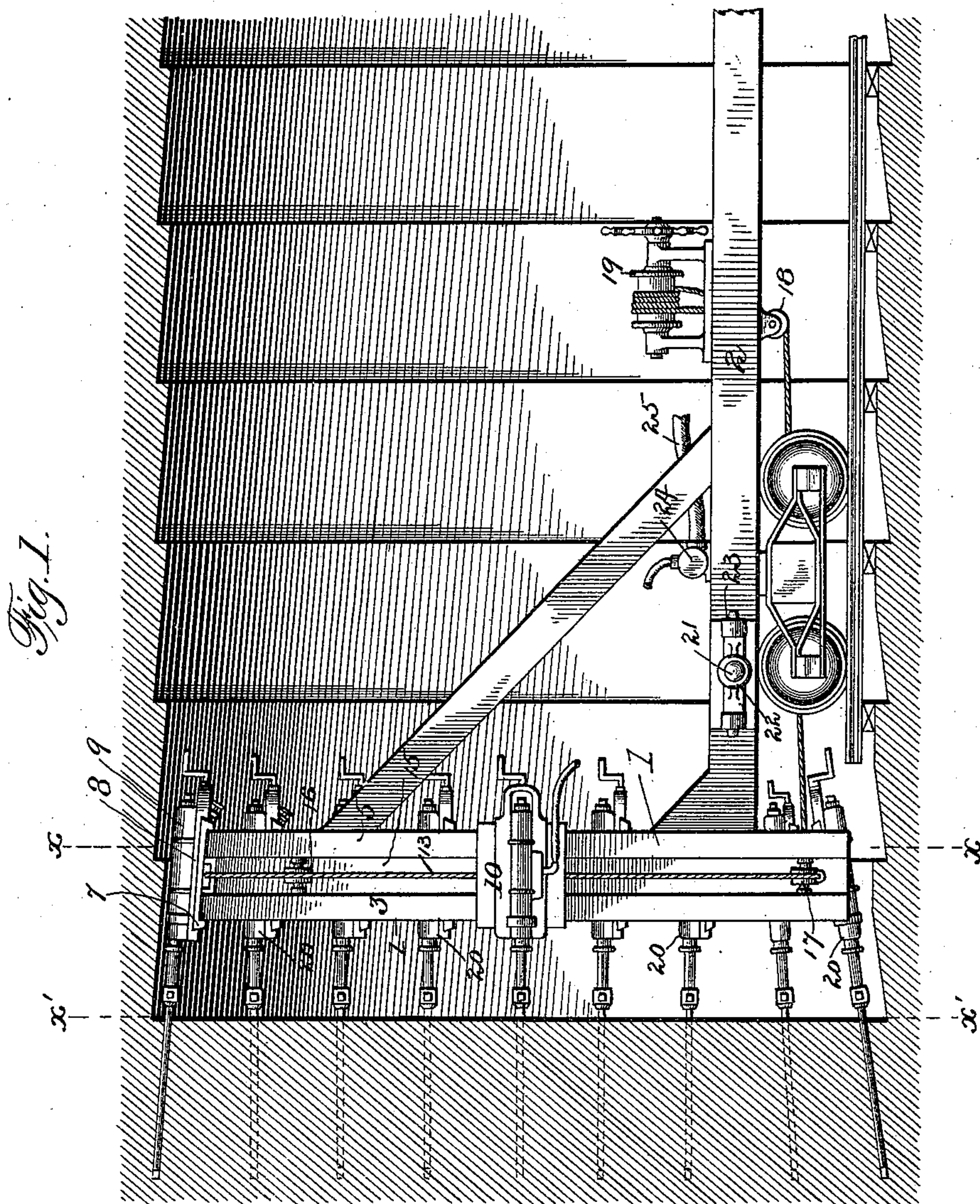
(No Model.)

3 Sheets—Sheet 1.

H. BYRNE.
APPARATUS FOR TUNNELING ROCK.

No. 545,675.

Patented Sept. 3, 1895.



Attest:
John Enders, Jr.
Henry L. Hazard.

Inventor:
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by Robert Burns
Attorney.

(No Model.)

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Fig. 3.

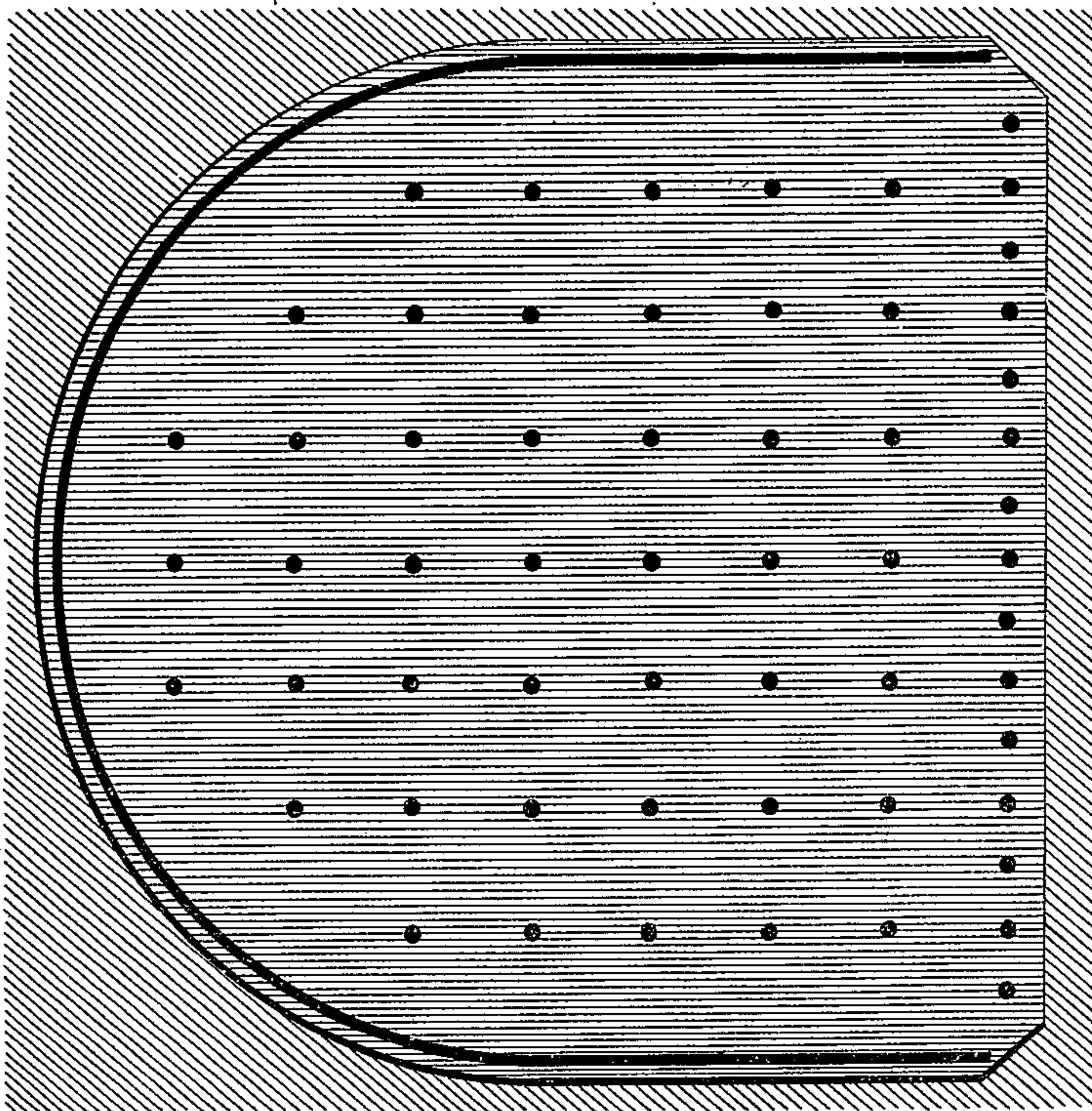
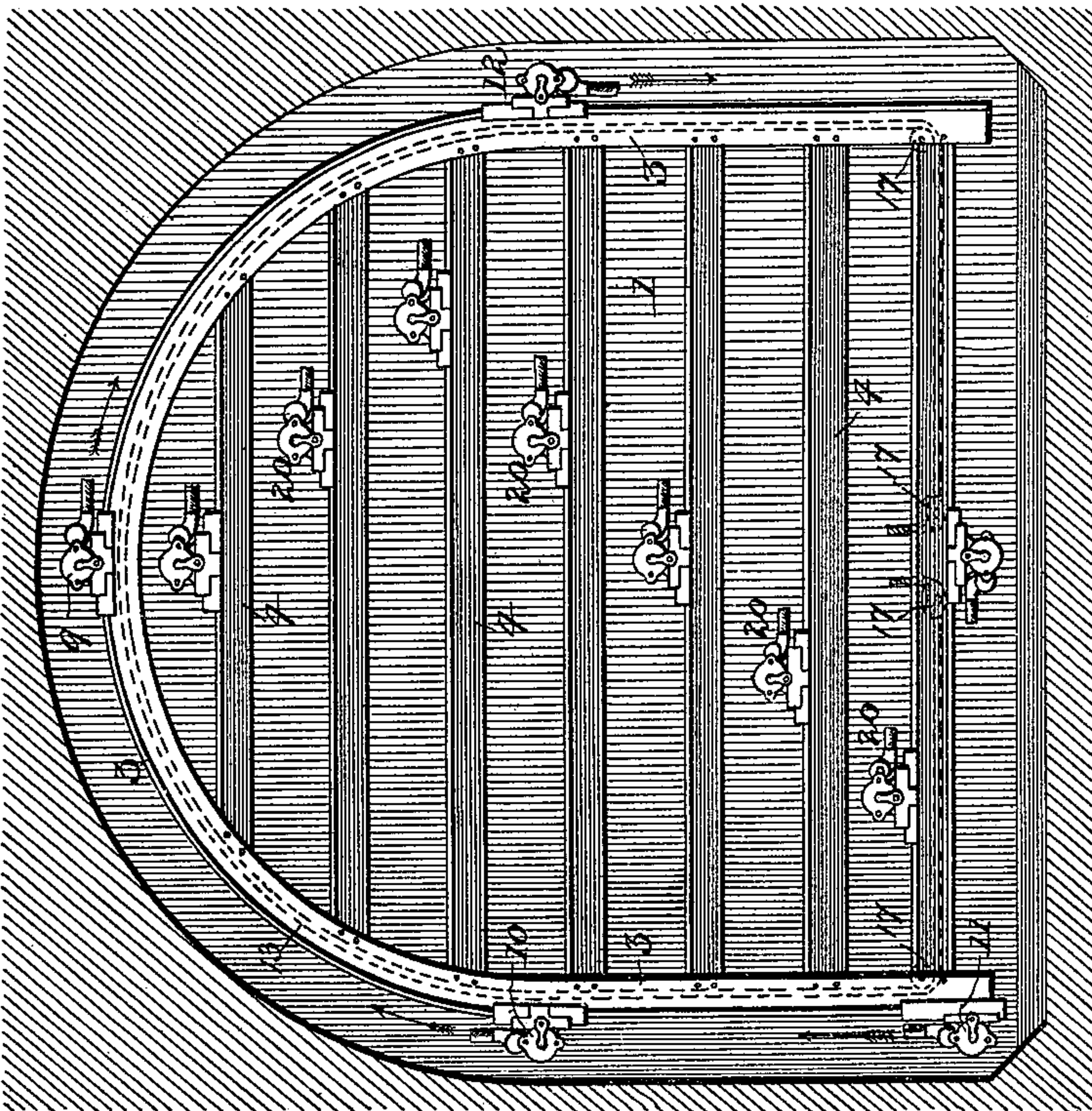


Fig. 2.



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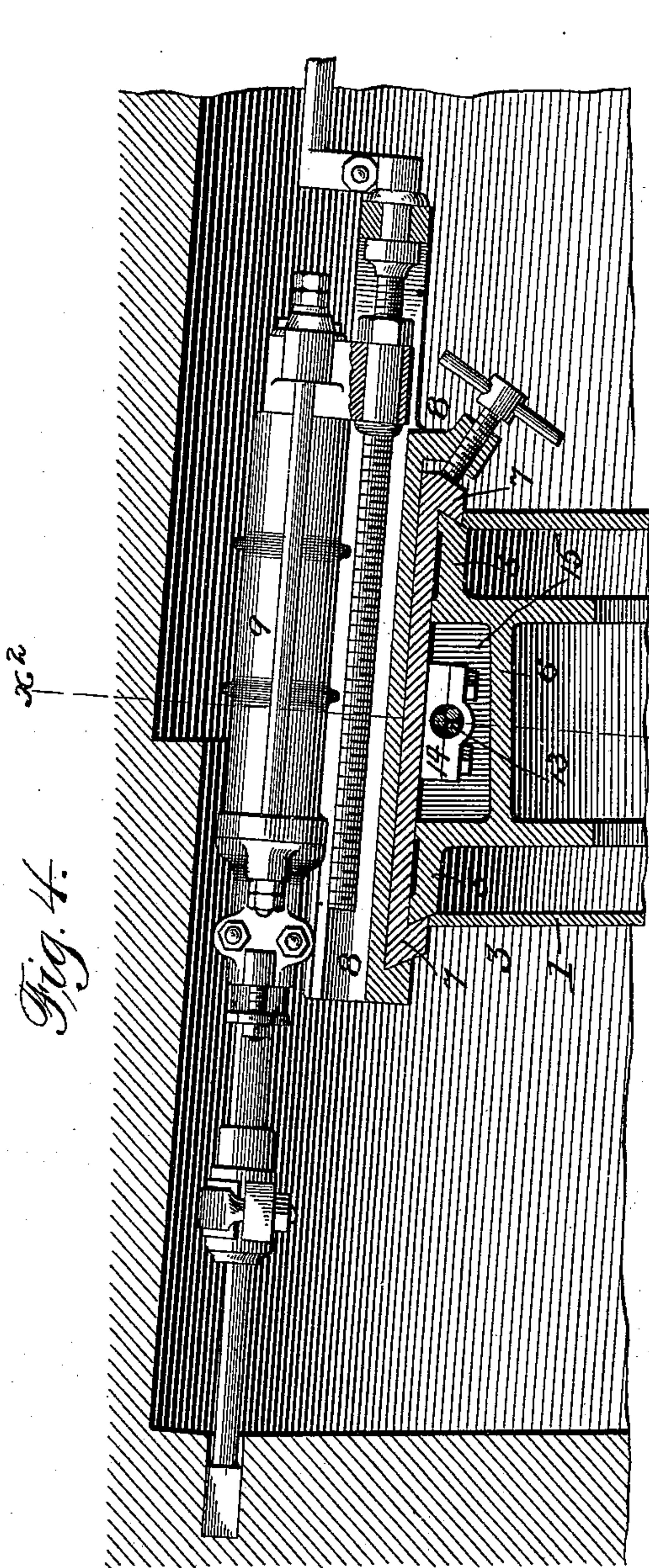


Fig. 4.

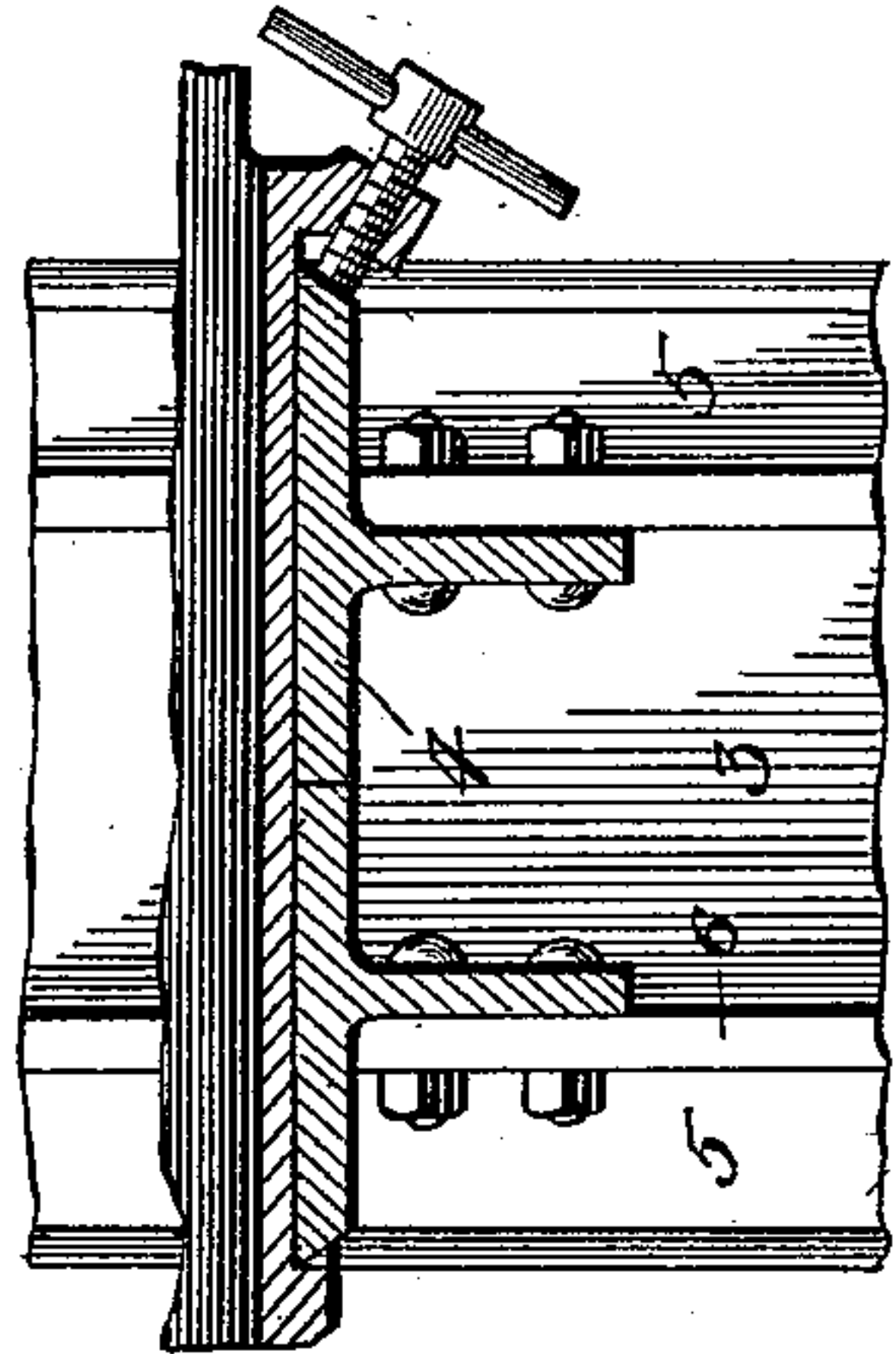


Fig. 6.

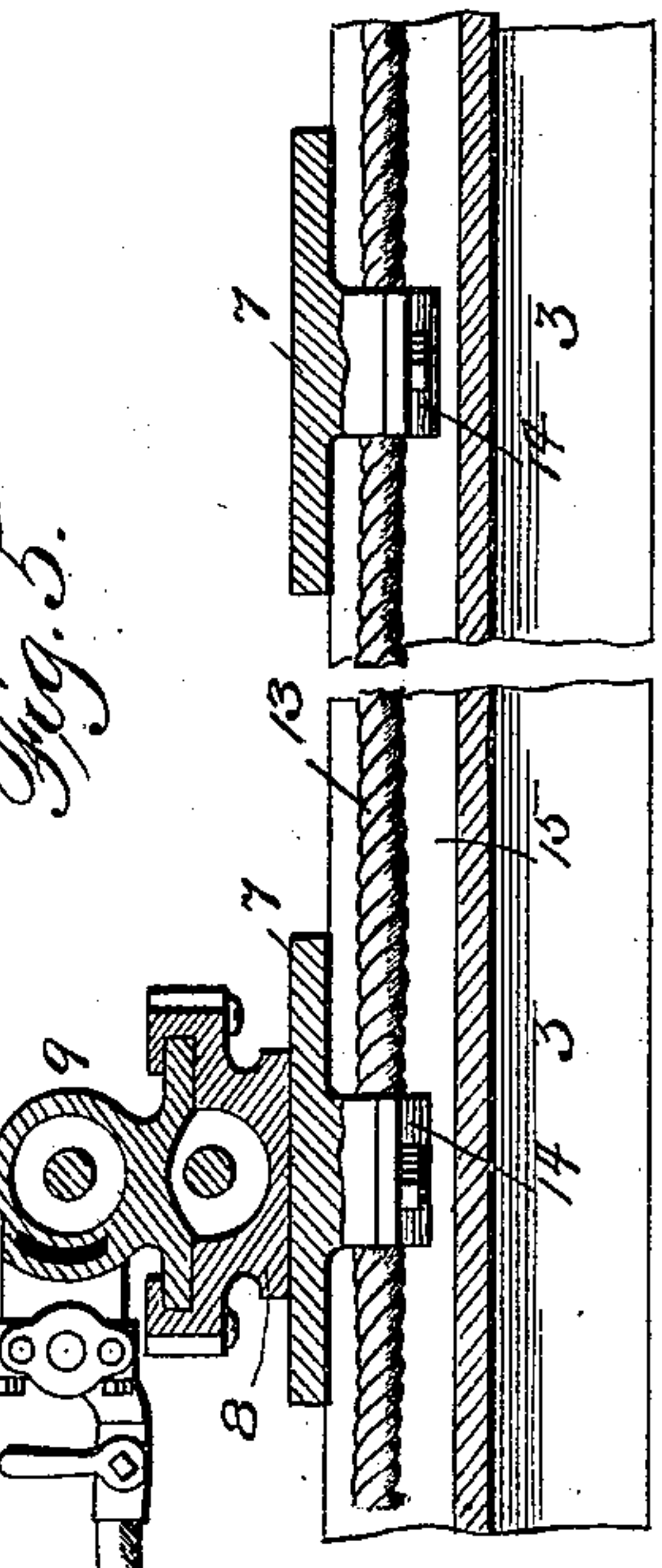


Fig. 5.

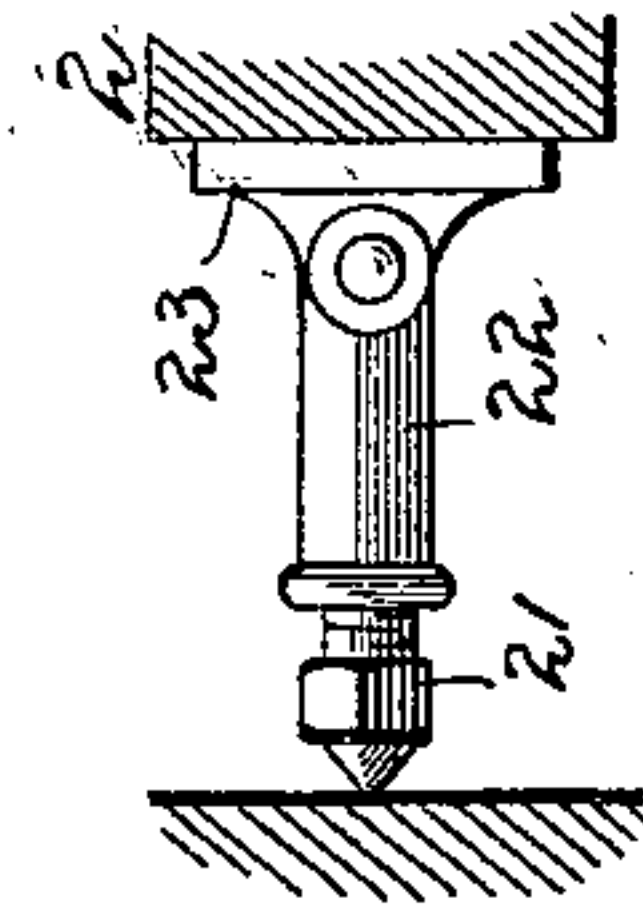


Fig. 7.

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UNITED STATES PATENT OFFICE.

HARRY BYRNE, OF CHICAGO, ILLINOIS.

APPARATUS FOR TUNNELING ROCK.

SPECIFICATION forming part of Letters Patent No. 545,675, dated September 3, 1895.

Application filed December 22, 1894. Serial No. 532,743. (No model.)

To all whom it may concern:

Be it known that I, HARRY BYRNE, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and Improved Apparatus for Tunneling Rock; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification.

The present invention relates to that particular manner of tunneling rock in which a marginal channel is first formed in the rock, after which the body of rock that is left is drilled, blasted away, and removed before the commencement of a succeeding marginal channel.

The present improvement has for its objects, first, to provide a simple, strong, and durable construction and arrangement of the tunneling apparatus, and in which the channeling-machines are supported and guided in their work, as well as the drills, by which the rocky core is prepared for blasting away, are supported during such operation, in a very perfect and efficient manner, and which also admits of their ready removal from point to point during the operation of piercing the rocky core or face at the various points required to receive a blasting charge or cartridge, and, second, to provide a simple and efficient means for imparting a traveling movement to the percussion channeling-machines during the formation of the annular channels or cuts before described; as will hereinafter more fully appear and be more particularly pointed out in the claims. I attain such objects by the construction and arrangements of parts illustrated in the accompanying drawings, in which—

Figure 1 is a longitudinal sectional elevation illustrating my present improved tunneling apparatus in working position within a tunnel of the present formation; Fig. 2, a transverse section of the same at line $x x$, Fig. 1, illustrating the vertically-arranged supporting-frame and the arrangement of the percussion channeling and drilling machines thereon; Fig. 3, a transverse sectional elevation of the same at line $x' x'$, Fig. 1, illustrating the face of the tunnel formed with the annular channel, the rocky core,

and the series of drill-holes in the same for the reception of the blasting-charges; Fig. 4, an enlarged detail sectional elevation illustrating a percussion channeling-machine and the manner in which the same is supported in an adjustable manner upon the upright supporting-frame of the tunneling apparatus; Fig. 5, a transverse sectional elevation of the same at line $x^2 x^2$, Fig. 4; Fig. 6, a detail vertical sectional elevation of one of the horizontally-arranged members of the main supporting-frame that supports the percussion drilling-machines with which the tunnel-core is pierced previous to the blasting away of the same; Fig. 7, a detail sectional elevation of the anchoring device at the side of the car for anchoring the same in a stationary condition within the tunnel.

Similar numerals of reference indicate like parts in the several views.

Referring to the drawings, 1 represents an upright frame of a form similar to that of the bore of the tunnel, and which may be supported in an upright and stationary manner within the tunnel in any usual and well-known manner, preferably, however, by means of a car or truck 2, at the end of which such frame is securely attached and braced, so as to effect a rigid connection. The upright frame 1 in the present invention will be of a skeleton construction and will consist of a marginal bow-shaped portion 3 and horizontal members 4, secured at each end to the bow portion 3. The bow-shaped portion 3 will in turn be formed with an outer plate portion 5, constituting a slideway for the channeling-machines, and an H-shaped inner body portion 6 to afford the requisite stiffness to such marginal member and also afford a ready and convenient means of attachment of the horizontal members 4, which are riveted or bolted to the inner flanges of such H-shaped body portion. The outer plate or slideway portion 5 will be planed along its face and edges, so as to form a smooth slideway for the sliding beds 7, upon which in turn are supported the percussion channeling-machines, of any usual and suitable construction, the supporting base or frame 8 of which is firmly clamped to the sliding beds 7, as illustrated in Figs. 4 and 5.

A series of four or more channeling-ma-

chines 9, 10, 11, and 12 will be usually arranged upon the upright supporting-bow 3, the number used, however, depending mainly upon the size of the tunnel and the nature of the rock operated upon. The series of channeling-machines 9, 10, 11, and 12 are connected together so as to move in unison, and such connection may be of any usual and suitable form, preferably the flexible connection 13 of wire-rope, as shown in the drawings, to which the various sliding beds 7, carrying the channeling-machines, are fixedly attached by means of the clamps 14, as illustrated in Figs. 1, 4, and 5.

In my preferred formation of the outer plate or slideway portion 5, as illustrated in Figs. 1 and 4, the same will constitute outward extensions of the H-shaped body portion 6, leaving a central recess or cavity 15 around the outer surface of the upright bow 3 to receive the flexible connection 13, which in its passage around the curved crown of such bow may be supported by the supporting-sheaves 16, journaled on said bow. The flexible wire-rope connection 13 will extend around suitable guide-sheaves 17 and 18 to an operating-capstan 19 or other equivalent operating device, so as to be capable of being operated by hand and impart the desired travel to the series of channeling-machines in forming the marginal channel or cut of the tunnel heretofore referred to.

The pair of channeling-machines 9 and 10 are adapted to have a curvilinear reciprocating traveling movement upon the semicircular top portion of the upright bow 3, so as to form the crown portion of the marginal channel or cut in the face of the rock. The pair of channeling-machines 11 and 12 will have a rectilinear reciprocating traveling movement upon the vertical sides of the upright portions of the bow 3, so as to form the vertical portions of the marginal channel or cut in the face of the rock. The series of channeling-machines 9, 10, 11, and 12 are set obliquely to the direction of the tunnel, so as to form an expanded marginal channel or cut, as shown, a succeeding series of such cuts constituting a tunnel formed by a series of expanded sub-bores that impart a serrated formation to the interior of the tunnel. With this particular arrangement great simplicity and effectiveness in the percussion channeling-machines may be obtained. The series of horizontal members 4 of the upright supporting-frame 1 constitute supports for the vertical series of percussion drilling-machines 20, that are adapted to be adjusted and clamped thereon in forming the series of drill-openings that are made in the rocky core-body of the tunnel-face for the purpose of blasting the same away. It is preferable to drill the lower row of such holes or blasting-orifices, as well as the row next adjacent, on an incline as shown in Fig. 1, so that the bottom of the tunnel will receive a serrated formation corresponding with the like formation of the sides and crown of the tunnel, the

purpose being the same in both instances—to admit of an ordinary percussion channeling or drilling machine being used and yet preserve a uniform dimension of the tunnel along its entire length; and in order to attain a still greater uniformity the point portions of the serrated formation of the tunnel-bore, either on the bottom or all portions thereof, may be subsequently broken away by a sledge or other suitable means. This removal of the points of the serrations on the bottom of the tunnel is of especial value in the present invention in that it admits of the tracks, &c., being arranged in proper place as the tunneling progresses.

In making the marginal channel as well as the drill-holes of the required depth the feeding adjustment of such machines may be made equal to such depth, or such feeding adjustment may be limited and the required depth of such channel and holes be attained by the substitution of a series of drill or channel bars of successively-increasing length.

21 is an adjustable anchor-rod screwing into a base portion 22, pivoted in an attaching-plate 23, secured at the side of the car or truck 2. There will be one or more of these anchor devices at each side of the car, so that by the screwing of the series of anchor-rods 21 outward against the wall of the tunnel the car will be securely anchored in position.

24 is a manifold head on the main car or truck 2, that receives a supply of compressed air through the flexible supply-pipe 25 and in turn supplies such compressed air in an individual manner to the different channeling and drilling machines by individual pipe connections therewith.

Where such percussion channeling and drilling machines are actuated by steam or electricity, a substantially similar means will be employed to convey such steam or electricity from its common source to the individual machines. In either case such an arrangement will require but a single disconnection of the main supply-pipe in the operation of removing the tunneling apparatus previous to the operation of blasting away that portion of the face of the tunnel that had been previously drilled and channeled.

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

1. In a rock tunneling apparatus, the combination of the upright supporting frame having a marginal formation corresponding with that of the tunnel, a series of traveling percussion channeling machines arranged to travel upon the outer surface of such frame, a flexible connection attaching the entire series of machines together to cause the same to travel in unison, and means for operating said flexible connection, substantially as set forth.

2. In a rock tunneling apparatus, the combination of the upright supporting frame, having a marginal formation corresponding with

that of the tunnel, a series of traveling percussion channeling machines, arranged to travel upon the outer surface of such frame, a flexible connection attaching the entire series of machines together to cause the same to travel in unison, and an operating capstan, the drum of which is connected with said flexible connection so as to actuate the same, substantially as set forth.

3. In a rock tunneling apparatus, the combination of the upright supporting frame having a marginal formation corresponding with that of the tunnel, and consisting of an upright bow having an H shaped cross section, the outer lateral flanges of which constitute slideways, a series of traveling percussion channeling machines arranged to travel upon the outer surface of such frame, a flexible connection attaching such machines together so as to travel in unison, and means for operating said flexible connection, substantially as set forth.

4. In a rock tunneling apparatus, the combination of the upright supporting frame having a marginal formation corresponding with that of the tunnel, and consisting of an upright bow having an H shaped cross section, the outer lateral flanges of which constitute slideways, a series of traveling percussion channeling machines arranged to travel upon the outer surface of such frame, a flexible connection attaching such machines together so as to travel in unison, and an operating capstan, the drum of which is connected with said flexible connection so as to actuate the same, substantially as set forth.

5. In a rock tunneling apparatus, the combination of the upright supporting frame having a marginal formation corresponding with that of the tunnel, and provided with a vertical tier of horizontal members, a series of traveling percussion channeling machines arranged to travel upon the outer surface of such frame, a flexible connection attaching the entire series of machines together, to cause the same to travel in unison, and a series of percussion drilling machines mounted upon the horizontal members of the main supporting frame, substantially as set forth.

6. In a rock tunneling machine, the combination of a carrying car or truck, means for anchoring the same within the tunnel, an upright supporting frame rigidly attached to the end of the car, and having a marginal formation corresponding with that of the tunnel, a series of traveling percussion channeling machines, arranged to travel upon the outer sur-

face of such frame, a flexible connection attaching such machines together so as to travel in unison, and means for operating said flexible connection, substantially as set forth.

7. In a rock tunneling machine, the combination of a carrying car or truck, means for anchoring the same within the tunnel, an upright supporting frame rigidly attached to the end of the car, and having a marginal formation corresponding with that of the tunnel, a series of traveling percussion channeling machines arranged to travel upon the outer surface of such frame, a flexible connection attaching such machines together, so as to travel in unison, and an operating capstan, the drum of which is connected with said flexible connection so as to actuate the same, substantially as set forth.

8. In a rock tunneling apparatus, the combination of a carrying car or truck, means for anchoring the same within the tunnel, an upright supporting frame rigidly attached to the end of the car, and having a marginal formation corresponding with that of the tunnel, and consisting of an upright bow having an H shaped cross section, the outer lateral flanges of which constitute slideways, a series of traveling percussion channeling machines arranged to travel upon the outer surface of such frame, a flexible connection attaching such machines together so as to travel in unison, and means for operating said flexible connection, substantially as set forth.

9. In a rock tunneling apparatus, the combination of a carrying car or truck, means for anchoring the same within the tunnel, an upright supporting frame rigidly attached to the end of the car, and having a marginal formation corresponding with that of the tunnel, and consisting of an upright bow having an H shaped cross section, the outer lateral flanges of which constitute slideways, a series of traveling percussion channeling machines arranged to travel upon the outer surface of such frame, a flexible connection attaching such machines together so as to travel in unison, and an operating capstan, the drum of which is connected with said flexible connection, so as to actuate the same, substantially as set forth.

In testimony whereof witness my hand this 14th day of December, 1894.

HARRY BYRNE.

In presence of—

GEORGE J. KEENAN,
ROBERT BURNS.