

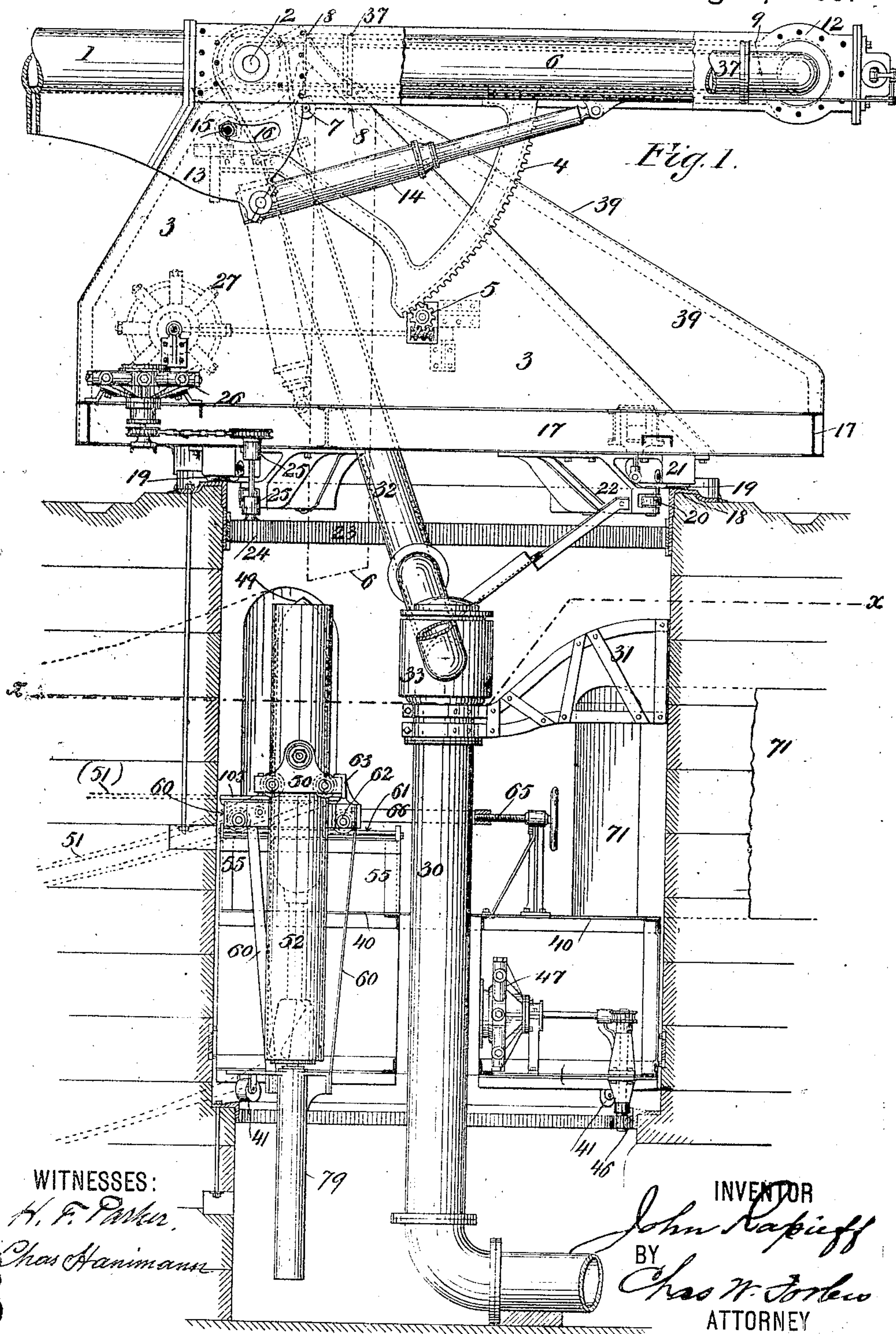
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6 Sheets—Sheet 1.

J. RAPIEFF.  
PNEUMATIC CANNON.

No. 502,759.

Patented Aug. 8, 1893.



WITNESSES:

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(No Model.)

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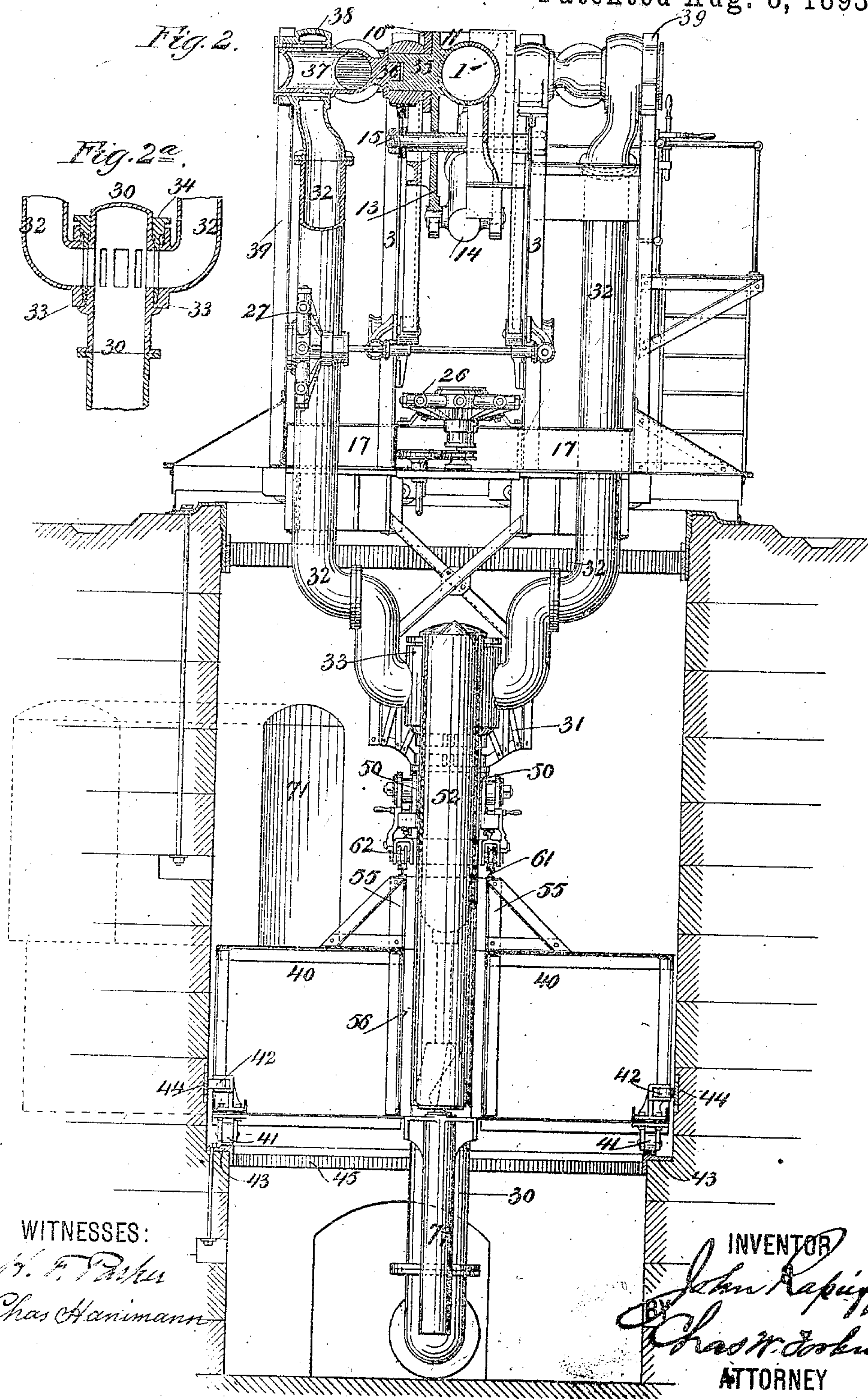
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Fig. 2.

Fig. 2a.



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(No Model.)

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Fig. 3.

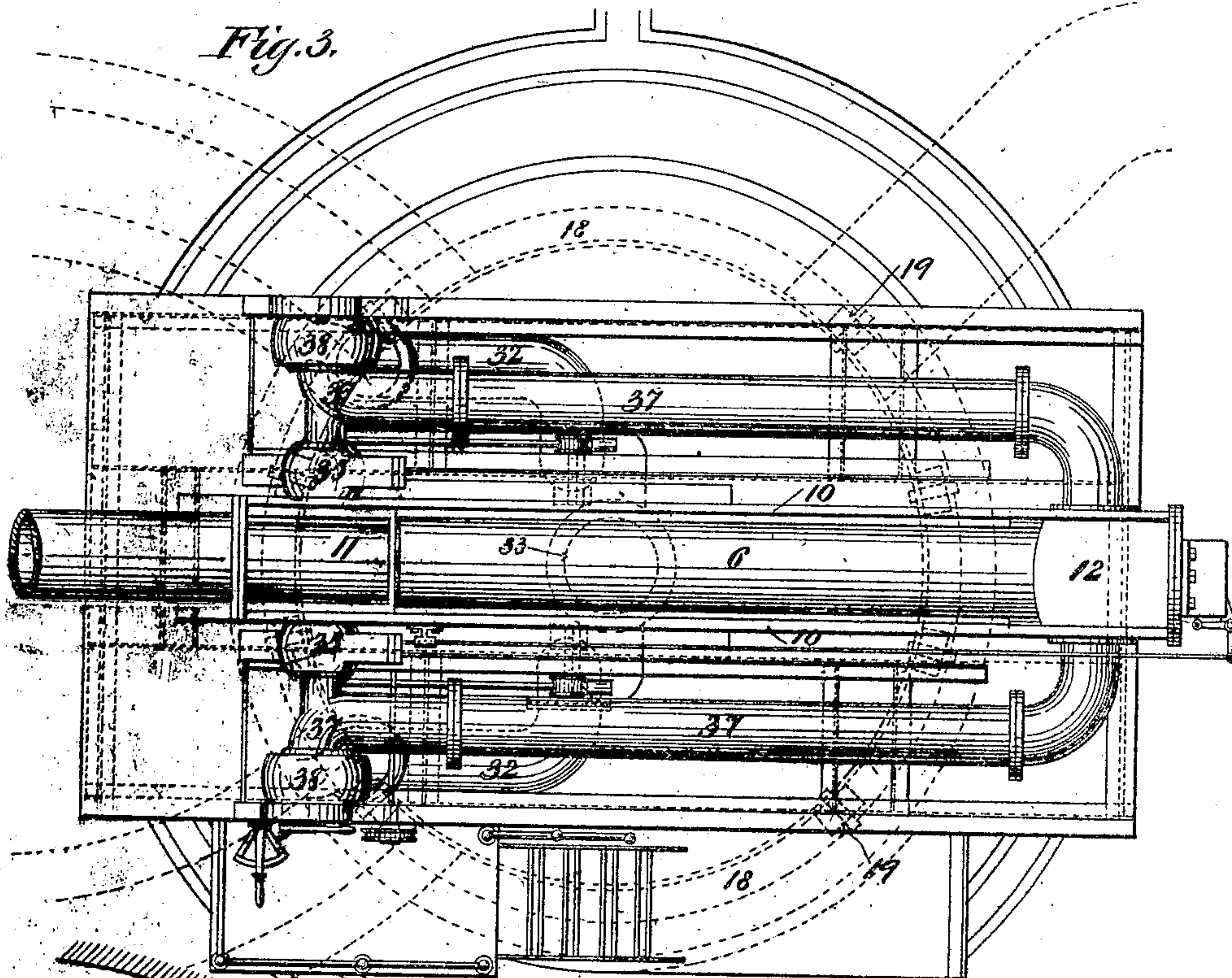
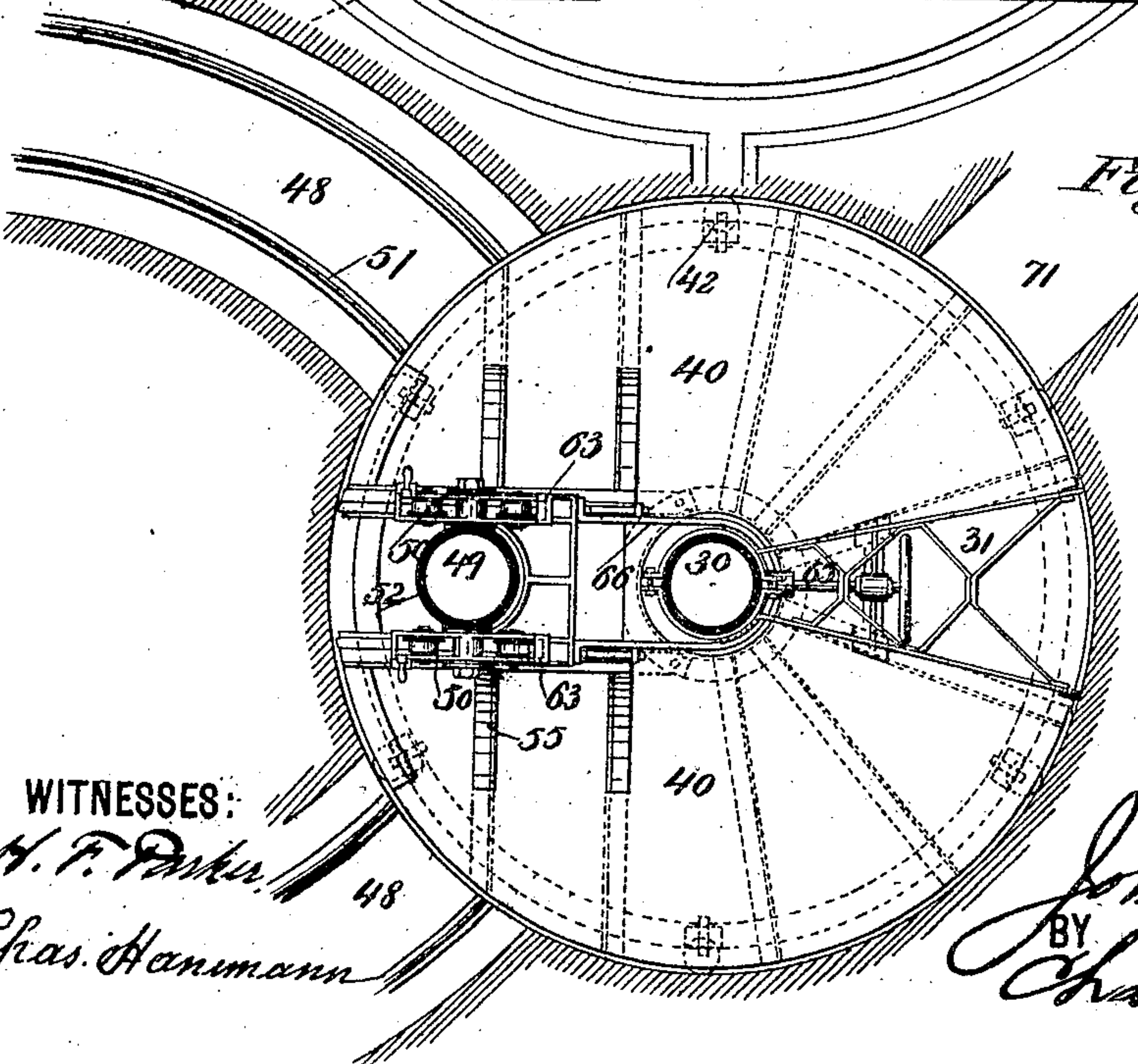


Fig. 4.



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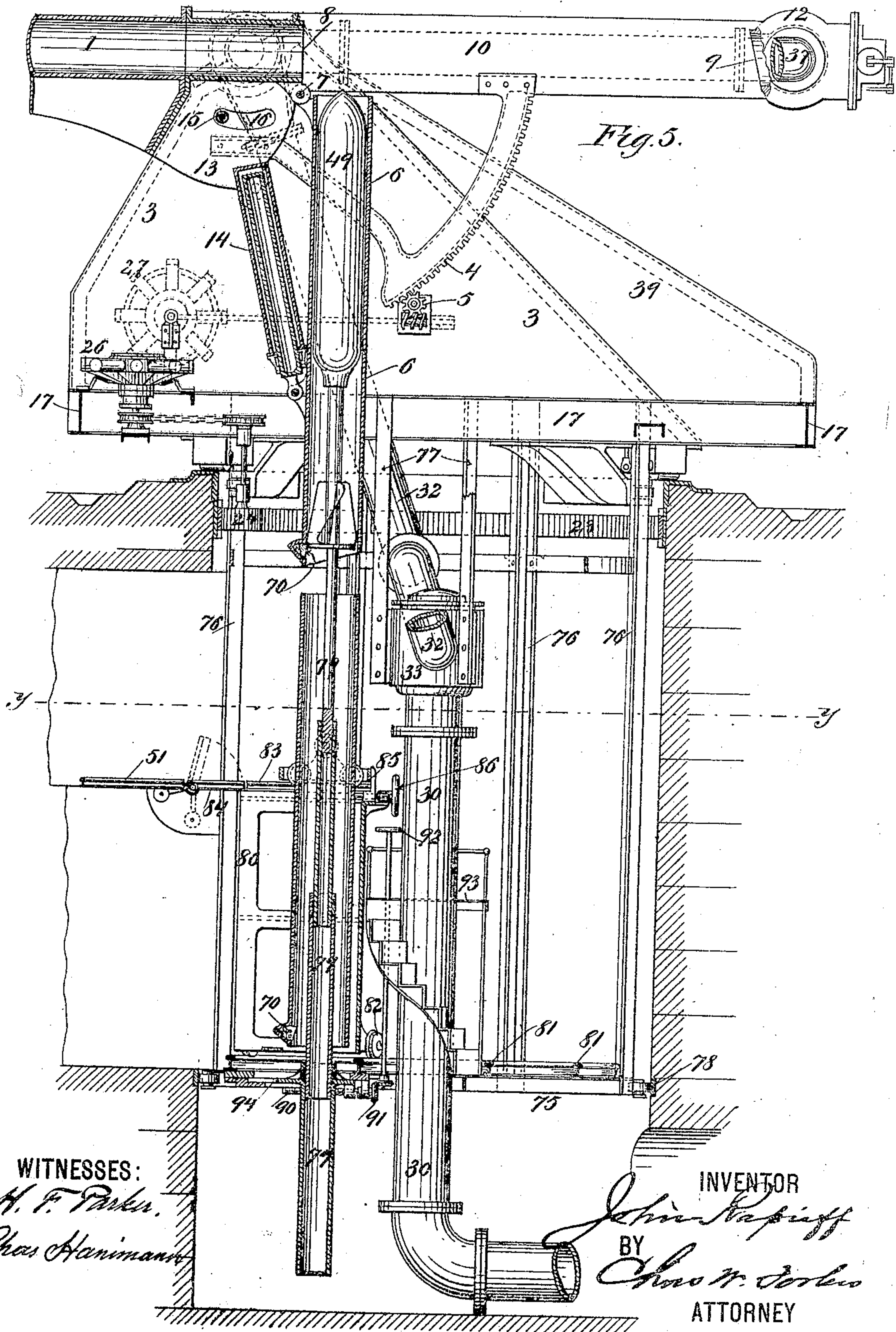
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*Fig. 6.*

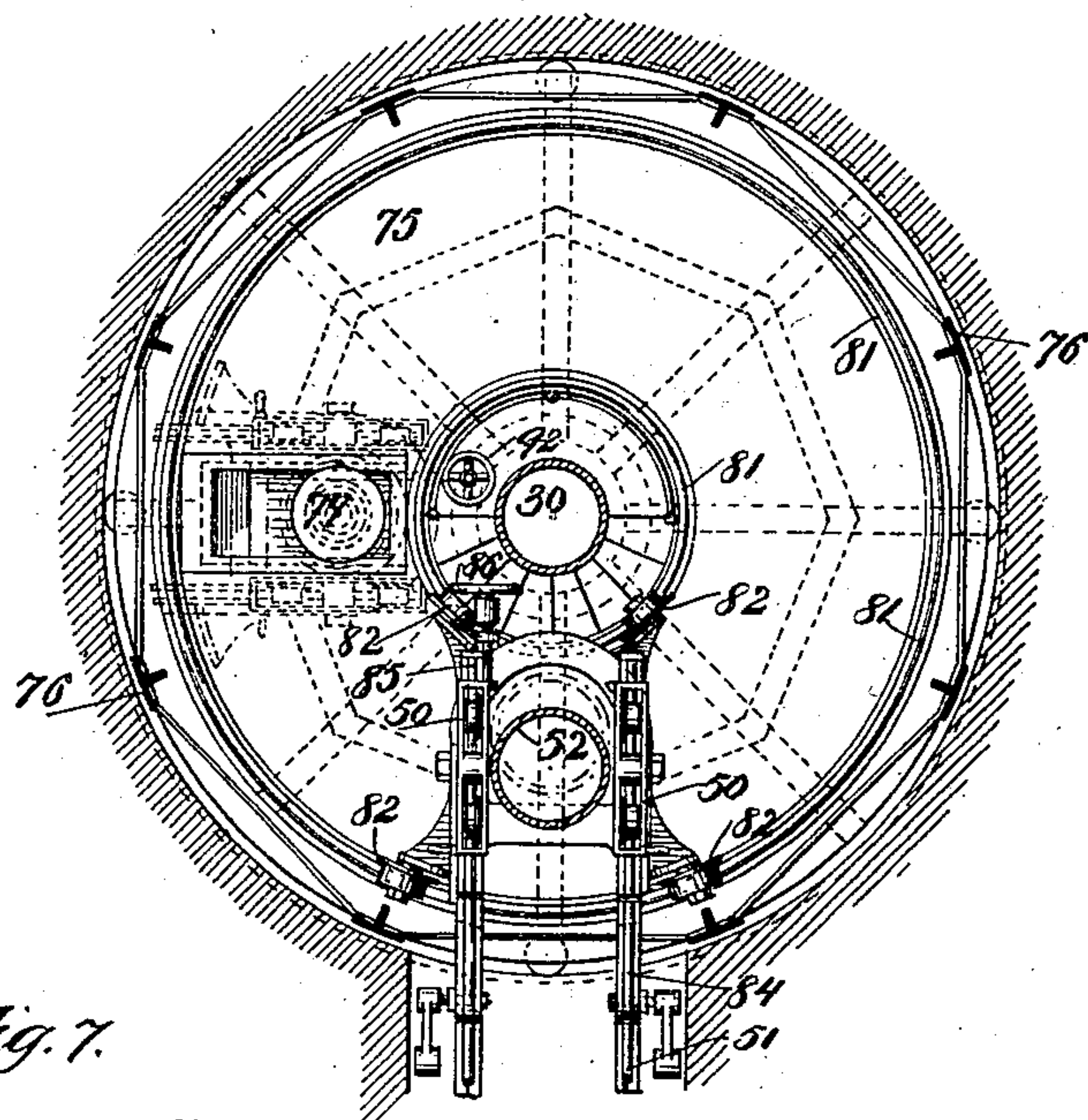
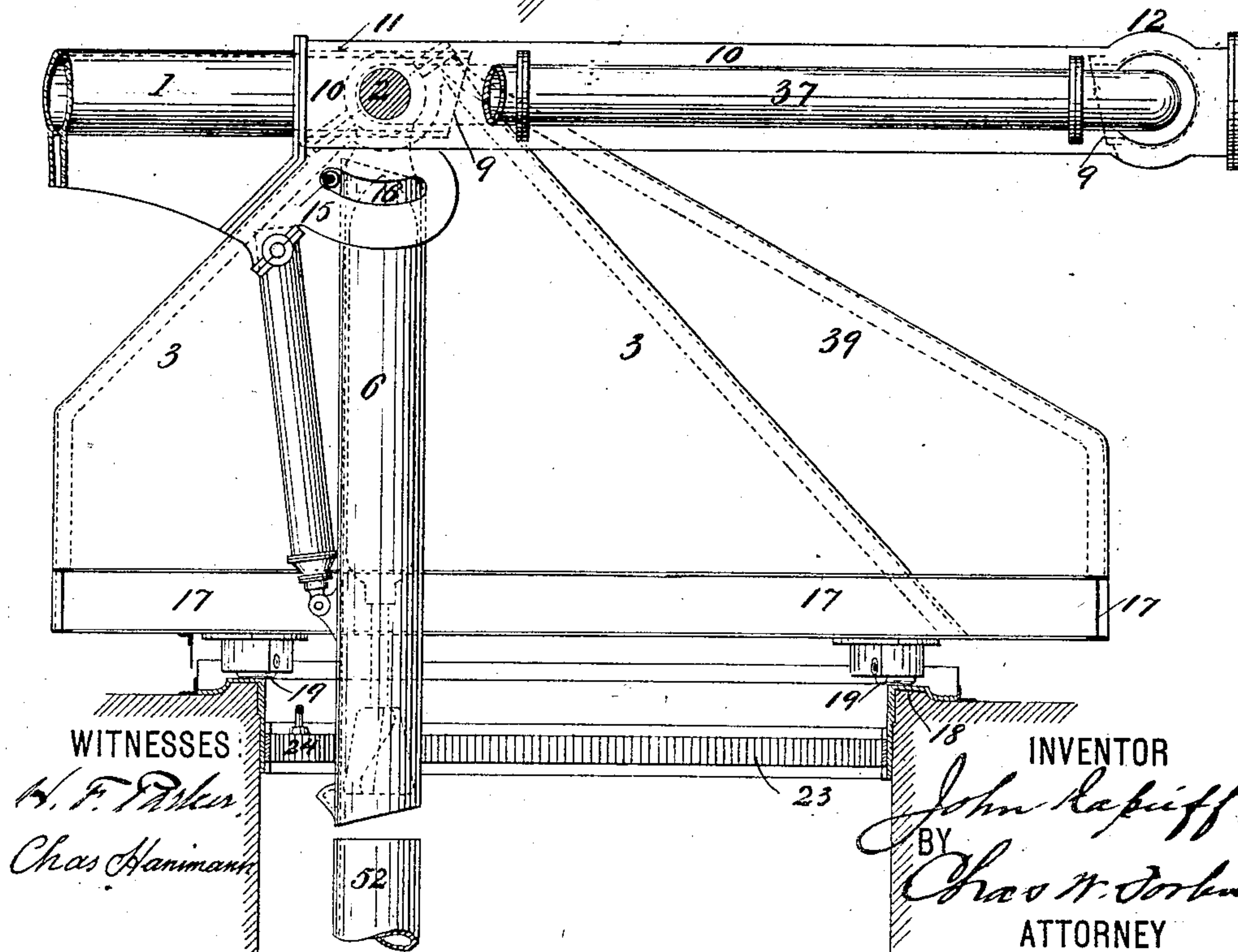


Fig. 7.





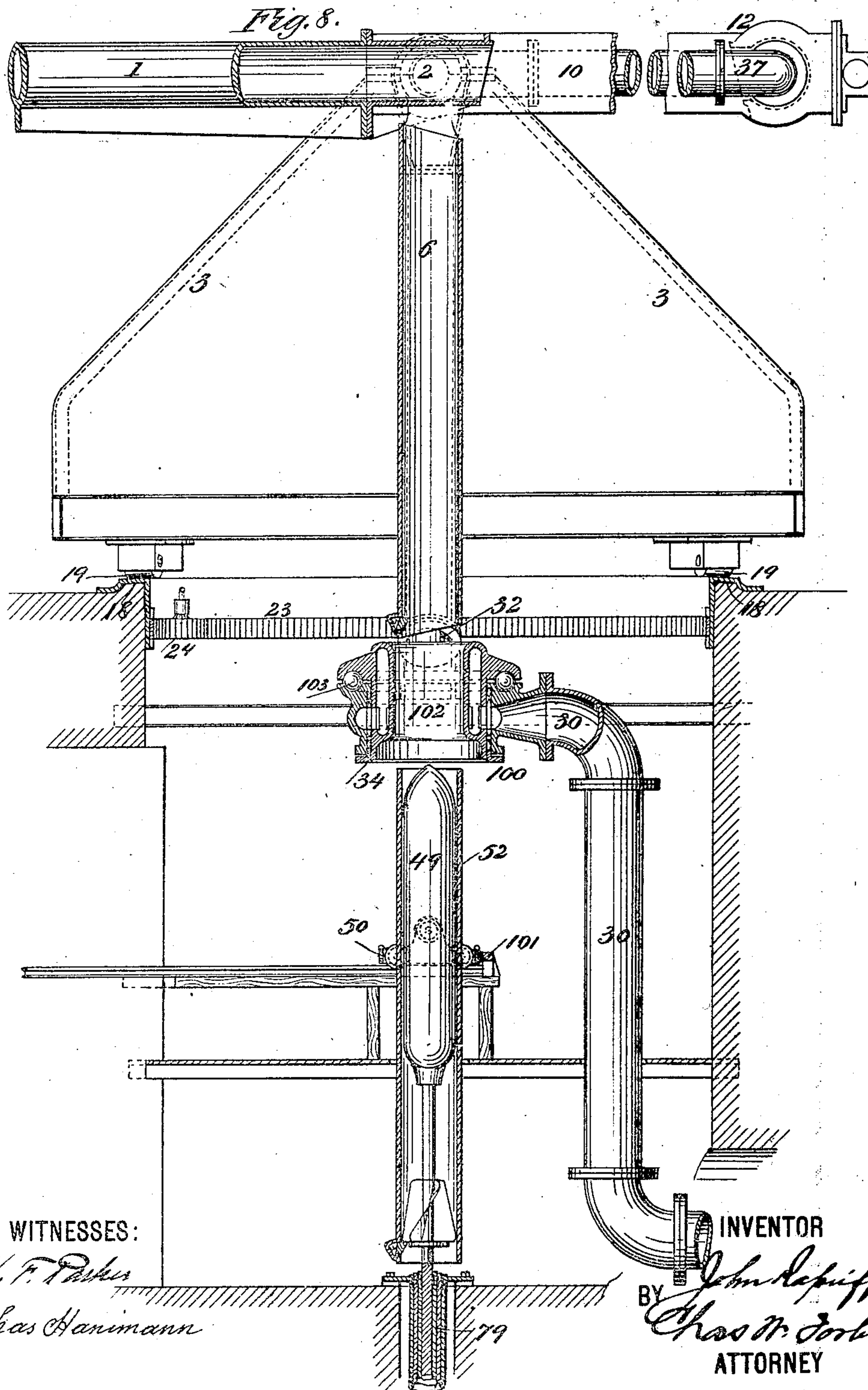
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# UNITED STATES PATENT OFFICE.

JOHN RAPIEFF, OF NEW YORK, N. Y.

## PNEUMATIC CANNON.

SPECIFICATION forming part of Letters Patent No. 502,759, dated August 8, 1893.

Application filed November 29, 1889. Serial No. 332,041. (No model.)

*To all whom it may concern:*

Be it known that I, JOHN RAPIEFF, a subject of the Czar of Russia, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Pneumatic Cannon, of which the following is a specification.

My invention relates to pneumatic cannon used in coast defense, to be stationed in suitable fortifications, and wherein the gun carriage is rotary to perform the training of the gun upon a stationary circular track.

My invention relates particularly to the means of conveying the projectiles charged with high explosives from subterranean vaults or magazines to a position beneath the gun and to means for elevating and loading the projectiles within the gun barrel.

My invention also relates to means for connecting the air pipe to the breech of the gun barrel by swiveled joints that permit the elevating and training movements of the gun.

My invention consists of certain novel instrumentalities; namely, wherein the projectiles are conveyed upon trucks from the magazine through subterranean tunnels to the loading pit beneath the gun; wherein the portion of the gun barrel in rear of the trunnions is permitted to swing downward upon a pivot located approximate to or upon the axis of the trunnions until it assumes a vertical position; and wherein the projectiles are then brought to a position directly beneath the depending breech and elevated into the same by a hydraulic ram, subsequent to which the breech is returned into alignment with the gun barrel.

In order to enable others skilled in the art to which my invention appertains to understand and use the same, I will proceed to describe its construction in detail, explain its operation, and subsequently point out in the appended claims its novel characteristics.

Reference being had to the accompanying drawings, in which similar numerals of reference indicate corresponding parts throughout the several views: Figure 1, is a side elevation, partly in section, of the gun and loading apparatus; wherein the breech is pivoted off the axis of the trunnions and the truck of the projectile is introduced within the loading pit upon an independent turn-table. Fig. 2

is a front elevation of Fig. 1; being also partly in section. Fig. 2<sup>a</sup>, is a detail view in section showing a joint of the air pipe. Fig. 3, is a plan view, and Fig. 4 a horizontal sectional view, on the line  $x-x$  of Fig. 1. Fig. 5, is a side elevation partly in section, of a gun and gun carriage similar to that shown in Fig. 1, but showing a modified construction of the loading apparatus wherein the projectile supporting table in the pit is hung from the gun carriage being rotative therewith, and wherein the projectile truck bearing frame is movable upon a circular track upon the said table. Fig. 6, is a horizontal section of Fig. 5, on the line  $y-y$ . Fig. 7, is a side elevation illustrating a further modification in the loading device wherein the swinging breech is pivoted on a common axis with the trunnions. Fig. 8, is a sectional elevation of a modification wherein the swinging breech is pivoted on the trunnions, and the latter are located whereby their axis intersects the vertical axis of the loading pit and the swiveled pipe joint therein, and whereby the projectile is loaded through a cylindric opening of the said pipe joint which is annular.

In Figs. 1 to 4, inclusive: 1, is the gun barrel capable of elevation upon the trunnions 2, in the gun carriage 3, by means of a segmental rack 4, and motor driven pinions 5, or other well known elevating mechanism.

6, is the depressible breech pivoted off the axis of the trunnions at 7, having an air tight joint at 8, in a plane perpendicular to the gun barrel, and an air tight joint at 9, in a plane oblique to the gun barrel to permit the necessary arc movement.

10, is a rearwardly extending frame rigid with the gun barrel, being securely riveted to the trunnion block 11, (Figs. 2 and 3.)

The frame 10 is composed of plates leaving a vertical interspace between them for the clearance of the movable breech section 6.

The extremity of the frame 10, bears the firing valve casing 12, composing the breech proper of the gun. The firing valve may be of any suitable construction such as heretofore described in various patents.

The webs 13, compose a part of the trunnion block 11, and to the heels of the webs a hydraulic ram 14, is swiveled, the same extending to a suitable part of the swinging



breech section 6, to elevate or lower it to the vertical position indicated by dotted lines, Fig. 1.

15, is a transverse stay bolt for binding together the upper portions of the trunnion supporting frames. The slot 16, permits the necessary movement of the webs 15, over the stay bolt when the gun is elevated.

The gun carriage is composed of the trunnion supporting frames and the longitudinal and transverse beams 17.

18, is the circular track on which the carriage is rotative.

19, are the bearing rollers, and 20, the guiding rollers, the latter traveling on the interior surface of the track; the said rollers having suitable bearings in the castings 21, 22.

23, is a circular rack, and 24, a pinion thereof having journals 25, to its shaft connected with the carriage frame.

26, is a water or other motor for driving the pinion 24, whereby rotation is imparted to the carriage to train the gun, and 27, is a similar motor for driving the pinions 5, whereby elevation is imparted to the gun.

30, is a stationary section of the pipe conducting from the storage reservoir for compressed air, which reservoir, and the air compressing machinery are located in a protected part of the fortification. The vertical pipe 30, is central to the loading pit being sustained in such position by the brace 31.

32, are branch sections of the pipe 30, being rotative at a fixed angle to the vertical axis thereof.

The rotary joint 33, connecting the pipes 30, and 32, which is shown in section in Fig. 2<sup>a</sup>, is composed of an outer sleeve 33, and an inner sleeve 34, secured to the end of the pipe 30, the latter having a closed head, and having together with the sleeve 34, series of lateral ports that connect with the pipes 32, in their various positions, and the novel features of such rotary joint are claimed in a separate patent application filed simultaneously herewith.

The trunnions 35, have sockets 36, into which the trunnioned sections 37, of the air pipes are centered, the said sections 37, having their outer trunnion bearings in the annular termini 38, of the pipe sections 32, and extending rearward to the firing valve.

The annular portions 38, of the pipes 32, are sustained in the outside frames 39, of the gun carriage and the sections 37, have rotative joints in the said annular portions similar in construction to that of the joint 33, so that constant air tight connection is maintained.

40, is a turn-table, on bearing rollers 41, and having guiding rollers 42, which appear in Figs. 2, and 4. The circular tracks 43, and 44, are respectively provided for the said rollers, and a circular rack 45, and pinion 46, driven by the independent motor 47, are the means of independently rotating the table 40.

48, are subterranean tunnels conducting

from the magazine located at a distance and through them the projectiles 49, are transported on the trucks 50, running on tracks 51. The trucks 50, have carrying cylinders 52, for guarding the projectiles during transportation from the magazine to the loading pit, and which cylinders also serve as guides through which the projectiles are elevated into the lowered breech section of the gun barrel.

The cylinders 52, are trunnioned in the trucks 50, whereby they are dumped to a horizontal position when empty on return to the magazine to receive the projectiles that are inserted horizontally.

55, are frames built up on the turn-table at each side of the space 56, therein which allows of the lateral entrance of the projectile in a vertical position.

60, is the ram suspending frame adjustable radially to the turn-table upon ways 61, of the frames 55, and bearing the receiving ways or tracks 105 which receive the trucks of the projectiles from the tramways of the tunnels. The frames 60, are borne upon rollers 62, on the tracks 61. The frame 60, is also open at the side toward the tunnel, and has stops at 63, to limit the entrance of the projectile truck thereon; the truck remaining in a fixed position relative to the ram suspending frame when once introduced so as to center the projectile over the ram 79.

The distance of the depending breech from the center of the loading pit varies according to the elevation of the gun, due to the position of the pivot 7, being varied. It therefore becomes necessary to adjust the ram suspending frame as aforesaid in order to center the projectile and the ram with the lowered breech. To accomplish this with accuracy a hand wheel and screw 65, are employed, by which a yoke 66, straddling the pipe 30, and connecting with the ram frame 60, is reciprocated.

Suitable stop pawls such as 70, illustrated in Fig. 5, may be employed in the truck cylinder 52, and also in the end of the swinging breech 6, to bear at several points around the tail or butt of the projectile and retain it in its successive positions.

The ram 79, employed is composed of a number of telescoping sections to elevate the projectile to the required height, as illustrated in section in Fig. 5. The tunnels 48, may be united into a single double tracked tunnel if desired. The tunnel 71, is an accessory for independent communication to the loading pit.

In Figs. 5 and 6 the foregoing description similarly applies except as to the turn-table and its accessories. Herein the turn-table 75, is suspended by hangers 76, from the gun carriage and turns with it. The upright section 30, of the air pipe is stationary, and the outside sleeve 33, of the joint, to which the pipes 32, connect, turns with the gun carriage as before, but the vertical pipe is sustained in central position by the sleeve 33, having hang-



ers 77, from the gun carriage in lieu of the brace 31. The suspended table is steadied by wheels 78, on a surrounding track.

80, is a transferring frame corresponding to the frames 55, in Fig. 1, being open at the side toward the tunnel for the entrance of the projectile vehicle.

81, are concentric circular tracks upon which the transferring frame is movable circularly upon its rollers 82.

The projectile truck 50, is run from the tunnel track 51, upon the track 83, of the transferring frame over a movable section of track 84, when the transferring frame is brought opposite the tunnel upon its tracks 81, such movable section being designed to permit the clearance of the hangers 76, when the gun is rotated.

The stop 85, which limits the advancement of the projectile truck, is itself adjustable by means of a screw operating hand wheel 86, so as to bring the projectile at a point directly beneath the lowered breech of the gun barrel.

The ram 79, being always in the radial line beneath the gun barrel, is confined to a radial adjustment with reference to the turn-table 75. Such radial adjustment is effected independently by means of a screw 90, operated by miter gears 91, and a hand wheel 92, accessible from platform 93, where an operator stands. The ram is radially movable in sliding ways 94.

In Fig. 7, I have illustrated the feature of pivoting the swinging breech to the trunnions of the gun; that is to say, on an axial line therewith inside the frames 10, between the same and the portion 11, of the gun barrel opposite the trunnions. I thereby obviate the features of adjustment necessary to vary the radial distance of the projectile from the center of the loading pit in order to coincide with the vertical position of the swinging breech which in this instance is invariably the same when depressed.

In Fig. 8, the swinging breech is also pivoted to the trunnions, and the axis of the latter in this instance is located to intersect the axis upon which the training movement of the gun is made whereby the aperture of the lowered breech comes over a fixed point in all positions of the gun. The pipe 30, is offset toward one side of the loading pit, and the rotary pipe joint 100, corresponding to 33, is made annular and of sufficient size to permit the upward passage of the projectile through it. By this construction I dispense with the use of a rotary loading table and the features of circular, as well as radial adjustment of the projectile vehicle such as are essential to the forms of construction hereinbefore described.

The tunnel track 51, extends to a fixed terminus within the center of the loading pit, having a permanent stop 101, for the projectile truck 50.

In construction, the annular pipe joint 100, is substantially similar in reference to the

packing sleeve 34, and the ports, to that of the joint 33. The pipe 30, is however in this instance connected to the exterior sleeve, the latter being stationary, while the interior annular portion 102, is rotary being connected to the pipes 32, entering at each side at an angle into the upper surface of the annulus.

103, is an anti-friction ball bearing to sustain the necessary weight of the annulus; the balls being employed in series in a well known manner between the annular grooves indicated.

It is to be understood that the motors and rams herein illustrated, are to be provided with the usual necessary pipes and connections for conveying water or other fluid under pressure, and also the proper valves for controlling the admission of the motive fluid thereto.

In the operation of my invention, one of the passages 48, is employed for the entrance of the loaded projectile trucks while the other is employed for the return of the empty ones to the magazine. In the form of turn-table shown in Fig. 4, the table is rotated at each loading operation to move its receiving ways 83, from the receiving tunnel to the point of training to which the gun is directed. The projectile being delivered from the cylinder 52, the ram 79, is retracted while the table is rotated to bring said receiving ways opposite the delivery tunnel; the table being actuated to perform its various movements without altering the position of the gun. In the construction employed in Fig. 6, the position of the gun may also remain undisturbed during the introduction of the projectiles, provided that the position of the hangers 76, does not chance to interfere with the line of the track. Should the position of the hangers interfere however, it becomes necessary to rotate the gun carriage to and fro at each loading operation. Separate receiving and delivery tunnels may be employed in the instance of Fig. 6, similar to those illustrated in connection with Fig. 4.

The arrangement of the swinging breech section shown in Fig. 7, is applicable to either the independent turn-table or to the suspended table.

The method of operation of the devices in Fig. 8, effects a saving of time over that required in the operation of the foregoing devices, inasmuch as no adjustment or turn-table movements are required, nor is the gun required to be moved off its training point during the operation of loading; such advantages being offset however, by the minimum sized packing surfaces acquired in the rotary joint 33, employed in the said foregoing forms of construction.

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

1. The combination with a pneumatic cannon, and its carriage, of a swinging breech section of the gun barrel pivoted at its forward



end to the permanent part of the gun barrel and having its axis movable, independent of the gun barrel from an alignment therewith to an alignment with a projectile loading mechanism in which the projectile is out of alignment with the gun barrel.

2. The combination with a pneumatic cannon and its carriage, of a gun barrel, a separated butt thereof supported in permanent alignment upon frames having an interspace open at the side, and a movable breech section of the gun barrel pivoted between said frames supplemental to the space between the gun barrel and the butt thereof.

3. The combination in a pneumatic cannon, of a trunnioned gun barrel and a swinging breech section thereof pivoted on a common axis with the gun barrel trunnions, the said breech section being capable of alignment with a projectile loading mechanism in which the projectile is out of alignment with the gun barrel.

4. In a pneumatic cannon, the combination with a gun barrel, and trunnions thereof, of a pneumatic pipe or pipes connected to the breech of the gun and having trunnions independent of the gun barrel trunnions but in a common axial line therewith.

5. In a pneumatic cannon, the combination of a gun barrel, trunnions and trunnion supporting frames thereof, a pneumatic pipe or pipes connected to the breech of the gun and trunnions in axial line with the latter and trunnion supporting frames for said pipes independent of those of the gun barrel.

6. The combination in a pneumatic cannon of a swinging breech section of the gun barrel pivoted at its forward end to the permanent part or to the trunnions of the gun barrel to move in an arc as described, and a hydraulic motive cylinder and plunger pivotally connected to a rigid part of the gun barrel frame aside from the pivotal center of the breech section, and to a suitable portion of the moving extremity of the said breech section.

7. The combination in a pneumatic cannon, of a pivoted movable breech section, permanent sections of the gun barrel to which the movable breech section is intermediate, and oblique jointing surfaces between the permanent sections and the movable section adapted for the purpose described.

8. The combination of a trunnioned gun barrel, a movable breech section thereof, a rotary gun carriage, a turn table below the carriage, a projectile conveying truck adapted to said turn table and an elevating ram beneath the turn table and radially adjustable together with the projectile truck at different distances from the center of the turn table, substantially as described.

9. In loading mechanism for ordnance the combination of a trunnioned gun barrel, a swinging breech section thereof pivoted aside from the axis of the trunnions, a rotary gun carriage, a table below and suspended from

the gun carriage and having a circular track concentric with the axis of the said carriage, a projectile truck bearing frame movable upon said circular track, and having receiving ways for the truck radial to the table center; and an elevating ram radially adjustable in the table in a plane common to that of the gun barrel to correspond vertically with the vertical position of the swinging breech.

10. In loading mechanism, for ordnance the combination of a gun and its carriage, a rotary turn-table below the gun carriage, receiving ways radially adjustable thereon a projectile truck adapted to said ways, a stop to determine the position of the truck with relation to the receiving ways and an elevating ram suspended from the radially adjustable receiving ways at a position beneath the projectile carried by the truck.

11. In pneumatic ordnance the combination of a trunnioned gun barrel, a swinging breech section thereof pivoted on an axis common to the trunnions, a rotary gun carriage, the vertical axis whereof intersects the horizontal axis of the trunnions, pneumatic pipes connecting a stationary reservoir with the movable gun barrel having an annular rotary joint in the vertical axis of the gun carriage beneath and in line with the lowered position of the swinging breech for the purposes specified.

12. In loading mechanism for ordnance, the combination, with a gun barrel, of a projectile truck consisting of a carrying cylinder trunnioned at a point intermediate of its length to horizontal wheeled-bearing side frames, within which the cylinder is movable in the arc of a circle to bring said cylinder in alignment with the gun barrel or portion thereof, substantially as described.

13. In loading mechanism for ordnance, the combination with a gun barrel, of a rotary turn-table and a projectile truck adapted to be received by said turn-table and consisting of a carrying cylinder trunnioned at a point intermediate of its length to horizontal wheeled-bearing side frames within which the cylinder is movable in the arc of a circle to bring said cylinder in alignment with the gun barrel or portion thereof, substantially as described.

14. In loading mechanism for ordnance, the combination with a gun barrel, of a turn-table rotative independent of and below the gun barrel, and a loading truck adapted to said turn-table whereby the gun may be loaded in any position thereof, substantially as described.

15. The combination with a gun barrel, of a movable breech section and a catch therein for holding the projectile in position, substantially as described.

16. The combination with a gun barrel, a movable breech section, a catch therein for the projectile, a loading truck having a cylinder for sustaining the projectile in align-



ment with the breech section and having a catch for holding the projectile, substantially as described.

17. The combination with a gun barrel, of a movable breech section, and a cylinder for holding the projectile in position to be moved into the breech section and adapted to form a continuation of said movable breech section whereby the gun is loaded under cover, substantially as described.

18. The combination with a gun barrel, and its carriage having an opening below the gun breech, of a movable breech section to the gun adapted to move down into the opening in the carriage, substantially as described.

19. The combination with a gun barrel, its carriage, a centrally arranged pipe joint connected with a pressure supply and with the gun and provided with a central opening, of a movable breech section to the gun barrel adapted to move down in alignment with said central opening of the pipe joint, substantially as described.

20. In pneumatic ordnance, the combination with the trunnioned gun barrel, its carriage sustaining the trunnions of the barrel, and a pressure supply pipe leading to the breech of the gun and sustained by the gun carriage independent of that portion sustaining the trunnions of the gun, of a rotary pipe joint interposed in said pressure supply pipe, one part of which is movable with the gun

barrel and its carriage and the other part fixed with respect thereto, substantially as described.

21. In pneumatic ordnance, the combination with a trunnioned gun barrel, a carriage supporting the trunnions of the barrel, a pressure supply pipe or pipes connected with the gun barrel in axial alignment with said trunnions, and supports therefor from the carriage independent of the gun trunnion supports, substantially as described.

22. In pneumatic ordnance, the combination with a gun barrel and its carriage, of a centrally arranged pressure supply stand-pipe mounted independent of the carriage and fixed with respect thereto, of supply pipes leading from said central pipe to the opposite sides of the gun barrel and connected with its breech and movable with the gun and carriage, substantially as described.

23. The combination with a gun barrel, and its trunnion block having depending webs, of a gun carriage, the side frames of which support the trunnion block, and a tie bolt for said side frames passing through an opening in the depending webs, substantially as described.

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