(No Model.) 3 Sheets—Sheet 1.

F. NOUAILHAC-PIOCH.

APPARATUS FOR DISCHARGING OR THROWING EXCAVATED OR OTHER MATERIAL.

No. 426,848. Patented Apr. 29, 1890.

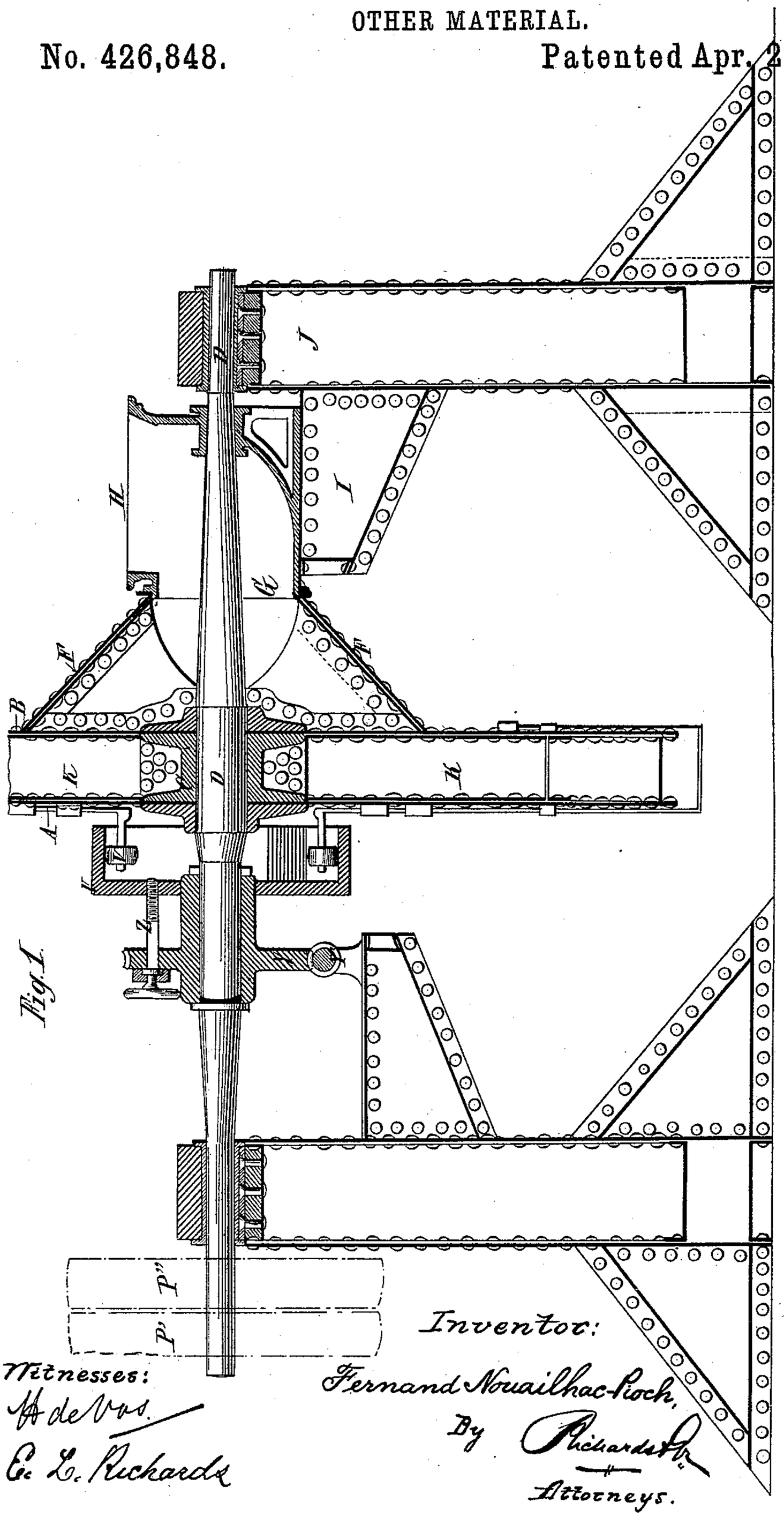

Fig. 1.

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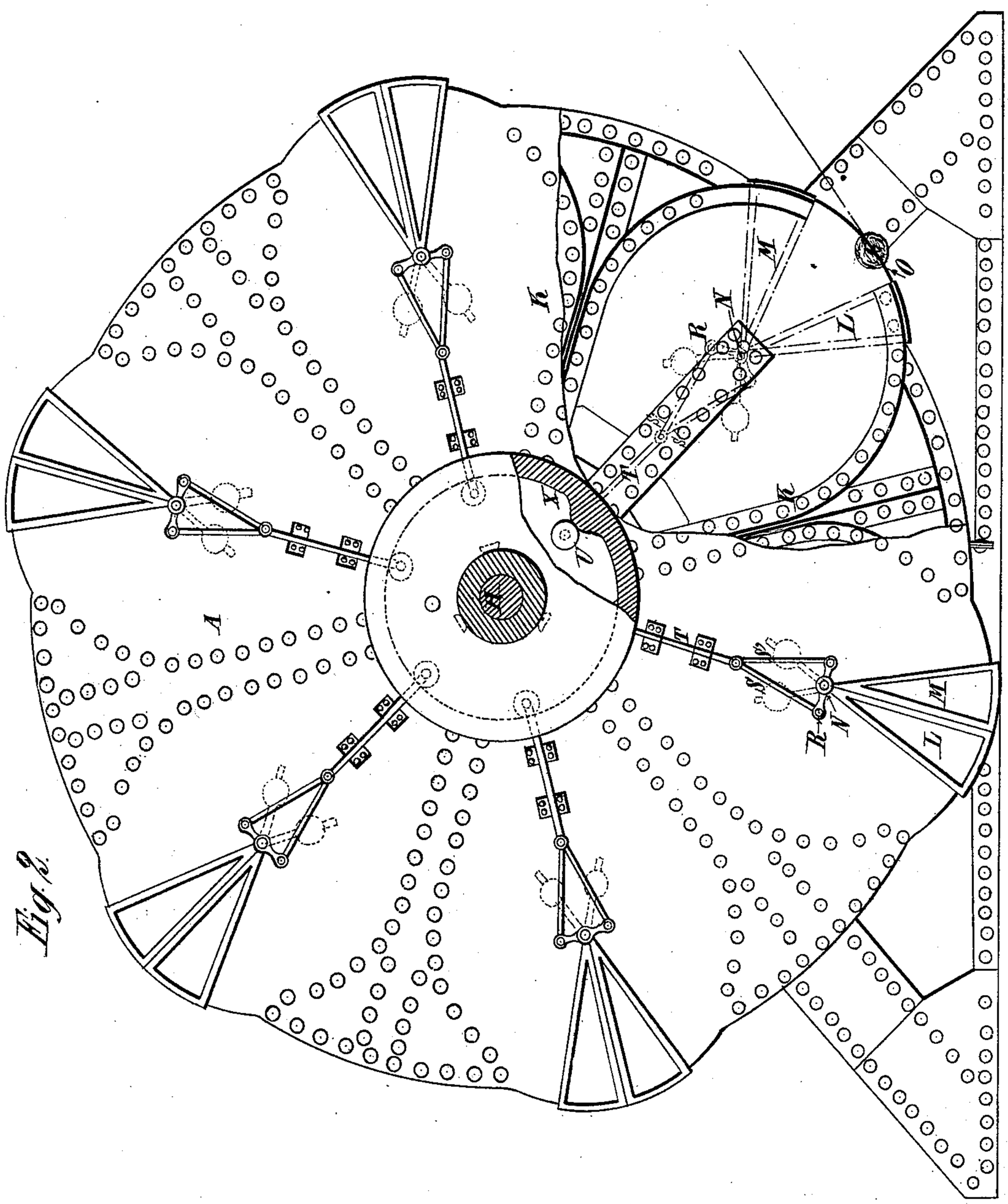

Fig. 2.

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(No Model.) 3 Sheets—Sheet 3.

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Fig 3

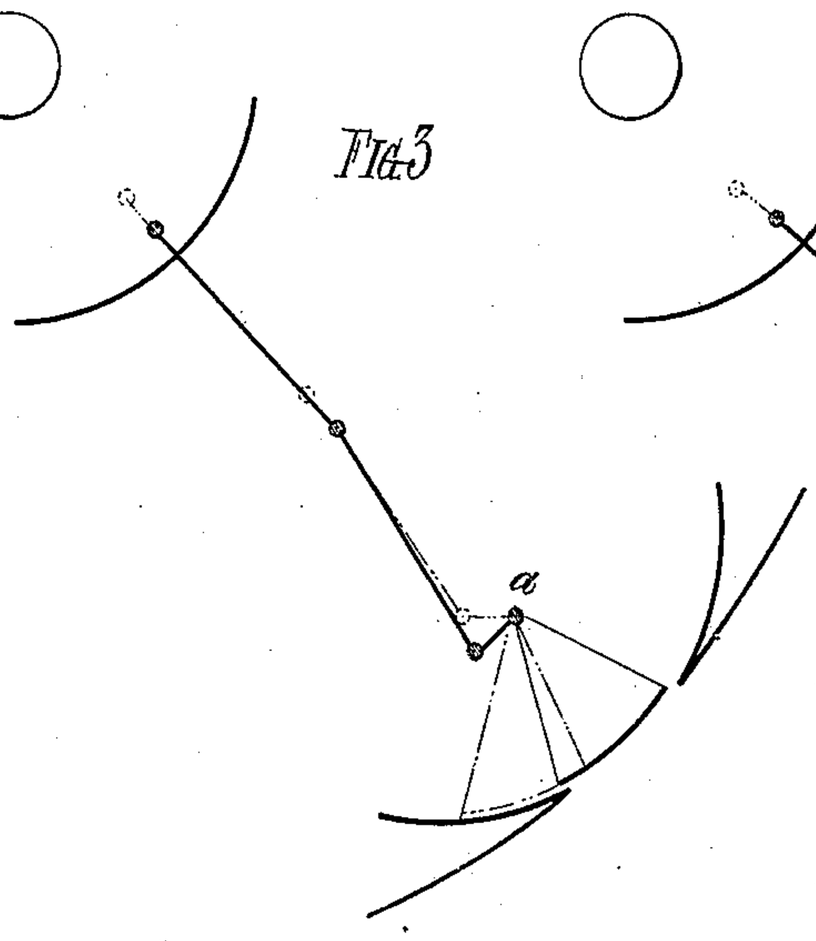


Fig. 4.

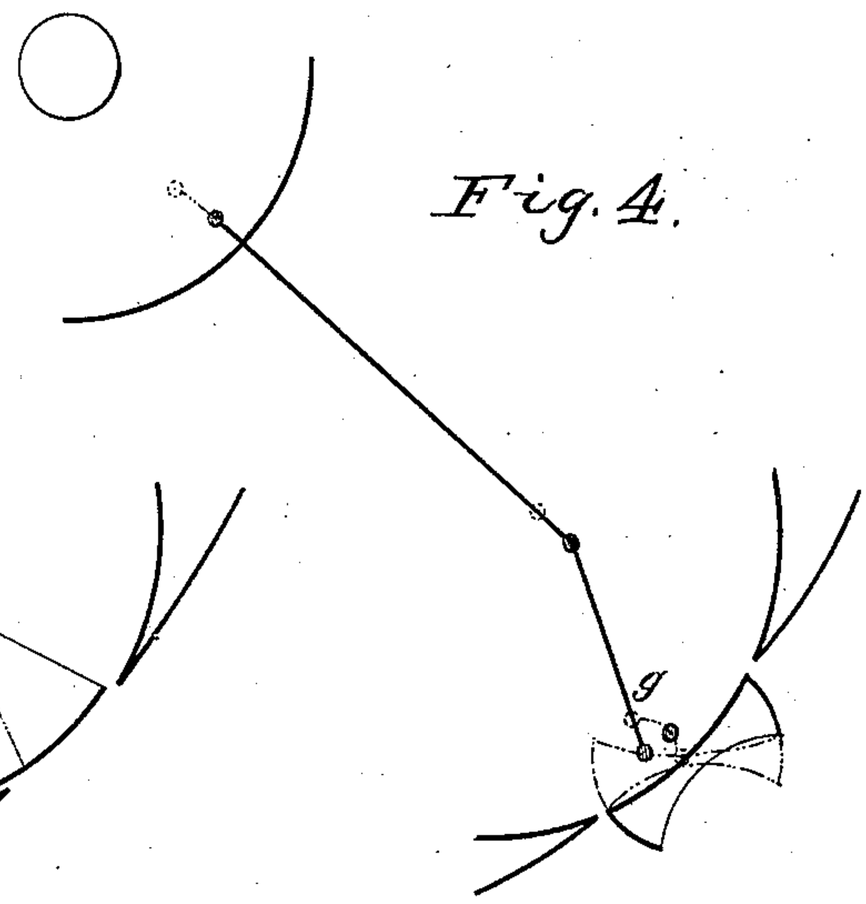


Fig 5

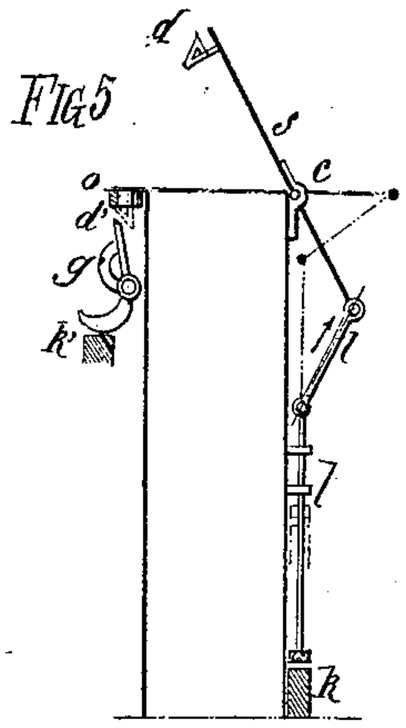


Fig 6

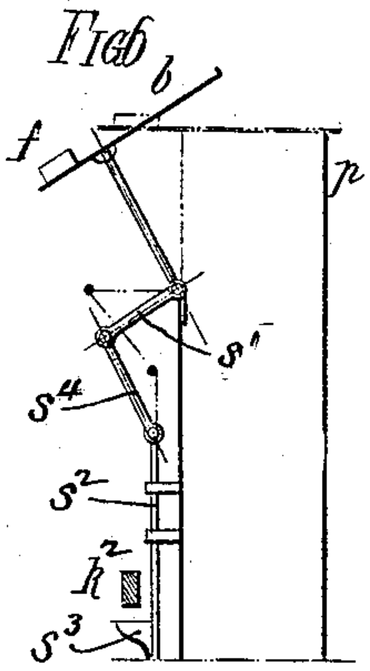
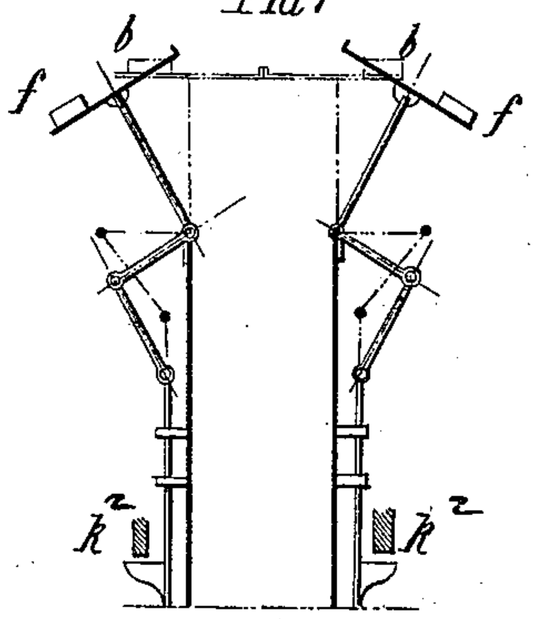


Fig 7



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UNITED STATES PATENT OFFICE.

FERNAND NOUAILHAC-PIOCH, OF PARIS, FRANCE.

APPARATUS FOR DISCHARGING OR THROWING EXCAVATED OR OTHER MATERIAL.

SPECIFICATION forming part of Letters Patent No. 426,848, dated April 29, 1890.

Application filed May 25, 1889. Serial No. 312,142. (No model.)

To all whom it may concern:

Be it known that I, FERNAND NOUAILHAC-PIOCH, a citizen of the French Republic, residing at Paris, in said Republic, have invented a new and useful Apparatus for Discharging or Throwing Excavated or other Material, of which the following is a full, clear, and exact specification.

The removal of excavated matter from the place of excavation to the place where it is deposited or formed in banks is for public works a question of very high if not paramount importance with regard to the rapidity and the cost of the execution of the work. Especially for the construction of the great canals of navigation, where considerable volumes of excavated matter are piled up by the sides of the passage which is to be dug, this question of the cheapness and quickness of the removal of the matter is of the very highest importance.

The widening of the canal of Suez and the completion of the canal of Panama under the best conditions of expedition and cheapness depend undoubtedly on the more or less perfected character of the means used for excavation and for the removal of excavated matter.

The object of my invention is an improved apparatus for removing excavated matter by the combined application of centrifugal force and ballistics.

In observing and analyzing the movement of the workman throwing away earth by means of his spade, it will be noticed that he imparts to this earth a rotary motion as quick as his forces will allow him to do on the axis going through the joints of his shoulders, and that at the moment that he considers the impulsion imparted sufficient to make his spadeful travel over the desired distance he retains his spade, and the excavated matter is lanced forward at a tangent to the surface of the spade, and impelled by the centrifugal force obtained by the impulsion of the muscles and the rotation on the joints of the shoulders. The earth thus thrown will take a parabolic trajectory, and the range depends essentially upon the force and the skill of the workman.

In likewise analyzing the movement of a child throwing a stone with a sling, it will be seen that he progressively imparts to the sling a rapid rotary motion around the forearm and the fist. Then at the moment that he considers the impulsion strong enough to drive the stone over the distance to the object (of which impulsion he is able to judge by the centrifugal tension of the two straps of the sling) he lets one of the straps go. The bag of the sling passes into a lateral position and the stone starts at a tangent to the circle of rotation and under an angle, the shape of which is determined by the natural skill and strength of the child. What is done by the workman and the child can also be done in an automatic way by a machine acted upon by a powerful motor—steam or other. For this purpose it is sufficient, first, to impart to a drum a more or less rapid rotary motion around a horizontal axis; second, to convey into this drum in a continual manner the excavated matter which is to be removed to the desired place; third, to arrange on the periphery of this drum a certain number of movable devices which in their general character act like spades, in which case their opening is effected by movements in the same or inverse direction in planes perpendicular on the axle of the rotation of the drum, or like slings, in which case their opening is effected by lateral movements perpendicular to the preceding; and, fourth, to effect in an automatic manner the opening of the spades or slings at the moment they successively reach a certain point for the release of the excavated matter, animated by the peripheric velocity of the drum under an angle determined by experience in order to have a suitable range.

The idea to use the spade or sling for lancing excavated earth or projectiles is as old as these instruments—that is to say, it dates from prehistoric centuries; but I do not believe that up to this time—at least not with regard to public works—the idea has been conceived to construct a machine performing in an automatic and continual manner a movement analogous to those of the digger or slinger, and to use this apparatus for the purpose of systematically removing matter from one place to another.

The apparatus consists, essentially, in a rotating drum divided by a certain number of

partitions into compartments, wherein the excavated matter is conveyed by means of a funnel. The periphery of the drum must be provided with openings allowing the matter to escape in the direction of the tangent under the action of the centrifugal force. Each compartment must be closed with an automatic closing device, which is opened at a suitable point by the medium of a lifter, the point where the opening is effected varying according to circumstances.

To be better understood, I shall separately describe the principal parts of this apparatus, reference being had to the annexed drawings, which make part of this specification, and wherein—

Figure 1 shows a longitudinal section of the apparatus. Fig. 2 is a side elevation with a detail of a spade-closing device. Figs. 3 and 4 are variations of spade-closing devices. Figs. 5, 6, and 7 are variations of sling-closing devices.

As the drum is bound to rotate at a great velocity, it must of course be constructed in a thoroughly solid manner. It is formed of two side pieces or walls A and B, of steel plate, mounted on a nave or boss C, fixed on the driving-axle D. These two side walls are connected by partitions, forming compartments. These partitions are arranged radially around the axle and are straight at their origin and then curved for the purpose of conveying the matter to the outlet. The walls of the drum might, if necessary, be braced against shocks, either by giving them a slight conical shape, or by connecting them through very solid cross-beams, or by strengthening them at the proper place. If a peripheric velocity of thirty meters can in general not well be surpassed for cast-iron fly-wheels, a velocity up to one hundred meters, and even more, may be safely attained by well-constructed steel wheels.

The excavated matter is conveyed in a continual manner into the drum. For this purpose a number of openings are arranged in the wall B, located in a concentric manner around the axle and corresponding in number with the compartments, the partitions of which terminate in the truncated cone F, in which all these openings branch out. This truncated cone is constructed integral with the drum, and is of course carried along in its rotary motion. On the other side an elbow-conduit G ends in said truncated cone, and carries on the opposite end a funnel H, wherein the matter is directly dumped by the dredging-machine, the excavator, &c. Though the driving-axle D is laid through the elbow-conduit G, the latter is stationary and is held by a support I, arranged on the central upright J of the frame carrying the arrangement. The introduction of the excavated matter can be done in different manners—for instance, by way of the center of the axle. In this case the axle must be made of hollow steel, and the central boring must of course have a diameter equal to the largest piece which is projected by the apparatus. It might also be let in at the periphery of the drum; but this method would involve too sudden changes of velocity. At present I prefer the method heretofore described, wherein the matter gradually assumes an increasing velocity as a consequence of the partitions in the truncated cone and the drum. In the drum are arranged, as before described, a number of partitions K, and on its periphery a corresponding number of orifices O are to be found. Each of these openings must be provided with a valve or closing device, which is opened in an automatical way at a certain moment in order to allow the matter to escape. A number of arrangements may be made to attain this result, and which bear the character either of a spade or a sling.

The system represented in Fig. 2 is an automatic spade-closing device. The proper spade is formed of two similar parts L M, pivoted together at N, so that if shut together these two parts completely close the opening O, and in their most open position they leave said opening entirely free, thereby allowing the matter contained in the compartment to escape. The closing of the spade is assured by the centrifugal working, which has the tendency to continually keep together the two parts. The valves may therefore be termed "centrifugally-controlled," inasmuch as centrifugal force tends constantly to operate them in a certain direction.

The following arrangement is made for the purpose of opening the device: Every sector L M is provided with a lateral arm R, which connects again, by means of the rods S S′, with a traction-bar T, carrying on its other side a roller U. This roller runs against the inside of a disk V, mounted on the axle D in such a manner that it is not carried along in its rotary motion. The inside surface of this disk is provided with a projection X, which works like a lifter by displacing the rollers U. When the roller is lifted, the traction-bar T and the rods S S′ are carried along, and in this manner the device is opened. At each revolution of the drum the roller U, passing over the projection or lifter X, will cause the device to be opened, which will be closed as soon as the roller has passed said lifter by the working of the centrifugal force. This will of course be repeated for each apartment of the drum, which is provided with a similar closing device.

Other spade devices might be used. For instance, a device consisting of a single part located either on the outside or the inside of the drum may be used. (See Fig. 3.) In this case the spade makes an oscillating movement around the stationary point *a*. Fig. 4 shows a modification in which the closing device

swings on the point *g*, located very near to it. With these devices the disk V must be arranged so that its position can be changed.

A screw toothed wheel Y, gearing with a worm Y′, allows of a circular adjustment. An adjusting-screw Z assures the longitudinal adjustment necessary for throwing the apparatus in or out of gear. The lifter X can consequently be placed at any suitable place in accordance with the desired direction of the projection of the matter. Sling-closing devices might also be adopted.

The arrangement shown in Fig. 5 opens by a hinge *e* on one end, while the other end is held by a spring-catch *d* similar to those used in locks. A pressure by an exterior arrangement on the staple will open the device. Other variations of this system are shown in Figs. 6 and 7.

As heretofore said, the adjusting-screw Z enables me to move the disk V in a longitudinal direction. This movement enables me to discontinue or start anew at pleasure the projection of the excavated matter during the rotation of the drum. Every other equivalent arrangement—for instance, levers or ratchet-wheels—might be used to attain this purpose. Consequently the engineer can entirely control the projecting of the matter at any suitable distance. It is even possible to increase or diminish the discharge of the apparatus by constructing the lifter in such a manner that the degree of opening will depend upon the place where the roller runs over the lifter. This result is easily obtained by giving it a sloping end. If all parts of the wheel and the lifter are symmetric, then the movement is reversible, and the matter may be thrown out on either side by simply reversing the machine. The motion can be transmitted by any suitable motor and in any suitable manner. The principal axle D is provided to this end with two pulleys P′ P″, one fixed and one loose, arranged on any suitable part of the axle. It may also be acted upon directly by a machine of very quick rotation.

Figs. 5, 6, and 7 relate to arrangements which may be used with covers rotating on an axle parallel to the projecting plane, as is the case with the sling. In Fig. 5 is shown a lid S, rotating on an axle C as a hinge, the centrifugal force tending to open the lid. The lid is kept closed by a cam K, which will bring the lid to its closed position by means of the link *l* and sliding rod *l′*, and thus force the sliding spring-catch *d* into the eye *o*. At the desired point or time of opening a tumbler *g* is pushed upward by the cam K′, presses on the spring of the catch *d*, and permits the lid to be quickly opened by the centrifugal force. In Fig. 6 the lid presents the special feature that the weight *f*, placed outside the line of hinging of the lid, carries the center of gravity of the lid beyond this line and has the tendency to cause the centrifugal force to keep the end *b* of the lid constantly against the side wall *p* of the apparatus. The closing being thus insured by the centrifugal force, an instantaneous opening can be obtained by an arm *s′*, link s^4, sliding rod s^2, and a cam K^2, tending to periodically engage a projection s^3 on said rod and draw the latter radially inward. Fig. 7 shows two mechanisms similar to the one of Fig. 6, symmetrically placed on each side of the plane of projection or discharge. It is only required to connect the stationary devices effecting the opening on each side and have the two cams K^2 K^2 operate together in order to obtain the simultaneous opening of the two symmetrical parts.

The applications of this apparatus are numerous. In the construction of canals, railroads, highways, &c., it may be used for the quick removal of the excavated matter. It may also be used in the construction of railroads for making the embankment. In the maintenance of canals for navigation, drainage, or irrigation it may be used to spread over the adjacent fields excavated earth charged with azotic matter, which is highly valuable for agriculture. In the maintenance of railroads it may be used to make free a road blocked up by snow. In the art of war it can be a useful help for the engineers and the artillery to throw up parapets at a distance or to fill up the ditches of fortifications. It might also be used as a war-machine, if it is made to lance pebble or rubble stones, bullets, grenades, or other projectiles of small dimensions not requiring a great precision nor a too great range.

Having thus described my invention, what I claim is—

1. In a centrifugal machine for discharging excavated material and other purposes, the combination, with a suitable hopper or feed device, of a rotary drum inclosed around its periphery and adapted to receive material therefrom, valves or gates carried by said drum, and means for opening said valves at a predetermined point or points, substantially as set forth.

2. In a centrifugal machine for discharging excavated material and other purposes, the combination, with a suitable hopper or feed device, of a rotary drum adapted to receive material therefrom, and hinged valves or gates carried by said drum and automatically operated, substantially as set forth.

3. In a centrifugal machine for discharging excavated material and other purposes, the combination, with a suitable hopper or feed device, of a rotary drum adapted to receive material therefrom, hinged and centrifugally-controlled valves or gates carried by said drum, an adjustable projection for opening said valves at a predetermined point or points, and means for adjusting the angular position of said projection relative to the cen-

ter and horizontal diameter of the drum, substantially as set forth.

4. In a centrifugal discharging-machine, the combination of a rotary drum inclosed around its periphery and adapted to receive and carry earthy material, a valve in the peripheral wall of the drum, and means for opening said valve at a predetermined point or points, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

FERNAND NOUAILHAC-PIOCH.

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T. GUY SONGSTER.