

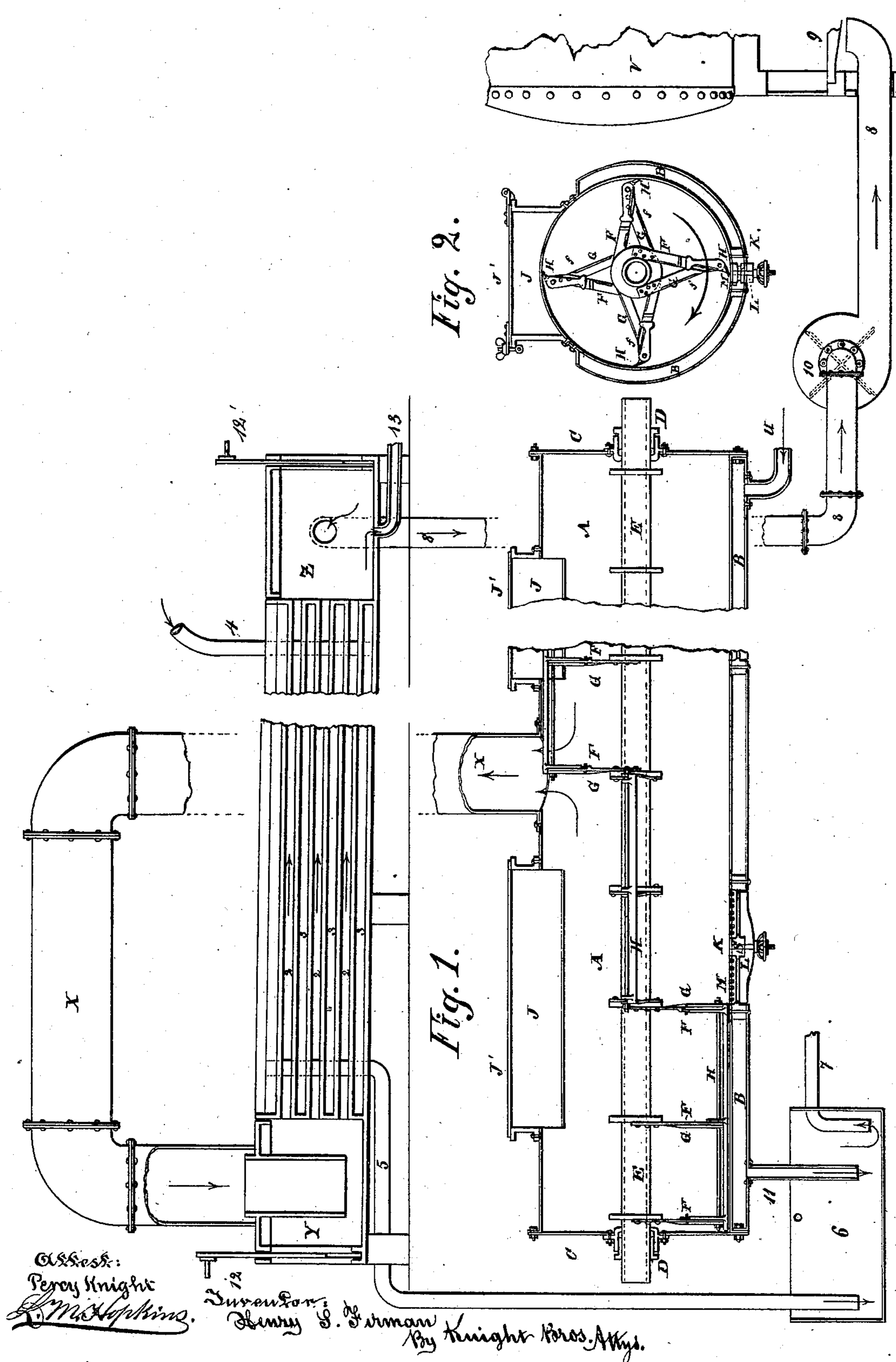
(No Model.)

2 Sheets—Sheet 1.

H. S. FIRMAN.

APPARATUS FOR REDUCING MATERIAL TO A PULVERULENT FERTILIZER.  
No. 255,269. Patented Mar. 21, 1882.

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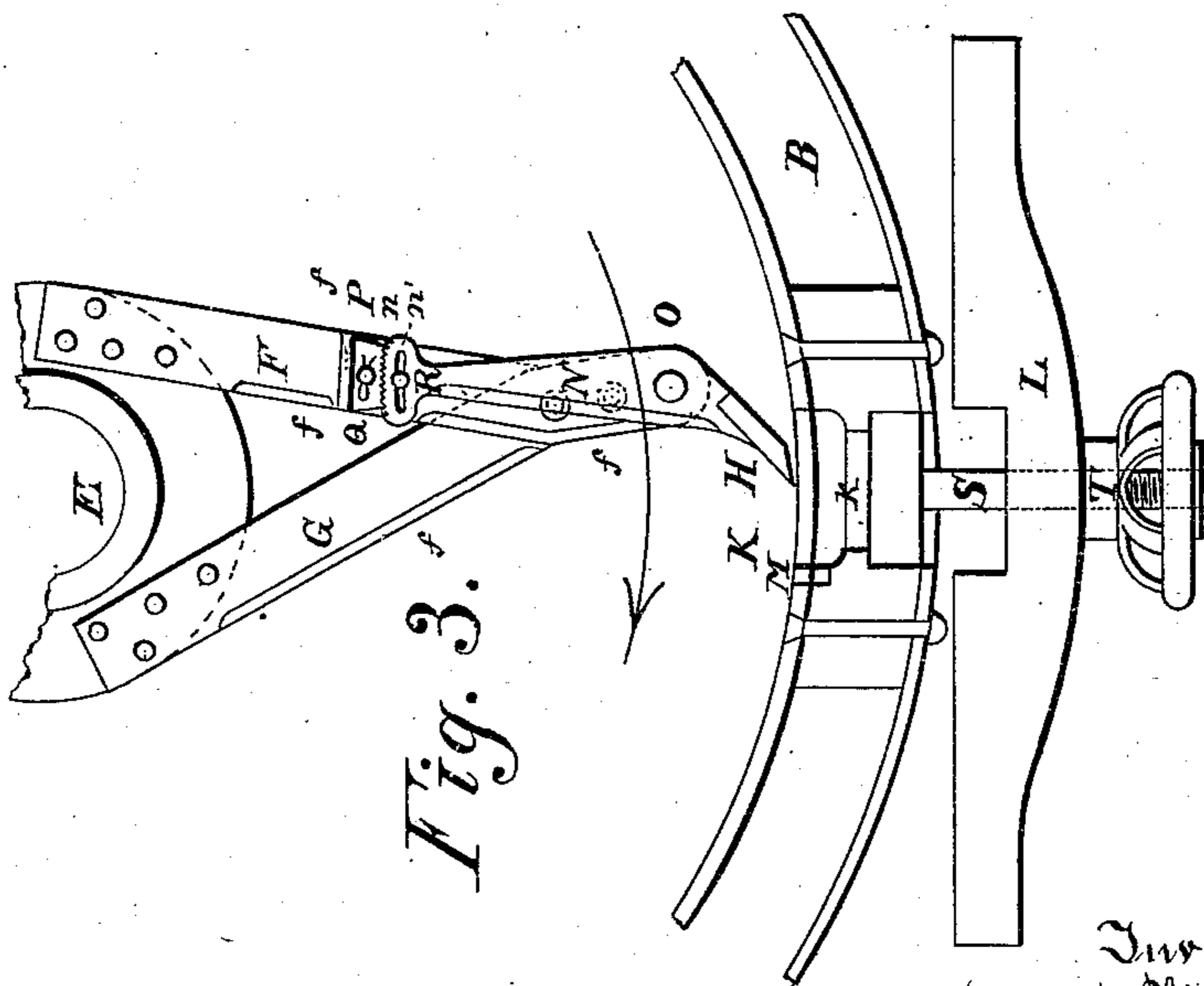
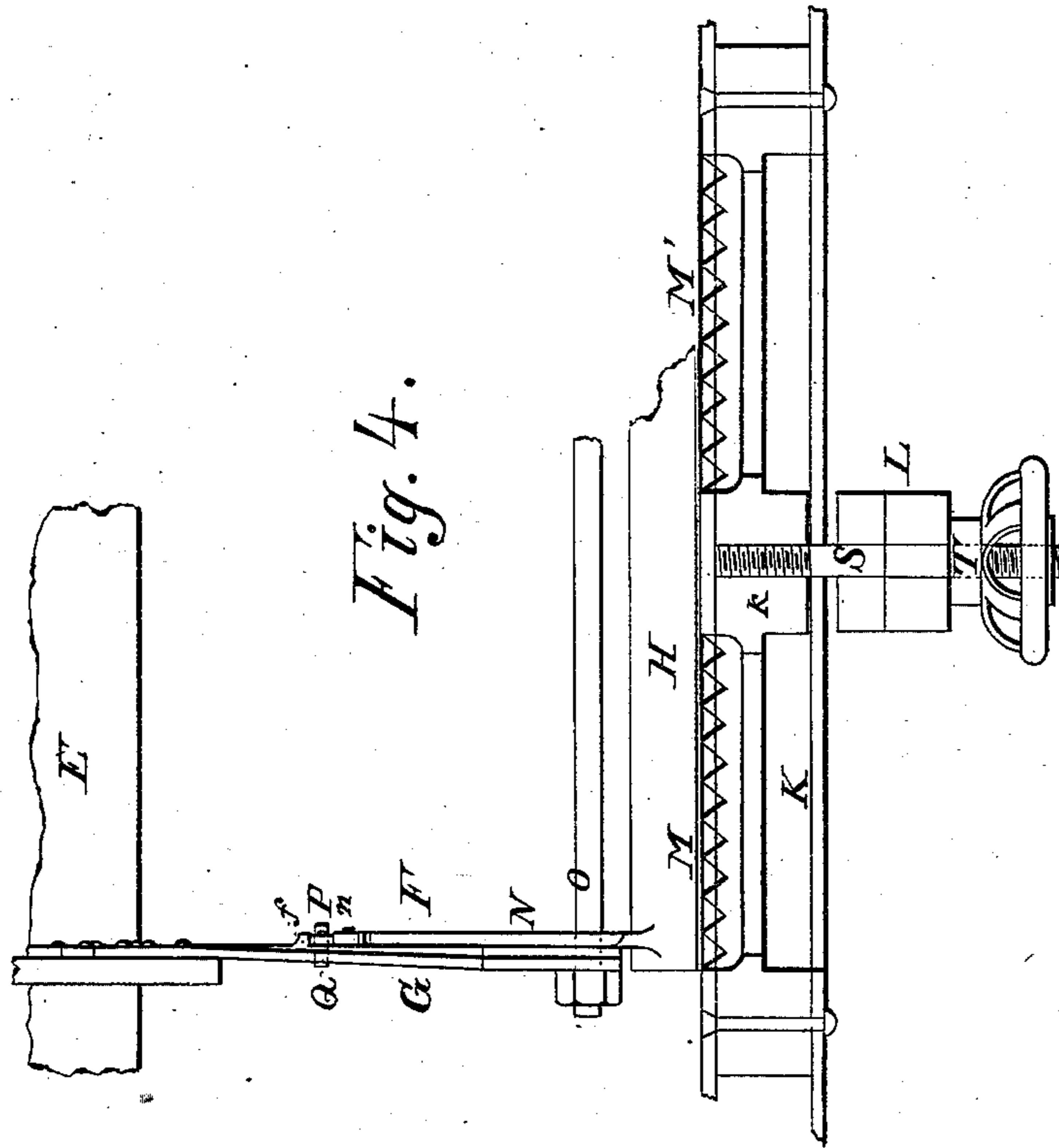
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Attest:  
Percy Knight  
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# UNITED STATES PATENT OFFICE.

HENRY S. FIRMAN, OF NEW YORK, N. Y.

APPARATUS FOR REDUCING MATERIAL TO A PULVERULENT FERTILIZER.

SPECIFICATION forming part of Letters Patent No. 255,269, dated March 21, 1882.

Application filed November 8, 1881. (No model.)

*To all whom it may concern:*

Be it known that I, HENRY S. FIRMAN, of New York, in the county and State of New York, have invented a new and useful Apparatus for Reducing Material to a Pulverulent Fertilizer, of which the following is a specification.

My invention is designed especially for the inodorous and simultaneous drying and grinding of divers kinds of organic refuse, such as soft bones, "tank-stuff," animal-tissues, excrementitious matters, blood, meat, the residue from dead carcasses, hair, &c.

Among important objects attained by my invention over other methods heretofore employed are great simplification and cheapness of the apparatus; a very material reduction both in the time and in the cost of treating and preparing for market, amounting, it is believed, to at least fifty per cent.; an important increase in the commercial value of the product; the completion of the process at a single continuous operation, thus obviating the necessity of subsequent sifting or grinding or of rehandling of the product—a matter of great importance both in a sanitary and commercial point of view.

The useful novelties comprise a new and useful construction and arrangement of disintegrating and comminuting or grinding devices; in mechanical association with a system of rotating disintegrating-blades, a special form of discharging-orifices to prevent "balling" of the material; a condensing arrangement for creating a partial vacuum in the grinding-cylinder, in connection with a utilization of the heat absorbed from the condenser to warm the boiler feed-water, and with suppression of the noxious emanations; certain details of construction, which, in connection with the foregoing, will be fully hereinafter described.

In the accompanying drawings, Figure 1 is an axial section of an apparatus embodying my invention. Fig. 2 is a transverse section of the cylinder, the discharge-apertures being shown closed. Figs. 3 and 4 represent to a larger scale portions of the disintegrating mechanism with the discharge-apertures open, Fig. 3 being a section in the plane of revolution, and Fig. 4 a section in the plane of the grinding-shaft.

The apparatus consists essentially of a horizontal cylinder, A, that may be wholly, but is preferably only partially, steam-jacketed, B. This cylinder may be of any suitable material, but is preferably of steel or mild steel, the outer concentric sheet inclosing the steam-jacket B being preferably of iron. By the use of steel or semi-steel for the cylinder proper I secure a much better radiating-surface for the heat with increased strength of material, and (what is also very important) the material under treatment is much less apt to adhere to the walls of a steel cylinder than it is to those of an iron one. The jacket preferably incloses the cylinder proper for three-fourths of its circuit, leaving the top unjacketed, as shown in Fig. 2. The heads C of the cylinder have suitable stuffing-boxes, D, for a shaft, E, which may be solid, but is preferably hollow for the reception of heated air or other heating agent to assist, when necessary, in warming the interior of the cylinder. To this shaft are attached arms F, composed of steel or mild steel, braced by stays G, as shown in Figs. 2 and 3, said arms being thin and being sharp at their advancing edges *f*, and being armed with steel knives or blades H, also thin and sharp at their advancing edges, operate to cut through and disintegrate the mass, instead of lifting it bodily. The shaft E is preferably revolved by a belted pulley at some part of its driving-gear, in order that the driving mechanism shall be capable of giving way before breakage of the machinery in the event of the accidental entrance of such refractory bodies as rocks, raw bones, fragments of iron, or broken bottles.

J represents filling-holes, closed by man-heads or covers J'.

I arrange in the bottom or under side of the cylinder one or more long and narrow discharging-holes, K K', with abruptly-angular edges. The longitudinal direction of these holes is parallel with that of the cylinder, and that one of the longitudinal edges which is opposed to the action of the knives is preferably notched, toothed, or serrated, as at M or M'. The closing-plates L fit within these holes, and their top surfaces, when the said plates are in place, are preferably about two inches lower than the cylinder-floor, so as to form thereby a sink or depression, whose effect is to catch and retain

agglomerated masses, lumps, or balls of the material, which the knives are thus enabled to cut through and break apart so as to prevent balling and to produce the finely-granulated condition desired. This effective comminution, operating simultaneously and coactively with the desiccating agencies, results in quickly and without detriment to the useful properties of the ingredients reducing the material to the proper pulverulent or granular form.

The cavities formed by the discharge-holes and the closing-plates serve as gathering or lodging places for such small and hard objects as gravel-stones, nails, and the like, which are thus detained until the process is finished, doing no harm, and are discharged in the act of emptying the machine.

The described form of discharging-hole, in conjunction with the revolving system of agitating-blades, enables the machine to be emptied in two minutes' time—an important consideration both sanitarily and economically.

Practice demonstrates the importance of ability to bring the edges of the comminuting-knives as nearly as possible in contact with the interior surfaces of the cylinder without touching the same. For this purpose spring-scrapers have been essayed to be used; but experience has shown their practical worthlessness. Indeed, in the treatment of certain kinds of material they have proved actually detrimental, because the spring causes the scraper to touch the cylinder side and to press upon it with more or less force, which increases the resistance proportionally, and consequently subjects the machinery to a serious amount of additional strain, and adds to the expense for more power to drive the mill. Furthermore, the spring-scraper does not always prevent material adhering to the sides of the cylinder, where it is apt to bake and harden so quickly that no spring that is practically available can enable the knife to scrape off the incrustated matter, and consequently the scraper yields and passes over it, so as to rapidly accumulate a hard-packed and tenacious enamel, where, from constant exposure to the heated plate, it scorches, and in so doing loses its most valuable properties, at the same time giving out a penetrating empyreumatic odor. This evil is substantially avoided in the action of my device, because the knives, being absolutely unyielding, prevent any serious accumulation of material on the cylinder-walls.

In order that the presentation of the knives may be capable of adjustment for any desired angle and proximity to the cylinder, according to the nature of the material to be operated upon and the purpose for which it is intended, and to enable the knives to be set up from time to time or removed for sharpening or substitution, I attach them to their arms in the manner following: Each knife H consists preferably of a wide chisel-formed blade, riveted or bolted fast to helves N N', of which each is pivot-bolted to its arms F. Each helve ter-

minates in a serrated segmental edge, n, concentric with the pivot O, to which fits a removable similarly-serrated key, P, which, after the knife has been brought to its desired adjustment, is secured in place by a locked bolt, Q, and by the confining-lug f' upon the arm F.

For additional security the helve may have a slot, n', also concentric with pivot O, for a bolt, R, by which the helve is clamped fast to the arm.

To facilitate discharge the closing plate L of each vantage is swung upon a central bolt, S, which, depending from a bridge, k, at the mid-length of the aperture, passes through the center of the plate, below which it carries a nut, T, by which the plate is held to its closed position, and which, being turned down, permits the plate to descend and be swung to a position parallel to and immediately underneath the bridge k, as shown in Figs. 3 and 4, so as to be entirely clear of the escaping contents.

U represents a pipe by which steam is conveyed to jacket B from a boiler, V.

X is a pipe through which the vapor evolved in the cylinder is conducted to a condenser of any suitable form. The form of condenser preferred by me consists of a receiving-chamber, Y, that connects with a discharging-chamber, Z, through a congeries of tubes, 2, surrounded by cold water contained in a tank, 3, which is supplied by a cold-water pipe, 4, and overflows through a pipe, 5, into a hot-water tank, 6, from which a pipe, 7, passes to the boiler-feed pump. The cylinder vapor-pipe X connects with the receiving-chamber Y. From the discharging-chamber Z a second vapor-pipe, 8, leads to the boiler-furnace 9, where the residue of uncondensed mephitic emanations from cylinder are consumed and rendered innocuous.

In order to expedite to any desired extent the discharge of noxious effluvia and at the same time consume the same, and by the same means aid the combustion in the boiler-furnace or a special furnace, I provide in a convenient part of the pipe 8 a blower, 10. The rarefaction or partial vacuum produced thereby in the comminuting-cylinder enables the desired evaporation to take place with a moderate degree of heat, and consequently with a complete saving of the valuable ammoniacal bases.

A pipe, 11, conducts the water of condensation of the steam-jacket B into the hot-water tank 6.

12 12' represent removable sliding ends or shutters located at the extremities of the condenser, whose elevation or removal enables the interior portions of the condenser—such as the tubes 2 and the chambers Y Z—to be inspected and cleansed at any moment with facility and dispatch. The water of condensation of the chamber Z escapes through a suitable drain-pipe, 13.

The above-described preferred form of my

improvement may be varied in non-essential particulars—for example, a grating flush with the floor of the cylinder may in some cases be substituted for the described open mouths of the discharge-apertures.

I claim as new and of my invention—

1. In a desiccator and mill for the purpose designated, the combination, with cylinder A, of disintegrating-arms F and knives H, both formed of thin plates of steel or mild steel set edgewise in direction of rotation and made sharp on their advancing edges, as shown and described.

2. In a desiccator and mill for the purpose designated, the long narrow angular discharging-holes K, with sink or depression formed by the walls of said hole and by the closing-plate L, and whose salient angle opposed to the advancing knife-edge is either sharply angular or toothed or serrated, as and for the purposes shown and set forth.

3. In a mill and drier for the purpose stated, the combination, with the cylinder A, of the revolving disintegrating-arms F and the knives H, pivoted thereto and adjustable thereon, as herein shown and described.

4. The provision at the discharge-opening K of a desiccator and mill for the purpose described, and in combination with the bridge k and the bolt S at the mid-length of said opening, and with the nut T, of the depressible and swinging closing-plate L, substantially as set forth.

5. In a mill and desiccator for the purpose set forth, the combination, with the disinte-

grating-arms F, with their attached knives H, of the specially shaped and arranged discharge-apertures K, having the serrated salient edges M or M' in opposition to the knife action, to secure grinding or granulating without balling, as set forth.

6. In a desiccator and mill for the purpose designated, the combination of the disintegrating-cylinder A and the condenser Y Z 2, connected therewith by vapor pipe or trunk X, all as herein shown and described.

7. In combination with a mill and desiccator for the purpose described, the condenser consisting of the cold-water tank 3, receiving and discharging chambers Y Z, tubes 2, and the sliding and removable ends or shutters 12 12', substantially as set forth.

8. The combined mechanical organism consisting of a hermetical cylinder, within which the material is comminuted under a moderate heat, a condenser with exhaust attachment for withdrawing fetid vapors from the comminutor and expediting desiccation of its contents, a boiler-furnace which receives the thus exhausted vapor, and water-supply pipes whereby the water, after performing refrigerating service in the condenser, is conveyed as heated water to the boiler-feed tank, substantially as and for the purpose set forth.

In testimony of which invention I hereunto set my hand.

HENRY S. FIRMAN.

Attest:

GEO. H. KNIGHT,  
F. R. McCORMICK.