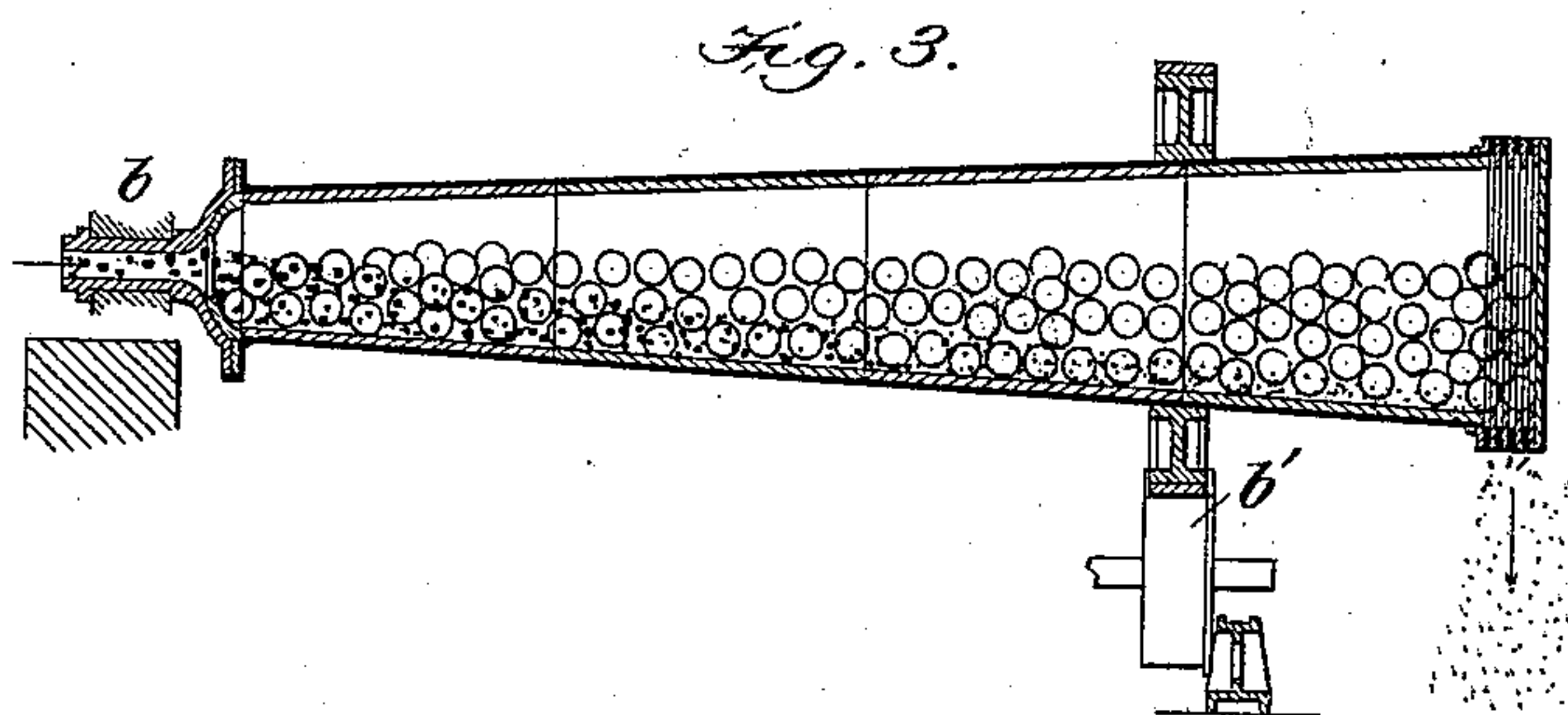
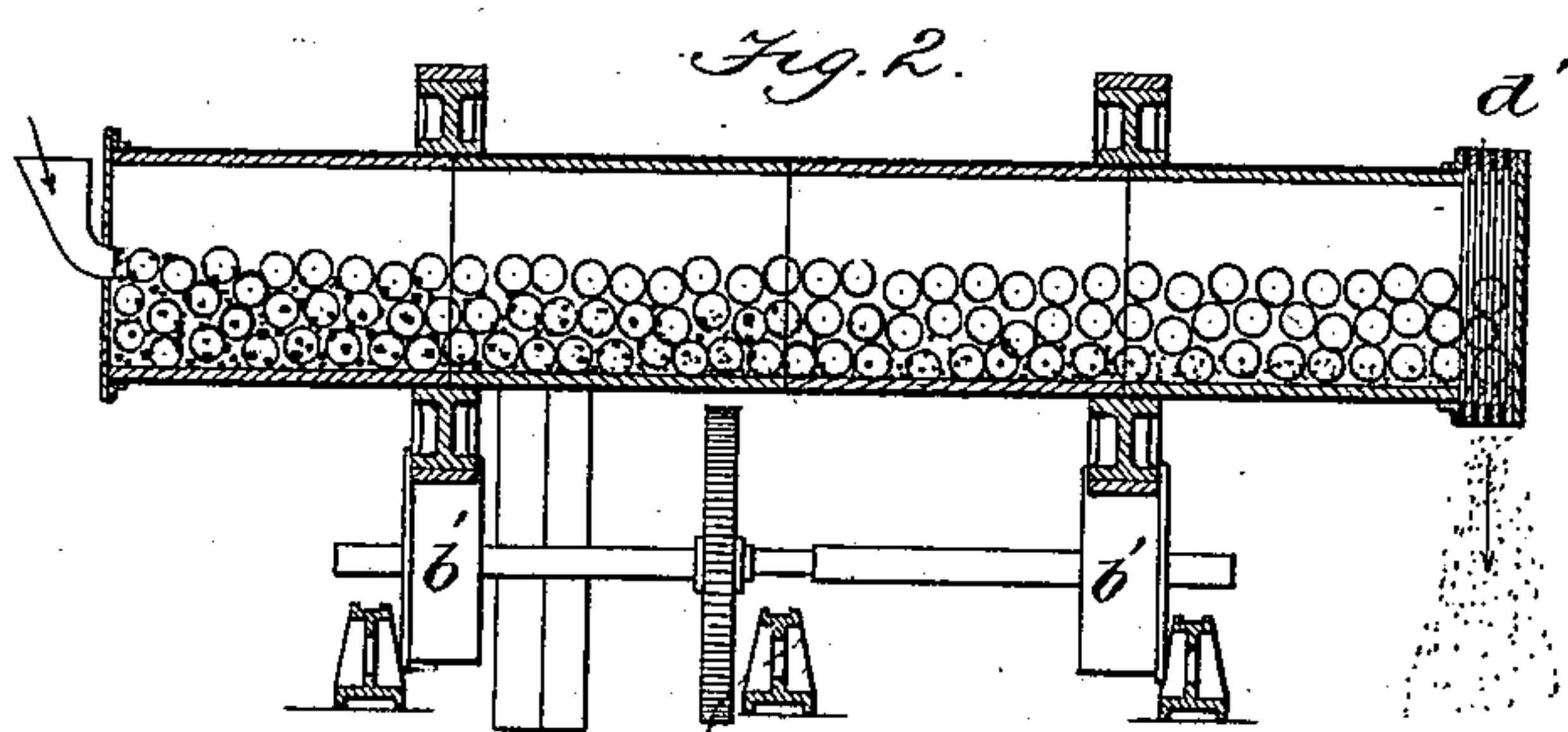
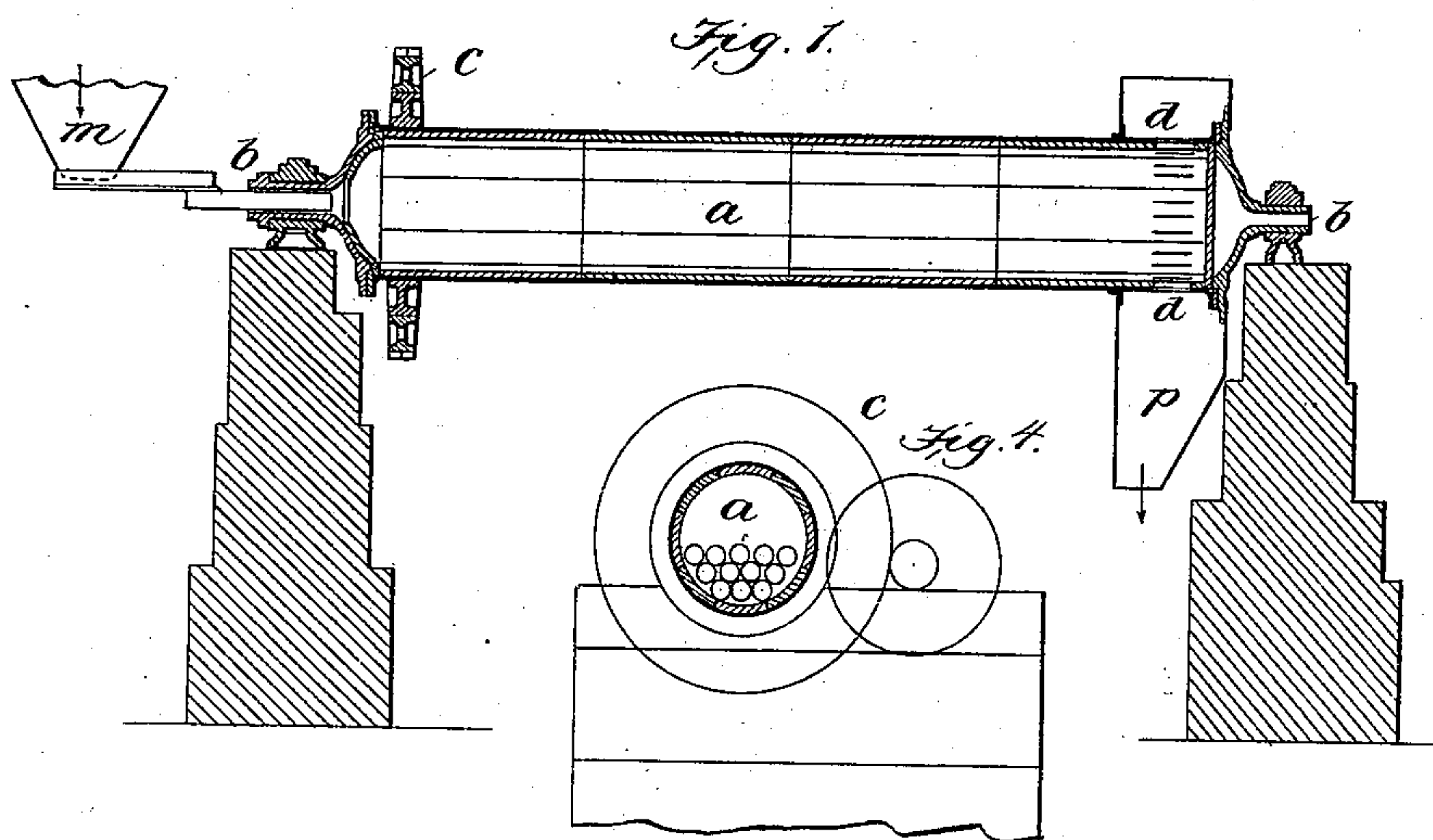


(No Model.)

J. DAVIDSEN.
TUBULAR BALL MILL FOR PULVERIZATION OF VARIOUS MATERIALS.
No. 548,115. Patented Oct. 15, 1895.



witnesses:

J. M. Fowler Jr.
S. M. Dorsett,

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UNITED STATES PATENT OFFICE.

JOSEPH DAVIDSEN, OF PARIS, FRANCE.

TUBULAR BALL-MILL FOR PULVERIZATION OF VARIOUS MATERIALS.

SPECIFICATION forming part of Letters Patent No. 548,115, dated October 15, 1895.

Application filed December 5, 1893. Serial No. 492,876. (No model.) Patented in France June 15, 1891, No. 214,148, and in Germany June 30, 1891, No. 62,871.

To all whom it may concern:

Be it known that I, JOSEPH DAVIDSEN, a citizen of Denmark, and a resident of Paris, France, have invented certain new and useful Improvements in Tubular Ball-Mills for Pulverization of Various Materials, (for which I have obtained Letters Patent in France, No. 214,148, dated June 15, 1891, and in Germany, No. 62,871, dated June 30, 1891,) of which the following is a specification.

The object of the invention is to secure a thorough comminution of the matter to be ground in a simple and economical manner.

The invention consists principally in the combination of a rotary drum having a horizontal or approximately horizontal axis and provided with a central inlet at one end and a peripheral outlet at or near the opposite end and a body of grinding-balls disposed in said drum and overlying one another in mass therein, the weight of the mass of balls upon the passing stream of material increasing from the inlet to the outlet of the drum. The material to be ground, entering the drum at the center of one end thereof, forms a bed or mass of material at said end of a depth equal to that portion of the radius of the cylinder which extends from the periphery thereof to the outer diameter of the inlet, and this depth of material gradually decreases from the inlet at one end to the outlet at the other, forming a thin layer or stream at the outlet end. Thus the weight and depth of the balls over the thin stream of material at the discharge end of the drum are much greater than at the inlet end, and this depth and weight increases from the inlet to the discharge end as the stream of material diminishes, so that the grinding action of the mill is greatly increased as the grinding proceeds and the material becomes thoroughly comminuted before it leaves the drum. This result is due to the mass of balls in a drum having an elevated inlet and a peripheral outlet.

In the accompanying drawings, Figures 1, 2, and 3 are vertical longitudinal sectional views of my improved ball-mill, showing various modes of construction. Fig. 4 is a vertical transverse sectional view of the construction shown in Fig. 1 and also showing the driving-gear.

Similar letters and figures of reference indicate corresponding parts.

Fig. 1 shows the simplest form of my improved pulverizing apparatus. It consists of a drum *a*, provided with pivots *b* at both ends. One of these pivots is hollow, and through the same the feed or supply is effected. At the other end the drum has a number of discharge-openings in the periphery smaller than the balls *s* used for grinding. Through these openings *d* the finished powder leaves the drum. The drum is always kept half-full, more or less, of balls disposed in mass in the drum in contact with one another, except as they are separated by the material being ground, and the drum is rotated by a driving-gear with cog-wheels *c*. (Shown in Fig. 4.) *m* is the supply-chute, and *p* the discharge-chute.

Fig. 2 shows another way of mounting the drum. Instead of pivots roller-bearings *b'* are here used to support the rotating drum. In this case the driving can be effected direct through the roller-bearings and the discharge can take place through an annular grate *d'* at the discharge end of the drum, as shown.

In Fig. 3 the drum is shown conical. The material is introduced at the smaller end and moves at an increasing speed toward the discharge-openings at the periphery of the larger end. In this case a combination of pivot and roller bearings is used to support the drum.

In such cases where the material to be treated is of a highly-abrading nature or where it is of importance that it does not come into contact with iron, the interior of the tube can be filled with a protecting cover. This can be made of iron, steel, stone, wood, china, or baked clay. The balls can in a like manner be made of the above-mentioned or other suitable materials.

The material being ground, on entering the drum at an axial inlet and leaving it at a peripheral outlet, forms a gradually-diminishing stream, extending from the inlet to the outlet end of the cylinder, and, as shown in Figs. 2 and 3, as the stream diminishes the depth of balls above it becomes greater. Consequently the weight and grinding action are gradually increased from the inlet to the outlet or from one end of the cylinder to the

other, and as the material is discharged it is in a finely-comminuted state. No blowing apparatus is required to pass the material through the drum. In the conical drum, the
5 peripheral outlet being at the larger end, the increase in weight and grinding action is greater than in the cylindrical form.

Having now particularly described and ascertained the nature of my said invention and
10 in what manner the same is to be performed, I declare that what I claim as new, and desire to secure by Letters Patent, is—

In a tubular ball mill, the combination of a rotary drum, having a horizontal or approxi-
15 mately horizontal axis and provided with an axial inlet at one end and a peripheral out-

let near the other end, and a body of grinding balls disposed in mass and overlying one another in said drum; the stream of material passing between the balls being gradually
20 diminished from the inlet to the outlet and the depth and weight of the mass of balls above the material gradually increased as the stream diminishes.

In testimony that I claim the foregoing as
25 my invention I have signed my name in presence of two subscribing witnesses.

JOSEPH DAVIDSEN.

Witnesses:

CLYDE SHROPSHIRE,
HENRY PEARTREE.