R. LUCKENBACH.

APPARATUS FOR PULVERIZING AND AMALGAMATING ORES.

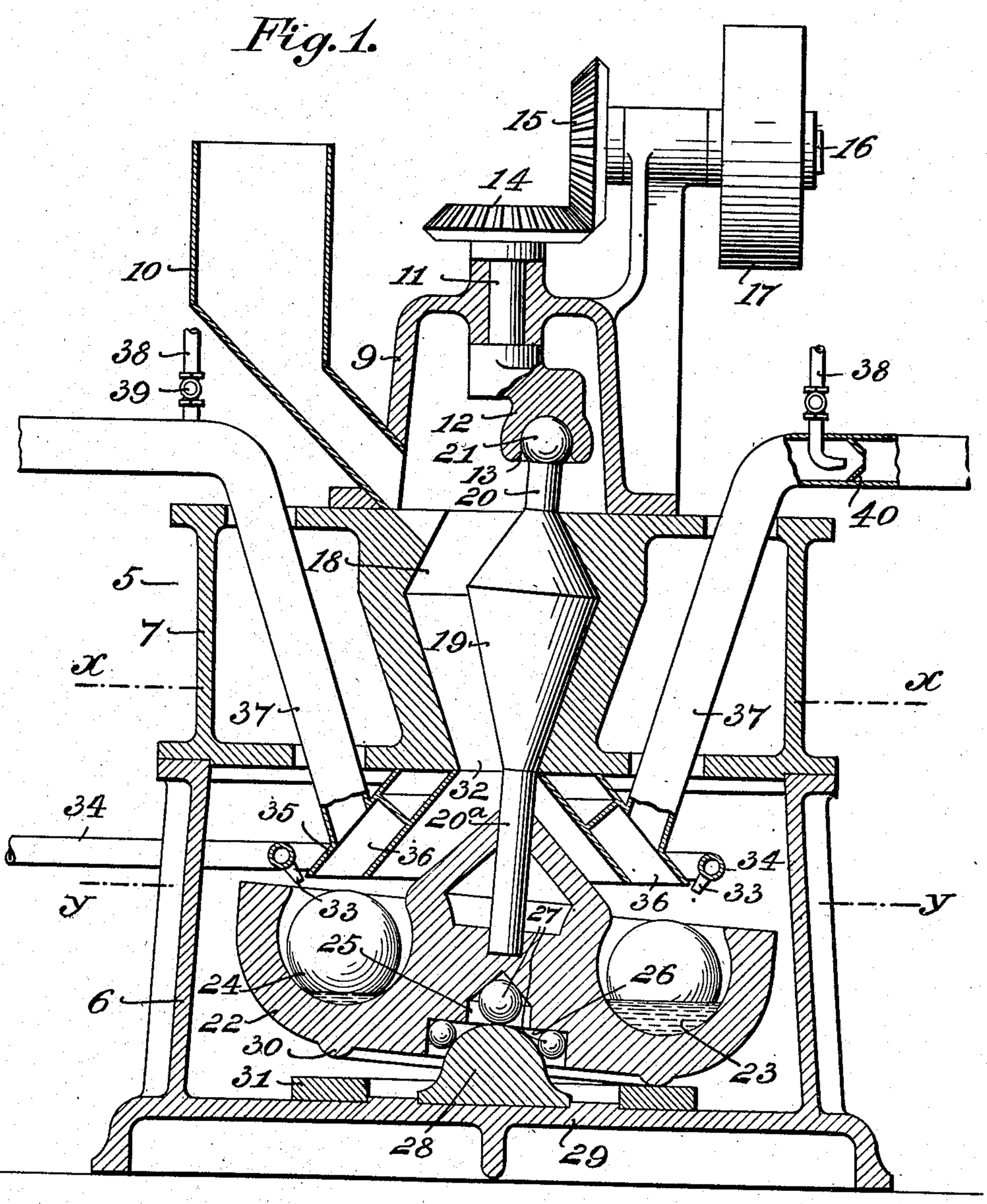
APPLICATION FILED SEPT. 16, 1907.

936,645.

Patented Oct. 12, 1909.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

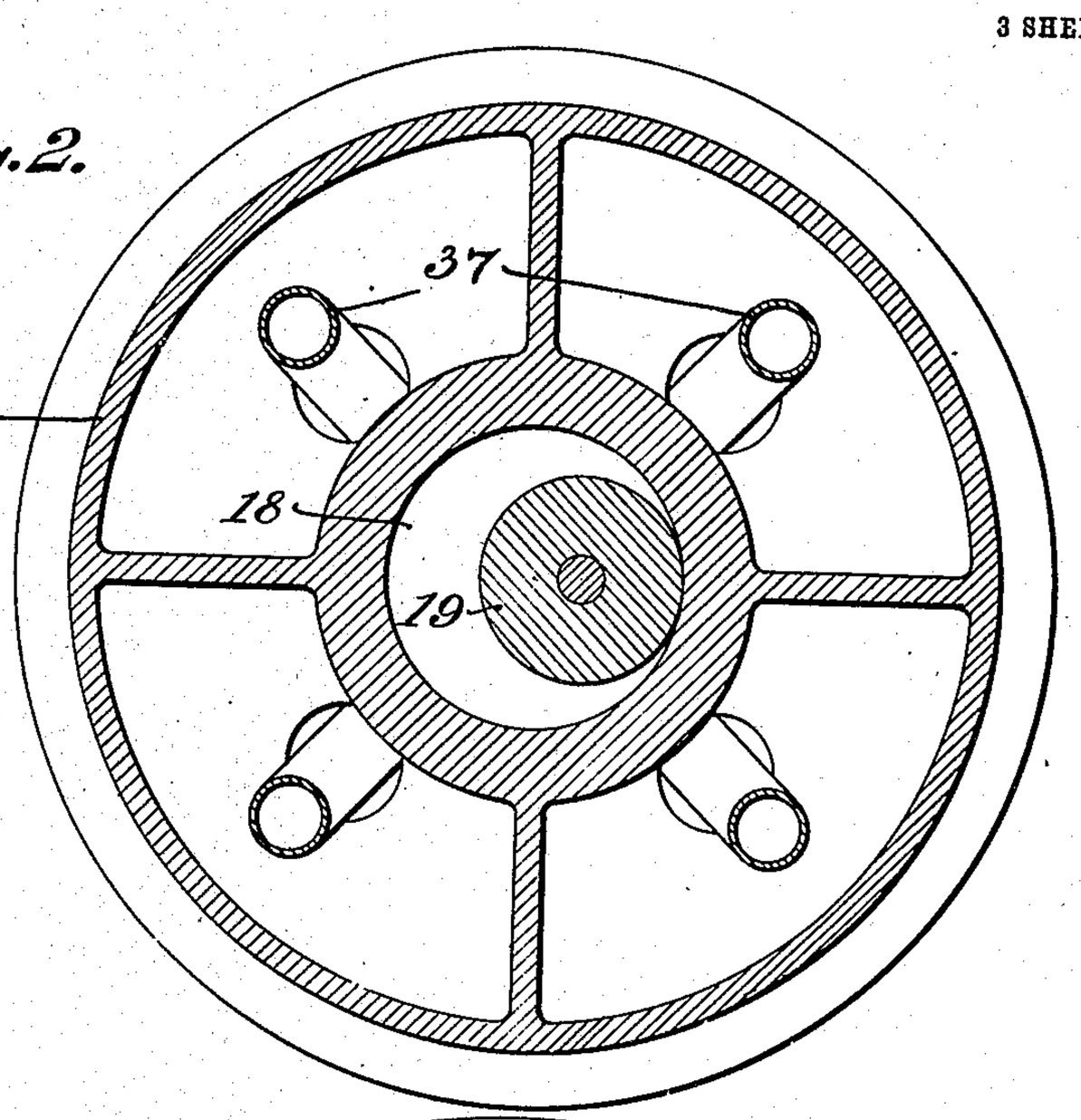
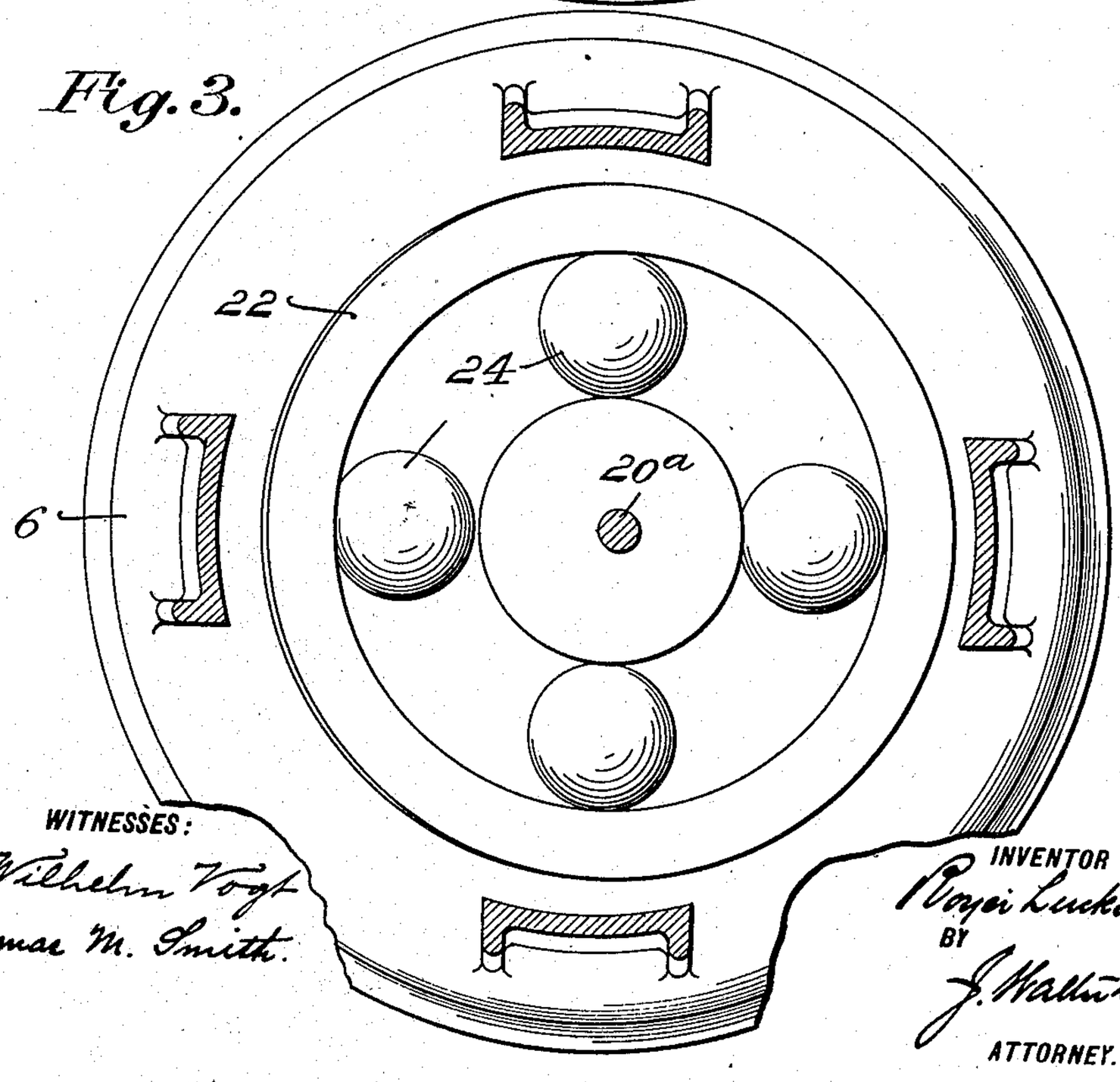


Fig. 3.



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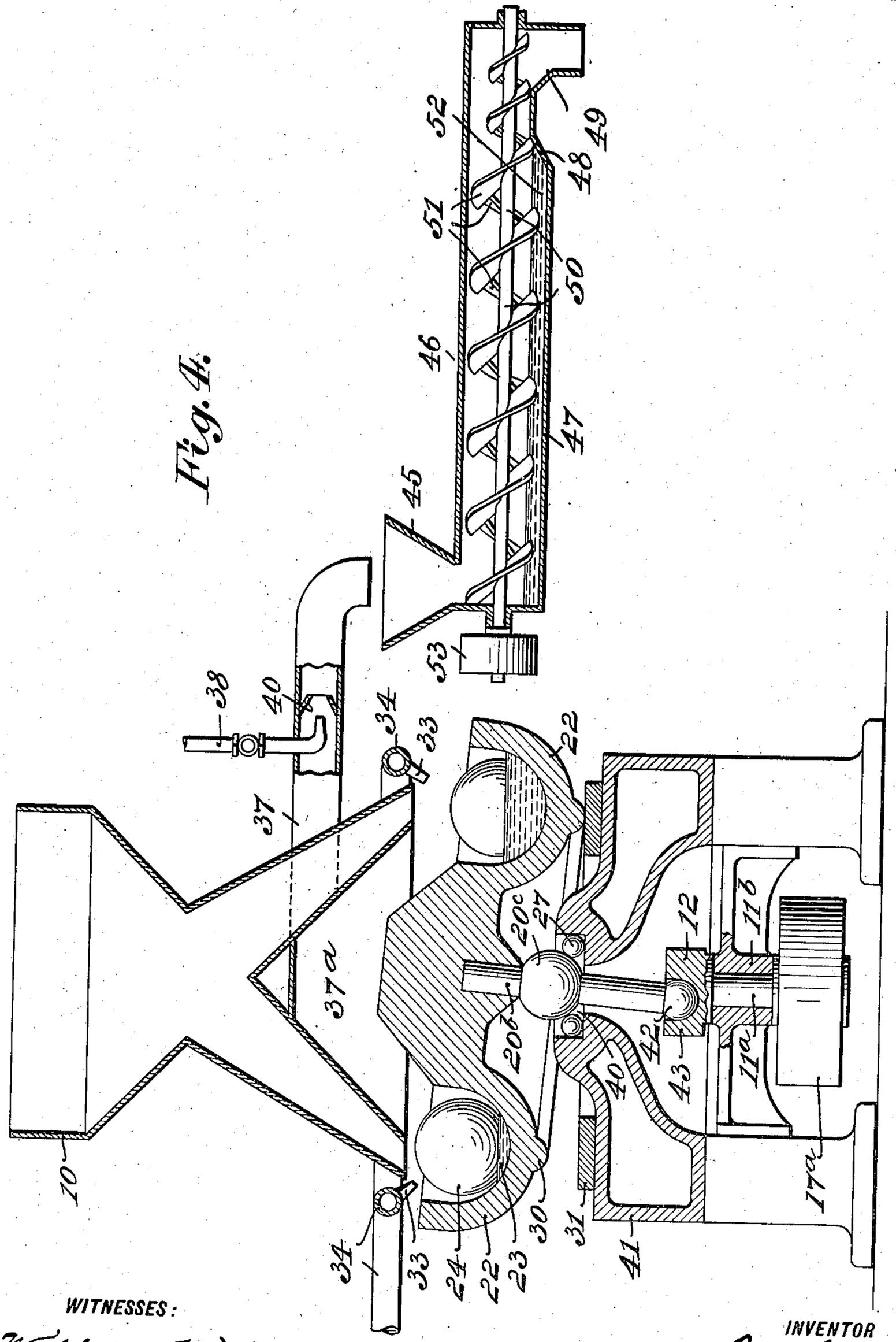
3 SHEETS—SHEET 3.

Fig. 4.



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APPARATUS FOR PULVERIZING AND AMALGAMATING ORES.

936,645. Specification of Letters Patent. Patented Oct. 12, 1909.

Application filed September 16, 1907. Serial No. 392,990.

To all whom it may concern:

Be it known that I, ROYER LUCKENBACH, a citizen of the United States, residing at Colwyn, in the county of Delaware and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Pulverizing and Amalgamating Ores, of which the following is a specification.

My invention has relation to an automatic apparatus for pulverizing and amalgamating ores to separate their values, mainly gold and silver, by causing mechanical amalgamation of their entrained values in their pulverized state with an amalgamating body by the direct active commingling of the mechanical means with the amalgamating body and which act to free tailings or gangue from the ore matter, aided by induced air currents, while the mechanical means act upon the ore values in transit, thereby to economically and efficiently free the values as well as permit the impelled freed tailings or gangue to be discharged without manual means employed to accomplish such results, in the series of operations progressively acting upon said pulverized ore matter.

The nature and scope of my said invention will be more fully understood from the following description taken in connection with the accompanying drawings, in which—

Figure 1, is a vertical section of an apparatus embodying main features of my said invention. Figs. 2 and 3, are, respectively, transverse sections through the combined pulverizer and amalgamator on the lines *x*, *x*, and *y*, *y*, of Fig. 1; and Fig. 4, is a vertical sectional view of another type of combined pulverizer and amalgamator connected with a tailing or gangue separator.

In the drawings, referring to Figs. 1, to 3, 5, is a combined pulverizer and amalgamator, consisting of sectional castings 6 and 7, supported upon each other and within which the active working parts of the apparatus for the defined results, are confined. 9, is a vertical bracket supported upon the casting 7, in which is supported a hopper 10, and a vertically driven shaft 11, carrying at one end an eccentrically arranged crank-arm 12, having a socket 13, and at the other end a miter-gear 14, meshing with a miter-gear 15, mounted on a horizontal driving shaft 16. This shaft carries a pulley 17, for the reception of a belt, not shown. 18, is a chamber located within the supported casting 7, and designated as an ore crushing or grinding chamber and within which a grinding or crushing device 19, is mounted to be gyrated therein by means of shafts 20 and 20ª, projecting from both ends of the device. The device 19, is preferably in form that of two truncated cones or frustums of cones placed base to base. The upper end of the shaft 20, is preferably formed into a ball 21, engaging a socket 13, of an eccentrically arranged crank-arm 12, and the opposite shaft 20ª, extends through a cone-shape portion of a casting 22, as illustrated in Fig. 1, forming the dish-shaped bottom or race for an amalgamating body 23, such as mercury or amalgam, and also is therein mounted a series of hardened steel balls 24, in action in said race, receiving a coating of the mercury or amalgam from the body 23. The casting 22, is provided centrally from the underside with a recess 25, offset at 26, for respectively, receiving and supporting in said recess and offset portion balls 27, in bearing contact with preferably a chilled casting surface 28, supported on the base-plate 29, of the casting 6. Around the base of the casting 22, is provided a circular projection forming a rib 30, and contacting with a circular ring 31, supported in a fixed position in the base-plate 29, of the casting 6. By the rotation of the pulley 17, on the shaft 16, from any suitable source of power, not shown, a gyratory action of the ore crushing and grinding device 19, within the chamber 18, is effected, to thereby cause ore matter falling by gravity through the throat of the hopper 10, into the chamber 18, and hence into direct contact with the device 19, to be reduced to a dry pulverized condition prior to its discharge into the path of action of the device 19, in a deflected course by the outlet 32, over the gyrated series of balls 24, which by bunching together and rotating in opposite directions to each other, in action, in the dish-shaped casting 22, effect a rapid reduction of the ore matter with its entrained values to bring the same into substantially a powdered condition and at the same time to assist the amalgamating body 23, to concentrate the values and to separate the powdered gangue from the values retained. As the tailings or gangue have no affinity for the body 23, the jets or streams of air issuing through tubes 33, connected with a sup-

ply pipe 34, from a suitable source, not shown, liberate the same, as will be presently more fully explained. The supply pipe 34, is supported from a cone-shaped hollow casting 35, forming the outer wall for the discharge of falling crushed matter from the ore crushing chamber 18, and also a conduit 36, with which is connected a series of outlet pipes 37, for freeing by suction the gangue or tailings from the recovered values of the ground ore matter. Suction is induced in the series of outlet pipes 37, by means of a forced draft directed through the injector pipes 38, and extending into the series of pipes 37, and each of which is provided with a regulating cock 39, to control the extent of forced draft therethrough. In each of the outlet pipes 37, beyond the air admission pipes 38, is preferably provided an inverted cone-shaped partition 40, with a central opening, whereby suction in the said pipes 37, is made effective to lift the powdered gangue or tailings freed of values therethrough, and away from the recovered values confined to the amalgam body 23, during the automatic continuous mechanical actions of the series of balls 24, in said body 23, of the casting 22. The gangue or tailings being taken up then by the induced air current and forced or sucked through the pipes 37, from the apparatus, onto a dump or into a suitable receptacle.

In the apparatus as illustrated in Fig. 4, the pulverized ore is deposited in the hopper 10, and falls by gravity into the path of the gyratory series of balls 24, in the race of the casting 22, containing an amalgamating body 23. The gyratory action of the casting 22, in this form of the apparatus, is effected by means of the shaft 20^b, secured to the casting 22, and having a ball bearing 20^c, contacting with a series of balls 27, mounted in the recess 40, of a standard 41. The opposite end of the shaft 20^b, is formed into spherical-shaped extremity 42, so as to engage a socket 43, of the eccentric crank-arm 12, mounted on one end of a vertical shaft 11^a, supported in a bearing 11^b, from the standard 41, and carrying a driving pulley 17^a. The standard 41, supports a ring 31, with which it contact periodically, in the gyratory movements of the casting 22, with the rib 30, on the bottom of the casting 22. The air jets or streams issuing through the tubes 33, from the supply pipe 34, are admitted at suitable distances apart over the gyrated series of balls 24, to lift ore matter freed of values, aided by the balls in the body 23, and by the suction action of the air induced through the conical space 37^a, connected with the outlet pipe 37, and injector pipe 38, in an outward direction, into the hopper 45, of a tailings separator 46. This separator is provided with a longitudinal chamber 47, having near the outlet end thereof an inclined plane 48, and a downwardly inclined discharge spout 49. Through the center of the separator chamber 47, is arranged a conveyer shaft 50, the series of blades 51, of which occupy staggered relationship to each other in their continuous connected position on the said shaft and are adapted by the gyratory actions of the same in the body 23, of mercury or amalgam within the race or channel 52, of the chamber 47, to cause not only a thorough amalgamation of all traces of entrained values of the gangue matter in the separator, but also by the series of blades of the conveyer a lifting of matter foreign thereto, which is conducted over the inclined plane 48, and discharged through the spout 49, onto a dump or into a suitable receptacle therefor. It may be here remarked that in exceptional instances only is it necessary to use the tailings separator 46, as described, because in practice it has been found that after the pulverized ore matter containing values to be recovered, has undergone the series of progressive actions as hereinbefore defined, the resultant matter is found to be freed of all values.

From the foregoing description of my invention as carried out by the different types of apparatus as explained, the ore matter is not only thoroughly pulverized containing entrained values, but by the automatic continuous series of operations, which the ore matter undergoes, is effected a complete amalgamation of the values with the aid of the mechanical means and amalgamating body having decided affinity for such matter, and none for the foreign matter; and moreover, without having to handle the foreign matter during the freeing of the same from entrained values of said ore matter.

Having thus described the nature and objects of my invention, what I claim as new and desire to secure by Letters Patent is:—

1. In an apparatus of the character described, a standard, a dish-shaped casting supported from the standard for containing an amalgamating body and balls, a hopper located above said casting and having an outlet arranged to discharge pulverized matter directly into said casting, means for conducting a fluid or liquid with the pulverized matter into said casting and while the balls are in action, a casting provided with a crushing chamber interposed between said hopper and casting, a pulverizing device located in said crushing chamber and connected with said casting and means for gyrating both the pulverizing device and casting, substantially as and for the purposes described.

2. In an apparatus of the character described, a standard, a ball bearing dish-shaped casting supported from said standard for containing an amalgamating liquid

body and series of balls, a hopper with an outlet located above said casting, a second casting interposed between said hopper and dish-shaped casting and supported by said standard having a grinding or crushing chamber, a device, consisting of two truncated cones united and arranged base to base with the stems thereof connected respectively, with said dish-shaped casting and with means for gyrating both said device and dish-shaped casting, substantially as and for the purposes described.

In witness whereof, I have hereunto set my signature in the presence of two subscribing witnesses.

ROYER LUCKENBACH.

Witnesses:
J. WALTER DOUGLASS,
THOMAS M. SMITH.