(No Model.) 2 Sheets—Sheet 1.

R. E. SHILL, Dec'd.

M. BAILEY, Administrator.

CRUSHING OR GRINDING MILL.

No. 523,085. Patented July 17, 1894.

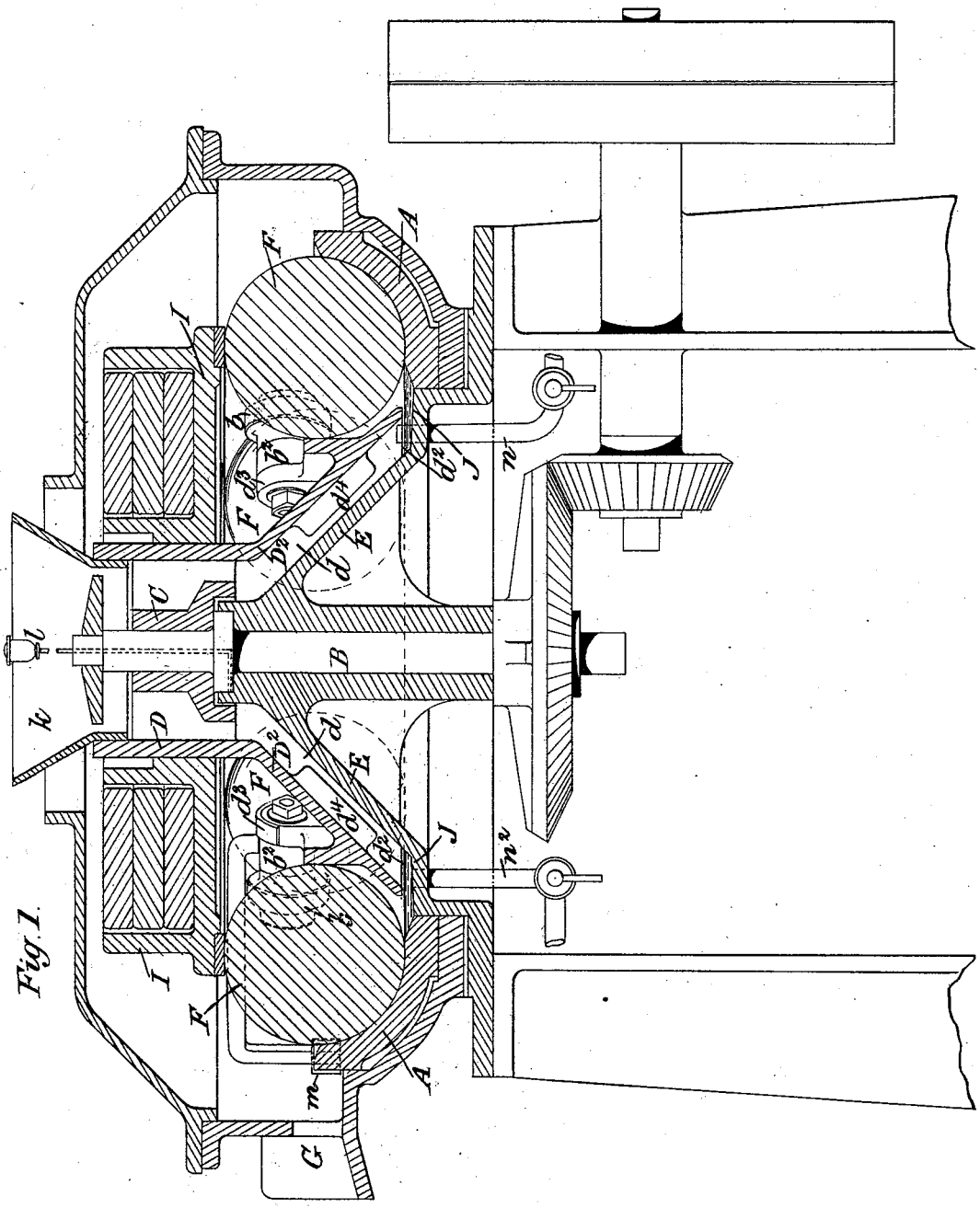

Fig. 1.

Witnesses:
Edwin Addick
F. B. Keefer

Inventor:
Richard E. Shill
by Marcellus Bailey
his Atty.

(No Model.)

2 Sheets—Sheet 2.

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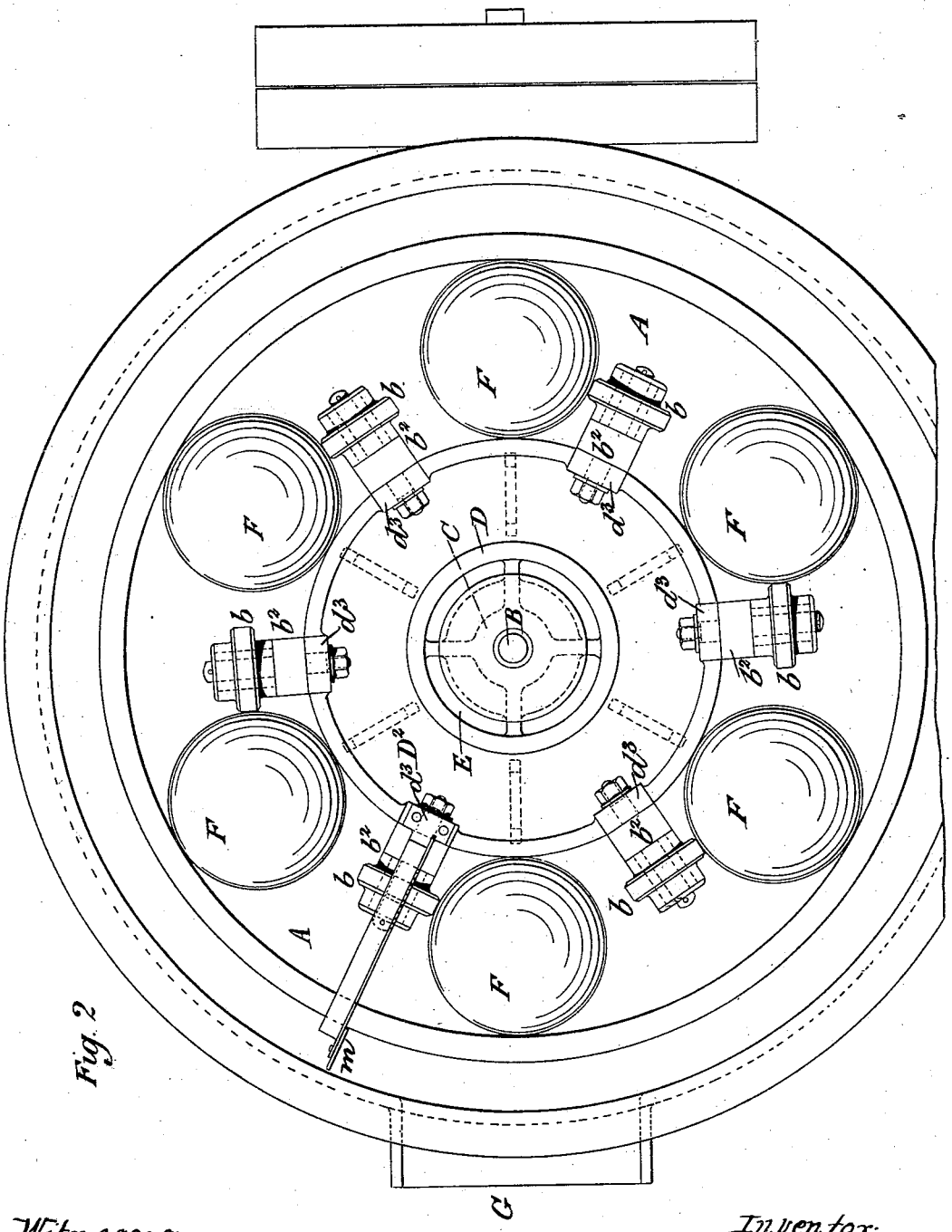

Fig. 2

Witnesses:
Estella Duck
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Inventor:
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by Marcellus Bailey
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UNITED STATES PATENT OFFICE.

RICHARD E. SHILL, OF LONDON, ENGLAND; MARCELLUS BAILEY ADMINISTRATOR OF SAID SHILL, DECEASED.

CRUSHING OR GRINDING MILL.

SPECIFICATION forming part of Letters Patent No. 523,085, dated July 17, 1894.

Application filed August 27, 1892. Serial No. 444,264. (No model.)

To all whom it may concern:

Be it known that I, RICHARD EDMUND SHILL, engineer, a subject of the Queen of Great Britain and Ireland, residing at 49 Crystal Palace Road, East Dulwich, London, in the county of Surrey, England, have invented certain improvements in or connected with crushing or grinding mills, more especially intended for grinding or reducing ores containing precious metals and for separating metals therefrom by amalgamation, of which the following is a specification.

My invention relates to mills of the kind wherein grinding or reducing is effected by means of balls revolving upon a circular track.

The object of my invention is to so feed the ore or material to be ground or reduced that it is more efficiently acted upon by the balls than hitherto and so that in the case of grinding or reducing ores containing precious metals the amalgamation of the precious metals is more thoroughly effected than hitherto and the general arrangement of the mill is such that the grinding or grinding and amalgamating is or are very efficiently performed.

According to my invention I arrange the outlet or outlets from the passage or passages, by which the ore or material to be acted upon is passed into the mill at a point near to the lower part of the balls and close to the race upon which they run and so also that where amalgamation is to be performed the delivery is immediately over a bath of mercury situated close to the portion of the mill in which the grinding effect is obtained. The outlet for the ground ore or material from the mill is situated at a higher level than the aforesaid delivery, the object of this being to prevent float gold or fine particles of gold or fine portions of the ore or material which may contain gold passing across the mill without being properly acted upon.

I will describe with reference to the accompanying drawings an arrangement according to my invention which I prefer, although I do not limit myself to the precise details.

Figure 1 is a vertical section and Fig. 2 is a plan with the upper part and tray removed.

I provide a circular race A mounted upon suitable foundations or framing having a driving shaft B passing centrally therethrough. This driving shaft B carries at its upper part a boss C connected to a tubular piece D through which the ore or material is fed into the machine. This tubular piece D at its lower part D^2 extends outward in the form of a frustum of a cone of such a size that it leaves a space *d* between its inner surface and a portion of similar formation at E forming the inner part of the main structure which carries the race and leaving at its lower part an opening d^2 which is situated close to and above the portion of the race against which the lower parts of the balls F bear. The outlet from the mill is situated preferably at a level about or above that of the center of the balls as shown at G. The balls F are driven by means of anti-friction rollers *b* arranged between the balls so as to engage therewith, and carried by arms b^2 bolted or secured to lugs d^3 formed on the exterior of the aforesaid conical part D^2.

The weight of the balls F may be supplemented by means of a tray I for containing weights, the said tray I bearing at its lower part on the top of the balls F and being fitted so that it can revolve round the tubular piece D aforesaid and yet be capable of rising and falling thereon.

When amalgamation is to be effected a trough J for containing mercury is situated immediately beneath the delivery opening of the aforesaid conical part D^2 and in close proximity to the portion of the race upon which the lower parts of the balls act.

When the machine is in operation the material which has been previously reduced to a sufficiently divided condition is fed into the tubular piece D aforesaid, and passes down through the space *d* inclosed by its conical part and is delivered at, or about, level with the lower parts of the balls F. As water or other liquid is fed in with the material to be operated upon and thus rises in the machine to the level of the outlets which are preferably above the center of the balls aforesaid, it follows that the delivery of the ore or material is always well beneath the level of the liquid in the mill and cannot take a direct course across the mill without being properly acted upon by the balls, and where the mercury trough J is provided it follows also that the

precious metals in the ore or material are very efficiently subjected to the action of the mercury thereby rendering amalgamation more complete. I find it advantageous to provide wings or vanes as at d^4 on the inside of the conical part D to act as stirrers on the water to release any air there may be among the material being passed into the apparatus.

The parts most subject to wear such as the race and the under part of the tray which bears on the balls may be made with detachable bearing parts which can be renewed when worn.

k is the feed hopper. *l* a lubricator. *m* a blade for facilitating the ejection of the material by the outlet G, and *n* is a pipe by which I draw off water and sludge from above the mercury before opening the outlet n^2 to draw off the mercury containing amalgamated gold.

I claim—

1. In an ore crushing or grinding mill, the combination of a suitable frame, a circular race or track, a series of balls revolving thereon, a passage directing the material to the balls and terminating at or about level with the lower part of the balls, and to one side of said race upon which they revolve and adjacent thereto, and one or more outlets arranged upon the side of the balls opposite to that of the inlet passage and at or above the level of the balls, whereby the material to be acted upon cannot pass to the outlet from the mill without first being operated upon by the balls, substantially as described.

2. In an ore crushing or grinding mill, the combination of a suitable frame, a passage arranged to deliver material to be acted upon and terminating at or about level with the race upon which the balls travel, a mercury receptacle located at the lower end of said passage and below its outlet and communicating therewith, a circular race, a series of balls revolving thereon, and one or more outlets arranged upon the side of the balls opposite to that of the mercury bath and passage, and about or above the center of the balls, substantially as and for the purposes hereinbefore set forth.

3. In an ore crushing or grinding mill, the combination of a suitable frame, a race, a series of balls revolving thereon, anti-friction driving mechanism for said balls arranged between the balls so as to engage therewith, and a tray for containing weights, said tray bearing at its lower part on the top of the balls, and being so arranged that it can revolve independent of the driver and is also free to rise and fall, substantially as set forth.

4. In an ore crushing or grinding mill, the combination of a suitable frame, a circular track or race, a series of balls revolving thereon, a passage directing the material to be operated upon to a point at or about level with the lower part of the balls, a mercury trough sunk below the level of said race, and one or more outlets arranged upon the side of the balls opposite to that of the inlet passage, substantially as described.

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

R. E. SHILL.

Witnesses:
WILLIAM F. UPTON,
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