(No Model.) 2 Sheets—Sheet 1.

T. A. READWIN.

ORE GRINDING AND AMALGAMATING MACHINE.

No. 259,424. Patented June 13, 1882.

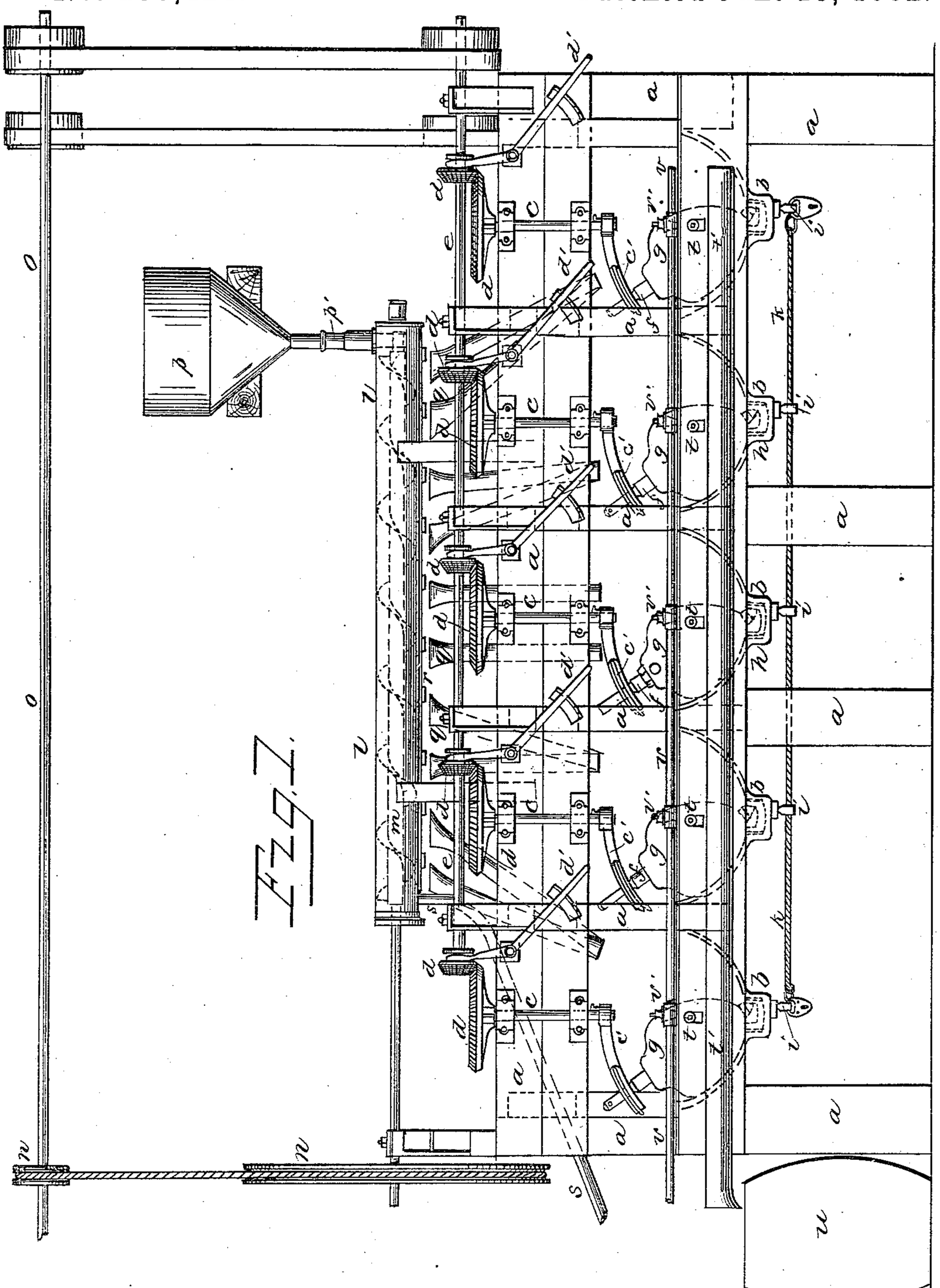

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Fig. 2

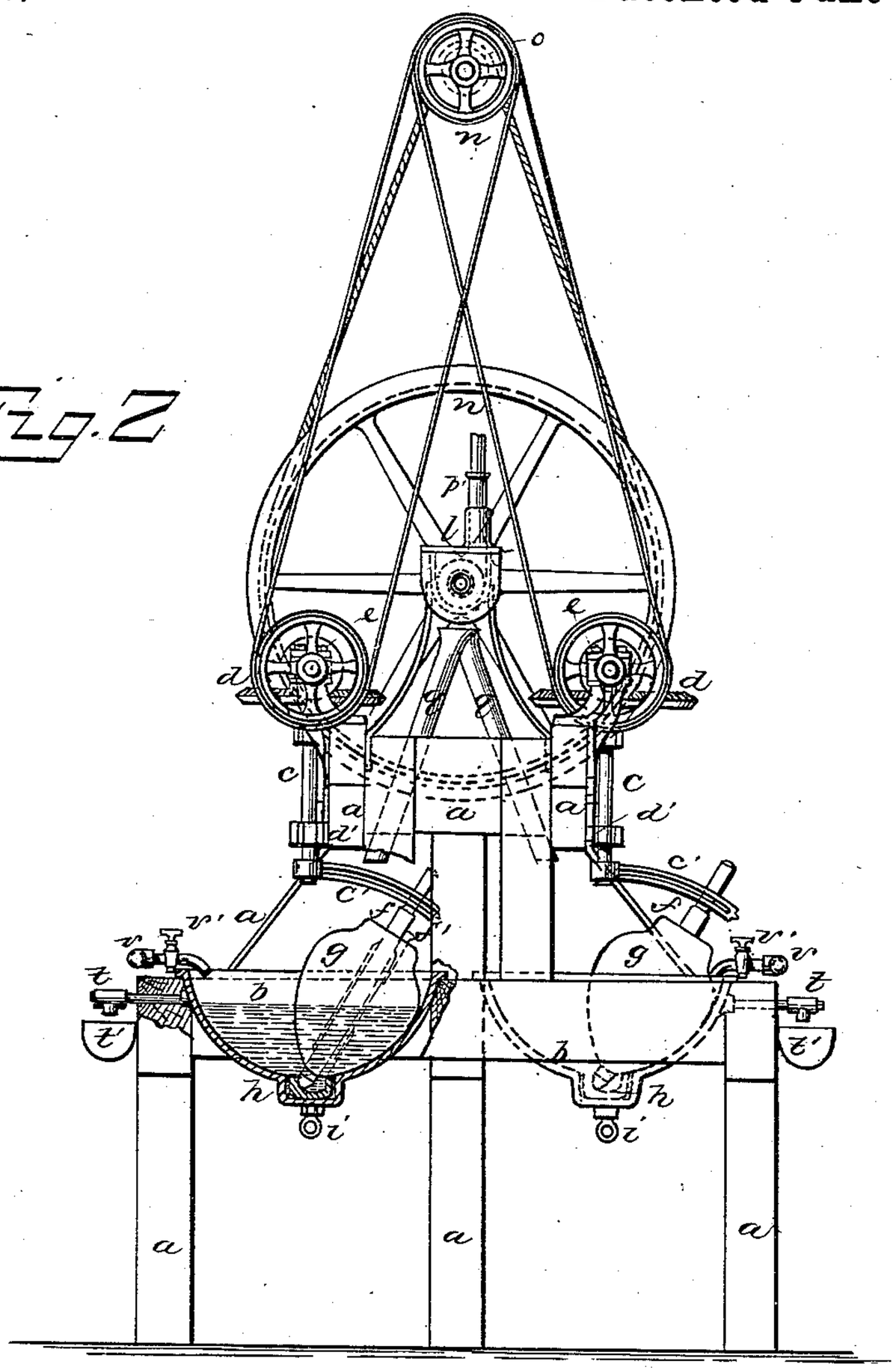
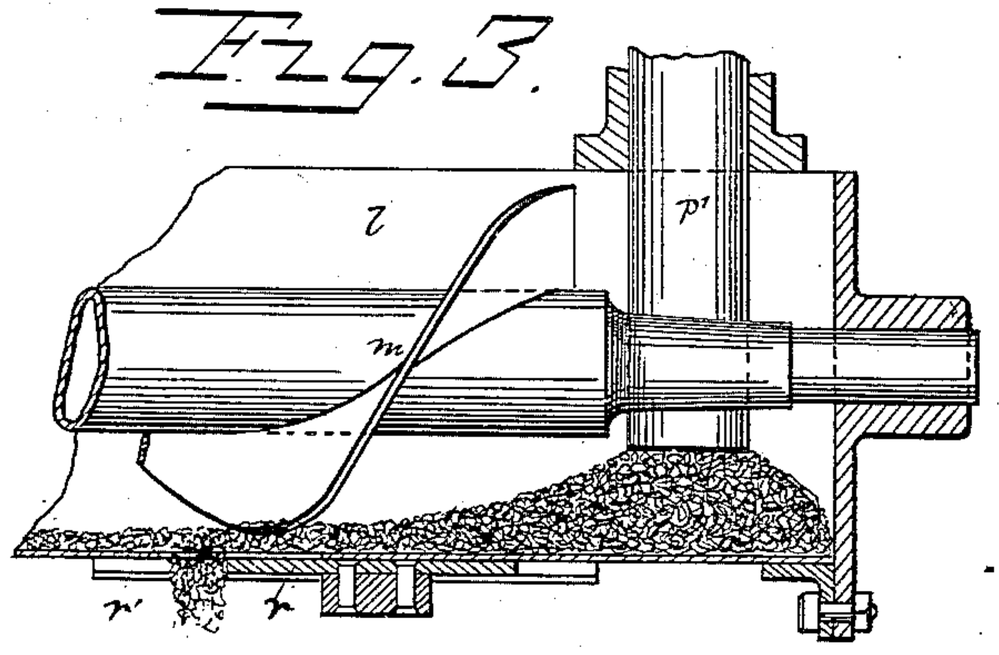


Fig. 3.



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UNITED STATES PATENT OFFICE.

THOMAS A. READWIN, OF BLOOMSBURY SQUARE, COUNTY OF MIDDLESEX, ENGLAND.

ORE GRINDING AND AMALGAMATING MACHINE.

SPECIFICATION forming part of Letters Patent No. 259,424, dated June 13, 1882.

Application filed March 6, 1882. (No model.) Patented in England August 22, 1881, No. 3,653.

To all whom it may concern:

Be it known that I, THOMAS ALLISON READWIN, a subject of the Queen of Great Britain and Ireland, residing at Bloomsbury Square, in the county of Middlesex, Kingdom of Great Britain and Ireland, have invented new and useful Improvements in Ore Grinding and Amalgamating Machines, (for which I have obtained a patent in Great Britain, No. 3,653, bearing date August 22, 1881,) of which the following is a specification.

This invention has reference to that kind of machine used for grinding ore and amalgamating gold or silver with mercury, wherein by an arm carried round by a vertical spindle suitably driven a pestle is caused to rotate about its own axis and to roll obliquely on the inner surface of a circular pan, whose half vertical section is of a form resembling that (as seen in corresponding section) of the rounded surface of the pestle.

In machines of this kind, as heretofore usually constructed, considerable wear takes place in the bearings of the vertical spindle, (to which neither oil nor grease can safely be applied,) also in the pestle-axis, also in the mercury-cup at the bottom of the pan. Moreover, considerable loss of time arises, owing to the irregularity due to hand-feeding, and there is no efficient provision against unauthorized withdrawal of the contents of the pan. Now, according to this invention, to obviate or mitigate these defects, the bearings of the vertical spindle are formed of hard wood or asbestus, and water is used as a lubricant.

The pestle-axis (heretofore usually made in one piece with or cast in the pestle-body) is made of hardened steel or phosphor-bronze, and removable from the pestle-body, and is fixed therein in such a manner that it can be shifted lengthwise or renewed at pleasure. The pan is recessed at the bottom and a square tapered hardened steel or phosphor-bronze cup is placed in the recess to receive the lower end of the pestle-axis, which works therein.

A long trough is provided to supply the entire set of pans. In this trough a screw is caused to revolve, so as to gradually propel any material placed in it from one end of the trough toward the other. For each pan there is an aperture, through which, as the material travels along the trough, some of it falls and is conducted to the pans, the quantity supplied to the pans being regulated by suitable means. According to one arrangement for this purpose each of the apertures in the trough is provided with a chamber of specific capacity, having inlet and outlet doors or valves, which are opened and shut at regular intervals by screws or gearing operated by the driving-shaft placed over the machine.

Another arrangement to produce the same effect consists of (for each pan) a boss on the screw-shaft carrying a cup or cups, which shall dip into the material and discharge the required quantity into a chute in a specified time, (the apertures in the bottom of the trough being in this case dispensed with.)

The arrangement I consider most advantageous is as follows: I form outlets at the bottom of the trough with adjustable shutters, which may be regulated so as to allow the required quantity of ore to pass through in a given time. The bottom of each pan is provided with an eyed tap-screw, and a wire or bar (which may be composed of wires stranded together) is put through the eye of each tap-screw in a series, and is secured by means of a lock and key.

In order that my invention may be well understood, I proceed to more particularly describe the same with reference to the accompanying drawings, wherein—

Figure 1 is a side elevation of a grinding and amalgamating machine embodying my invention, and comprising a set of ten amalgamating-pans fitted with gyrating pestles. Fig. 2 is an end elevation, partly in section, of the right-hand or driving end of the machine, to a reduced scale. Fig. 3 is an enlarged sectional elevation of a portion of the feeding-trough.

a is the framing of the machine, which supports the pans *b*, of which ten are here shown by way of example and as being a convenient number; but more or less may obviously be employed.

c are vertical shafts driven by gearing *d* from

the driving-shaft *e*, the gearing *d* being disconnected, when required, by shifting the pinion out of gear along the shaft *e* by means of the levers *d'*. These shafts *c* carry each a hooked arm, *c'*, in which freely rests the axis or spindle *f* of the pestle *g*, so as to carry the pestle around, at the same time allowing it to rotate about its axis, the half vertical section of the pan approaching approximately the rounded surface of the pestle, as shown in section in Fig. 2.

The bearings of the vertical shafts *c* are formed of hard wood, prepared asbestus, or other material which will wear well when lubricated with water. The lubricant is supplied to the bearings through holes formed in the bosses of the large gear-wheels *d*.

The pestle-axis *f*, which is made of hardened steel or phosphor-bronze, is fitted to the pestle-body, so as to be easily removable therefrom, by means of keys *f'*, as shown in Fig. 2, (or the spindle may be screwed into the body and secured by a check-nut, or the spindle may be fixed by set-screws passing through the top end of the pestle-body,) and so that the pestle-body can be shifted lengthwise of it at pleasure.

The bottom of each pan is recessed so as to receive a hardened-steel or phosphor-bronze cup, *h*, in which works the lower end of the pestle's axis, and which holds the mercury for amalgamating the gold, silver, or metal to be extracted, as it is reduced or separated from the ore.

i i are eyed tap screws, screwed into the bottoms of the pans to allow, when unscrewed, of the mercury or amalgam being run off from the said cups, through which a corresponding hole is bored and tapped to permit of easy removal by a ring-bolt.

A wire or bar, *k*, which may be composed of wires stranded together, is passed through the eyes of the screws *i i* and secured thereto by lock and key, so as to prevent the unauthorized withdrawal of the contents of any of the pans.

l is a trough carried above the pans and having a screw-bladed shaft, *m*, which revolves therein by means of the wheels *n n*, driven from the shaft *o*, which screw feeds the crushed ore fed from the hopper *p* to each of the pans by means of chutes or spouts *q*.

The adjustable tube *p'* is capable of being shifted up or down, so as to regulate the supply of crushed ore to the trough *l*.

r r are sliding shutters (shown in section at Fig. 3) fitted to the bottom of the trough, which shutters regulate the openings *r'*, so as to allow the requisite quantity of ore to pass through in a given time.

s is an overflow-pipe, which carries off the superfluous ore as it collects at the farther end of the trough, from whence it is returned to the feeding-hopper *p*.

t t are overflow-pipes to allow the surplus water, together with the baser metals and gangue in a finely-divided condition, to escape from the pans by the troughs *t' t'* to receivers *u*. Two or more outlets may be applied to each pan, when required, at different levels.

v v are pipes running the length of the pans, provided with cocks *v' v'* for supplying water to the said pans.

The operation of the machine is as follows: The cups *h* are filled with mercury. For treating ores containing ingredients injurious to ordinary mercury I use specially-prepared mercury. Water is then run into the pans through the cocks *v'* up to the level of the outlets *t*. The pestles are then set in motion by throwing the bevel-wheels *d* into gear, forcing the pestles to revolve in the pans by means of the arms *c'*. The hopper *p* being filled with ore crushed to the required size, the ore falls into the trough *l* at such a rate as may be allowed by the adjustment of the tube *p'*. The screw *m*, being set in motion, carries the ore along the trough and causes it to pass in a uniform layer over the adjustable apertures *r'*, the screw being so connected with the shaft that it shall revolve at a proportionate rate with the pestles, supplying the necessary quantity of ore per minute to each of the pans. The ore, it will be observed, will thus be supplied gradually and in the proper quantities to the pans, and by the crushing and grinding action of the pestles on the pans it will be reduced to a finely-divided condition, in which state it is presented to the mercury in the cups *h*. The mercury catches the amalgamable portion of the precious metals contained in the pulverized ore, and thus forms the required amalgam. During the process the water, together with the baser metals and gangue, is continually flowing through the overflow-pipes *t*. When it is required to withdraw the mercury and amalgam the wire rope or rod *k* is withdrawn from the eyes of the tap-screws and the mercury and amalgam run off, as required.

Having described the nature of my said invention and explained the manner in which it is to be or may be carried into practical effect, I hereby declare that what I consider to be novel and original, and therefore claim, is—

1. In a machine for grinding and amalgamating ore, the combination of the rotating pestle, the removable and adjustable pestle-axis *f*, the hooked slotted arm *c'*, and the vertical spindle, substantially as described.

2. In a machine for grinding and amalgamating ore, a pan formed with an internal recess at its bottom, in combination with a hard-metal cup to contain mercury for use in the amalgamating process, said cup being such as can be easily removed and renewed, substantially as described, and for the purpose specified.

3. In a machine for grinding and amalgamating ore, a hard-metal cup to contain the mercury, provided with a tapping-hole for withdrawing matters from said cup, and suitable means, such as described, for closing said

hole, in combination with the fastening device to secure said cup against unauthorized withdrawal of its contents, substantially as described.

4. In a machine for grinding and amalgamating ore, the combination, with pans *b*, pestles *g*, and means for operating the same, of a trough, *l*, screw-feeder *m*, chutes or spouts *q*, and means for regulating the quantity of ore delivered in a given time to each pan, substantially as described, and for the purpose specified.

5. In a machine for grinding and amalgamating ore, the combination of the trough *l*, screw-feeder *m*, chutes or spouts *q*, sliding shutters *r*, and overflow-pipes *s*, substantially as described.

THOMAS ALLISON READWIN.

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