

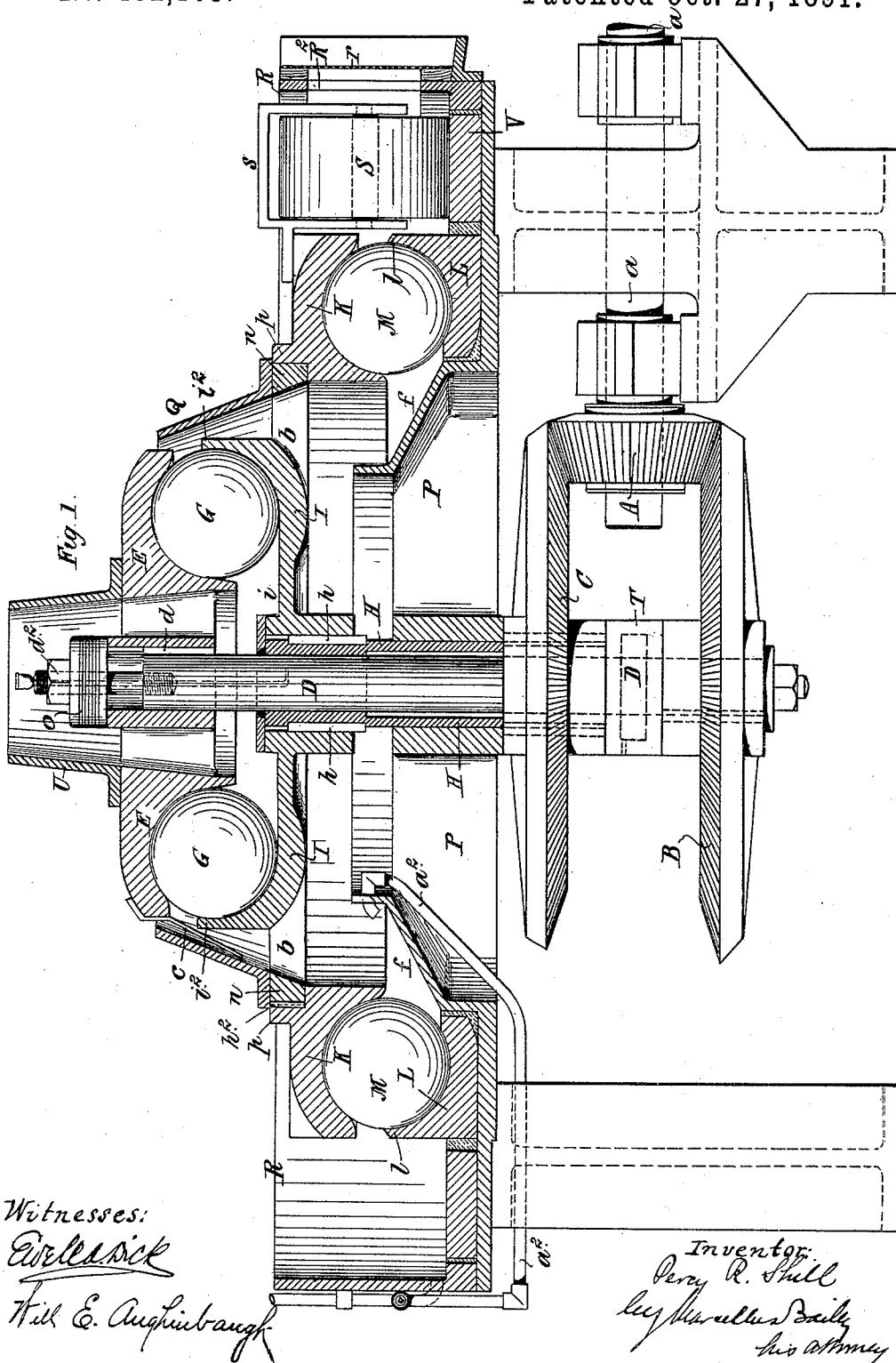
(No Model.)

2 Sheets—Sheet 1.

P. R. SHILL.
ORE CRUSHER.

No. 462,103.

Patented Oct. 27, 1891.



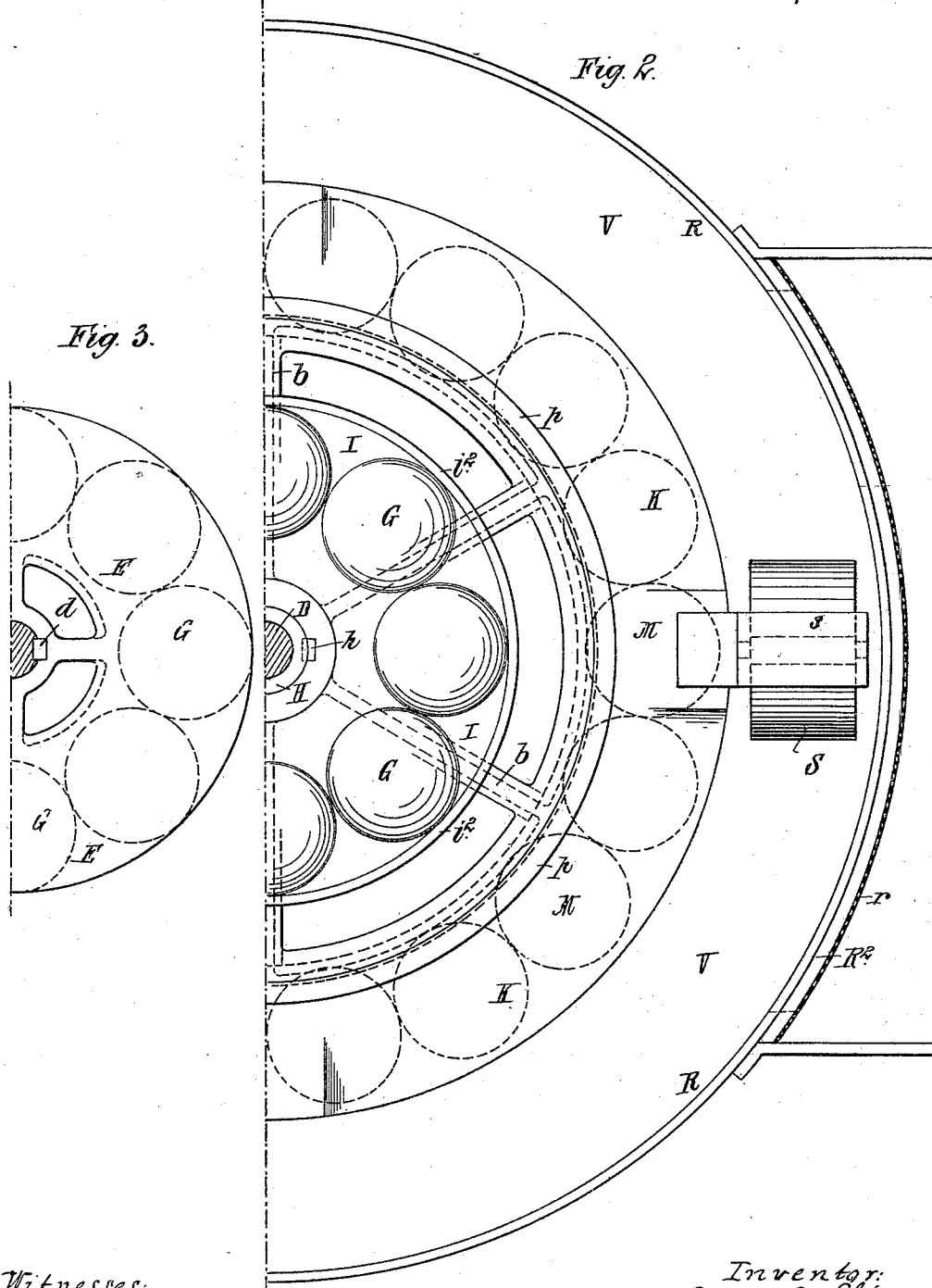
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Witnesses:

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Inventor:

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his attorney

UNITED STATES PATENT OFFICE.

PERCY R. SHILL, OF EAST DULWICH, ENGLAND.

ORE-CRUSHER.

SPECIFICATION forming part of Letters Patent No. 462,103, dated October 27, 1891.

Application filed January 2, 1889. Serial No. 295,157. (No model.) Patented in England July 2, 1886, No. 8,682, and December 10, 1888, No. 18,020.

To all whom it may concern:

Be it known that I, PERCY RICHARDSON SHILL, engineer, a subject of the Queen of Great Britain, and residing at 37 Worlingham Road, East Dulwich, in the county of Surrey, England, have invented certain Improvements in Crushers, (for which I have obtained patents in Great Britain, No. 18,020, dated December 10, 1888, and No. 8,682, dated July 2, 1886,) of which the following is a specification.

My invention relates to machinery for crushing or reducing and amalgamating auriferous quartz or ore and for crushing or reducing other materials, such, for example, as cement.

The invention relates to the class of machines in which the crushing or reducing action is obtained by means of balls or spheres working in annular races.

The present invention has for its object to provide an improved arrangement and combination of the parts of such machines, whereby the construction is simplified and the machine is rendered more efficient in action when the machine is used for crushing gold-bearing quartz or auriferous rock or minerals. I preferably provide the machine with means for amalgamating the pulp in the same machine, as hereinafter described.

I will describe the invention with reference to the accompanying drawings as arranged for crushing or reducing and amalgamating gold quartz or ores, from which its general application for crushing, grinding, or reducing other materials will also be readily understood.

Figure 1 of the accompanying drawings represents in vertical section a crushing and amalgamating machine constructed according to my invention; and Fig. 2 represents the machine in half-plan, the race of the upper series of balls being removed, this race and series of balls being represented separately in half-plan in Fig. 3.

The machine is driven by any suitable gearing, but preferably by a bevel wheel or pinion A on a shaft *a*, which bevel-wheel gears into two bevel-wheels B and C, the lower one B of which is fixed on the lower end of a vertical shaft D, having connected to it and driving the top race E, bearing on the series of crushing-balls G. The other bevel-wheel C is

fixed on the lower end of a sleeve H, working on the aforesaid vertical shaft D. This sleeve H has connected to it and drives the bottom race I of the series of balls G. To this race I is secured the top race K of the lower series of crushing-balls M, so that the said race K is also driven by the said sleeve H. The said series of balls M is situated at a lower level than that of the upper series G and works on a stationary annular race L of larger diameter than the race of the upper series of balls G, so that the material discharged from the outside of the upper series can be conducted by the combined action of gravitation and centrifugal force to the inward side of the lower series of balls M.

The vertical shaft D is provided with a feather *d*, which engages loosely with a key-way or groove in a boss provided with radial arms connected to the top race E of the upper series of balls G, and the bottom race I of the upper series of balls G and the top race K of the lower series of balls M are similarly driven by a feather *h* on the sleeve H, engaging with a boss carrying arms connected to the bottom race I of the upper series of balls. By these means the races E, I, and K are allowed a certain freedom of vertical motion by sliding upon the shaft D and on the sleeve H, an elastic or compressible washer or spring O being interposed between the boss of the top race E of the upper series of balls and a nut *d*² or stop on the end of the vertical shaft. The bevel-wheels B and C, being driven by the pinion situated between them, rotate in opposite directions, so that as the lower wheel B drives the shaft D and the top race E of the upper series of balls in one direction the lower race I of the upper series of balls and the top race of the lower series of balls are driven in the opposite direction by means of the sleeve H and the upper wheel C. The bottom race I of the upper series of balls is preferably made separate from the top race K of the lower balls, the race I being provided with a turned rim *n*, fitting inside an annular projection *p* on the race K, in which it is fixed by a key or keys *h*². The bottom race of the lower series of balls is stationary, the same consisting of a ring L, supported by an annular main frame P, cast with arms ra-

diating from a central boss, forming a bearing for the sleeve H, which in turn forms the bearing in which the vertical shaft D rotates. A pipe a^2 is carried up through the frame P, 5 formed by these arms, for the purpose of supplying a regulated quantity of water to the material acted upon before it passes under the lower series of balls. The outer edge of the bottom race I of the upper series of balls 10 is surrounded by an annular casing Q, inclining inward and upward, which casing directs the materials downward and causes them to pass through openings or spaces between arms b , Fig. 2, connecting the said race I to 15 the top race K of the lower series of balls. Any material caught by and tending to accumulate on these arms is knocked off by a finger or fingers c , attached to the top race of the upper series of balls. The bottom race 20 of the lower series of balls is surrounded by an annular amalgamating-trough R, containing quicksilver and having running therein cylindrical rollers S, rotating in frames s , carried by the revolving top race of the lower 25 series of balls, so that the said rollers S move round with this race and travel in the amalgamating-trough R. The inner side of the said amalgamating-trough R is formed by the outer side or lip of the bottom race 30 L of the lower series of balls, and the outer side of the said trough is made of a height sufficient to retain the materials with a wide opening at one side, (at R^2 , Fig. 2,) through which the material can overflow after being 35 acted on by the rollers S and the quicksilver in the trough R. This opening R^2 is provided with a screen or sieve of wire-gauze r , and communicates with a chute or receptacle, in which any particles of gold that may 40 have escaped the action of the amalgamator can be collected in the usual way. The vertical driving-shaft D is suspended by the nut d^2 on its upper extremity, bearing on the compressible washer or spring O, supported by 45 the top race E, which is supported on the upper series of balls G. The sleeve H is supported by a hollow distance-piece T, forming a receptacle for oil and resting on the boss of the bevel-wheel fixed on the lower extremity 50 of the vertical shaft D. The upper series of balls G consequently receives the pressure due to the weight of the shaft and parts connected therewith. The same pressure, with the addition of the weight of the upper balls 55 and of the races I and K, is transmitted to the lower series of balls M, which consequently works under a pressure considerably greater than that under which the upper series of balls G works, and the amount of 60 pressure on both series of balls can be regulated by adjusting the nut d^2 .

The material to be operated upon (being previously, if necessary, reduced to small fragments) is introduced into a central hopper 65 U on the top race E and falls onto the boss or central part of the plate i , carrying the bottom race of the upper series of balls

G. The rotary motion of this plate causes the material to move outward and to pass under the balls G of the upper series, when 70 it undergoes a certain amount of grinding or reducing and gradually works out over the outer edge or lip i^2 of the race I of the upper series of balls into the annular casing Q, the material falling therefrom between the arms 75 b into an annular trough or receptacle inside the lower series of balls, the said trough or receptacle presenting an inclined surface f , which, acting in combination with the water 80 supplied at this part of the apparatus by the pipe a^2 , causes the partially-reduced material to pass under the balls M of the lower series, by which the reducing and pulping of the said material is completed. The thickness or 85 consistency of the pulp or mud thus produced can be regulated by adjusting the quantity of water supplied through the pipe a^2 . The said pulp or mud as it accumulates overflows the outer edge or lip l of the race and passes 90 into the amalgamating-trough R, the bottom of which is constructed with an annular plate V, supporting the rollers S, which are carried round with the top race K of the lower series of balls, the ends of the spindles on which the said rollers S rotate preferably engaging 95 with slots in the roller-frames s , in order to allow the said top race to move vertically without lifting the rollers S. An additional supply of water may be introduced into the pulp in the amalgamating-trough in order to 100 render it sufficiently fluid to pass through the gauze screen or sieve r .

It will be evident that I may, if desired, use the top series of balls with the races above and below it driven in opposite directions 105 without the lower series of balls and races, in which case, if the amalgamating-trough be used, it can be fixed outside the race I and the roller-frames s can be fixed to the upper race E.

I claim—

1. In a crusher, the combination of the races carrying the upper series of balls with the races carrying the lower series of balls, the bottom race of the lower series of balls being stationary, said top race of the upper series of 110 balls revolving in a direction opposite to that of the lower race of the upper series of balls and the top race of the lower series of balls, and means for driving the races adapted to revolve, substantially as and for the purposes 120 hereinbefore set forth.

2. In a crusher, the combination of the top and bottom races carrying the upper series of balls, the top race and bottom stationary race carrying the lower series of balls, said bottom 125 race of the upper series of balls and top race of the lower series of balls being driven in an opposite direction to that of the top race of the upper series of balls, the races carrying the lower series of balls being arranged out- 130 ward from and beyond the boundary of the races carrying the upper series of balls, the annular frame or receptacle having an inclined surface f , arranged to conduct the ma-

terial acted upon by the upper series of balls to the lower series of balls, and means for rotating the revoluble races, substantially as described.

5 3. In a crusher, the combination of the races carrying the upper series of balls, the races carrying the lower series of balls, the bottom race of the lower series of balls being stationary, and the bottom race of the upper series
10 of balls and the top race of the lower series of balls being driven in a direction opposite to that of the top race of the upper series of balls, the races carrying the lower series of balls located on a lower level than the races carrying
15 the upper series of balls and arranged outward from and beyond the said races carrying the upper series of balls, the annular inclined frame P, arranged as described, and means for rotating the revoluble races, substantially as set forth.

20 4. In a crusher, the combination of the top and bottom races carrying the uppermost balls and the races carrying the lowermost balls, the said races K and L carrying the
25 lowermost balls being on a lower level than the races carrying the uppermost balls and arranged outwardly from and beyond the said races carrying the uppermost balls, and means for rotating the top race E in a direction opposite to that of the races I K, as set forth.

30 5. In a crusher for crushing and reducing materials, an annular amalgamating-trough surrounding the bottom race of the lower series of balls having running therein cylindrical rollers rotating in a frame carried by the top race of the lower series of balls, whereby the said rollers move round with this race and

travel in the said amalgamating-trough, substantially as set forth.

6. In a crusher, the combination, with a suitable frame, of the shaft D, carrying the race, and the sleeve H, carrying the races I K, the fixed race L, and the two series of balls G and M, and means for driving the said shaft and sleeve, substantially as set forth.

7. In a crusher of the kind herein described, the combination, with the stationary race L and balls M, of the races K I, secured to the sleeve H, capable of vertically moving thereon, the balls G, and the race E, secured to the shaft D, so as to be vertically movable thereon, and the spring, substantially as set forth.

8. In a crusher for crushing and reducing materials, a series of balls or spheres placed between annular races which are rotated in opposite directions, in combination with a series of balls placed between races situated at a lower level than the upper series and arranged outwardly from and beyond the said upper series, and passages so arranged that the material which has been acted upon by the first series passes downward and outward to the other series of balls to be acted upon for being further reduced, substantially as specified.

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

P. R. SHILL.

Witnesses:

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W. I. WEEKS,

Both of 9 Berchin Lane, London, E. C.