

2. In a breaking, crushing, or pulverising machine, the employment of two jaws consisting of sectors of rollers and oscillated upon their respective axes, so that the faces formed by the arcs of the jaws act as and for the purposes described.

3. In crushing and pulverising machine, a pair of jaws, the top parts of which act as rock-breakers or crushers, and the lower parts of which act as grinders or pulverisers, one of such jaws having a faster motion than the other.

4. A breaking, crushing, and pulverising machine, consisting of a pair of jaws having the top parts of their faces formed as breakers or crushers, and the lower parts of their faces formed as grinders or pulverisers, and having a higher rate of motion imparted to one jaw than to the other substantially, as fully set forth in the within specification, and illustrated in the drawings herewith.

Dated this 13th day of September, 1894.

HENRY HUGHES,  
Agent for Applicants.

AN IMPROVED MACHINE OR APPARATUS FOR PULVERISING OR REDUCING GOLD-BEARING QUARTZ OR ORES OR OTHER HARD SUBSTANCES.

I, Edward Waters, of No. 131, Willam Street, Melbourne, in the Colony of Victoria, Patent Agent, do hereby declare the nature of my invention for "An Improved Machine or Apparatus for Pulverising or Reducing Gold-bearing Quartz or Ores or other Hard Substances," and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The object of this invention is to provide machines and apparatus for pulverising or reducing gold-bearing quartz or ores or other hard substances, and has more especially for its object to provide a machine or apparatus which will act in a very efficient manner, and which is of comparatively small first cost, and capable of acting with a minimum of wear of its operating parts.

I will describe the invention with reference to the accompanying drawing. Fig. 1 is a vertical section, Fig. 2 an end elevation, and Fig. 3 a plan of a machine made in accordance with this invention. Figs. 4 and 5 show larger detail views of the arrangements for admitting water to the apparatus.

The machine or apparatus consists of a disc A, constituting a conical grinding path, and of rollers B, which act in conjunction with the said disc A, to effect the pulverising or reduction of the ore or material under treatment, the said disc A and rollers B being each in the form of a cone, or of a frustrum of a cone, so proportioned to each other that their surface-speeds throughout their meeting-line are the same at any given point. The said disc A and rollers B are situated in a vessel or receiver C, into which the material to be acted upon is fed by any suitable means, the said receiver or vessel C having an inlet or inlets for water at or towards its lower part, and an outlet or outlets at or near its upper part for light refuse freed from precious metal.

The inlet or inlets for water is or are made preferably through the bearing or bearings of the axis or axes of the disc A and rollers B by the pipes  $d$  and passages  $d^2$ , and thence by a passage  $d^3$  around each axle out by an opening or holes  $d^4$ , into the interior of the receiver or vessel C, as shown clearly in Figs. 4 and 5. The material to be operated upon is pulverised or reduced between the disc A and rollers B, and heavy portions or precious metals pass downwards, and may be amalgamated by mercury introduced into the lower part of the apparatus, the light, finely-divided matter from which the heavier portions or precious metals have been separated being carried up by the water and out by an outlet or by outlets at or towards the upper part of the receptacle or vessel C. The disc A and rollers B may both be positively rotated, but it is preferred to rotate the rollers B by pulleys  $b$ , and cause them to rotate the disc A, the said disc A and rollers B being preferably pressed together by weights or springs adjustable to give the requisite pressure. The conical disc A is carried by a stem  $a$  passing through a stuffing-box  $c$ , the stem being mounted in a cross-bar E, having an upward pressure exerted by springs  $e^2$  acting on rods  $e$  attached to its ends. Through stuffing-boxes  $b^2$  project two shafts  $b^3$ , their inner ends being secured to the aforesaid conical rollers B, which bear on the aforesaid disc A, the outer parts of the shafts carrying the pulleys  $b$  or other gearing by which they are driven, and being supported in bearings as shown.

The inlet for the material to be operated upon enters the vessel or receptacle, and the water is admitted at the axes of the rollers, as hereinbefore described. The vessel or receptacle C is provided below the acting surfaces of the disc A and rollers B with an outlet  $f$  (or outlets) by which the heavy deposited portions or precious metals can be drawn off as required, and above there may be provided another outlet  $g$  (or outlets), by which heavy gangue or sludge can be removed.  $C^2$  is an inclined trough for receiving the overflow to conduct it to an outlet pipe or channel.

It will be understood that there may be one, two, or more rollers B acting in conjunction with the disc A.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is—

1. The arrangement and combination of parts constituting the pulverising or reducing machine, or apparatus, substantially as hereinbefore described, and illustrated by the accompanying drawings.

2. In pulverising or reducing machines or apparatus, the combination of a conical grinding surface, and a grinding roller or grinding rollers, enclosed in a casing, and with an inlet for water from below, and an exit therefor from above, substantially as hereinbefore described.

Dated this 16th day of August, 1894.

EDWARD WATERS.