(No Model.)

G. FRASER.

GRINDING AND AMALGAMATING MILL FOR GOLD OR SILVER ORES.

No. 466,162. Patented Dec. 29, 1891.

Fig. 1.

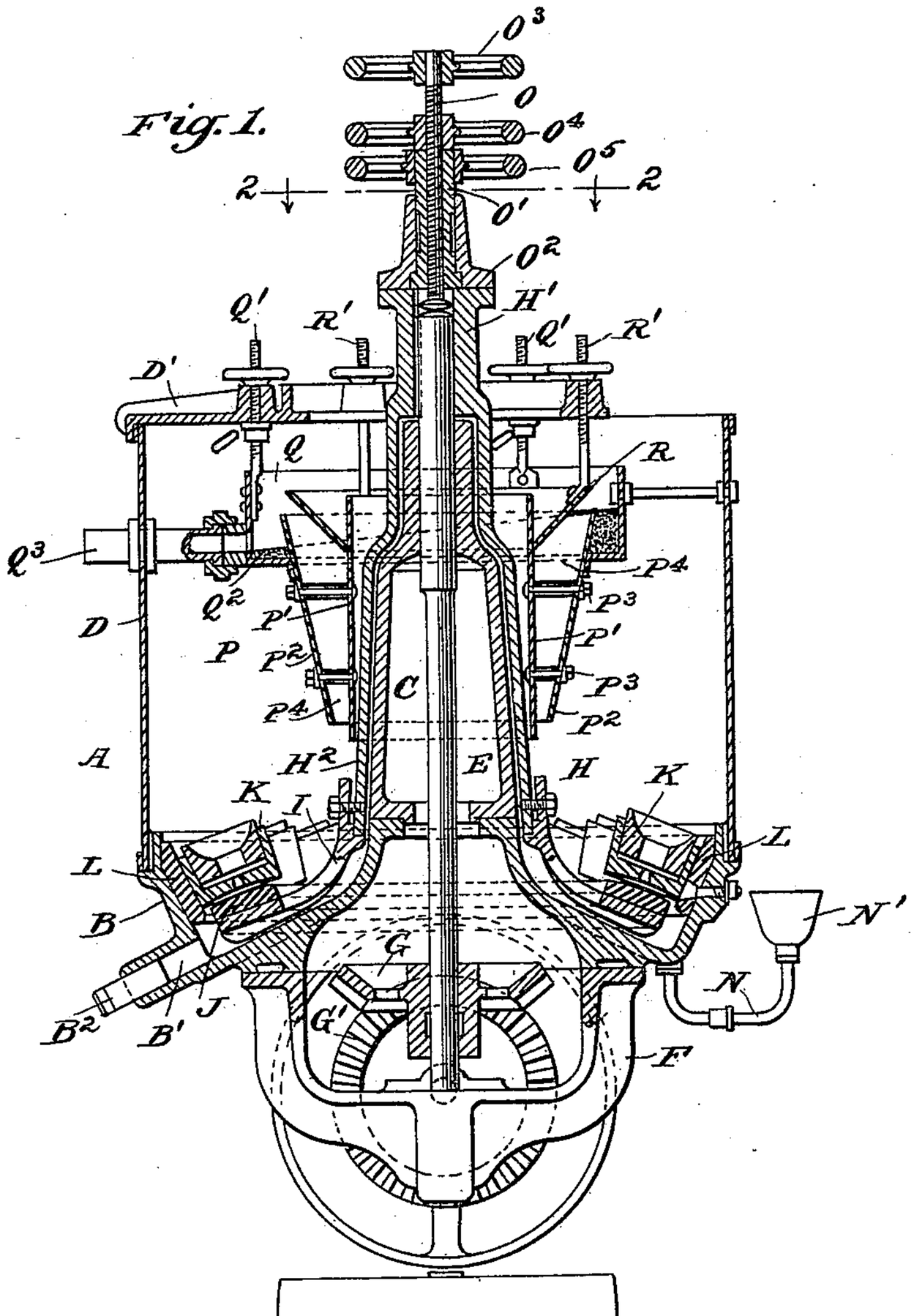
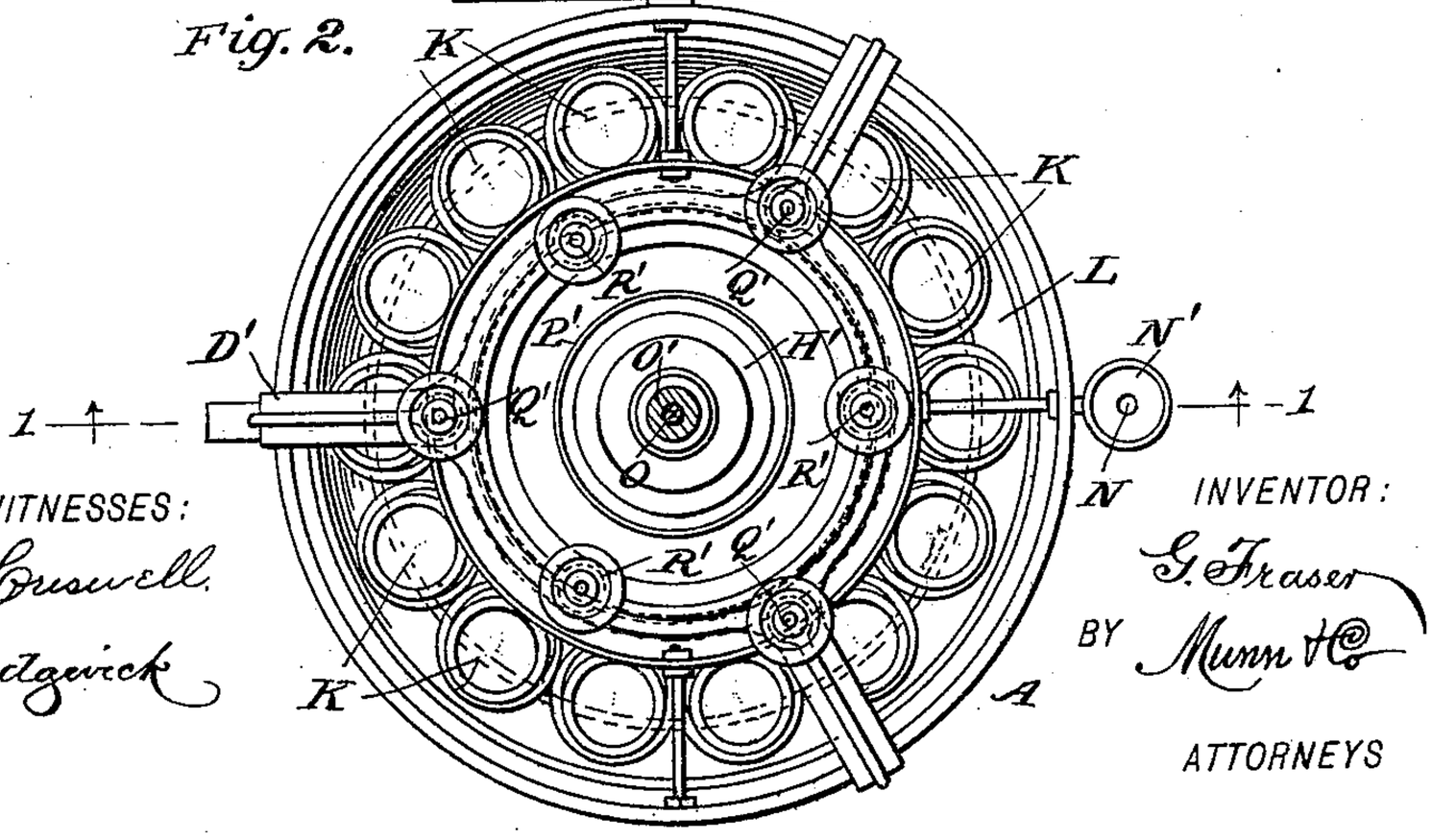


Fig. 2.



WITNESSES:

J. A. E. Brownell.

C. Sedgwick

INVENTOR:

G. Fraser

BY Munn & Co

ATTORNEYS

UNITED STATES PATENT OFFICE.

GEORGE FRASER, OF AUCKLAND, NEW ZEALAND.

GRINDING AND AMALGAMATING MILL FOR GOLD OR SILVER ORES.

SPECIFICATION forming part of Letters Patent No. 466,162, dated December 29, 1891.

Application filed February 7, 1891. Serial No. 380,580. (No model.)

To all whom it may concern:

Be it known that I, GEORGE FRASER, engineer, a subject of the Queen of Great Britain, and a resident of Auckland, New Zealand, have invented a new and useful Improvement in Grinding and Amalgamating Mills for Gold or Silver Ores, of which the following is a specification.

The object of the invention is to provide a new and improved grinding and amalgamating mill designed to reduce gold, silver, tin, or other mineral ores and hard substances, and which is simple and durable in construction, very effective, and continuous in operation, completely separating the precious metal from the tailings at a very low cost, at the same time making it possible to work low-grade ores.

The invention consists of certain parts and details and combinations of the same, as will be hereinafter fully described, and then pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar letters of reference indicate corresponding parts in all the figures.

Figure 1 is a sectional side elevation of the improvement on the line 1 1 of Fig. 2, and Fig. 2 is a sectional plan view of the same on the line 2 2 of Fig. 1.

The improved grinding and amalgamating mill is provided with a fixed casing A, the lower part B of which is circular and has its side wall slightly inclined, as is plainly shown in Fig. 1. The bottom of this lower part or receptacle B inclines upward and has its central part extended vertically to form a central hub C, which extends with its upper end in line with the upper edge of the shell D, secured to the lower receptacle B. In the hub C is mounted to revolve a shaft E, set with its lower end in a step attached to the under side of the receptacle B. A bevel gear-wheel G is secured near the lower end of the shaft E, and meshes into a correspondingly-shaped gear-wheel G′, secured on a driving-shaft, connected in the usual manner with suitable machinery for imparting a rotary motion to the said shaft and consequently, by the gear-wheels G′ and G, to the shaft E. The latter carries the muller H, revolving in the casing A and provided with a central hub H′, held by a key on the upper end of the shaft E. From the hub H′ extends downward over the hub C a shell H^2, carrying on its lower end a spider I, slightly curved, as is plainly shown in Fig. 1, and supporting near its outer edge a ring J, on which are mounted, loosely, grinding-rollers K, placed close one to the other, so that their peripheral surfaces are in grinding contact with each other and also in grinding contact with the inner surface of a ring L, secured to the side wall of the lower receptacle B. When the muller H is rotated within the casing, the said grinding-rollers K are forced by centrifugal force in contact with the said fixed ring L, so as to revolve and thereby grinding the material under treatment both on the ring L and between the several rollers

In the bottom of the receptacle B is formed an outlet-opening B′, adapted to be closed by a plug B^2 and serving to withdraw the amalgamated material whenever desired. In order to charge the receptacle B with quicksilver a pipe N is provided leading into the bottom of the said receptacle B and bent upward to support at its upper end a cup N′, into which the quicksilver is introduced, so that the quicksilver flows by its own weight into the receptacle B, it being understood that the said cup N′ is arranged above the bottom of the said receptacle.

In order to adjust the muller H, a screw O is provided, screwing in a nut O′, secured in a keeper O^2, fastened on the upper end of the hub H′. A hand-wheel O^3 is fixed on the outer end of the said screw O, so as to conveniently turn the latter in order to raise or to lower the muller H. It is understood that the inner end of the screw-rod O abuts against the upper end of the shaft E, thereby causing a raising or lowering of the muller when the screw-rod is turned. When the muller is in the proper position, the screw-rod O is locked in place by a wheeled nut O^4, screwing on the screw-rod O against the upper end of the nut O′. The latter can also be turned in its keeper O^2, being provided for this purpose with a hand-wheel O^5.

In order to carry off the tailings the casing A contains a silent overflow P, provided with an inner annular shell P′, arranged close to the shell H^2 of the muller H. From this inner shell P′ is supported a second outer shell P^2

by stay-bolts P^3 or by other means. The outer shell P^2 is in the shape of a truncated cone placed in an inverted position, as is plainly shown in Fig. 1. The two shells P′ and P^2 form an annular space the lower end of which is narrower than the upper end, which latter forms the exit for the tailings.

The upper end of the outer shell P^2 discharges into a hopper Q, supported from screw-rods Q′, passing through a cap D′, held on the upper end of the shell D and engaging wheeled nuts. Stay-bolts may be also employed for holding the hopper Q in place, the stay-bolts being secured directly to the shell D. The hopper Q is provided with an inclined bottom Q^2, the lower end of which leads to an outlet-pipe Q^3, passing to the side of the shell D and leading to a suitable settling-tank or other receptacle for further treating the tailings.

Between the shells P′ and P^2 and at their discharge end is arranged a regulator R, formed of a ring of the shape of an inverted truncated cone, the inner end of the said ring fitting closely onto the outer surface of the inner shell P′. The regulator R is hung on screw-rods R′, passing through the cap D′ and engaging wheeled nuts, so as to raise or lower the said regulator R to increase or diminish the space forming the outlet discharging into the hopper Q.

The operation is as follows: Quicksilver is put or introduced into the receptacle B through the cup N′ and pipe N. The muller H is raised so that its ring J is about two inches off the bottom of the receptacle B, as is plainly shown in Fig. 1. The casing A is then about half-filled with water, and then motion is imparted to the shaft E, so that the muller H revolves within the said casing, say, about sixty to eighty revolutions per minute. The ore to be treated is then fed by a suitable feeding device into the casing A, the ore having previously been treated to a crushing, so as to pass through a sieve of one-half inch mesh. The centrifugal force from the revolving muller H keeps the rollers K hard up against the ring L, the friction of which causes the entire series of rollers to revolve each on its own bottom, thus revolving and grinding on top of the ring J. Besides grinding on the outer ring L the rollers also grind one against the other. For a muller of about five inches diameter the ore is fed in at a rate of from five to eight hundred-weight per hour, and a quantity of water is introduced in proportion to the nature of the ore under treatment. Through the revolving of the muller H and the separate revolving of each of the rollers K there is a complete circulation of the particles of the ore among the grinding-surfaces until the precious metals, such as gold and silver, are entirely freed from the tailings. By the centrifugal force of the muller H the heavy portions of the ground substances are thrown out to the periphery of the mill, while the lighter portions are more in the center of the mill, at which point the silent overflow P is applied to carry off the said lighter portions. The height of the overflow is placed at a considerable distance from the grinding-surfaces, so that a further separation of the lighter material is obtained by the law of gravity. By feeding the ore and water at the periphery of the casing A displacement takes place at the center by discharge through the silent overflow P, as is previously described, and illustrated in the accompanying drawings.

It is understood that the lighter portions or tailings pass between the shells P′ and P^2 into the hopper Q, from which the tailings flow through the pipes Q^3 to an outside receptacle to be further treated. The flow of the tailings into the hopper Q is under the control of the operator, who can adjust the regulator R so as to let more or less tailings pass from the shells P′ and P^2 to the hopper Q. By this machine a complete separation of the particles of the substances under treatment is made. It will further be seen that the outer shell P^2 of the silent overflow cuts off all commotion from the contents of the outer portion of the mill, while the inner shell P′ of the said silent overflow cuts off all commotion caused by the friction of the central shell H^2 of the muller H, it being understood that the contents of the annular space between the two shells H^2 and P′ remain in a state of quiet, so that as the mill is fed with ore and water the overflow carries away only particles of light specific gravity, while gold and silver, which are of a greater specific gravity, go to the bottom of the receptacle B and are there amalgamated with the quicksilver. The quicksilver containing the amalgam is taken from the mill through the pipe N and the cup N′, if desired; or it may be run out at the outlet B′ by withdrawing the plug B^2.

The advantages of this machine are that it forms a complete crusher and amalgamator in itself, crushing from half-inch mesh to the finest pulp. The silent discharge or overflow carries away only matter of light specific gravity, while gold and silver, which are of a greater specific gravity, are retained in the receptacle B and amalgamated with the quicksilver.

The machine dispenses with the use of gratings or screens, copper-plate tables, riffles, blanks, and berdans.

The machine further reduces the loss of quicksilver to a minimum, and also permits of reducing low-grade ore at a profit.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. In a grinding and amalgamating mill, the combination, with a fixed casing having an annular grinding-surface, of a revolving frame in the casing, and a series of grinding-rollers

supported loosely upon the revolving frame and in contact with each other, whereby the rollers will be revolved upon the frame in contact with each other and with the grinding-surface of the casing, substantially as described.

2. In a grinding and amalgamating mill, the combination, with a receptacle containing a fixed grinding-ring, of a revoluble frame mounted to revolve within the said casing and provided with an annular ring, and a series of rollers supported loosely on the ring of the said frame, grinding one against the other and all on the said rings of the frame and receptacle, substantially as shown and described.

3. In a grinding and amalgamating mill, the combination, with a receptacle containing a fixed grinding-ring, of a revoluble frame mounted to revolve within the said casing and provided with an annular ring, a series of rollers supported loosely on the ring of the said frame, grinding one against the other and all on the said rings of the frame and receptacle, and means for continually removing the tailings from the said receptacle and charging the latter with quicksilver, substantially as shown and described.

4. In a grinding and amalgamating mill, the combination, with a fixed casing and a revolving muller, of an annular overflow arranged at the center of the casing and communicating at its upper end with an outlet-pipe, substantially as described.

5. In a grinding and amalgamating mill, a silent overflow comprising an inner and outer shell, a hopper into which discharges the said outer shell, and an outlet-pipe leading from the said hopper, substantially as shown and described.

6. In a grinding and amalgamating mill, a silent overflow comprising an inner and outer shell, a hopper into which discharges the said outer shell, an outlet-pipe leading from the said hopper, and an inclined bottom arranged in the said hopper and leading with its lower end to the said outlet-pipe, substantially as shown and described.

7. In a grinding and amalgamating mill, a silent overflow comprising an inner and outer shell, a hopper into which discharges the said outer shell, an outlet-pipe leading from the said hopper, and a movable regulator held in the discharge of the said two shells, substantially as shown and described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 24th day of December, 1890.

GEORGE FRASER.

Witnesses:

WALTER GREENSHIELDS,

WILLIAM GREENSHIELDS.