F. G. HESSE.

Almalgamator.

No. 69,564. Patented Oct. 8, 1867.

Fig: 1.

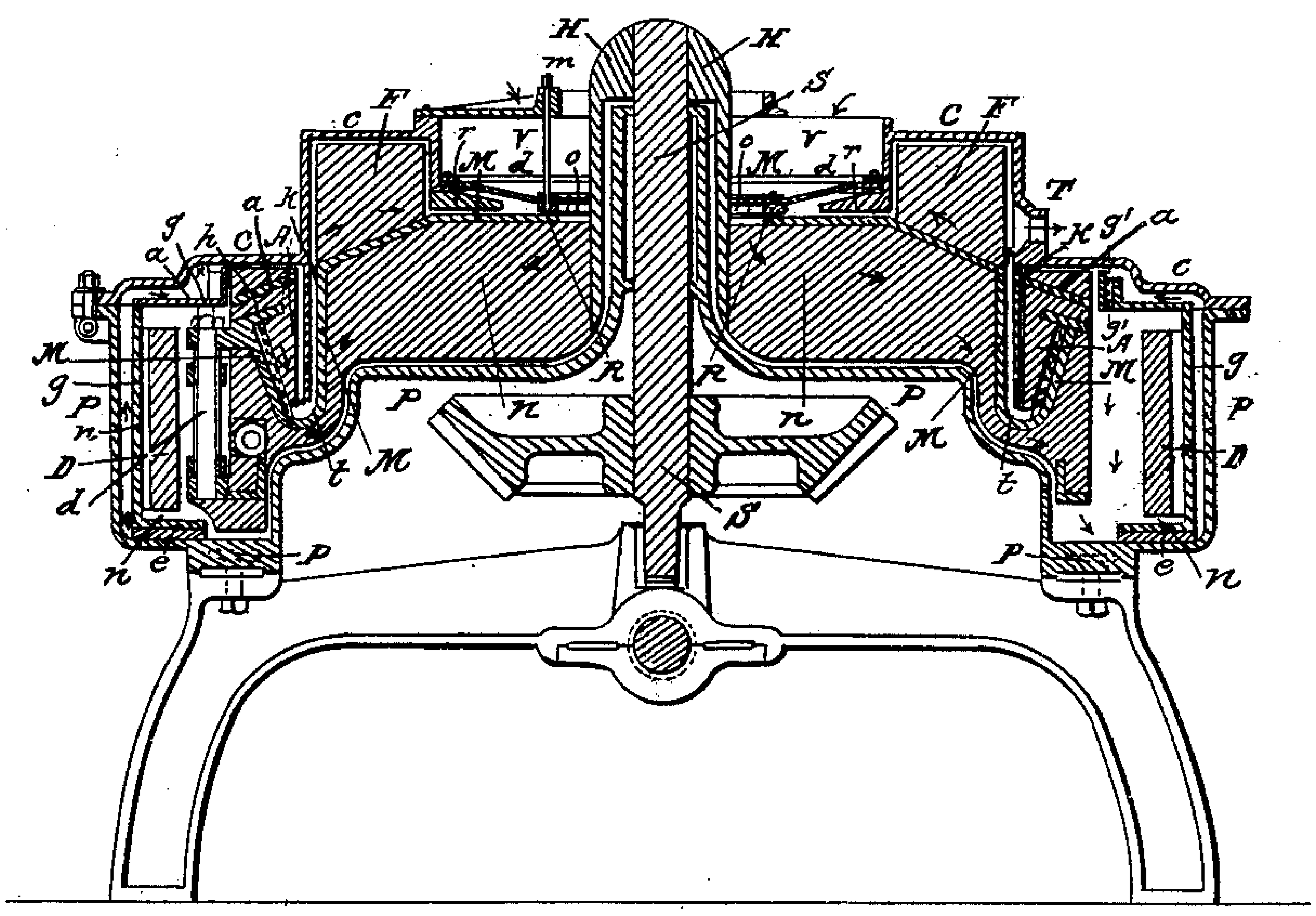

Fig: 4.

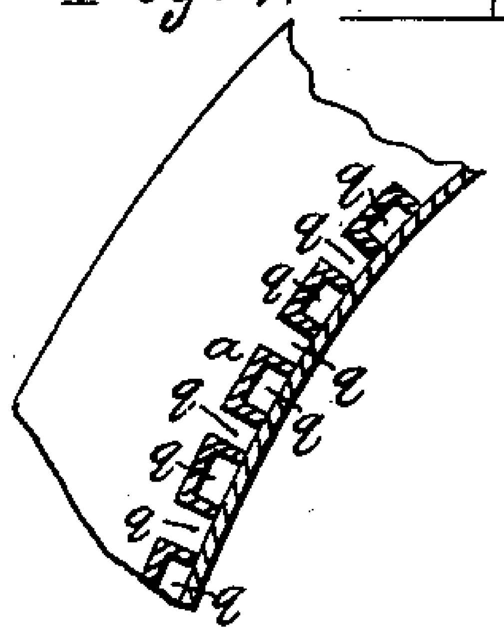

Fig: 2.

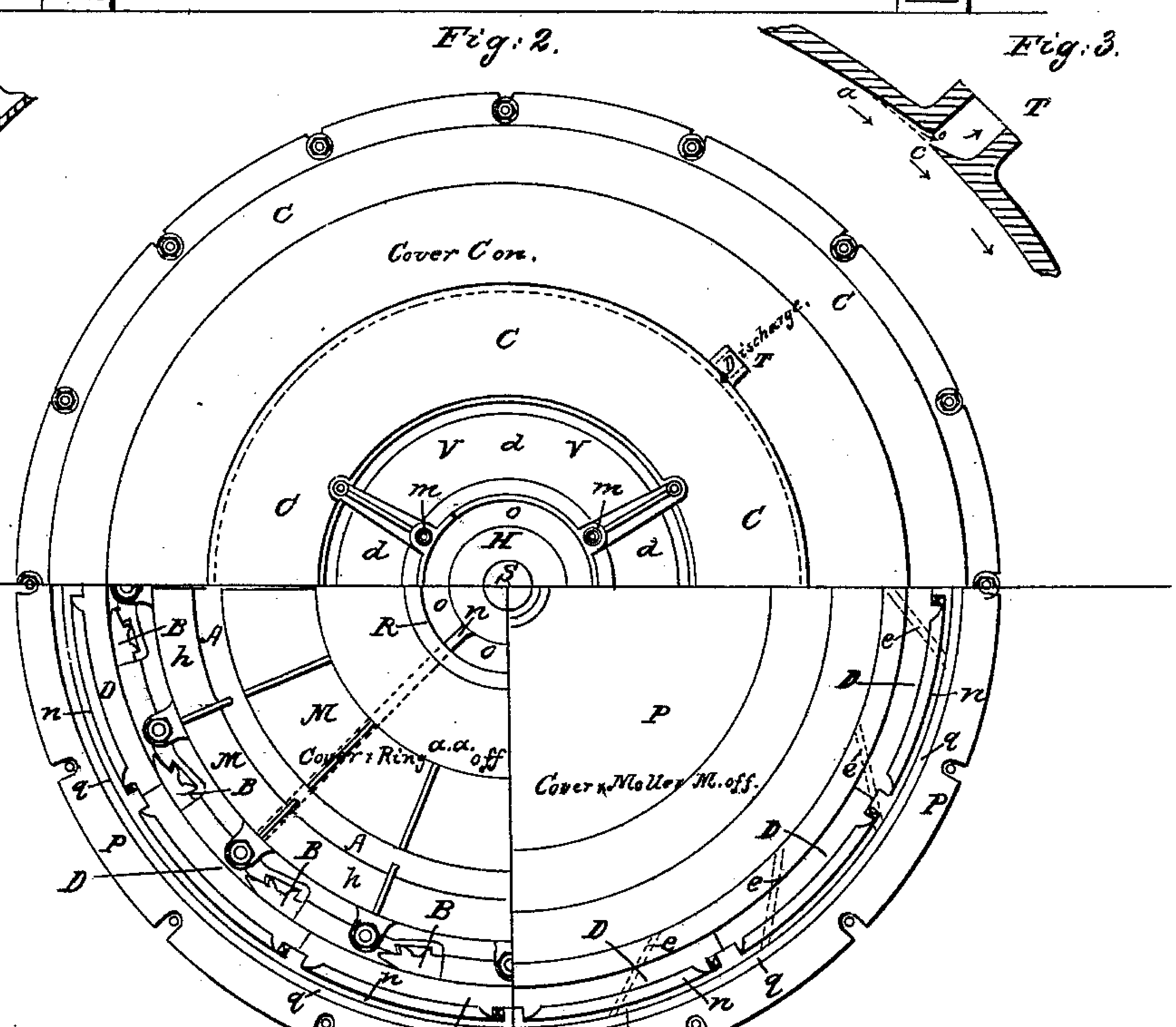

Fig: 3.

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FREDERICK G. HESSE, OF SAN FRANCISCO, CALIFORNIA.

Letters Patent No. 69,564, *dated October* 8, 1867.

IMPROVED AMALGAMATOR.

The Schedule referred to in these Letters Patent and making part of the same.

TO ALL WHOM IT MAY CONCERN:

Be it known that I, Frederick G. Hesse, of San Francisco, in the county of San Francisco, and State of California, have invented a new and useful Machine for Grinding and Amalgamating Gold and Silver Ores; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same, reference being had to the annexed drawings, making a part of this specification, in which—

Figure I is a transverse section.

Figure II a top view, exposing the different parts.

The machine belongs to that class of grinding and amalgamating-pans which receive the coarse tailings from the mill, and operate upon the same during their passage through the pan, receiving and discharging continuously.

The object of my invention is comprised in the following points, viz: first, rapidity in grinding, with economy in wear and power; second, efficient amalgamation without loss of mercury; third, discharge must be capable of adjustment as to the size of particles; fourth, the operation of the pan must be independent of the quantity of water it receives from the mill.

The first of these points "grinding," has been obtained, not by the manner or intrinsic action of the grinders, which have been used heretofore, but by the co-operation of the following principle, viz, the grinders receive and operate at once upon those particles only which require grinding, or which exceed that size to which the discharge has been adjusted. The other points will be more clearly understood from the operation of the machine.

Description.

To enable others skilled in the art to make and use my invention, I will proceed to describe its construction and operation.

The machine consists of three main parts, viz, the stationary bowl or pan P, its cover C, and the revolving stationary muller M, to which are attached the shoes B. The revolving parts are painted in indigo, and the portion gray.

Fig. I represents a section of a plane passing through the centre line of shaft S. The central part of bowl P contains the bearing for shaft S. *n n* represents a cylinder with the flange *n*, to which are cast ribs or wings, *e e*, on which *n n* rests concentric with the pan P, and forming with the same the space *g* and *e*. The dies D are fastened to *n*, as shown in Fig. II. The cover C is secured to P by means of flange and screws. The annular disk *a a* is fastened to the cover C, forming with the same a circular channel, which communicates with *g* at its outer periphery; at its inner periphery it communicates with the pan by means of a series of channels, *q*, and tubes, *q*, Fig. IV. The muller M, which is fastened to the hub H by means of four wings, *n*, forms the amalgamating-chamber A, and holds suspended the shoes B, by means of bolts *d*, about which they are allowed to turn. *t* represents a cylinder cast to the cover C, and which projects into the amalgamating-chamber A, forming with M a narrow passage, *k*. The cover C and muller M form the annular chamber, "filtering-chamber," F. The bottom *d* of the receiving-vessel V is made of gutta percha, in order to allow the ring R to be raised or lowered to form an adjustable passage between R and M. *r* represent wings cast to C. The muller M is provided with ribs or wings, both below and above, in order to impart rotary motion to the water. In the drawing, the wings are shown shaded with blue lines.

Now, let us suppose the pan to be filled with water, discharge T to be closed, and M to be made to revolve by means of shaft S and bevel-wheels connected to the same. The wings revolving with M will impart rotary motion to the water, but the stationary wings *r*, under the gutta-percha bottom *d*, will destroy said motion, thereby destroying the centrifugal equilibrium, and causing a column of water of the same length to press forward under M, (directly under R *r*,) with its full centrifugal head. This centrifugal head depends on the velocity of rotation, and on the inner and outer radius of the column of water, the velocity of which has been destroyed. If we call *n* the number of revolutions per minute, *r* and $\underset{\cdot}{r}$ the radial distances of the ends of that column of water destroyed, the centrifugal head, expressed in feet, will be equal to .00017 $n^2 (r^2 - \underset{\cdot}{r}^2$.) For this reason a current of water is formed in the direction of the arrows, from F through channel between *d* and M, and between R and M through *o*, and then outwards between P and M. A similar current is formed by means of the stationary wings *e*, (under *n*,) flowing through *e*, and upwards in the cylindrical space *g*, through channel between *a* and C, thence through the holes *q* and *q*. The quantity of water discharged through *q* and *q* is made so far in excess of that of the first-named current mentioned above that it not only furnishes said current its necessary quantity, but sends a large amount of water downwards, as indicated by the arrows, Fig. I. The direction of the main current is *n e g q h* A *k* F *r* R *o*. The quantity of flow may be regulated by means of the three screws *m*, which raise or lower the ring R, thereby adjusting the annular opening between R and M. Now, let us open the discharge T. It will cause the water to issue with a velocity due to the centrifugal head of said point. Let us also suppose a supply of water and tailings from the mill to flow into the receiving-vessel V equal in quantity to the discharge, which is made self-regulating by means of a float in V, acting on a valve which operates on the discharge T, (not shown in drawing.) The circulation will still continue, and the quantity of water flowing through *o* will be equal to the water discharged through T, and to the return current between M and R; but, since the quantity of water discharged through T, or the quantity received from the mill, is about one-tenth of the quantity in circulation, a variation in the supply does not affect the circulation sensibly.

With reference to the above explanation, the operation will be as follows:

The pulp is received from the mill into the vessel V, and rotary motion is given to the muller M at the rate of from eighty to one hundred revolutions per minute. The pulp or tailings follows the circulating current *o n e g*, and issues through openings *q*, whence it is carried centrally through the narrow revolving channel *h*. In this channel *h* the particles are acted upon by two opposing forces, viz, centrifugal force, which opposes their passage through *h*, and resistance of the current which tends to carry the particles along through *h*. Particles above a certain size (relatively to their specific gravity) will therefore be rejected and pass directly under the influence of the grinders, of which there are sixteen, the weight of each being about five pounds. As the particles pass from grinder to grinder, they will be carried downwards and follow again the main current *e g*, and so on; and if not fine enough, they will again be thrown under the grinders, as above explained, until they are reduced sufficiently to follow the current against centifugal force through channel *h*. The current *h* determines the fineness or size; and as this current, or the velocity of flow through *h*, is adjustable by means of the screws *m*, so is the size of the particles which are admitted to pass through *h*.

The amalgamating-chamber A contains a charge of mercury from fifty to one hundred pounds, which takes the position (a part of a parabola) as indicated by red lines, Fig. I, depending on the angular velocity of rotation and the distance from the axis. In descending from *h* through A, the particles contained in the water will be forced by centrifugal force on the surface of the mercury. The pulp is then carried upwards through *k* into the "filter-chamber" F. From the dimensions of F it follows that the central current is very small, and as centrifugal force is opposed to said current, it will admit only particles of minute size to be carried centrally; the balance will be discharged through T. A section of this discharge is represented in Fig. III. *a b* forms a tangent with the inner circumference of F. The velocity of rotation is indicated by arrows.

It will be seen from the above that the pulp is forced and held against the outer circumference of F, where it revolves, and, following the tangent *a b*, is discharged through T, together with a certain amount of water. All the water necessary to work the pan is the quantity discharged through T, a quantity about one-fifth of the usual allowance from the mill; and yet the quantity in circulation is about ten times the usual allowance.

I may mention a point of great practical value: The operation of the pan in rejecting particles of a given size, or the action of the separating-channel *h*, is independent of variations in speed, owing to the peculiar mode of creating a current by means of a centrifugal head. The latter increases with the square of the angular velocity; the current due to said head is therefore directly proportional to the velocity of rotation. The two forces in *h* increase or decrease therefore proportionally; that is to say, the centrifugal force of a particle increases with the square of the angular velocity of rotation, and the resistance of the water increases with the square of its velocity; but, since the velocity of current is proportioned to the angular velocity, the resistance of the water increases with the square of the velocity of revolution.

Since the filing of my caveat, on the 20th day of April, 1866, the pan has been practically tested in the mines. Its grinding capacity was found to be about twelve tons in twenty-four hours, at a speed of eighty revolutions per minute, which is nearly four times the capacity of the grinders used heretofore, and requiring the same power, (three-horse.) No mercury could be lost in the amalgamation. Thirty-seven tons of tailings, which had been worked before and containing fine mercury, (floured mercury,) were passed through the pan. The mercury in chamber A was then found to weigh fifteen pounds above its original weight. The action of all parts in the pan has been proved perfect. The discharged pulp is of an evenness never known before. Variations in the quantity of water the pan received from the mill produced no difference in its action. This latter point is of great importance, rendering this class of pans practical. It is due to the discharge T, whereby the pulp, together with a small quantity of water, is discharged, leaving the main body of the water free to return to its action. This action of the "filtering-chamber" F is based on the same principles as that of a machine for clearing water continuously by centrifugal force, and for which I have filed a caveat.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. Separating as to size, by means of the separating-channel *h*, wherein the particles are acted upon by the two opposing forces, centrifugal force and resistance of a current of water, said current being produced by a centrifugal head, and made adjustable in the manner and for the purpose substantially as described.

2. Combining separation with grinding, in order to prevent the grinders from acting upon particles already fine enough, substantially in the manner as described.

3. I claim the revolving amalgamating-chamber A, in combination with the stationary cylinder *t*, and also in combination with the current of water, as described.

4. I claim the discharge T, in combination with the filtering-chamber F, and a current of water produced by centrifugal action, for the purpose and in the manner substantially as described.

5. The annular channel *g e*, formed behind the grinding surfaces, and in combination with the annular disk *a a*, forming an annular channel under C, which communicates with *g*, for the purpose of producing by centrifugal action an upward current therein, the strength of which may be regulated by the dimensions of *n*, for the purpose substantially as described.

FREDERICK G. HESSE.

Witnesses:

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