

961,905.

Fig. 1.

Fig. 2.

Witnesses.
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UNITED STATES PATENT OFFICE.

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KENT ORE REDUCTION COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF
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AMALGAMATOR.

961,905.

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To all whom it may concern:

Be it known that we, ALICE J. SMITH and HENRY W. KENT, citizens of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Amalgamators, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

The purpose of this invention is to provide an improved apparatus for amalgamating ores.

It consists in the elements and features of construction illustrated and described as indicated in the claims.

In the drawings:—Figure 1 is a vertical axial section of an apparatus embodying the structure and adapted for the use of the process constituting this invention, the pulp-supply pipe being broken away near the apparatus. Fig. 2 is an elevation of the pump for supplying the pulp, and the discharge pipe therefrom, which is the supply pipe shown broken away in Fig. 1.

The purpose of the apparatus shown in the drawings is to cause discharge of the pulp to be treated in relatively fine jets into the bottom part of a body of mercury, A, contained in a tank or receptacle, B, and heated to preferably the boiling point of water, as by a steam jacket, C, extending under and encompassing the bottom part of the tank or receptacle up to the desired height of the mercury therein, whereby the pulp is forced into the mercury instead of having mercury forced into it or permitted to pass into it by gravity. The pulp thus forced into the mercury rises through it by reason of its lesser specific gravity, and is also dispersed throughout the mercury by the ebullition of the water coming in contact with the hot mercury, causing the mercury to be agitated and the pulp to be even more thoroughly subdivided and diffused through the mercury than it would be by merely being discharged into it in small jets, as stated. The receptacle B is provided with an overflow opening, A¹, near the top at which the water and lighter refuse passes out, other overflow or draw-off connections, A² and A³, being provided, the first almost immediately above the level of the mercury,—that is, the level at which it stands when cold and settled,—and the others,

A³,—one or more—intermediate this level and the highest overflow level. At these different levels below the highest overflow, there may be drawn off the different concentrates which result. The gold and silver amalgam being heavier than the mercury settles to the bottom and accumulates in a layer which may be removed periodically, this most conveniently being done through an opening in the bottom of the receptacle at the center thereof, the bottom being slightly sloped from all sides to the center to cause the ready delivery of the amalgam through the discharge pipe, D, connected at such central opening and extending through the steam jacket, C, and provided with a controlling valve, D¹, below the latter. For discharging the pulp in small jets into the lower part of the body of mercury, as described, it is preferred to employ a conical discharge head, E, having a multiplicity of small pipes, F, extending off from it in all directions diverging laterally and downwardly and terminating very near to the bottom of the receptacle, B. Preferably, this conical discharge head has its upper diameter substantially equal to its slant height, so that an axial section is an equilateral triangle; but the precise form is not essential, except as a means of obtaining the largest area for connection of the discharge pipes, F, consistent with a given capacity of the head. The discharge head is closed at the top by a cap, G, which has a central opening for the supply pipe, H, through which the pulp is discharged by direct pressure from a suitable pump, such as the rotary pump, T, adapted to afford pressure exceeding that which will be developed in the tank, B, when the latter is full to the height of the overflow, A¹.

It is important for the most efficient operation of the structure for its purpose that the pump, T, should be located as short distance as possible from the tank and discharge head so that the minimum opportunity may exist for the pulp to settle before it is delivered into the discharge head, the desirable condition being that the pump should receive the pulp at as short distance as possible from the point at which it is last mixed with water, and that the pulp should be kept in such condition of agitation that no settling can possibly occur until it is delivered through the discharge head. This

important characteristic of the relation of the pump to the discharge head is indicated in the claims by specifying the pump as "proximately connected" with the discharge head.

For distributing the pulp and preventing it from being projected to the bottom of the discharge head, which might tend to cause the accumulation of heavier fragments at the bottom, it is preferable to employ a baffle plate or distributor, K, suspended under the discharge mouth of the supply pipe, H, a short distance below the top of the head, the plate being approximately half the diameter of the hopper at the level at which it is thus suspended, so that the pulp discharged on the plate and deflected thereby is delivered from the margin thereof against the inclined sides of the head along which any part undischarged through the pipes, F, may descend for further opportunity of discharge through the pipes lower down.

In order to dissolve the slimes and free the metal particles from the coating usually of greasy material which defeats the attack of the mercury, and to clear the mercury itself from that coating, there is provided a small pipe, L, entering through the side of the pipe, H, and extending downward axially therein, and terminating a very short distance above the center of the baffle plate, K. This pipe is connected with a pump, represented conventionally at M, whose intake, the pipe, O, leads from a tank, J, containing a suitable solution for the purpose stated. The piston, N, of the pump, M, may be operated in any convenient manner, as by a belt around the pulley, P. The interior of the tank, and both the interior and the exterior of the discharge head, E, and pipes, F, and preferably, also, the baffle plate and its supports, are thoroughly enameled to protect them against the attack of mercury. The tank, B, may be covered or left open, as preferable, at the annular portion around the top of the pulp hopper, E.

It is preferred to support the discharge head, E, and its feed pipe, H, and connected parts, in such manner that the head and all said connected parts may be lifted bodily from the tank whenever the latter is to be cleared of its contents or cleansed; and for that purpose, the final downwardly extending section, H, of said supply pipe, is connected with a horizontal section, H¹, by a T-fitting, H², whose unused opening may be closed by a plug, H³; and this T-fitting is carried in a sling, consisting of two links, H⁴, H⁴, engaged respectively with the two ends of the horizontal element of the T, and with a hook on the end of a suspending chain or cable, represented by the last link thereof, U, which may be understood as extending over a pulley, not shown, and connected with any suitable hoisting means, not shown, for lifting

the entire suspended parts, the horizontal element, H¹, of the supply pipe being joined to the fixed section, H², of such pipe by coupling flanges, h¹, which may be detached to permit the structure to be lifted. The pipe, O, is similarly detachably coupled at O¹ for the same purpose.

The important advantages of this structure may be partly understood from the foregoing, but may be particularized as being: first, the conducting of the pulp without opportunity for settling into, and its discharge within, a body of mercury; and this is to be distinguished from its discharge into such body, for the purpose to be effected is to cause the first contact of the pulp with the mercury at a sufficient distance below the top of the mercury body and at a point where it is completely enveloped by the mercury to insure it as long a path as possible through the mercury in rising to the top of the latter, and also to insure the distribution of the pulp definitely throughout the body of mercury, so that for each particular portion of the discharge,—that is, that which is delivered through each particular discharge pipe,—there shall be a definite portion of the mercury body ready to receive it and act upon it, and this cannot be effected when the pulp is merely discharged into the mercury,—that is, injected into it from the mouth of any discharge pipe or nozzle outside the mercury body,—but can only be effected when the pulp is conducted down into the mercury body, as by the intrusion of the discharge pipe therein, so that it is positively led or forced and guided, and in that sense conducted, to the point of its discharge within the mercury as near the bottom thereof as possible without defeating the proper discharge of the pulp; second, that the path of each portion of pulp which is thus conducted into and discharged in the mercury, from the point of its discharge to the surface of the mercury, is obstructed by the discharge pipes, diverging laterally and downwardly, so that the pulp is compelled to take a circuitous course and thereby is kept longer in contact with the mercury. The oblique arrangement of the discharge pipes is the means by which this path is obstructed and the circuitous course compelled; third, the same arrangement of the discharge pipes makes them constitute a complete guard or fender interposed between the amalgam which accumulates at the bottom of the mercury and the upper surface, so that the stealing of the amalgam by spooning it out which would be an easy matter in the absence of such protection, is rendered practically impossible, or so difficult that a very ordinary amount of watching will prevent it; fourth, the provision for withdrawing the discharge head and its discharge pipes, leaving the entire tank accessible after the concentrates

and refuse have been drawn off down to within a very short distance of the level of the mercury, makes it possible to completely clean the mercury down to a clear surface by skimming the thin layer which may be left in thus drawing off the concentrates, and which is left only for the purpose of avoiding the waste of mercury which might result from attempting to draw off the concentrates down too close to the level of the mercury; and this having been done, the amalgam and mercury being drawn off through the bottom by opening the valve, D', the customary wringing process can be employed to separate the mercury from the amalgam, the mercury being then recovered in a perfectly pure state and the amalgam also free from dross. The advantages of this over any mechanism in which it is possible for the mercury to be partly floated away will be obvious; fifth, with a depth of four inches of mercury in a tank twelve inches deep, the quantity of mercury is adequate for attacking and engaging the precious metals contained in the pulp of the richest quality, so that no precious metal will ever be lost for lack of sufficient mercury to hold it in the passage of the pulp through it. The sufficiency of the quantity of mercury indicated may be appreciated upon considering that a depth of a half inch of gold amalgam in the bottom of the four-inch-deep mercury body, leaving seven-eighths of the mercury still quick, will amount to one hundred thousand dollars value in each running, and if the apparatus is therefore cleaned up whenever a half inch of amalgam is accumulated,—that distance being left below the end of the discharge pipe with this intention,—the frequency of the step in the process consisting of cleaning up will constitute a negligible element in the expense of the operation; sixth, the mercury being heated to a comparatively high temperature, preferably the boiling point of water, is in such extremely fluid state that the metal in the pulp discharged within it is instantly attacked, the mercury having no tendency to globule upon the surface of the grains containing or consisting of the precious metal, and as a result, practically all the precious metal values will be extracted if the pulp has been reduced to sufficiently fine condition to expose the metal. The solvent delivered through the pipe, L, at the center of the pulp as it enters the discharge head, is thoroughly diffused throughout the entire body of pulp and performs its function of cleaning every grain of it before it is conducted into the mercury; and its delivery within the mercury follows so promptly after this cleaning that there is no opportunity for the greasy material to re-accumulate. A sufficient quantity of the solvent being supplied, which may be graduated ac-

cording to the condition of the pulp,—that is, as to quantity and character of the slimes which it contains,—there will be an excess above the amount necessary to clean the pulp which will operate to clean the mercury also, such excess being delivered with the pulp through the pipes, F.

We claim:—

1. An amalgamating apparatus comprising a receptacle for the mercury and pulp to be treated; a downwardly feeding discharge head having a multiplicity of relatively small discharge pipes diverging downward and opening for discharge of the pulp within the mercury space near the bottom thereof in the receptacle, and directly acting and pulsating means for supplying agitated pulp under pressure to such discharge head.

2. An amalgamating apparatus comprising a receptacle for the mercury and pulp to be treated; a discharge head intruded into the receptacle said discharge head having downwardly converging sides and provided with a multiplicity of relatively small discharge pipes projecting off divergently from said converging sides and distributed substantially over the entire area of said sides and terminating for discharge near the bottom of the receptacle within the mercury space thereof for conducting the pulp to its discharge within the mercury body the outer tier of said pipes terminating in close proximity to the wall of said receptacle, and means for supplying pulp under pressure to the discharge head.

3. An amalgamating apparatus comprising a receptacle for the mercury and pulp to be treated; means for conducting the pulp into the lower part of the receptacle for discharge within the mercury body, said means comprising a multiplicity of pipes disposed above their discharge ends with transverse or lateral trend for screening and obstructing access to the bottom of the receptacle.

4. An amalgamating apparatus comprising a receptacle for the mercury and pulp to be treated; a discharge head having a multiplicity of relatively small discharges opening within the mercury space of the receptacle for conducting the pulp to and delivering it at points below the mercury level; a pulp discharge pipe leading into the top of said discharge head; a baffle plate within the head opposed to the discharge mouth of the pipe; and means for supplying the pulp under pressure through such pipe for discharge against the baffle plate.

5. An amalgamating apparatus comprising a receptacle for the mercury and pulp to be treated; a downwardly feeding inverted conical pulp discharge head having a multiplicity of relatively small discharge pipes opening within the mercury space near the bottom thereof in the receptacle and

distributed over substantially the entire area of said bottom, such discharge head being otherwise closed; and a force pump connected proximately with the discharge head for forcing the pulp positively thereinto for discharge therefrom.

6. An amalgamating apparatus comprising a receptacle for the mercury and pulp to be treated; a discharge head intruded into the receptacle, said discharge head having downwardly converging sides and being provided with a multiplicity of relatively small discharge pipes projecting off divergently from said converging sides and forming a screen above their discharge ends in the path of rise of the material discharged for obstructing and deflecting the material rising through the mercury to the surface thereof.

7. An amalgamating apparatus comprising a receptacle for the mercury and pulp to be treated; means for conducting the pulp into the lower part of the receptacle for discharge within the mercury body, said means comprising a multiplicity of pipes disposed with transverse trend throughout their intrusion into the mercury space, and extended by such lateral trend as a screen above substantially the full area of the bottom of the receptacle.

8. An amalgamating apparatus comprising a receptacle through the mercury and pulp to be treated; a discharge head having a multiplicity of small discharges opening with downward and lateral trend within the

mercury space, the discharge head being otherwise closed; a force pump connected proximately with the discharge head for agitating and forcing the pulp positively thereinto for discharge therefrom through such multiplicity of small discharges.

9. An amalgamating apparatus comprising a receptacle for the mercury and pulp to be treated; a discharge head intruded into the receptacle having downwardly converging sides and being provided with a multiplicity of relatively small discharge pipes projecting from and distributed over substantially the entire area of said converging sides and terminating for downward discharge within the mercury space of the receptacle, the discharge head being otherwise closed; a force pump connected proximately with the discharge head for forcing the pulp positively thereinto for discharge therefrom through such multiplicity of small discharge pipes.

In testimony whereof, we have hereunto set our hands, respectively, at Milwaukee, Wisconsin, this 19 day of July, 1907, and at Chicago, Illinois, this 18 day of July, 1907.

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