

Jan. 25, 1955

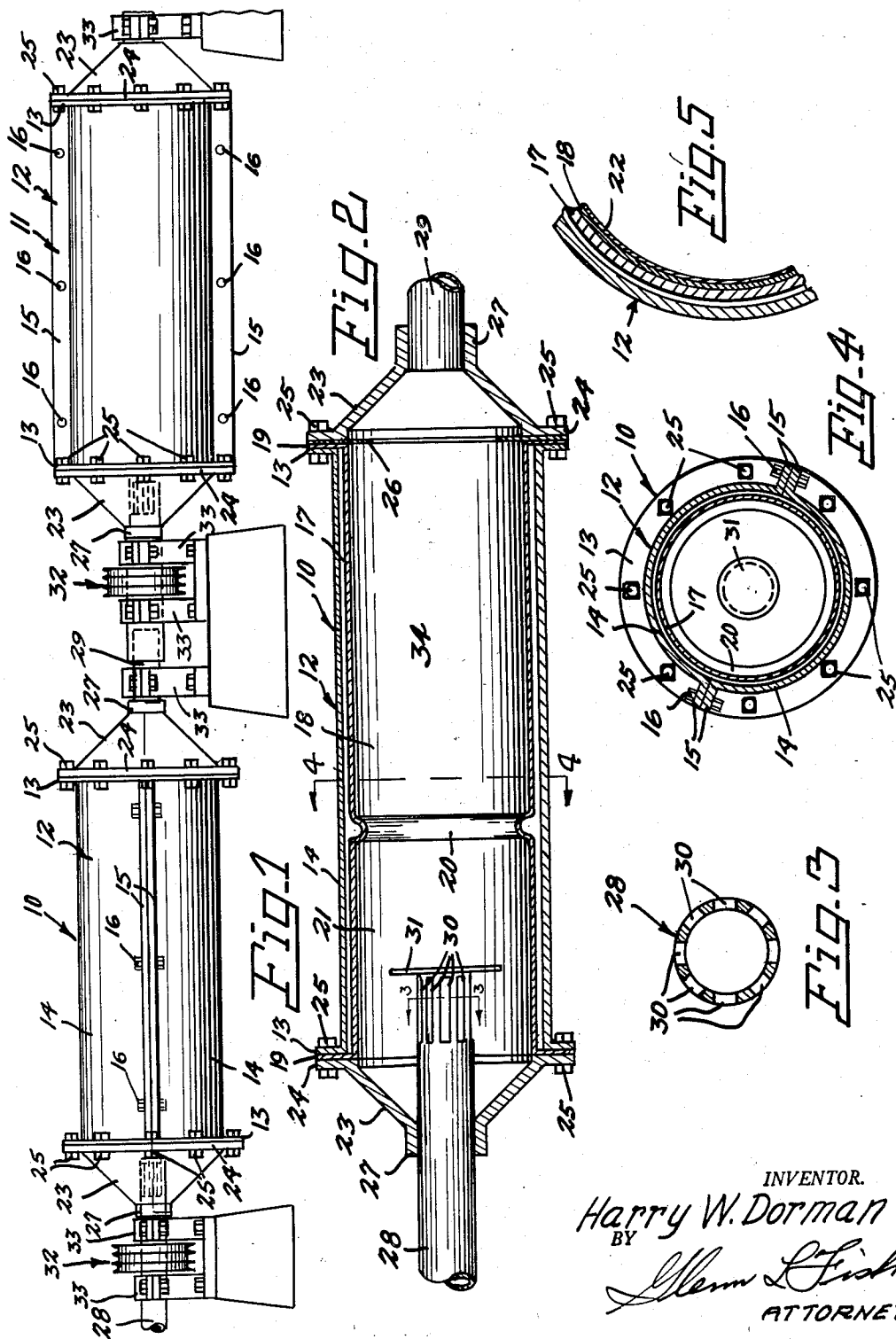
H. W. DORMAN

2,700,467

APPARATUS FOR REDUCING PRECIOUS METALS

Filed May 11, 1953

2 Sheets-Sheet 1



INVENTOR.
Harry W. Dorman
BY
Glen L. Fish
ATTORNEY

Jan. 25, 1955

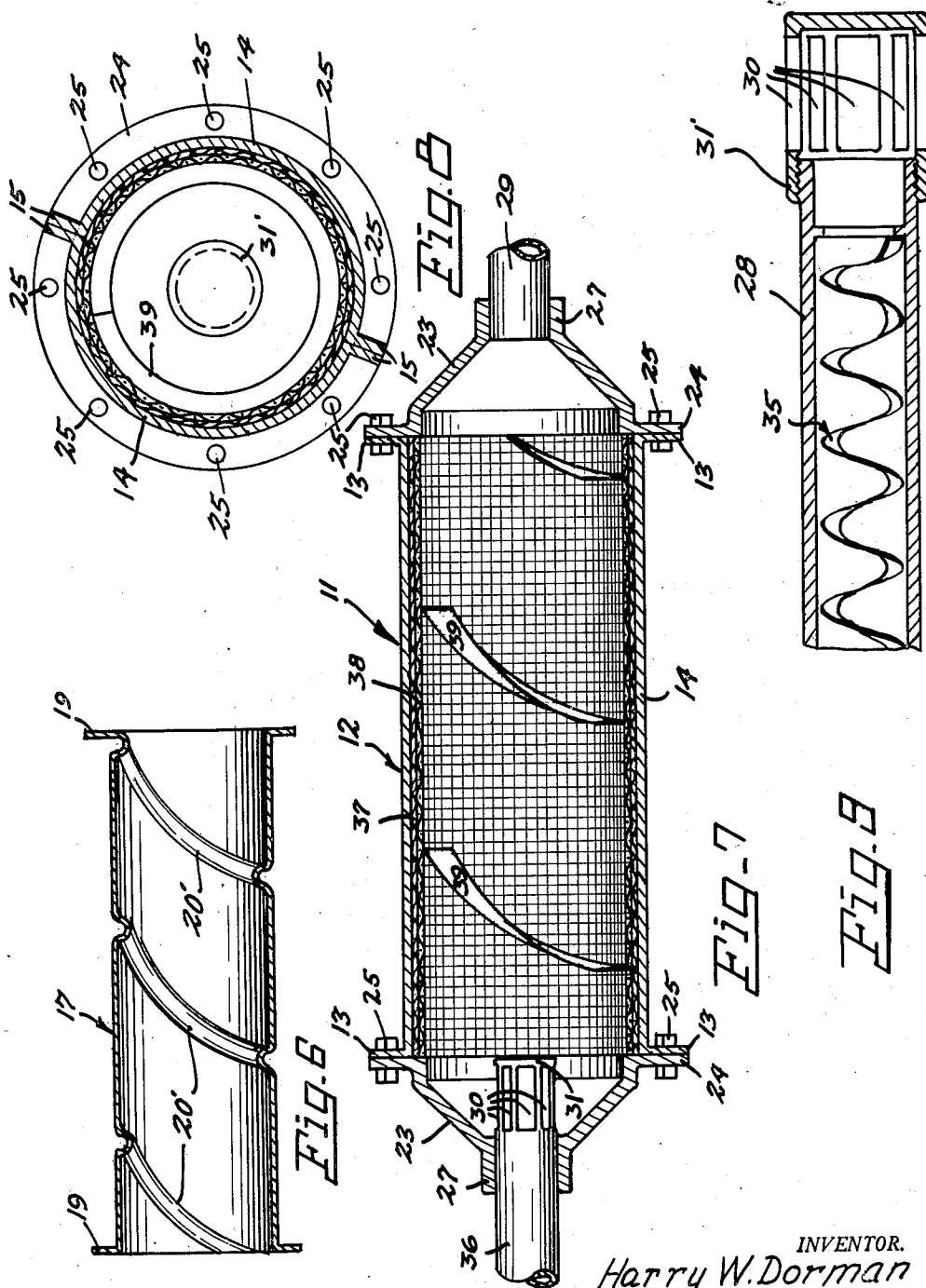
H. W. DORMAN

2,700,467

APPARATUS FOR REDUCING PRECIOUS METALS

Filed May 11, 1953

2 Sheets-Sheet 2



INVENTOR.
Harry W. Dorman

BY

Norm L. Lofish
ATTORNEY

1

2,700,467

APPARATUS FOR REDUCING PRECIOUS METALS

Harry W. Dorman, Spokane, Wash.

Application May 11, 1953, Serial No. 354,154

3 Claims. (Cl. 209—199)

The present invention is apparatus for reducing precious metals from ore.

One object of the invention lies in the provision of an apparatus adapted to reduce precious metals having an affinity for mercury by means of centrifugal force.

Another object of the invention lies in the provision of a centrifuge having mercury therein and adapted to receive pulverized ore suspended in a liquid carrier whereby the precious metal is driven by centrifugal force into the mercury to form an amalgam.

Another object of the invention is to provide means to reduce precious metals having an affinity for mercury by utilizing a compartmented centrifuge containing mercury.

Another object of the invention lies in the provision of an apparatus for reducing precious metals which comprises a pair of centrifuges which may be independently rotated at selective speeds to completely separate the precious metals in ore and having an affinity for mercury.

These and other objects of the invention will become apparent during the course of the following description.

In the accompanying drawings, forming a part of this specification, and in which like numerals are employed to designate like parts;

Figure 1 is a side elevation showing a physical embodiment of the present invention;

Figure 2 is a longitudinal cross section taken through the first centrifuge;

Figure 3 is a transverse cross section taken at line 3—3 of Figure 2;

Figure 4 is a transverse cross section taken at line 4—4 of Figure 2;

Figure 5 is a fragmentary enlarged transverse cross section through a wall section of the first centrifuge;

Figure 6 is a longitudinal vertical cross section of a modified tube adapted to be contained within the housing of the first centrifuge;

Figure 7 is a longitudinal vertical cross section taken through the second centrifuge;

Figure 8 is a transverse cross section of the same; and

Figure 9 is a view partially in longitudinal cross section showing an inlet pipe.

Referring now more particularly to the drawings, I have shown a pair of spaced centrifuges 10 and 11 which form parts of the separator and are applicable to the practice of the present process. The centrifuges are not identical and the one indicated by the numeral 10 will be termed the first centrifuge and the one designated by the numeral 11 will be termed the second, since the pulp advances into the first centrifuge and thence the second.

In the disclosure, the centrifuges are disposed in axial alignment with their axes on a horizontal plane. It will be understood, however, that the axis of each centrifuge may be vertically disposed if desired and they need not be axially aligned to function properly.

The first centrifuge 10 comprises an elongated cylinder 12 having outwardly disposed annular flanges 13 at each end. The cylinder may be made of any suitable material but for reasons of structural support, I am presently employing steel. The cylinder is formed of two semicylindrical sections 14 having longitudinally extending flanges 15 along their marginal edges and companion flanges 15 are secured together by means of bolt and nut units 16.

Within the cylinder 12 of the first centrifuge, I have provided a tubular sleeve 17 which has a silver inner

2

face 18 and may be of any desired material, adequate to support the face. Presently, the body of sleeve 17 is copper with a silver plate on its inner face. Outwardly extending annular flanges 19 are carried at the open ends of the sleeve 17. Intermediate the length of the sleeve 17 I have provided an inwardly disposed annular rib 20 which divides the centrifuge into compartments. The receiving compartment 21 at the forward end of the sleeve 17 is internally coated with mercury as at 22 of Figure 5. The mercury, having an affinity for silver, will adhere to the surface thereof and form a cushion or coating thereon. If desired, free mercury may also be introduced into the first compartment, that is, more mercury than will normally adhere to the side walls of the sleeve, but not in quantities great enough to overflow rib 20 into the discharge compartment 34.

The ends of the cylinder 12 and sleeve 17 are closed by means of tapered end caps 23 which have annular flanges 24 adapting them to be bolted by means of bolt and nut units 25 to the flanges 13 of the cylinders 12 with the flanges 19 clamped therebetween. The end caps 23 are provided with circumferentially extending sleeves 27 and these sleeves are adapted to receive the inlet and outlet pipes 28 and 29. As indicated, the sleeves may be secured about the pipes 28 and 29. However, it will be understood that suitable fluid tight bearings may be incorporated in the sleeves and the pipes 28 and 29 may be stationary while the centrifuge is adapted for rotation if found desirable.

In the event it is desired to provide a restricting ridge, plane collar 26 may also be clamped intermediate the flanges 24 and 13 and its central aperture may be of any desired size to provide a ridge of the height desired.

The inlet pipe 28 communicates an agitating tank (not shown) to the interior of the receiving compartment 21 and the pipe is provided with radial slots 30 and end plate 31 which cause the inflowing pulp to be discharged radially from the pipe toward the mercury coated annular inner wall of the receiving compartment 21.

In the present disclosed embodiment of the invention, pulleys 32 are secured to the inlet pipe 28 which is carried in a bank of self-aligned bearings 33 and a suitable rotating source of power (not shown) is belted to the pulleys 32 to impart rotary movement to the centrifuges 10 and 11.

The speed of rotation of the centrifuge 10 need be only sufficiently fast to cause the elements having a specific gravity of 13 or more to hold to the annular face of the compartment 21. It will thus be seen that elements such as gold, mercury and platinum will adhere to the surface and be amalgamated with the mercury while the lighter elements, by means of the flow of the pulp from the receiving agitator tank out through the discharge pipe 29, will be discharged from the centrifuge. The speed of rotation will vary according to the diameter of the compartment 21 and according to the elements to be separated. Greater speeds may be employed if desired and the separation will be adequately accomplished. Theoretically, the speed of an 18-inch diameter receiving compartment could be increased to 4000 R. P. M. However, at this speed, it is found that the lighter pulverized materials such as rock, iron, etc., are inclined to cake upon the walls and interfere with the amalgamation of the precious metals and the mercury. At such speeds, however, the slight difference in weight distribution of the centrifuge sets up sufficient vibration to adequately dislodge the packed elements and permit the heavier elements to amalgamate with the mercury. Obviously, for reasons of operational costs and machine wear, it is contemplated rotating the centrifuge at much slower rates of speed, even as low as 300 R. P. M., and even though I have not conducted actual experiments at speeds lower than this, theoretically, it will operate at somewhat less R. P. M.

In practice, it is found that the talc and other finely pulverized elements which are not amalgamable with mercury will form a tough skin over the surface of the mercury and this causes the mercury to flake or flour off in very minute quantities and be carried by the advancing pulp into the second or discharge compartment 34. The

mercury, having a greater specific gravity than most of the known elements, will be disposed on the silver lining of the discharge compartment 34. In the event any of this mercury should pass the barrier 26 and enter the discharge pipe 29, it will be again separated and recovered in the second centrifuge 11.

Within the inlet pipe 28, it is desirable to provide an agitator which will maintain the pulverized ore in suspension in the vehicle fluid. To accomplish this, I have provided a spiral 35 which may be rotated to advance the pulp through the pipe 28 and simultaneously agitate the material sufficiently to maintain the ore in suspension. Also the spiral may be fixed within the pipe and when the pipe is being rotated at high speed, the pulp is advanced by means of rotation of the spiral.

In the second centrifuge 11, I utilize an identical housing which comprises the cylinder 12 formed from semicylindrical sections 14 having flanges 15 bolted at 16 and supplied with end caps 23. This centrifuge is provided also with pulleys 32 and bearings 33 and an inlet pipe 36 which is adapted to receive the outlet pipe 29 carried in a bearing 33 and communicate the two centrifuges.

The inlet pipe is provided with radially disposed slots 30 and an end plate 31 and may be of the type shown in Figure 2 or be provided with a separate cap 31', as shown in Figure 9, threadedly engaged to the end of the inlet pipe as 28 or 36.

Within the cylinder 11, I provide a fabric sleeve 37 which may be of burlap or corduroy and within this sleeve is a wire mesh cylinder 38. The wire mesh cylinder is provided with a spiral flange 39 on its inner face and designed to advance the pulp entering the second centrifuge therethrough and discharge it through discharge pipe 29. Any mercury or heavy precious metal which may, by chance, pass from the first centrifuge will thus, by centrifugal force, be deposited in the fabric 37 from whence it may later be removed.

As shown in Figure 6, I have provided a modified sleeve 17 and, instead of having the circumferentially extending inwardly disposed ridge 20, I provide a spirally disposed ridge 20' which, it is anticipated, will advance the pulp through the sleeve 17. In this modified construction the complete inner face of the sleeve will be coated with mercury.

In practicing the disclosed invention, I first pass the mined ore in dry form through a primary crusher where it is reduced to approximately one-half inch mesh. The product is then reduced to approximately 40 mesh through a secondary wet grinder and is subsequently pulverized to

from 150 to 300 mesh and suspended in a liquid carrier which may be water. During this pulverizing process, I introduce sufficient cyanide to place the free gold in solution and introduce the product into an agitating tank 5 which maintains the suspension of the particles and solution of the gold and, after agitation for a suitable length of time, say 16 hours, a valve is opened and the solution is permitted to flow freely through the inlet pipe 28 into the centrifuge where the previously described process is effected and separates the particles of metals from the pulp amalgamating the metals having an affinity for mercury therein. After completion of the separation, the cylinders 10 and 11 are opened and the sleeves 17 and 37 are removed, the amalgam is scraped from the sleeve 17 and the precious metals are reduced in a conventional retort. The mercury and amalgam is removed from the fabric sleeve 37 and also separated in a conventional retort, and the mercury is thus saved and re-used innumerable times.

20 Having thus described my invention, I claim:

1. A centrifugal separator comprising an elongated cylinder having semicylindrical sections releasably united; an annular sleeve disposed within the cylinder; said sleeve having an inwardly disposed annular ridge defining compartments; mercury coating the inner face of said sleeve; outwardly extending annular flanges on the marginal ends of said cylinder and sleeve; end caps secured in closing relation to the ends of the cylinder and clamping said flanges; and inlet and outlet pipes communicating with the cylinder through said end caps.

2. A centrifugal separator as defined in claim 1 wherein the inlet pipe is provided with radially disposed discharge slots positioned within the first compartment of said sleeve and having a cap closing the open end of said inlet pipe.

3. A centrifugal separator comprising a pair of intercommunicating centrifuges, one containing mercury for amalgamation and the other containing a fabric sleeve for confining amalgam escaped from the first centrifuge.

References Cited in the file of this patent

UNITED STATES PATENTS

969,591 Abeel ----- Sept. 6, 1910
1,603,125 Lewis ----- Oct. 12, 1926

FOREIGN PATENTS

794 Australia ----- of 1931