

“Improvements in Apparatus for the Recovery of Precious Metals from their Solutions,” and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

My invention has for its object the recovery of precious metals, such as silver, gold, platinum, &c., from solutions of the same by means of a new and improved apparatus, the apparatus being constructed to effect the deposition or “precipitation” of the precious metal or metals in solution upon a “precipitating” substance, or “precipitant,” which is in a solid but more or less finely-divided state.

The apparatus, for instance, is designed to recover gold, silver, platinum, &c., from solutions of their haloid by means of the employment therein of dense but more or less finely-divided carbon, sub-sulphide of copper, or other known solid and suitable precipitant; again, also, for the recovery of the same metals from their cyanide-solutions by means of the finely-divided zinc product commercially known as “zinc fume,” and generally for analogous requirements.

It is necessary that whenever the nature of the precipitant used and the degree of fineness to which it is found desirable to reduce it primarily, it shall be of greater specific gravity than the liquid or solution desired to be precipitated by it, so that the precipitant shall tend to settle from the liquor by gravitation. Further, it is necessary to my invention that the solution or liquor to be precipitated shall percolate upwards through the mass of solid finely-divided precipitant.

In an apparatus with parallel vertical sides the upward flow of liquor would tend to carry off finely-divided particles of precipitant, unless special means were taken to prevent this. Filters tend to become clogged, and are generally useless for my purpose, so that I retain the particles of the solid precipitant upon whose surfaces the precious metals are in course of deposition within my apparatus by inducing subsidence of them. This I effect by continually reducing the upward rate of liquor-flow, which is secured by constantly increasing the area of the liquor-column as it rises higher in the apparatus.

My apparatus takes the form of a funnel. The liquor enters (under a sufficient pressure or head) through the bottom orifice; it then meets with and thoroughly mixes with the mass of finely-divided precipitant in a condition of suspension in the liquor. The solid finely-divided particles do not sink against the comparatively rapid inflow, or are prevented from so doing to any extent by means of an automatic valve of ordinary type. By this intimate admixture of liquor with precipitant the deposition of the precious metal in solution in the former is effected upon the minute surfaces of the latter. It only now remains to remove the depleted liquor from the particles of the solid “precipitate” containing the gold, silver, &c.

As the liquor continues its upward flow, by virtue of the continually-diverging sides of the apparatus the area of the liquid column becomes greater and greater; the rate of the vertical upflow is thereby correspondingly reduced. This continues until a point is reached at which the upflow is so vertically slow that the finest particles are able to settle or subside against it. At any point, therefore, above this limit or zone the absolutely clear liquid may be drawn off from the apparatus free from suspended particles, and depleted of its precious-metal contents.

I do not confine myself to any special section of the funnel in a horizontal direction: it may be square or polyangular, oval, &c.; but I prefer it for many purposes circular, as giving more uniform admixture and flow throughout the whole space.

If the precipitation of the precious metals be deemed to be incomplete in one apparatus, owing to the richness of the original liquor or to other causes, the outflow may be caused to pass into a second similarly-arranged apparatus, or through two or more such apparatus placed in series; but in general one apparatus can be made to secure practically complete removal of the precious metals dissolved in a given liquor, by the use of a suitable precipitant.

If a series of two or more such apparatus be employed, the first of the series may be used to enrich quantities of precipitant which have been only partially used up to their fullest capacity of precipitating the precious metals; whilst the succeeding members of the series are supplied with the necessary amounts of less rich or quite fresh precipitant in order to remove any remaining traces of gold, silver, &c., which may escape unprecipitated in the outflow from the first apparatus. The poorer precipitates in these last apparatus are in course of time removed through the bottom of the apparatus, and transferred to the first one of the series, there to be enriched to their full capacity, whilst their place is taken by fresh quantities of poorer or quite unused precipitating agent, and so on.

When the precipitate is deemed to be sufficiently rich it is removed from the apparatus by a “three-way cock” at the bottom thereof, or any other suitable arrangement, and the precious metal it contains finally recovered by any known and suitable method, such as, in the case of the employment of a carbon precipitant, by burning, or, in case of the use of a zinc precipitant, by smelting.

The apparatus is also supplied with a small central funnel for the introduction of fresh quantities of precipitant from time to time to the point of maximum precipitating action in the apparatus—i.e., near the inflow. By providing this funnel with a bell-shaped or inverted-funnel termination a sort of “chamber” is produced in the lower part of the apparatus, having an annular space for the passage of liquor between the rim of the smaller funnel and the sides of the large one. This chamber is of considerable aid in promoting the action of the precipitant by keeping the bulk of it constantly near the liquor-inflow, and securing perfect admixture by means of the vortex currents, &c., it induces.

It is further desirable to break the rapid rush of inflowing liquors at their point of entry into the apparatus, and to secure their subdivision and intimate admixture with precipitant as early as possible. This I effect by capping the end of the inlet-pipe with a small perforated cone or distributor. The perforations may be from one-quarter to one-tenth the diameter of the inlet-pipe, but their total area must be larger than that of the sectional area of the pipe. The holes may be bored