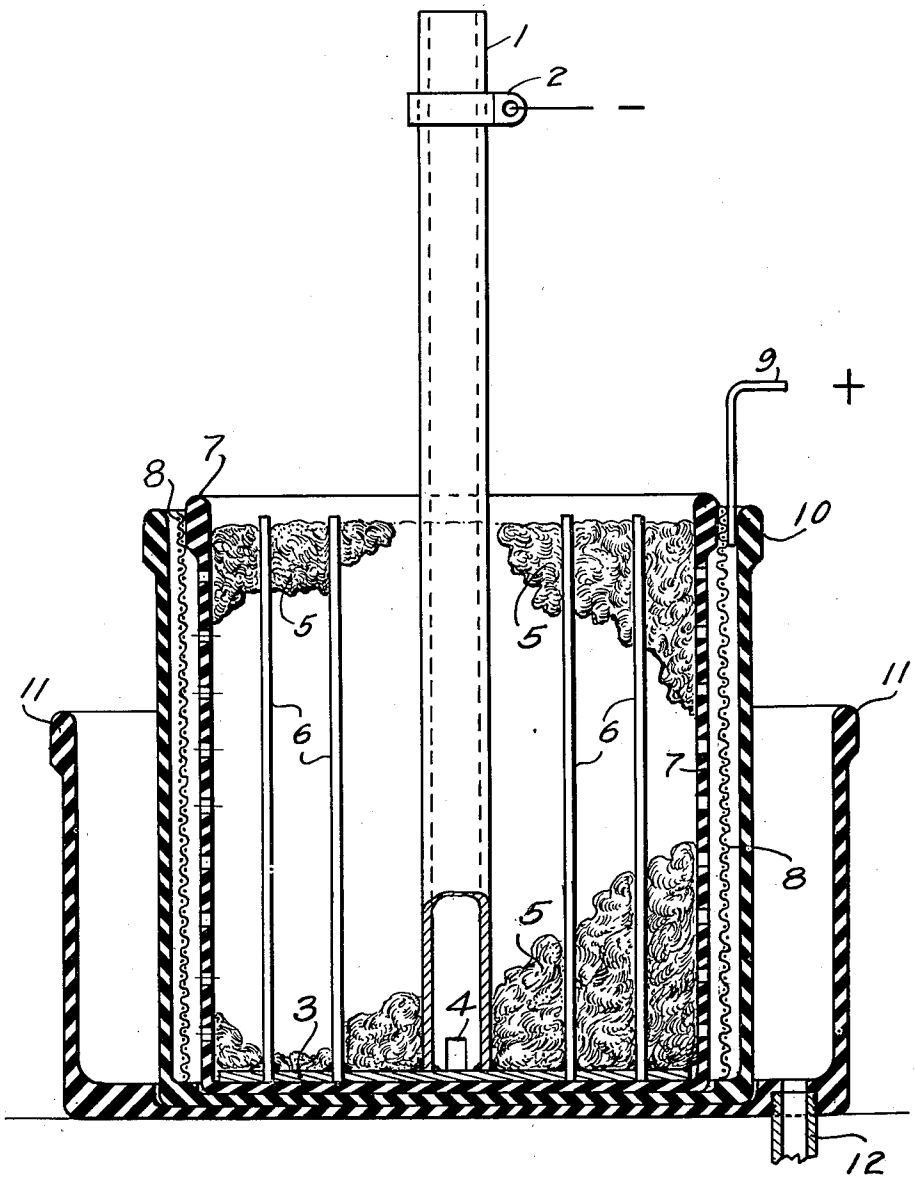
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PROCESS OF REGENERATING ACTIVATED CARBON LOADED WITH ADSORBED GOLD

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PROCESS OF REGENERATING ACTIVATED CARBON LOADED WITH ADSORBED GOLD

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1 Claim. (Cl. 204—109)

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The invention described herein may be manufactured and used by or for the Government of the United States for governmental purposes without the payment to me of any royalty thereon in accordance with the provisions of the act of April 30, 1928 (ch. 460, 45 Stat. L. 467).

This invention relates to the production of gold and more particularly to the regeneration of activated carbon employed for adsorbing or absorbing gold from dilute cyanide solutions thereof.

In my co-pending application Serial No. 127,761 filed November 16, 1949, now Patent No. 2,579,531, entitled "Process for Extracting Gold and Silver," there has been described a process for regenerating activated carbon loaded with adsorbed gold involving treating such carbon with caustic sodium sulfide solution to extract the gold therefrom, separating the thus-regenerated activated carbon, stripping the gold from the pregnant caustic sodium sulfide solution by electrolysis between an insoluble anode and a precoated charred excelsior cathode, and recovering the deposited gold. In this process it is necessary to precoat the charred excelsior cathode by employing it as the cathode in a gold cyanide electrolyte so as to deposit an amount of gold thereon sufficient to reduce its internal resistance to an operative point. This precoating constitutes an additional phase of the process which it would be desirable to obviate. Additionally, charred excelsior is a particularly fragile substance which can be handled or manipulated only with extreme care. It has now been found that by means of the instant improvement one need not precoat the cathode material but instead may use a cathode material of great durability and which is readily available.

In accordance with this invention, there is employed as a cathode material in my above-described process stainless steel wool, preferably a stainless steel wool made from stainless steel containing about 17% chromium and known to the trade as "Type 430, Medium Grade." Other stainless steels may, of course, be employed, the only requisite being that they be not substantially corroded by caustic sodium sulfide solution. For example, stainless steels composed of iron containing 18% chromium and 8% nickel and those in which a portion of the iron is replaced by cobalt can be employed; although, as above stated, it has been found that a 17% chromium stainless steel is not corroded by the electrolyte but is readily disintegrated as will be explained hereinafter.

As explained in my above-mentioned co-pending application, the gold-bearing activated carbon is leached with caustic alkali sulfide solution, suitably one containing from 1 to 5% sodium sulfide and from 2 to 8% sodium hydroxide. The thus-regenerated activated carbon is washed and returned to the mill circuit for further adsorption of precious metal values. The gold-bearing caustic sodium sulfide solution is then employed as an electrolyte between an insoluble anode and the stainless steel wool cathode of this invention. It is unnecessary to precoat the cathode. In general, a voltage between two and six volts, preferably about three volts, has been found satisfactory in the operation of the electrolysis.

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Any suitable electrolytic cell may be employed, such as, for example, the cell described in my above-mentioned application Serial No. 127,761 co-pending herewith, filed November 16, 1949. A very satisfactory electrolytic cell is the circular one described in my co-pending application Serial No. 131,654 filed December 7, 1949, now Patent No. 2,563,903, dated August 14, 1951, entitled "Electrolytic Cell for the Deposition of Gold and Silver from Solutions."

As shown in the aforesaid application Serial No. 131,654, which was allowed May 15, 1951, a suitable electrolytic cell, in which there can be employed the stainless steel wool cathode of this invention, is illustrated in the accompanying drawing. Referring to the drawing, the cathode assembly of the cell comprises, in part, a vertically mounted, electrically conductive inlet pipe 1 for introducing gold sulfide or other metal-bearing solution into the cell. The pipe 1 also serves as a negative bus bar or conductor of electricity into the cell and for this purpose is provided with a negative contact 2. The pipe 1 is fastened at its lower end to a radially extended disc 3 in such fashion as to make an electrically conductive joint, as by welding. Near the lower end of the pipe 1 is an aperture 4 for permitting the solution entering through the pipe 1 to emerge therefrom into contact with a surrounding body of stainless steel wool 5. In order that better electrical contact may be made between pipe 1 and the stainless steel wool 5, the disc 3 is provided with a plurality of vertically extending wire rods 6 spaced about and parallel to the pipe 1. The rods 6, the plate 3 and the pipe 1 are constructed of an electrically conductive material which is not substantially corroded by the solution being electrolyzed. In the case of a caustic alkaline solution of gold, these members can suitably be constructed of stainless steel, preferably the stainless steel known as "18–8" which contains about 18% chromium and about 8% nickel, the balance being substantially all iron.

In order to restrain the stainless steel wool 5 in position, a retaining member is provided which is of such form as to permit the egress of solution from contact with the cathode material into contact with a circumferentially disposed anode. As shown, the retaining member may take the form of a perforated basket 7 made of hard rubber or other non-conductive material, into which nests the plate 3 and which restrains the stainless steel wool 5. As shown, the perforated basket

7 engages the plate 3 so as to space the rods 6 and the pipe 1 in their correct locations. A suitable anode 8 peripherally encircles the basket 7 and, as shown, such anode may take the form of stainless steel wire mesh rolled to define an open cylinder. The mesh anode 8 is provided with a positive terminal 9 and is spaced closely adjacent to and encircling the retaining basket 7. The anode 8 and the cathode assembly above described are placed in a concentrically surrounding weir cup 10 which serves the purpose of controlling the fluid level in the electrolytic cell while, at the same time, restraining the anode 8 into an equally spaced relationship to the stainless steel wool 5 in the cathode assembly. The weir cup 10 is provided with cylindrical side walls and preferably a closed bottom, the whole being constructed of hard rubber or other suitable non-conductive, non-corrosive material. A launder 11, provided with an outlet 12, embraces the weir cup 10 and the whole assembly to provide a supporting base therefor. The launder 11 collects the overflow from the weir cup 10 and directs the stripped solution away from the cell through the outlet 12.

In operation, the retaining basket 7 and the cooperating cathode conducting assembly defined by the pipe 1, plate 3 and the rod 6 are filled with stainless steel wool 5. Thereupon, a caustic sodium sulfide solution of gold or other metal-bearing solution is introduced through the pipe 1 and proceeds through the aperture 4 into contact with the stainless steel wool 5 and the anode 8. After a sufficient quantity of solution fills the weir cup 10, it overflows into the launder 11 and passes out through the outlet 12. The contact 2 is connected with a source of negative current not shown, and the anode connection 9 is similarly connected to the positive current source. Electrolysis then proceeds and gold or other metal to be deposited is deposited largely on the stainless steel wool 5. The electric current passes by way of the solution through the perforations in the basket 7 to the anode 8 and thence out of the cell through the positive terminal 9. As soon as the gold or other metal content of the initial solution has been stripped therefrom, additional gold-bearing solution may continuously be introduced through the pipe 1 and continuously stripped of its metal content.

Stripped solution is withdrawn from the cell through the outlet 12 and may be used for the solution of additional quantities of gold or the like. After the stainless steel wool 5 has taken up a sufficient quantity of gold or other metal, passage of current and solution through the cell is discontinued and the retaining basket 7, together with the stainless steel wool 5 and the pipe 1, are withdrawn from the cell. The plate 3 is withdrawn from the basket 7 by means of the attached pipe 1 and the loaded stainless steel wool 5 discharged for working up of its gold content. Thereupon, the plate 3 and attached rods 6 and pipe 1 are reinserted in position into the basket and recharged with additional stainless steel wool 5. The basket and enclosed cathode assembly are then reinserted into the weir cup 10 inside the anode 8. The cycle can then be repeated.

The following illustrative example shows how this invention may be carried out but it is not limited thereto:

Example

38 grams of stainless steel wool containing 17% chromium and the balance being substantially all iron (Type 430) was placed in the cathode

compartment of an electrolytic cell provided with means for introducing electrolyte into the mid-portion of the stainless steel wool cathode, and contact means for connecting the negative bus bar to the stainless steel wool. A stainless steel screen anode was disposed about the periphery of the stainless steel wool cathode but was prevented from contacting the same by means of a hard rubber separator of circular cross-section. Four liters of the gold impregnated stock sodium sulfide solution was circulated through the cell at the rate of 4 liters per minute while a current of 9 amperes was used. The electrolyte was employed at a temperature between room temperature and about 35° C. and a voltage of between 2 and 5 volts was required to secure the desired current. The test was repeated four times over a period of 7 days reusing the same stainless steel wool in order to determine the effect of rust or local corrosive action if any. The results of the tests are tabulated as follows:

	Milligrams of gold per liter			
Zero hour	1,050	1,100	1,460	1,430
First hour	500	480	790	810
Second hour	140	180	320	240
Third hour	100	80	80	60
Test number	1	2	3	4
Percent extraction	90.5	92.7	94.5	95.8

From the tabulated data it is apparent that the extraction efficiency improved with each succeeding test. At the completion of the tests the gold-laden steel wool was dissolved in hot 25% sulfuric acid to dissolve out as much iron as possible from the stainless steel wool. The remaining residue was washed with water, dried and then melted in a graphite crucible while fluxing it with soda ash, borax, silica and nitre. A high purity gold bullion assaying 996 fine and a clean slag were obtained.

Since many apparently differing embodiments of this invention will occur to one skilled in the art, various changes may be made in the embodiments herein described without departing from the spirit and scope of the invention.

What is claimed is:

In a process for regenerating activated carbon loaded with adsorbed gold involving dissolving the gold content with caustic sodium sulfide, separating the regenerated active carbon, and electrolytically stripping the dissolved gold between an insoluble anode and a cathode, the improvement which comprises employing stainless steel wool as the cathode and recovering the gold therefrom, after deposition thereon, by dissolving said stainless steel wool in hot sulfuric acid and separating the solution from the precipitated gold.

JOHN BENJAMIN ZADRA.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
591,571	Richards	Oct. 12, 1897
2,325,660	Chamberlain	Aug. 3, 1943

OTHER REFERENCES

Transactions of the American Electrochemical Society, vol. 35, published 1920, pages 251, 253, 257.