

(No Model.)

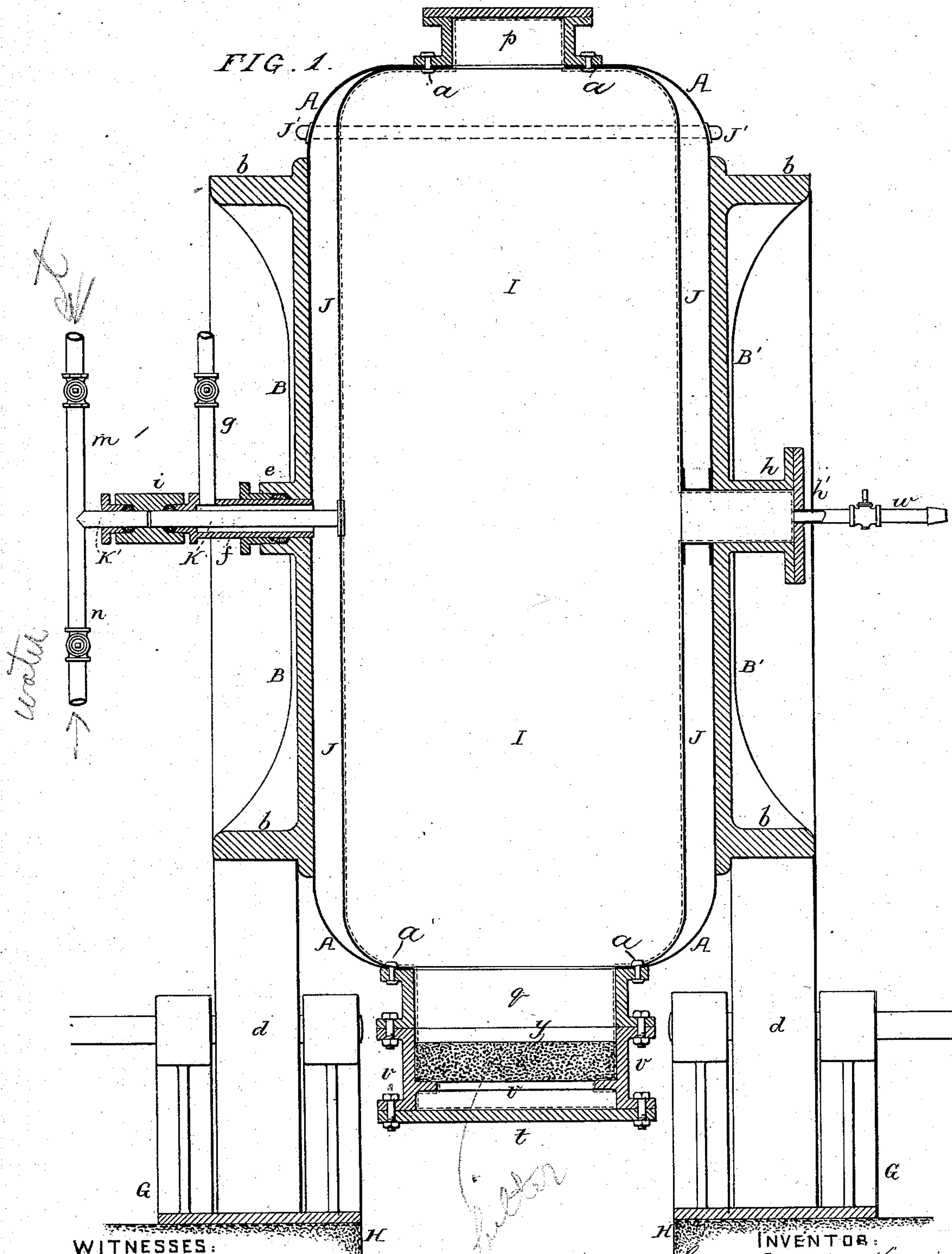
2 Sheets—Sheet 1.

G. A. KOENIG.

Process of Extracting Silver from Ores.

No. 235,784.

Patented Dec. 21, 1880.



WITNESSES:

H. L. Fulemunder  
Henry Howson Jr.

INVENTOR:

George Augustus Koenig  
by his Attorneys  
Howson and Son

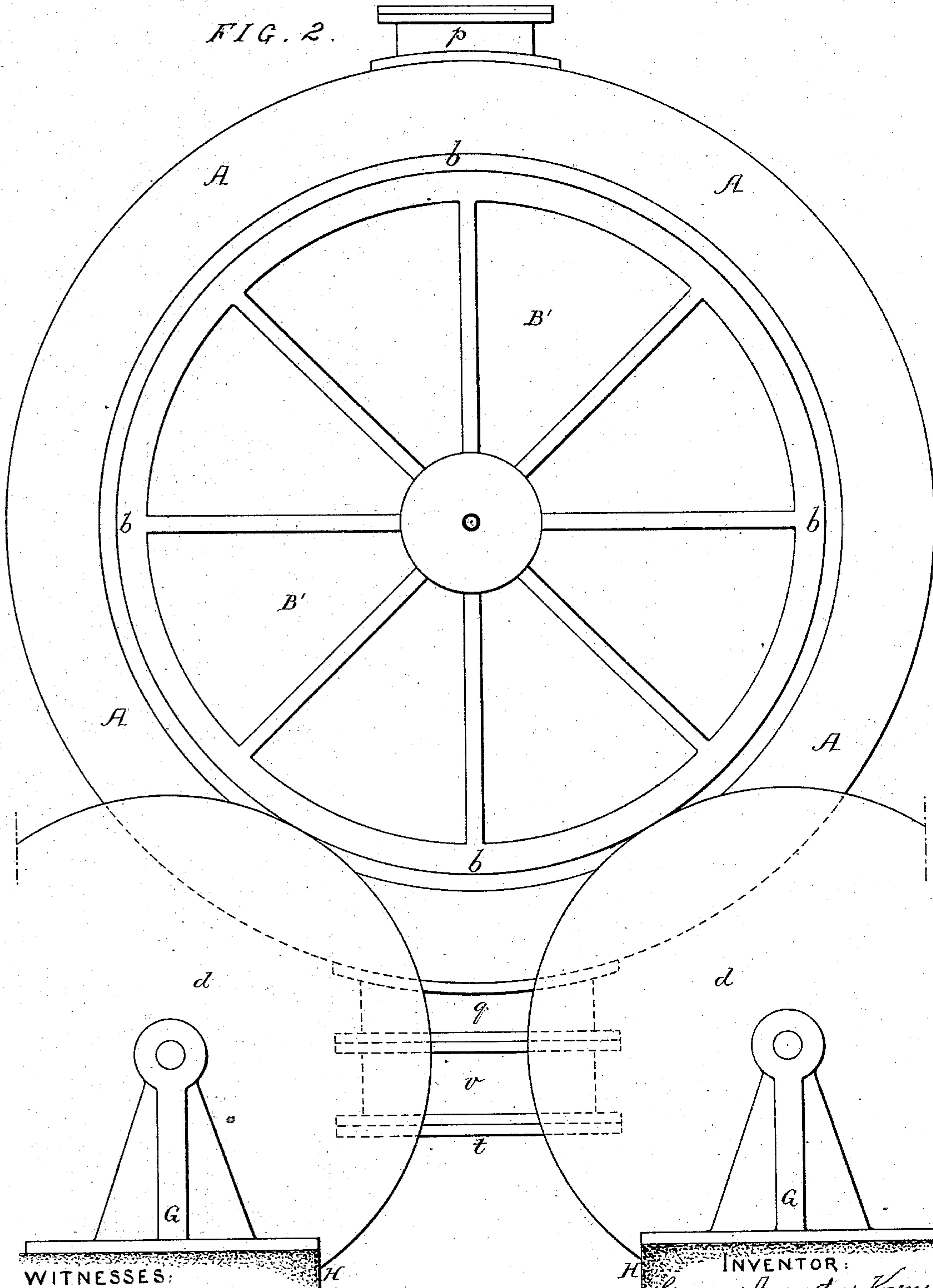
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FIG. 2.



WITNESSES:

H. L. Tulenwider.  
Henry Howson Jr.

INVENTOR:

George Augustus Koenig  
by his Attorneys.  
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# UNITED STATES PATENT OFFICE.

GEORGE A. KOENIG, OF PHILADELPHIA, PENNSYLVANIA.

## PROCESS OF EXTRACTING SILVER FROM ORES.

SPECIFICATION forming part of Letters Patent No. 235,784, dated December 21, 1880.

Application filed June 19, 1880. (No model.)

*To all whom it may concern:*

Be it known that I, GEORGE AUGUSTUS KOENIG, a subject of the Emperor of Germany, residing in Philadelphia, Pennsylvania, U. S. A., have invented an Improved Process of Extracting Silver from Its Ores, of which the following is a specification.

My invention relates to an effective and economical mode of obtaining chloride of silver from silver ores; and my invention consists, mainly, in subjecting the pulverized ores to the combined action of a decomposing agent and a solvent applied under heat and pressure, as described hereinafter.

In the accompanying drawings, Figure 1 is a vertical section of apparatus which I prefer to use in carrying my invention into effect, and Fig. 2 a side view of Fig. 1.

A is a plate-iron vessel, made in the form of a hollow disk, to which are secured the two substantial plates B B', of cast-iron—one on each side of the vessel—each plate being furnished with an annular flange, b, adapted to the peripheries of wheels d, the shafts of which turn in suitable bearings on stands or frames G, secured to a suitable foundation, H, so that the vessel admits of being revolved at pleasure.

Within the outer vessel, A, and united thereto at points a, is an inner vessel, I, forming, with the said outer vessel, two steam-spaces, J J, and this inner vessel is lined with lead, or is otherwise so lined as to resist both the abrading action of the ore and the chemical action of the decomposing agents and solvents, as explained hereinafter.

Through a central stuffing-box, e, on the plate B of one side of the vessel passes a pipe, f, communicating in one direction through a tube, g, with the steam-space of a boiler, and in the other direction with one of the spaces J, connection between the latter and the other space J being made by an external tube, J', so that by opening a cock with which the tube g is furnished steam may be admitted to the two spaces or steam-jackets, which should be provided with a suitable outlet.

Through the pipe f extends a tube, K, extending across the steam-jacket to the interior of the lined inner vessel, to one side of which it should be secured in any suitable manner,

the tube terminating in a box, i, and communicating within the same with another tube, k', having two branches, m and n, each furnished with a suitable cock, the branch m communicating with the steam-space of the boiler and the tube n with a supply of water.

The pipe f, its tube g, box i, and tubes k', m, and n, must be stationary, being held by any suitable appliances, so that when the vessel is rotated its stuffing-box e will revolve on the pipe f, while the pipe k revolves in the box i. By this arrangement I am enabled to introduce steam into the jackets at any time to introduce steam into the interior of the lead-lined vessel, or to admit water into the same.

On the side plate, B', of the vessel is a central tubular projection, h, furnished with a detachable cover, h', the interior of this projection being lined with lead and communicating with the interior of the lead-lined vessel I.

A tube, w, furnished with a suitable cock, extends through and is secured to the cover h', and to this tube may be secured, by a suitable swivel-connection, a tube communicating with a generator of chlorine gas, which it has not been deemed necessary to illustrate in the drawings.

On the end of the vessel is a lead-lined branch, p, through which the said vessel is charged, and through which the spent ore is discharged, and there is on the end of the vessel another branch, q, to which is secured an annular casting, v, containing a filtering-disk, y, which may be of porous fire-brick, and the annular casting is provided with a detachable cover, t.

The vessel while stationary is, in the first instance, charged to about one-third of its capacity with the pulverized ore, either in a dry or moist state, a saturated solution of common salt equal in weight to that of the ore being also introduced into the vessel. After closing the branch p of the vessel the latter is rotated for a sufficient length of time to bring about an intimate admixture of the salt solution with the ore, and this admixture may be facilitated by providing the lead-lined interior of the vessel with projections, which should either be of lead or clothed with lead, the projections being arranged spirally, or in any other manner which will promote the admixture of the con-



tents of the vessel. Steam is now admitted through the pipe K to the interior of the vessel, so as to drive the air therefrom through the pipe *w*, which has not yet been connected to the chlorine-gas generator. After the air has been expelled the steam is cut off from the vessel, the cock of the pipe *w* closed, and cold water is admitted to the vessel by opening the cock of the branch *n*. After a partial vacuum is thus created within the vessel the cock of the water-pipe is closed, and the tube of the chlorine-gas generator is then connected to the tube *w*, the cock of which is opened, so as to permit the chlorine gas to enter the vessel. The vessel is now rotated until a gage attached to the chlorine-generator indicates that no further absorption of the gas takes place, after which the cock of the tube *w* is closed, and steam admitted first into the jackets to prevent condensation in the interior of the vessel and until the contents of the vessel are at the temperature of boiling water, after which steam is admitted to the vessel itself, which is rotated until all the chlorine introduced into the same has entered into chemical combination with the ore.

If the ore is of such a character as to demand a second or any further number of charges of chlorine, these must be made as above described, the number of charges depending on the quantity of sulphurets originally present in the ore and upon the degree of roasting to which the ore may have been subjected.

The treatment of the contents of the vessel having been completed, it is held stationary in the position shown in the drawings, and the cover *t* is removed, when the internal pressure will force the liquid contents through the filter, after which the ore remaining in the vessel is first washed with fresh salt solution to remove the adhering valuable metallic portions, and then with hot water to take up the salt, all being forced through the filter. The vessel is now turned to such a position that the spent ore can be discharged through the branch *p*, when the vessel will be ready for a repetition of the above operations.

As regards the filtered salt solution, the silver may be removed from it by any of the processes heretofore practiced of obtaining the silver from such solutions.

It may be remarked here that the ore to be treated may or may not be roasted, the propriety of roasting the ore being determined by its quality; but in no case should salt be used in roasting.

In place of chlorine gas, hypochloric or hypochlorous acids or aqua regia may be used as decomposing agents, having the same effect as chlorine gas when used with a saturated salt solution under heat and pressure; and other solvents may be used in place of the salt solution, in conjunction with the decomposing agent under heat and pressure, such, for instance, as chlorides of potassium, magnesium, iron, manganese, or copper.

I am aware that it has been proposed to treat ores of silver by boiling the same in a solution of common salt and hydrochloric acid in the presence of free chlorine gas; also, by applying chlorine to the treating-vessel from which the air has been exhausted; also, by mixing the ore with lime and water in air-tight tanks, introducing chlorine gas thereto and adding acid; but the difference between these processes and my invention will be readily understood by the foregoing specification.

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

1. The mode described of treating silver ores for obtaining therefrom a solution of chloride of silver, the said mode consisting in subjecting the ore to chlorine and common salt, or their equivalents, under heat and pressure, substantially as described.

2. The mode described of first subjecting silver ore to chlorine and common salt, or their equivalents, under heat and pressure, and then separating the solution from the spent ore by filtration, substantially as described.

3. The within-described steam-jacketed vessel A, its branch *p*, filtering-discharge branch, and inlets and outlets, the whole being combined substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

GEORGE A. KOENIG.

Witnesses:

JAMES F. TOBIN,  
HARRY SMITH.