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J. H. GILLIES.

APPARATUS FOR SEPARATING SULFIDS FROM THEIR ORES.

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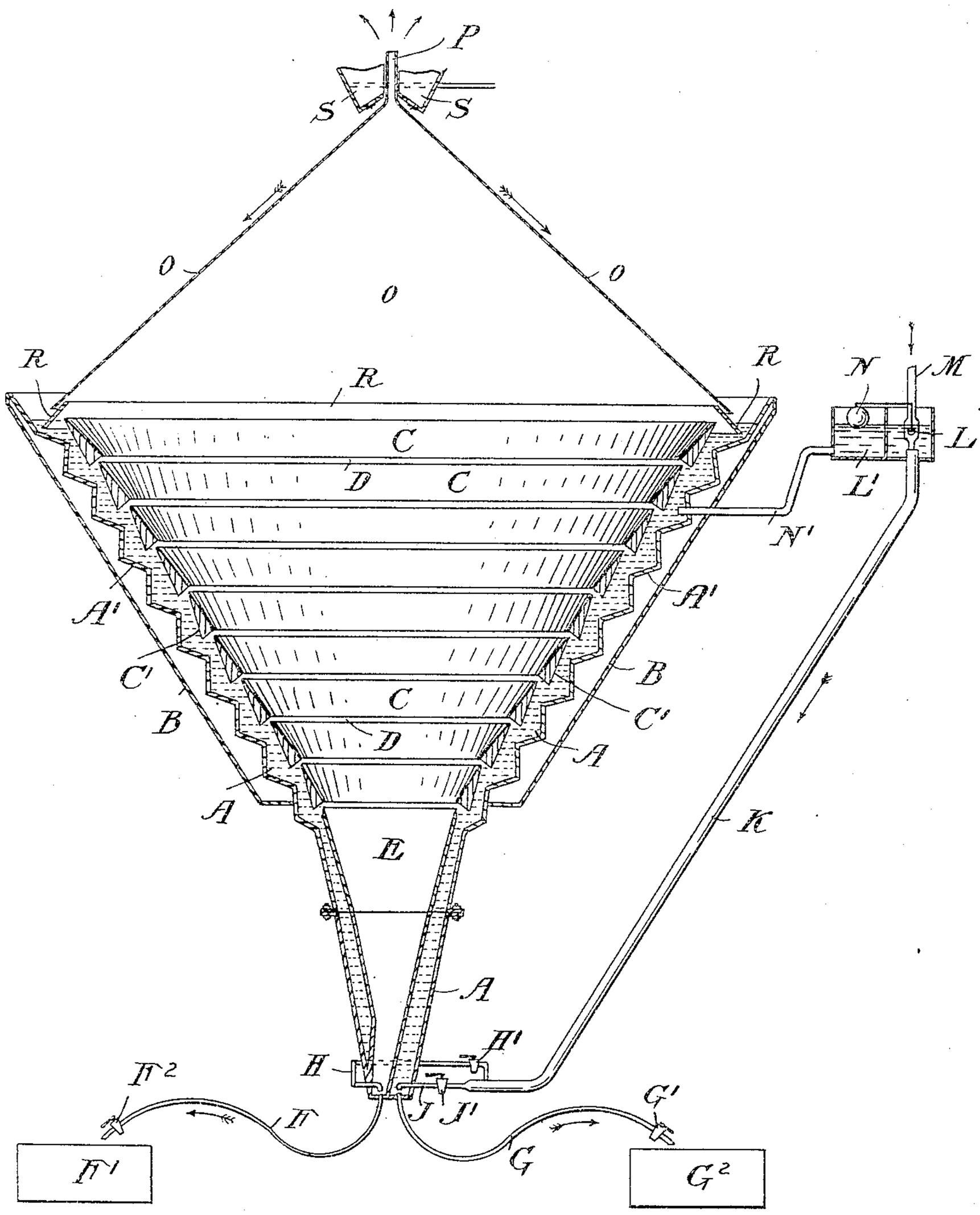

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UNITED STATES PATENT OFFICE.

JAMES HYNDES GILLIES, OF MELBOURNE, VICTORIA, AUSTRALIA.

APPARATUS FOR SEPARATING SULFIDS FROM THEIR ORES.

SPECIFICATION forming part of Letters Patent No. 778,747, dated December 27, 1904.

Application filed September 7, 1904. Serial No. 223,603.

To all whom it may concern:

Be it known that I, JAMES HYNDES GILLIES, a subject of the King of Great Britain and Ireland, residing at No. 454 Collins street, Melbourne, in the State of Victoria, Australia, have invented certain new and useful Improvements in Apparatus for Separating Sulfids from Their Ores, of which the following is a specification.

The object of this invention is to provide an economical system of treating pulverized sulfid ores or tailings, and refers particularly to an economical method of introducing active chemical liquid into the treating-vat during the process of dealing with the said pulverized ores or tailings.

The invention applies to that system of winning the sulfids from the ores or tailings known as the "wet acid" or "saline" process, wherein certain liquid chemicals create gas from some of the constitutents in the sulfid ores, such gas forming small bubbles which attach themselves to the particles of sulfid and raise the latter upward toward the surface of the said liquid chemical.

In order that my invention may be the more easily understood, reference may be made to the accompanying drawing, which illustrates one form of apparatus embodying the salient features of my invention.

In the drawing I have illustrated a sectional elevation of said apparatus.

In the drawing, A represents a receptacle consisting of a circular metal tank, an inverted truncated cone in shape and surrounded on its outside with an outer shell B. A is constructed in the form of approximately annular steps A′. The tread of these steps A′ have a fall from their inner toward their outer edges. The steps A′ are preferably constructed of lead regulus or other material suitable for as far as possible resisting the corrosive action of the acid or saline liquid used in the machine for treating the sulfid ores. It will be noticed that a space is arranged between A and B, so that steam or hot fluid may be circulated in such space for heating the liquid contained in the said receptacle A. Within the said receptacle A are set a number of annular blocks C, that are in section approximately of the form of right-angled triangles. These blocks are preferably made of glass and arranged so as to form as near as possible a series of rings within the receptacle A, being held in their position by any suitable inclined metal standards. It will be noted that each ring thus formed will in the downward direction be of a lesser diameter than the one above it. Spaces D are allowed between each of such rings, while beneath the lowest ring and near the bottom of the receptacle A is a circular vessel E, provided at its base with an escape-pipe F. It will be seen from the drawing that E is somewhat funnel-shaped and is of greater diameter at its top than the lowest ring C, but of lesser diameter than the receptacle A at that part. The pipe F leads away to the receiving-tank F′ and is controlled by a cock placed at F^2. At the bottom of A is a leadaway duct or pipe G, controlled by a cock G′, through which the tailings from the bottom of A may escape into the residual dross-tank G^2. Entering into the circular vessel E, near its bottom, is an inlet liquid-chemical pipe H, controlled by a cock at H′, while a similar liquid-chemical inlet-pipe J enters close to the bottom of the receptacle A and is controlled by a cock J′. Both the pipes H and J are branches of the main liquid-chemical supply-pipe K, which leads from a cock L. The cock L is set in a small tank L′ and receives its supply through the medium of a pipe M from a liquid-reservoir placed at a higher level. The cock L is governed by a ball N, which in its turn is actuated by the level of the liquid chemical in the receptacle A, a through duct or passage N′ keeping both the tank L′ and the receptacle A in open communication with one another.

O is a hood for distributing the supply of pulverized material in an even manner into the circular margin of A. This hood O is provided with an open leadaway pipe or flue P to carry away any steam that may collect in O from the exhalations during the working of the chemical liquid in the receptacle A. The bottom of O incloses the top of an annular baffle-plate R, so placed as to cover the top of the uppermost annular set of blocks C. The function of the said annular baffle-plate R is

to continue the direction of the pulverized ore which flows down the outside of the hood O to a point below the surface of the chemical solution immediately above the outer circle of the first of the steps A′. The underneath surface of the annular baffle R serves to direct the sulfids acted upon by the solution beneath it over the upper edge of the blocks C, so that when such sulfid particles upon losing their gas-bubbles fall again they will descend into the main body of liquid in A and thence downward over the interior faces of each of the said annular blocks C into the central funnel-shaped vessel E.

In operation the receptacle A is first filled to almost its top with the chemical liquid to be used. Heat is then applied in the jacket between A and B. The pulverized sulfid ores or tailings are then allowed to evenly flow from a receiver at S, on to and down along the hood O until they fall onto the annular baffle R, whence they fall onto the first of the steps A′ and find their way down along such heated steps toward the bottom pipe G. During their passage downward the valuable sulfids become separated from the drossy residue by reason of the chemical action causing small gas-bubbles to form upon such sulfid particles. These valuable particles by reason of their buoyancy work their way up along the under sides C′ of the annular blocks C until they come to the nearest annular opening D, whence they escape into the main body of liquid in the receptacle A. Here they rise to the top of the surface of the liquid and lose their bubbles. Being thus bereft of their balloon-like support, the said sulfid particles then fall either directly or along the faces of the blocks C into the funnel-shaped vessel E. Here they escape through the pipe F into the tank F′. Cold chemical liquid (of the same nature as the heated liquid above) enters by the pipe H and flows away through F, together with the sulfids, and thus automatically and synchronously supply as much cold liquid at the needed point as will run away at the pipe F with the sulfids. Preferably, but not arbitrarily, I place the escape-pipe F directly under the cold inlet-pipe H. The theory of this (the most important portion of my invention) is that the heated liquid in the higher portions of the receptacle A is not appreciably reduced in temperature by the incoming liquids nor being reduced in level by the liquid necessarily escaping at F to carry away the sulfids and that as an equivalent amount of cold liquid is entering near the bottom to that running away at the bottom the level of the heated liquid in the receptacle A is not interfered with, the fact being borne in mind that heated liquid will not descend nor will cold liquid ascend under the conditions set forth in this apparatus. As the heating of the chemical liquids to an unnecessarily high temperature under present systems causes the receptacle, and especially its heating portions, to be more easily attacked by the corrosive action of the said chemical fluids, it follows that it is desirable to employ such heating systems as little as possible, and this is facilitated by my improvements. The residue or drossy matter will continue to fall down the surfaces of the step A′ until it reaches the bottom of A and will escape at G into the tank G^2, and in like manner the pipe J supplies the cold liquid similarly to that hereinbefore set forth with reference to H. Regarding the arrangement of the ball N and cock L it will be seen that owing to the communication through the medium of N′ the said ball N will maintain an adjustment of liquid through L to correspond with the escapement of the chemical liquid at the bottom of A. It will be seen that the cocks H′ and J′ can be adjusted according to what is found necessary for the inlet of cold chemical fluid into their respective chambers.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. An apparatus for separating sulfids from ores comprising a treatment pan or vessel, means for heating the same, means for conveying a supply of cool or cold liquid to the bottom of said pan, and means for permitting said liquid to escape from the bottom of the pan to carry away the drossy matter without lowering the temperature or the level of the heated liquid in the upper part of said treatment pan or vessel.

2. An apparatus for separating sulfids from ores comprising a treatment-pan, means for heating the same, a vessel within the lower part of said pan, means for conveying a supply of cool or cold liquid to the bottom of said vessel, and means for permitting the said liquid to escape from the bottom of said vessel to carry away the separated sulfids without lowering the level or the temperature of the heated liquid in the upper part of the said treatment pan or vessel.

3. An apparatus for separating sulfids from ores comprising a treatment pan or vessel, means for heating the same, means for conveying a supply of cool or cold liquid to the bottom of said pan, and means for permitting said liquid to escape from the bottom of the pan to carry away both the drossy matter and the sulfids but independently of one another and without lowering the temperature or the level of the heated liquid in the upper part of the said treatment pan or vessel.

4. In an apparatus for separating sulfids from ores and in combination, a receptacle, means for heating the same, an annular series of angular blocks arranged above one another with a space between, a vessel set below said blocks, an inlet pipe or duct for conveying liquid to said vessel, an outlet pipe or duct for sulfids and liquid leading from said

vessel, an inlet pipe or duct for conveying liquid to said receptacle, and an outlet pipe or duct for residual or drossy matters leading from said receptacle.

5. In an apparatus for separating sulfids from ores and in combination, a receptacle formed with steps, an outer shell to form a heating-chamber, an annular series of angular blocks arranged above one another with a space between, a vessel set below such blocks, an inlet pipe or duct for conveying liquid to said vessel, an outlet pipe or duct for sulfids and liquid leading from said vessel, and an inlet pipe or duct for conveying liquid to said receptacle, and an outlet pipe or duct for residual or drossy matters leading from said receptacle.

6. In an apparatus for separating sulfids from ores and in combination, a receptacle, means for heating the same, an annular baffle-plate, a hood, means for distributing a supply of pulverized ore over said hood, an annular series of angular blocks set with openings between them through which the gasified sulfid particles may pass but not return, a vessel below said blocks, inlet and outlet pipes for liquid and sulfids respectively leading to and from said vessel, corresponding inlet and outlet pipes for liquid and drossy residue respectively leading to and from said receptacle and a ball-and-cock system for maintaining a level of liquid in the receptacle.

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

JAMES HYNDES GILLIES.

Witnesses:
A. O. SACHSE,
A. HARKER.