No. 887,268. PATENTED MAY 12, 1908.

J. E. PORTER & A. L. CLARK.

EXTRACTING APPARATUS.

APPLICATION FILED FEB. 27, 1907.

2 SHEETS—SHEET 1.

Fig. 1.

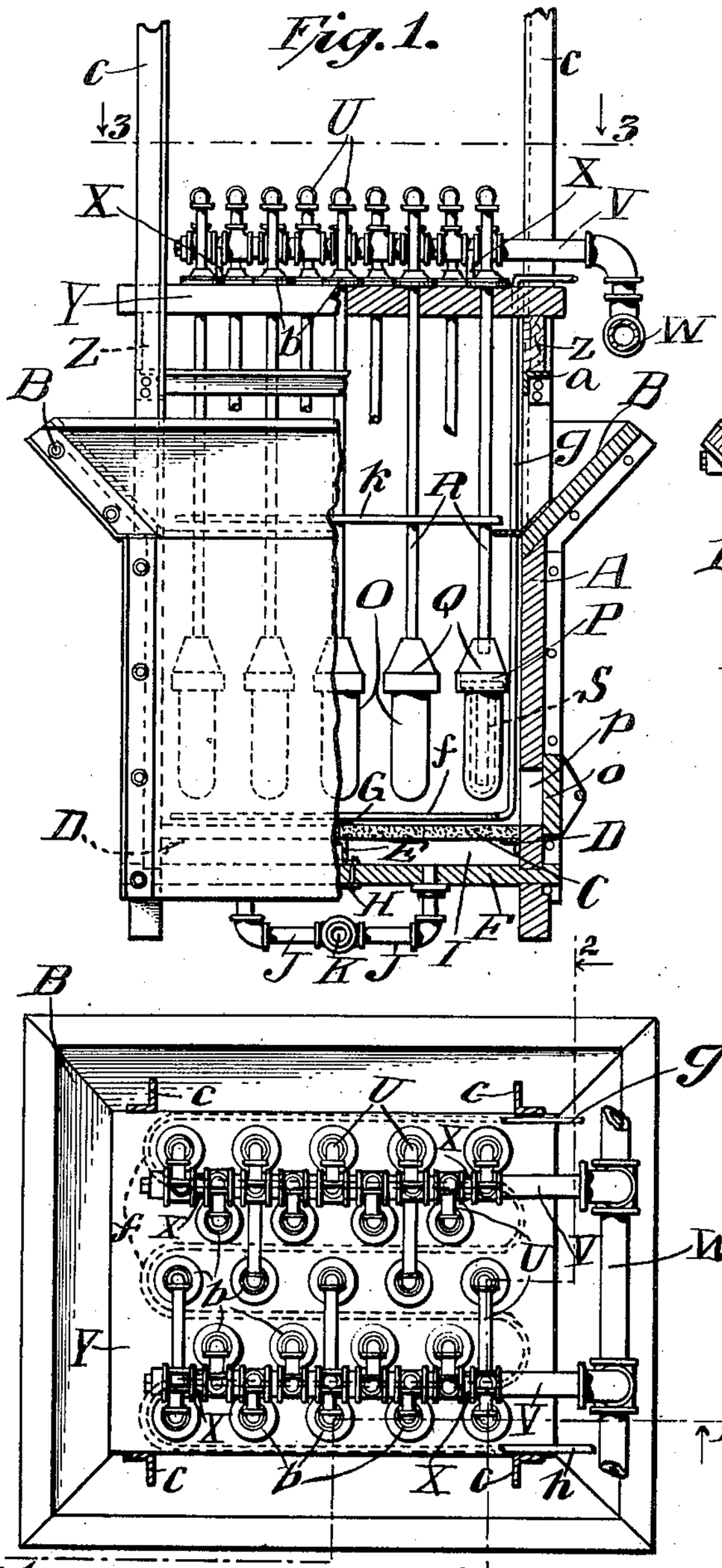

Fig. 2.

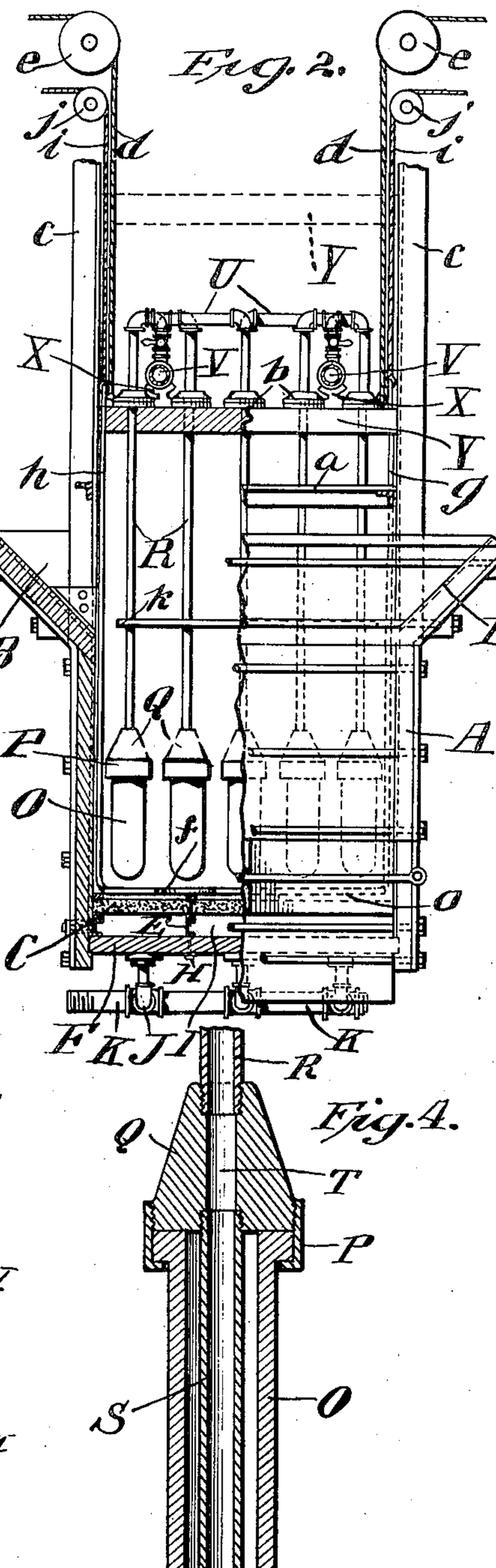

Fig. 3.

Fig. 4.

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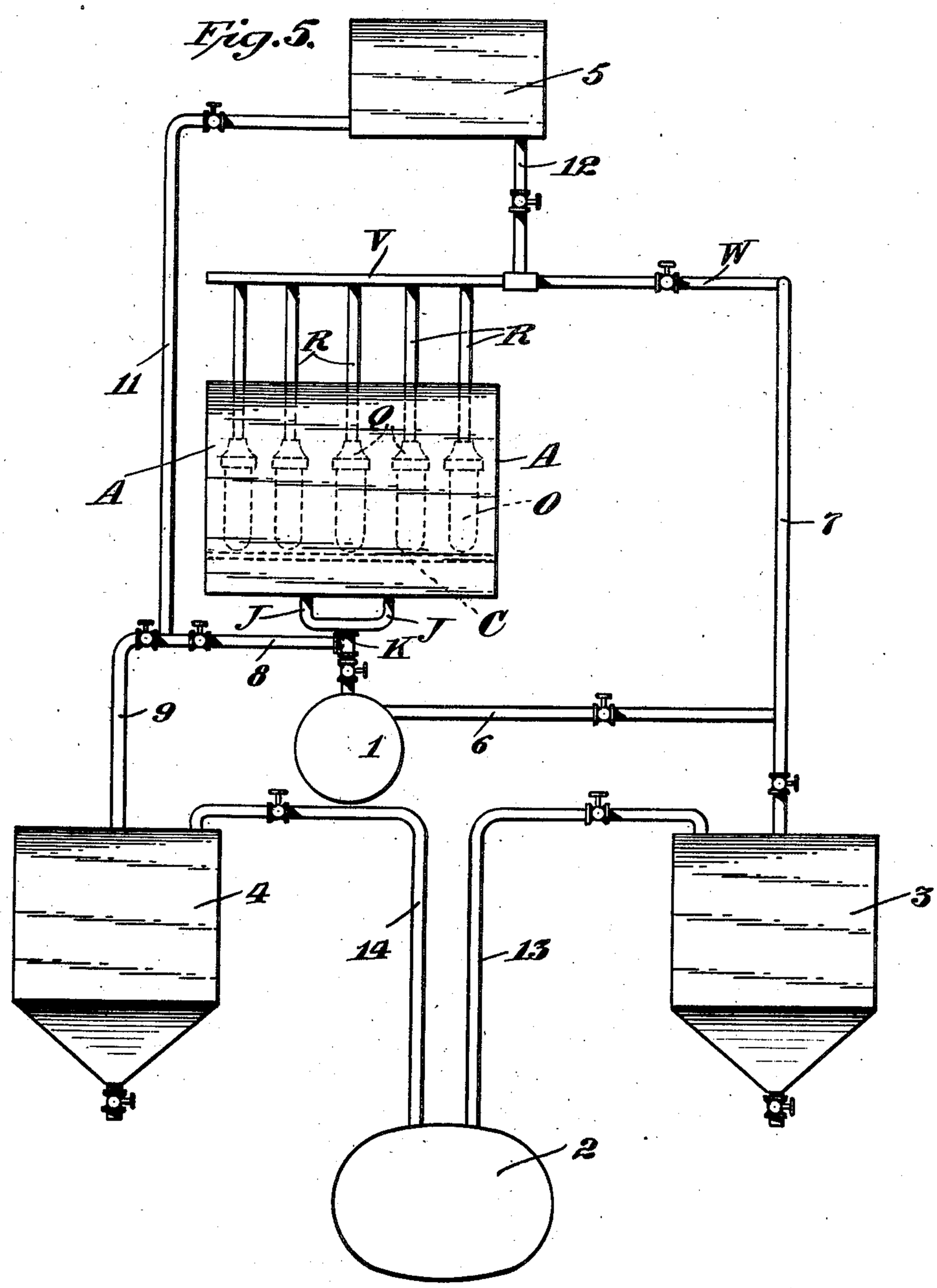
2 SHEETS—SHEET 2.

Fig. 5.



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UNITED STATES PATENT OFFICE.

JAMES EDWARD PORTER, OF SYRACUSE, AND ARTHUR L. CLARK, OF NEW YORK, N. Y., ASSIGNORS TO THE JUST MINING AND EXTRACTION COMPANY, A CORPORATION OF NEW YORK.

EXTRACTING APPARATUS.

No. 887,268. Specification of Letters Patent. Patented May 12, 1908.

Application filed February 27, 1907. Serial No. 359,658.

To all whom it may concern:

Be it known that we, JAMES E. PORTER, a citizen of United States, and resident of Syracuse, New York, and ARTHUR L. CLARK, a citizen of United States, and resident of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Extracting Apparatus, of which the following is a specification, accompanied by drawings.

This invention relates to Improvements in extracting apparatus, more particularly to apparatus for agitating, extracting and filtering a mass of ore undergoing treatment.

The apparatus is especially useful in the treatment of low grade highly refractory sulfid ores which are unsuitable in their raw state for cyaniding or for profitable treatment commercially by any process.

The apparatus is particularly adapted for cyanid process for extracting the precious metals from their ores, but the invention may be used in any connection to which it is found applicable.

The objects of the invention are to improve upon the construction and operation of ore treating apparatus and increase the efficiency thereof.

Further objects of the invention will hereinafter appear and to these ends the invention consists of apparatus for carrying out the above objects embodying the features of construction, combinations of elements, and arrangement of parts having the general mode of operation substantially as hereinafter fully described and claimed in this specification and shown in the accompanying drawings, in which,—

Figure 1 is a partial sectional side elevation of apparatus embodying the invention on the line 1—1 of Fig. 3. Fig. 2 is a partial sectional elevation of the apparatus on the line 2—2 of Fig. 3; Fig. 3 is a top plan view of the apparatus; Fig. 4 is an enlarged detail vertical sectional view taken through one of the cylinders of the apparatus; Fig. 5 is a diagrammatic view illustrating the apparatus.

Referring to the drawings, A represents a suitable tank, which may be constructed of wood or metal as desired. In this instance the tank is shown as constructed of wood. Any suitable construction may be provided for the tank, and in this instance the tank is provided with a flaring upper edge B to prevent the material from boiling over.

The tank is provided with a rigid false bottom C of suitable porous material, as for instance earthenware or material from which porous cylinders are made. Any suitable porous mineral septum may be used for a false bottom C, through which air and liquid may be forced or sucked as desired. As shown, the false bottom C is constructed of slabs supported from the sides of the tank in any suitable manner, as by means of the angle irons D and supported at the meeting edges or joining surfaces of the slabs by means of brackets E, carried upon the bottom F of the tank and secured thereon in any suitable manner. Preferably metal straps G are arranged above and below the meeting edges of the plates forming the false bottom C, and bolts H pass through the straps and the brackets E. Means are provided for forcing air into the space I between the bottom F and the false bottom C or for causing suction underneath the false bottom C, in this instance pipes J being provided branching from the main pipe K, said branch pipes either extending through the bottom F or communicating with the apertures therein. If desired liquid, as water or a solution of any character may be forced through the pipes K and J.

Means are provided for raising and lowering the porous cylinders O out of and into the tank A. These cylinders are preferably constructed as indicated in Fig. 4, in which the porous cylinder O of suitable material, as instance earthenware, is secured in a collar P which is screwed on to the head or casting Q, in turn carried on to the screw threaded end of the pipe R. As many of the porous cylinders and supporting devices are provided as desired, and preferably the cylinders are arranged in staggered form, as indicated in Fig. 3. Preferably the distances between centers of the cylinders are all substantially equal, thereby obtaining a maximum effect in the tank. Also suitably screwed or otherwise secured to the head or casting Q of a cylinder is a pipe S extending substantially the full inside length of the cylinder and open at the bottom near the inner bottom of the cylinder. All of the cylinders are provided with the pipes S, which may be removed as desired and replaced by pipes of different length. The head or casting Q of a cylinder is shown hollow, being provided with the passageway T, so that a continuous

passage is formed by the pipes R, passages T and the pipes S. The pipes R all connect with branch pipes U, leading to longitudinal main pipes V, from which air pressure or suction or water or solution may be supplied. The main pipes V communicate with a cross pipe W, which in turn leads to the vacuum tank or air pressure receiver. The longitudinal pipes V are supported in suitable cradles X from the cross beams Y, which in turn are carried by the side beams Z on the angle irons *a*. Any suitable construction may be provided for the frame carrying the piping, whereby the frame may be raised and lowered. In this instance the pipes R are parted and provided with flanged connections *b* above the cross beams Y, whereby the upper portions of the pipes may be removed from the lower portions or else the cylinders may be removed with portions of the pipe R as desired. We are not to be understood as limiting the invention to the construction of cylinder and supporting means shown and described for any suitable means have been disclosed for carrying out the objects of the invention.

As shown, vertical standards or uprights *c* are provided extending upwardly from the tank forming ways for guiding the cross beams Y and side beams Z of the frame work and means are provided for raising and lowering the frame work, in this instance ropes or chains *d* being shown extending over pulleys *e*. These ropes or chains may be provided with counterweights or connected to suitable engines or motors.

Preferably means are provided for heating the mass undergoing cyanidation or other treatment, and in this instance a steam coil is provided comprising the pipes *f* extending back and forth over the area of the tank between the rows of cylinders O, and vertical pipes *g* and *h* lead upwardly from the horizontal pipes *f* to conduct the steam to the coil and carry off the exhaust steam. Means are also provided for raising and lowering the steam pipes, in this instance chains or ropes *i* being provided carried over the pulleys *j* and attached to counterweights or adapted to be operated by a motor or engine. Preferably braces *k* are provided between the pipes R to keep them from swaying. Any suitable braces may be provided for the remainder of the tank and apparatus. Preferably there is a gate *o* for the flushing out opening *p* at the lower portion of the tank.

In the operation of the apparatus, let it be assumed that dry crushed ore is to be cyanided in our apparatus. To the tank A is first added a certain quantity of water, less than the total amount required for the operation and the steam coils *f* are lowered into the water, and steam is turned through the coils to commence the heating. The agitation of the liquid is also commenced by turning on air pressure into the pipes K and J leading underneath the false bottom C. The compressed air is forced through the porous false bottom and passes into and through the liquid in finely divided streams, or in other words the air is atomized as it were by means of the mineral septum, and in passing into the liquid keeps the same in constant and gentle agitation throughout. The cylinders O having been lowered into position in the tank, the ore to be treated is charged into the tank by degrees. While the ore is being charged in, the air pressure is turned on in the pipes W, V, U and R, thereby forcing air out through the porous cylinders O into the mass. The liquid is also agitated by the air passing through the porous false bottom and the porous cylinders, thereby keeping the finely divided material in a state of suspension. The air emerges from the rigid porous mineral material in the form of evenly distributed, excessively minute bubbles and the presence of a constant succession of these minute ascending bubbles in every portion of the mass keeps the fine particles of ore in suspension, permitting no packing or clogging and insuring that each individual particle shall be constantly in contact with a jacketing layer of thoroughly aerated liquid. Next the desired quantity of alkaline earth oxid is added to the material in the tank sufficient to neutralize any acidity in the ores. If the ore is of such a nature that it can be ground wet to alkalinity this is not necessary. At the end of about one-half an hour, more or less, the material in the tank will be heated up to the desired degree, which would be about 190 degrees F. and the acidity will be removed. The calculated amount of cyanid is then added to the mass and the solution is brought up to the required volume and strength in the tank by the further addition of water if required. The agitation and heating are continued for about five hours, the initial strength of the solution being about one-fourth percent. of potassium cyanid. The heat is maintained about 190 degrees F.

At the end of about five hours, the solution in the tank is strengthened to about six-tenths percent. of potassium cyanid by the addition of more cyanid, and the agitation and heating are continued from about 10 to about 15 hours longer. Constant bulk may be maintained by the occasional addition of fresh water. At certain stages of the operations alkaline earth oxid or peroxid is added for two reasons, first, to neutralize any carbonic acid that might be present or have been formed, or that contained in the injected air; secondly, to produce a coagulating or flocculating effect and maintain the said effect throughout the treatment, not allowing any resolution of the alkaline earth compounds during the treatment. Preferably

the alkaline earth oxid or its hydrate is maintained in excess in the solution to effect the coagulation. If peroxid is used the additional effect is produced of supplying oxygen to the solution.

At the end of the agitation period the steam coils are raised from the bottom of the tank to an elevated position. Agitation is continued through the false bottom C while the air pressure is withdrawn from the cylinders O and suction applied through the piping, thereby filtering the solution through the porous cylinders O. By maintaining the air pressure through the false bottom C while suction is applied to the interior of the cylinders O, the filtering operations are very greatly aided and made more efficient, because the agitation of the mass by the air rising from the false bottom causes the slimes to become thoroughly mixed and prevents them from stratifying, packing, or adhering tightly on the porous cylinders during filtration. This is one of the great advantages of the apparatus owing to which very much more rapid filtration and efficient results are produced than in any other apparatus hitherto devised. Furthermore the upward air currents through the mass keep the liquid circulating or splashing over the entire sides of the cylinders so that instead of having air only sucked through the upper portions of the cylinders, thus losing the vacuum effect, the entire mass undergoes filtration. The mass is therefore forced up on the sides of the cylinders instead of leaving the upper portions of the cylinders bare. After the agitation and suction have been continued for the desired time, more water is added to the tank and the suction is continued with agitation through the bottom, thereby removing the valuable solutions which remain in the mass after the first filtration. The agitation stirs up the material in the bottom of the tank and forces it up around the sides of the cylinders.

Another way of treating the mass after the first filtration is to force water outwardly through the porous cylinders O from the interior through the piping, thereby cleaning the surfaces of the cylinders. When the desired amount of water has been forced into the tank the water pressure is removed, and the whole system of cylinders and piping is raised out of the tank, and any suitable form of mechanical agitator lowered in the mass in the tank and operated to agitate the mass mechanically thereby breaking up any lumps that may have remained. At the same time air is continued to be forced through the porous false bottom C to agitate the mass and aid in breaking up the particles therein. After the particles are all broken up and in suspension in the solution the mechanical agitator is removed and the porous cylinders are again lowered into the tank and suction applied to filter the solution as before, while air is being forced through a porous false bottom C. These operations are repeated as often as necessary to remove the valuable solutions. Finally the pressure in the pipes K and J at the bottom of the tank is removed and suction applied to said pipes, thereby filtering the remaining solution through the porous false bottom C and thus recovering the lost portions of the valuable solutions.

In Fig. 5, compressed air is supplied from tank 1 to either the cylinders O in the tank A, or beneath the false bottom C, or to both at the same time. 2 represents a vacuum tank by means of which a vacuum may be applied to the cylinders O through the receiver 3 or applied to the bottom C through the receiver 4, or to both at once. Water or solution may be supplied to the cylinders O or to the bottom C, or to both from the tank 5. Suitable piping and valves are provided for carrying out these objects. The air pressure tank 1 is connected by pipe 6 with pipe 7, which in turn connects with the supply pipe W and with the receiver 3. Air tank 1 is also connected by pipe 8 with pipe 9 which leads to receiver 10, and pipe 11 connects pipe 8 with water tank 5. Said water tank is also connected by pipe 12 with pipe W. The vacuum tank 2 is connected by pipes 13 and 14 with receivers 3 and 4 respectively. The pipes are provided with suitable valves for enabling the apparatus to be connected with the various tanks as desired.

Obviously some features of this invention may be used without others and the invention may be embodied in widely varying forms.

Therefore, without limiting the invention to the devices shown and described, and without enumerating equivalents, we claim and desire to obtain by Letters Patent the following:—

1. The combination of a tank having a porous bottom, means for forcing air through said bottom, porous cylinders adapted to be raised and lowered out of and into said tank, means for raising and lowering said cylinders, and means for forcing air through said cylinders.

2. The combination of a tank having a porous bottom, comprising a mineral septum, means for applying air pressure and suction to said porous septum, porous cylinders of mineral material adapted to be raised and lowered out of and into said tank, means for raising and lowering said cylinders, and means for applying air pressure and suction to said cylinders.

3. The combination of a tank having a porous bottom, means for forcing air through said bottom, porous cylinders adapted to be raised and lowered out of and into said tank,

means for raising and lowering said cylinders, means for forcing air through said cylinders, and means for applying heat to said tank.

4. The combination of a tank having a porous bottom, comprising a mineral septum, means for applying air pressure and suction to said porous septum, porous cylinders of mineral material adapted to be raised and lowered out of and into said tank, means for raising and lowering said cylinders, means for applying air pressure and suction to said cylinders, and means for applying heat to said tank.

5. The combination of a tank having a porous bottom, means for forcing air through said bottom, porous cylinders adapted to be raised and lowered out of and into said tank. means for raising and lowering said cylinders, means for forcing air through said cylinders, heating coils for said tank, and means for raising and lowering said coils into said tank.

6. The combination of a tank having a porous bottom, comprising a mineral septum, means for applying air pressure and suction to said porous septum, porous cylinders of mineral material adapted to be raised and lowered out of and into said tank, means for raising and lowering said cylinders, means for applying air pressure and suction to said cylinders, heating coils for said tank, and means for raising and lowering said coils into said tank.

7. The combination of a tank having a porous bottom, means for forcing air through said bottom, porous cylinders adapted to be raised and lowered out of and into said tank, means for raising and lowering said cylinders, means for forcing air through said cylinders, heating coils for said tank, and means for raising and lowering said coils into said tank independently of the movement of the porous cylinders.

8. The combination of a tank having a porous bottom, comprising a mineral septum, means for applying air pressure and suction to said porous septum, porous cylinders of mineral material adapted to be raised and lowered out of and into said tank, means for raising and lowering said cylinders, means for applying air pressure and suction to said cylinders, heating coils for said tank, and means for raising and lowering said coils into said tank independently of the movement of the porous cylinders.

9. The combination of a tank having a porous bottom, consisting of acid and alkali resisting mineral material, means for applying air pressure and suction to said bottom, porous cylinders consisting of acid and alkali resisting mineral material, adapted to be raised and lowered out of and into said tank, means for raising and lowering said cylinders, and means for applying air pressure and suction to said cylinders.

10. The combination of a tank having a porous bottom, consisting of acid and alkali resisting mineral material, means for applying air pressure and suction to said bottom, porous cylinders consisting of acid and alkali resisting mineral material, adapted to be raised and lowered out of and into said tank, means for raising and lowering said cylinders, means for applying air pressure and suction to said cylinders, and means for applying heat to said tank.

11. The combination of a tank having a porous bottom, consisting of acid and alkali resisting mineral material, means for applying air pressure and suction to said bottom, porous cylinders consisting of acid and alkali resisting mineral material, adapted to be raised and lowered out of and into said tank, means for raising and lowering said cylinders, means for applying air pressure and suction to said cylinders, heating coils adapted to be raised and lowered out of and into said tank, and means for raising and lowering said coils.

12. The combination of a tank having a porous bottom, consisting of acid and alkali resisting mineral material, means for applying air pressure and suction to said bottom, porous cylinders consisting of acid and alkali resisting mineral material, adapted to be raised and lowered out of and into said tank, means for raising and lowering said cylinders, means for applying air pressure and suction to said cylinders, heating coils adapted to be raised and lowered out of and into said tank, and means for raising and lowering said coils independently of the movement of the porous cylinders.

13. The combination of a tank having a bottom, a porous false bottom over said first named bottom, means for applying air pressure and suction to the chamber between said bottoms, porous cylinders adapted to be raised out of and lowered into the tank, means for operating said cylinders, means for heating the material within the tank, and means for applying air pressure and suction to said cylinders.

14. Apparatus for cyaniding ore comprising a tank having a rigid bottom of porous material and means for forcing air through such bottom into the tank.

15. Apparatus for cyaniding ore comprising a tank having a rigid bottom of porous material and means for applying air pressure and suction to said bottom.

16. Apparatus for cyaniding ore comprising a tank having a rigid false bottom of porous mineral material and means for forcing air through such bottom into the tank.

17. Apparatus for cyaniding ore comprising a tank having a rigid bottom of porous mineral material, heating coils arranged in said tank and means for forcing air through such bottom into the tank.

18. Apparatus for cyaniding ore compris-

ing a tank having a bottom of porous mineral material, heating coils arranged in said tank near the bottom of said tank, and means for forcing air through said bottom into the tank.

19. Apparatus for cyaniding ore comprising a tank having a bottom of porous mineral material, porous mineral cylinders arranged in said tank and means for forcing air through said porous bottom and through said porous cylinders.

20. Apparatus for cyaniding ore comprising a tank having a bottom of porous mineral material, porous mineral cylinders arranged in said tank and means for applying air pressure and suction to said porous bottom and said porous cylinders.

21. Apparatus for cyaniding ore comprising a tank having a bottom of porous mineral material, porous mineral cylinders arranged in said tank, heating coils also arranged in said tank and means for forcing air through said porous bottom and through said porous cylinders.

22. Apparatus for cyaniding ore comprising a tank having a bottom of porous mineral material, cylinders comprising a hollow porous mineral septum arranged in said tank, and means for forcing air through said porous bottom and through said porous cylinders.

23. Apparatus for cyaniding ore comprising a tank having a bottom of porous mineral material, cylinders comprising a hollow porous mineral septum, and a pipe at one end extending into the hollow of said porous mineral septum, and means for forcing air through said porous bottom and through said cylinders.

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

JAMES EDWARD PORTER.
ARTHUR L. CLARK.

Witnesses as to signature of James Edward Porter:

F. E. ENGELHARDT,
STUART C. HEMINGWAY.

Witnesses as to signature of Arthur L. Clark:

FREDERICK W. ERB,
FRANK C. ERB.