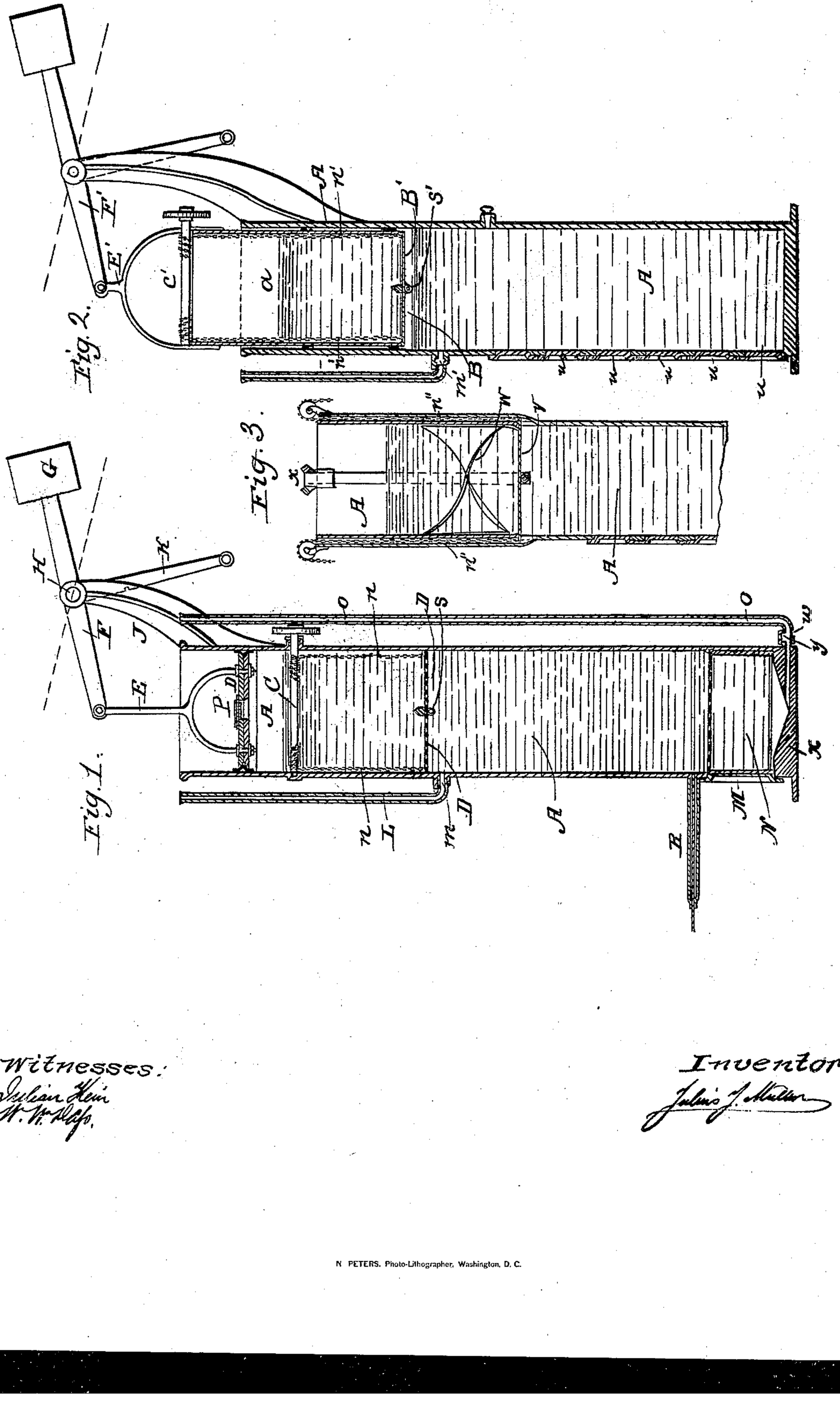
J. J. MULLER.

Machine for Concentrating Ores.

No. 33,171.

Patented Aug. 27, 1861.



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JULIUS J. MÜLLER, OF NEW YORK, N. Y., ASSIGNOR TO HIMSELF, W. H. McVICKAR, AND H. E. ROEDER, OF SAME PLACE, AND P. WEILER, OF BELLEVILLE, NEW JERSEY.

IMPROVED ORE-SEPARATOR.

Specification forming part of Letters Patent No. **33,171**, dated August 27, 1861.

To all whom it may concern:

Be it known that I, JULIUS J. MÜLLER, of New York, in the county and State of New York, have invented a new and Improved Mode of Concentrating Ores or Tailings; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

The nature of my invention consists in first agitating pulverized ore or minerals in a quantity of water or fluid, and then allowing the same to fall while in this state of agitation into a lower vessel or a lower apartment of the vessel by its relative specific gravity, whereby a separation of the different particles is obtained. For this purpose I employ a deep vessel or vessels filled with water or any other suitable fluid, in the upper part of which the pulverized minerals are first agitated until all particles are mechanically suspended in the fluid, when by the sudden opening of suitable doors or valves the agitated minerals are allowed to subside into the water or fluid in the lower part of said vessel, where, by the law of gravity and in exact proportion to the specific gravity of each substance, the several particles of the pulverized minerals will arrive at the bottom in regular layers, those particles containing valuable metals, and consequently those of the most value, having a greater specific gravity, forming the lowest layer, while those of less value and less specific gravity, such as earthy particles, form the upper layer.

In Figure I, A represents a vessel filled with water or any other suitable liquid. This vessel is made from twelve to twenty or more feet in height, or of such a height as may be required to give sufficient time and the necessary velocity for the different particles to arrive in regular order at the bottom. About five feet from the top end doors B are arranged, hinged in the middle to a bar S. These doors are perforated and covered with very fine wire-cloth, and have chains or cords *n* attached, fastened to a roller C, whereby said doors may be opened or shut, as may be desired.

The top part of the vessel A is provided with a piston D, connected through the rod E to one end of a lever F. The other end of this lever F is provided with a weight G to counterbalance said piston D. This lever F is attached to a shaft H, turning in suitable bearings in the frame J. A lever K is attached to said shaft H to give a vibrating motion to the lever F, and consequently a corresponding up-and-down motion to the piston D. This piston is provided with suitable packing and with one or more valves P, opening outward.

L is a pipe connected with the vessel A some distance below the perforated doors B and provided with a self-acting valve *m*, opening inward or toward the inside of the vessel A.

Near the bottom of the vessel A a large door M is arranged for the purpose of taking out the receiving-vessel N. This receiving-vessel N is made with a perforated bottom covered over with very fine wire-cloth and is for the purpose of facilitating the operation and to save time between each operation. A perforated bottom may likewise be placed into the lower part of the vessel A some distance above the solid bottom *x*, upon which the minerals may be precipitated. The perforated bottom in the vessel A or in the receiving-vessel N, as well as the perforated doors B, must be covered with fine wire-cloth, so as to prevent the minerals falling through the same, but at the same time to allow air to pass through. Between the perforated bottom in the vessel A or the perforated bottom of the receiving-vessel N and the solid bottom *x* of the vessel A a pipe O is made to enter, constructed similar to the pipe L and provided with a self-acting valve *w*, opening toward the inside of the vessel A.

Above the door M a valve or slide R is arranged in such a manner that by the same the column of water above said valve or slide can be shut off while the precipitated minerals in the bottom of the vessel A or the receiving-vessel N, containing the same, are removed, saving thereby the necessity of refilling the vessel A after each operation. By the introduction of this receiving-vessel N considerable time will be saved by each operation, as after each precipitation this box or

vessel N can easily and in a very short time be removed and replaced by an empty box.

The manner of operating is as follows: The pulverized ore or minerals before they are to be operated upon must first be passed through several sieves of different textures or separated by some other known process, so as to obtain all particles of the pulverized minerals for one operation as much alike in size and magnitude as possible. The vessel A is then filled with water or any other suitable fluid some distance above the doors B, which latter are then shut by means of the shaft C, operating the chains *n*, attached to the said doors. The pulverized ore or minerals are then thrown upon the doors B either through the valve P in the piston D or through any other opening, which must afterward be closed up tight. The piston D is then put in motion, by which means a vacuum will be produced during the upward motion of the piston above the body of water and the minerals situated upon the doors B. The production of this vacuum above the water and minerals will cause air to enter through the pipes L and O, which after passing through the water will force itself upward through the minerals upon the doors, at the same time forcing the same upward. By the return-stroke or downward motion of the piston the valve P in this piston will open, so as to allow the air to escape, while at the same time the valves *m* and *n* in the pipes L and O will be closed by the pressure of water against the same and prevent any further introduction of air. The ore or minerals being therefore during this downward motion of the piston relieved from the agitating action of the air will sink down again upon the doors B. This agitation of the minerals or forcing the same upward by a current or jets of air will be repeated by each upward stroke of the piston, while the precipitation of the same will happen by each downward motion of said piston. By this repeated agitation of the ore or minerals the different particles of the same are separated and thoroughly mixed together with the water or fluid, so as to produce as much as possible a mechanical mixture of every particle of the ore or minerals separately with the water, while by the repeated precipitations the lightest particles and those of the least specific gravity will soon come uppermost. When this operation has been continued some time, but while the ore or minerals are still being agitated, the doors B are suddenly opened, whereby the ore or minerals will sink into the body of water or liquid in the lower part of the vessel A. The pipe L is then closed, so as to prevent any further introduction of air through the same. The separate particles, which, as above stated, have been sieved and are consequently as near as possible all of the same size or magnitude, and which by the above-mentioned operation have been separately mixed with the water or fluid, begin to sink into this lower body of fluid at a velocity exactly in proportion to their different specific gravity. To retard this precipitation a little and at the same time to insure a perfect separation of the different particles from each other, the motion of the piston is continued for some time after the doors have been opened, whereby air is caused to enter through the pipe O, meeting the different particles of minerals and retarding particularly the lighter particles in their precipitation, insuring thereby a more distinct separation. The motion of the piston is then stopped, whereby the current of air through the pipe O ceases and the minerals are allowed quietly to settle and collect in the bottom of the vessel A or in the receiving-vessel N. When the precipitation is completed, the valve R is closed, whereby the column or body of water or fluid above said valve is shut off from the lower part, and the door M is then opened to take out the ore or minerals or to withdraw the vessel N containing the same and replace an empty box. The door M is then again closed, the valve or slide R opened, and the vessel A replenished with water or fluid; when the above-described operation can be repeated.

As above mentioned, the minerals are for each operation, on account of their being sieved or otherwise separated, all of exactly the same size or magnitude, in consequence of which during their precipitation those which contain any quantity of valuable metal will, in consequence of their greater specific gravity, arrive sooner at the bottom of the vessel A than those which contain a less quantity or different metals and are lighter. The lowest layer will therefore consist of those particles containing gold, silver, lead, &c., while the layer above will consist of particles containing iron, copper, zinc, &c., and the earthy particles will form the top layer; or, in other words, the valuable minerals will be concentrated into the lowest layer by this mode of operation and can easily be separated from the less valuable minerals and earthy substances.

Instead of making a piston to work in the upper part of the vessel A to produce a vacuum in the manner and for the purpose above described, a cylinder or box Q may be fitted into the vessel A, Fig. II, the bottom of which consists of doors B′, hinged in the middle and supported and operated by chains *n*′, as above described. This cylinder or box is provided with suitable packing to make the same work air-tight in the vessel A, and is connected to a beam F′, through which the same is moved upward and downward in the vessel A, similar to a piston. The vessel A is filled with water or fluid until the same stands some distance above the doors B′, when the pulverized ore or minerals are thrown upon the doors B′. The minerals, being very finely pulverized, will form a solid body upon the doors, preventing the water above the same passing through when the cylinder Q is moved upward, forming thereby the equivalent of a

solid piston, which produces thereby by each upward motion of said cylinder Q a vacuum below the minerals situated upon the doors B′ and below said doors. This vacuum thus formed will cause the air to flow in through the pipe L′, filling up the space between the top of the water and the under side of doors B′ or cylinder Q. When the cylinder moves downward, the valve *m′* in the pipe L′ closes, and the air situated then between the bottom of said cylinder and the body of water or fluid will be forced through the doors B′, the ore or minerals forcing the same upward and producing thereby the same result as above mentioned. When the cylinder moves upward again, the minerals will fall back upon the doors, forming again the equivalent of a solid piston, necessary for the production of the required vacuum. By the repeated up-and-down motion of this cylinder a current of air will be made to pass through the minerals by each downward motion of said cylinder, agitating and mixing thereby the ore or minerals thoroughly with the water or fluid, after which the thus-agitated minerals are allowed to subside into the body of water or fluid by the opening of the doors B′, according to their specific gravity and by which the heavier and more valuable particles are separated from the lighter particles or those of less value and fall in different layers upon the bottom.

Instead of producing a vacuum above the ore, as represented in Fig. I, or below the ore, as shown in Fig. II, for the purpose of causing thereby a current or jet of air to pass through the minerals, so as to agitate the same with the water or fluid, an air-pump may be attached below the doors B and air forced into the vessel below the doors at short intervals, which, while forcing itself through the ore or minerals, will agitate the same in a manner similar as above described.

Instead of operating the ore by causing a current of air to pass through the same, as above mentioned, the vessel A may be arranged with solid doors V (see Fig. III) in the upper part of said vessel, hinged in the center and operated by chains for the purpose of opening or shutting the same. Above these solid doors V an upright shaft is then arranged, provided with arms, wings, or a spiral screw W, and made to revolve by means of gearing X or any other suitable contrivance. The vessel A being filled with fluid or water up to a certain height above the doors V and above the screw W, the doors V are closed, and the pulverized ore or minerals are thrown upon the same, when the shaft, with its arms, wings, or screw, is set in motion. The motion of the arms will produce a continual agitation of the body of water or fluid above the doors V and of the minerals, mixing the same thoroughly together, so as to produce as much as possible a mechanical suspension of every particle of the minerals separately in the water. The doors V are then opened and the minerals allowed to sink into the body of water below, according to their specific gravity, as above described and mentioned.

In the above-described operation the precipitated ore or minerals are after each operation or precipitation removed from the machine.

With some description of minerals the earthy substances, which, as above mentioned, form the upper layer, will, after the precipitation is completed, be found sufficiently strong and compact to allow of two or more precipitations to be made upon the already-precipitated minerals without danger that the lower and most valuable layer of the next operation will, on account of its weight, sink into or mix with the upper layer of the before-precipitated minerals. In this case the valve or slide R and the receiving-vessel N are dispensed with, as well as the pipe O, and doors U U are provided, one above the other, for nearly the whole height of the lower part of the vessel A (see Fig. II) for the purpose of taking out the thus-precipitated ore or minerals. If several precipitations are made in this manner, one upon the other, the ore which is the coarsest should first be operated with, then with the next finer ore, and last with the finest, as the coarser the ore is the greater height will be required for the ore to fall, so as to obtain a distinct separation of the heavier from the lighter particles of minerals.

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

1. Isolating the particles of pulverized ore or minerals while being mechanically agitated from the main body of water or liquid fluid through which they are subsequently allowed to fall, substantially as shown and described.

2. Providing the fluid-containing vessel with trap-doors or their equivalent, constructed substantially as described and capable of being closed and opened for retaining the ore or for allowing the same to subside into the fluid at pleasure, in combination with the piston or other suitable suction device for mechanically agitating the particles of ore or minerals by air and otherwise, whereby the agitation of the said ore may be effected previous to its being allowed to fall through the mass of fluid, essentially as herein set forth.

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