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H. A. ALLEN.

APPARATUS FOR SEPARATING MATERIALS OF DIFFERENT GRAVITIES.

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NO MODEL.

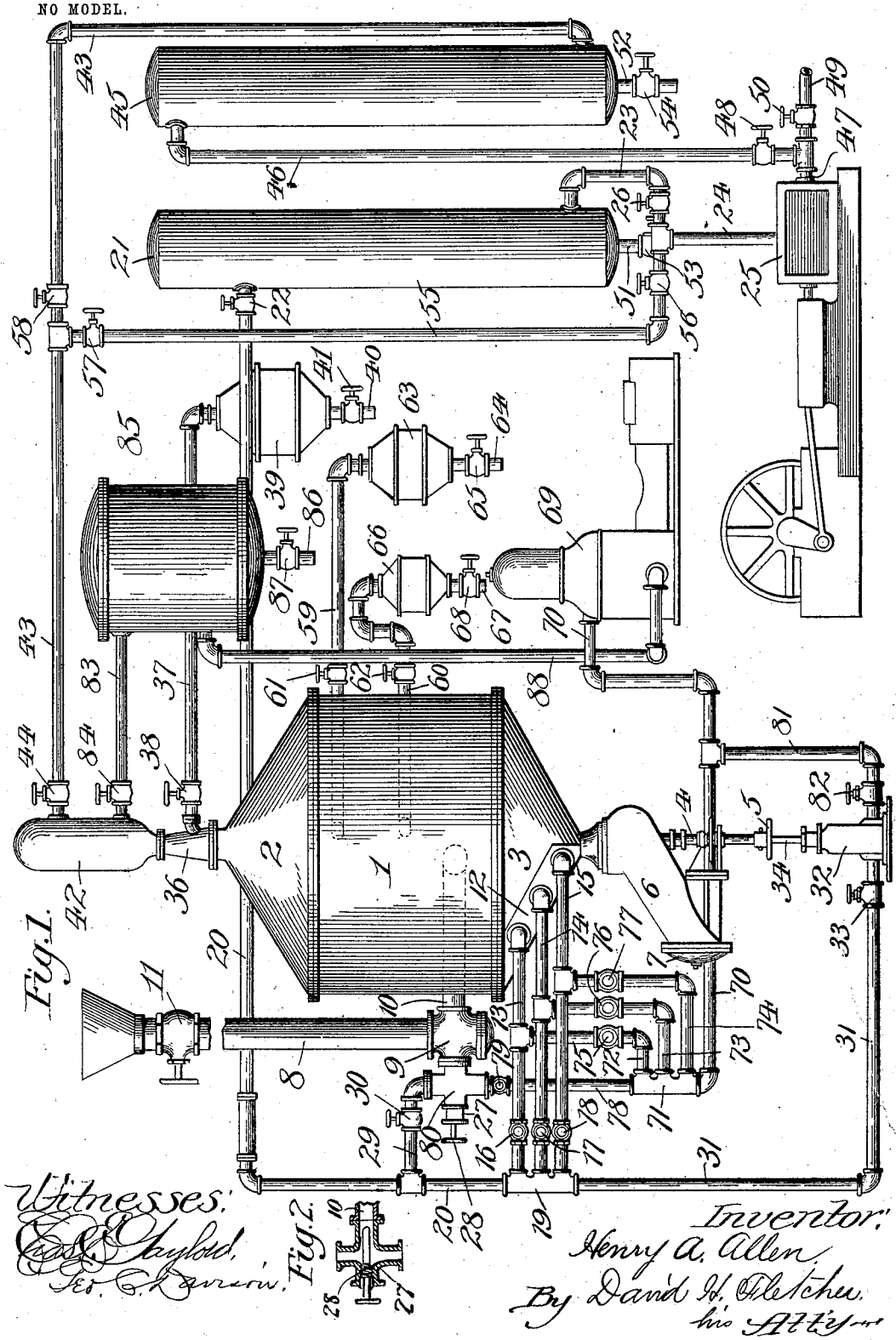


Fig. 1.

Fig. 2.

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UNITED STATES PATENT OFFICE.

HENRY A. ALLEN, OF CHICAGO, ILLINOIS.

APPARATUS FOR SEPARATING MATERIALS OF DIFFERENT GRAVITIES.

SPECIFICATION forming part of Letters Patent No. 762,870, dated June 21, 1904.

Application filed March 16, 1903. Serial No. 148,044. (No model.)

To all whom it may concern:

Be it known that I, HENRY A. ALLEN, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Apparatus for Separating Materials of Different Gravities, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in which similar numerals of reference in the different figures indicate like parts.

The object of my invention is to so construct an apparatus for separating material of different specific gravities that the principle of the vortex whirl may be utilized in conjunction with a gaseous fluid and liquid operating throughout a closed system, said gaseous fluid and liquid aiding to produce a separating action upon the mass of material to be treated. I accomplish said object by means of a closed circular vessel having eduction-openings at the upper and lower parts, respectively, with means for introducing the materials to be separated or treated, together with a gaseous fluid and a liquid under pressure, the latter being introduced, preferably, tangentially to the body of said receiving vessel and arranged to circulate through an auxiliary system in such a way that the gaseous fluid and liquid may be used over and over to any predetermined extent.

A further object is to provide means whereby the pressure upon the system may be varied at will, while at the same time the relative volume in circulation of the gaseous fluid and liquid may also be varied with respect to each other. I accomplish said objects in the manner hereinafter specified, and particularly set forth in the claims.

In the drawings, Figure 1 is a side elevation of a separator, a pump, a compressor, together with the necessary reservoirs and connecting-pipes which serve to complete the system; and Fig. 2 is a longitudinal sectional view of an adjustable nozzle.

Referring to the drawings, 1 represents a hollow cylinder, preferably formed of metal, which constitutes the body of the separator. Bolted or otherwise attached to suitable flanges upon the respective ends of said cylinder are end pieces 2 3, preferably of conical shape, as shown, the one forming the bottom and the other the top of the separator. A central discharge-opening is formed in the bottom, which opening is normally closed by means of a valve (not shown) upon the upper end of a screw-threaded valve-stem 4, having a hand-wheel 5. An inclined conduit 6 is provided with an opening at the lower end normally closed by means of a cap 7, secured thereto in an approved way. The construction of said valve, discharge-conduit, and other special features in connection therewith are fully shown and described in an application heretofore filed by me as Serial No. 116,672, filed July 23, 1902, and I make no claim thereto in this application. A vertical charging-pipe 8 is connected, by means of a jointed fitting 9, with a horizontal induction-pipe 10, arranged tangentially to and in communication with the cylindrical portion of said separator. The charging-pipe 8 is preferably provided with a closing-valve 11 at or near its upper end. The bottom 3 of the separator is preferably provided with a vertical portion 12, with which is connected, by means of suitable fittings, as shown, a series of pipes 13 14 15, the inlet of which is tangential to the part 3. Said pipes are provided, respectively, with shut-off valves 16, 17, and 18. Said pipes 13, 14, and 15 connect with a fitting 19, which in turn connects with a service-pipe 20 in communication with a closed reservoir 21, a valve 22 being interposed in said pipe. The reservoir 21 is connected, by means of a pipe 23, with the eduction-pipe 24 of a pump 25, a valve 26 being interposed to shut off communication when desired, as hereinafter described.

Connected with the fitting 9 is a fitting 27, to which is connected a nozzle which is extended into and is concentric with the pipe 10. Said nozzle, the details of which are shown in Fig. 2, is rendered adjustable by means of an adjusting-screw 28. A pipe 29, together with suitable fittings shown, serves to connect the fitting 27 with the pipe 20, a valve 30 being interposed between the two.

Connected with the fitting 19 is a pipe 31, leading downwardly and thence horizontally to a hollow casing 32, said pipe 31 being a continuation of the pipe 20 and being provided

with a valve 33. The upper part of the casing 32 is provided with a suitable stuffing-box, through which is projected a vertical pipe 34, which is carried upwardly through the hollow tube 4 into the throat of the opening at the bottom of the separator, thus forming a nozzle adapted to be adjusted by means of a hand-wheel 5.

Rigidly attached to the top 2 of the separator is a fitting 36, with which is connected a discharge-pipe 37, having a valve 38 therein. The discharge-pipe 37 is in communication with a closed receiver 39, having an outlet 40, normally closed by means of a valve 41. Above the fitting 36 is a chambered dome 42 in communication with said fitting, the upper part of which is connected, by means of a pipe 43, having a shut-off valve 44 therein, with the lower portion of a tank or reservoir 45, the upper portion of which is connected, by means of a pipe 46, with the intake-pipe 47 of the compressor 25, a valve 48 being interposed in the pipe 46. A pipe 49, having a shut-off valve 50, enables air or other fluid to be taken from the atmosphere or any suitable source of supply at will. Sediment-pipes 51 52 in the tanks 21 and 45, respectively, enable the sediment to be withdrawn from said tanks at will, valves 53 54 being provided to close said outlets. A pipe 55, having valves 56 57 therein, serves to connect the eduction-pipe of the compressor with the pipe 43, and thereby with the chamber of the part 42. A valve 58 is located in the pipe 43 for the purpose hereinafter stated. The pipe 55 is intended to be used only for cleaning out the separator, and it should be understood that the valves 56 and 57 are normally closed, while the valve 58 is normally open.

Discharge-pipes 59 60, having valves 61 62, respectively, are located in the upper part of the body of the separator, substantially as shown, and are designed to be used for classifying purposes. The pipe 59 leads to a closed receptacle 63, having a discharge-pipe 64, in which is interposed a shut-off valve 65, while the pipe 60 leads into a like receiver 66, having a like discharge-pipe 67, closed by means of a valve 68.

A pump 69 is located in suitable proximity to the receiver 1, with which pump is connected an eduction-pipe 70 in communication with a fitting 71, from which branch pipes 72 73 74 are led to connect, respectively, with the pipes 13, 14, and 15, said branch pipes being provided with valves 75, 76, and 77, respectively. A pipe 78, having a valve 79, serves to connect the fitting 71 with a fitting 80, which is connected in turn with the fitting 9. A branch pipe 81 also leads downwardly from the pipe 70 and is connected with the chambered fitting 32, a valve 82 being interposed in the former.

Connected with the dome 42 is a pipe 83, having a valve 84 therein, said pipe being in communication with a closed receptacle 85, provided with a drip-pipe 86, normally closed by means of a valve 87. The receptacle 85 is connected in turn, by means of a pipe 88, with the intake of the pump 69.

The operation of my improved apparatus is as follows: The material or materials to be separated having been fed into the separator through the feed-pipe 8 and the valves 26, 22, 30, 16, 17, 18, 33, 38, 44, 48, 61, and 62 being opened and the valves 11, 50, 53, 54, 56, 57, 41, 65, and 68 being closed, the action in connection with the compressor will first be explained independently of that of the pump. Assuming that air or other gaseous fluid is to be utilized, it is forced by the compressor outwardly throughout the pipe 23, tank 21, and pipe 20 into the separator through the several branch pipes 27, 13, 14, 15, and 34, assuming the several valves to be open, as described. This serves to impart a whirling and otherwise agitating action to the fluids and materials within the separator, whereby the particles of different gravity may tend to separate. The air or gaseous fluid passes upwardly through the chamber 42 to the pipe 43, receptacle 45, and pipe 46, back to the compressor, thereby completing a cycle.

The fluid circulation induced by the pump 69 is as follows: Upon opening the several valves 75, 76, 77, 79, and 82 of the induction-pipes and 84 of the eduction-pipe, which latter is presumed to be normally open, a fluid circulation will be established from the pump through the several branch induction-pipes enumerated and the separator, from whence it will pass through the pipe 83, receptacle 85, and pipe 88, back to the pump. With the compressor 25 in simultaneous operation the gaseous and liquid fluids will be commingled within the separator in substantially equal quantities. The proportions, however, may be varied at will by manipulating the several valves controlling the induction-pipes. For example, assuming the valve 33 to be closed and the valve 82 to be open liquid only would pass into the separator through the pipe 34. If the valves 17, 75, and 77 were closed and the valves 16 and 18 opened, liquid only would pass through the pipe 14 and air or other gaseous fluids through the pipes 13 and 15. So with the pipe 10 the character of the ingoing medium would depend upon the manipulation of the valves 30 and 79. It will thus be seen that any desired modification may be made as a result of the special manipulation of said several valves, and that regardless of the relative character of the fluid employed. For example, air or other gaseous fluid and water, or air or other gaseous fluid and oil, or a liquid chemical mixtnre may be employed, it being obvious that whichever it may be it may be used over and over with comparatively little loss, which loss, if of air or gaseous fluid, may be made up through the pipe 49 by closing the valve

48 and opening the valve 50 until the required pressure is attained. The liquid loss may be replenished through the charging-pipe 8 or from any suitable source of supply communicating with the intake-pipe of the pump 69.

It is obvious that either the gaseous-fluid system or the liquid system may be used intermittently by manipulating the necessary valves, as shown—that is to say, the respective systems may be alternated or used in any combined manner desired. By opening the valves 56, 57, and 50, which are normally closed, and closing all the other valves, which are normally open, air may be taken from the atmosphere or from an air-pressure tank through the pipe 49 and the necessary pressure induced in the main receptacle, when upon opening one or all of the valves 41 65 68, the discharge-valve in the bottom of the receiver 1, and removing the cover 7 the pressure may aid in forcing out all or a part of the incased or inclosed materials.

It is obvious that the apparatus may be used at will for a continuous or intermittent treatment of the ore. In the former case the charge-pipe 8 should be of such a height as to permit a static head to be maintained sufficient to overcome any predetermined pressure in the main receptacle.

In order to draw off materials at different levels at will, the valve in the bottom of the receptacle would normally be for continuous operation entirely or in part open. The tube 34, ending in a nozzle, would be adjusted to act similar to the well-known "hydraulic separator." When it is desired to draw off the material from the chamber 6, said bottom or discharge valve may be closed, the cover 7 taken off, the material removed, the cover replaced, and the bottom valve again opened to the position of normal running. A similar course may be pursued in removing materials from the receptacles 39, 63, and 66, the valves 38, 61, and 62 being first closed and the valves 41, 65, and 68 being opened. After the material has been removed, all the valves can then be returned to their respective normal working positions.

Having thus described my invention, I claim—

1. An ore-separator in which is combined a closed separating vessel, a source of gaseous-fluid supply, a source of liquid-supply, a circulating system leading from said separating vessel in a continuous closed circuit back thereto, and means for forcing said gaseous fluid and liquid through said system.

2. An ore-separator in which is combined a closed separating vessel, a source of gaseous-fluid supply, a source of liquid-supply, a plurality of conduits forming a circulating system leading in a closed circuit from said separating vessel back thereto, means for forcing said liquid and gaseous fluid through said system and suitable valves for controlling the flow thereof at will.

3. An ore-separator in which is combined a closed separating vessel, means for introducing thereto the material to be separated, independent sources of liquid and gaseous fluid supplies, independent conduits forming circulating systems leading in closed circuits away from and back to said separating vessel, means for discharging the materials acted upon, means for independently forcing circulation through said separating systems and suitable valves for controlling said circulation.

4. An ore-separating apparatus in which is combined a closed separating vessel, means for introducing thereto the materials to be separated, means located at different levels for discharging the particles of different specific gravities, pipes leading into said separating vessel, a gaseous-fluid compressor and a liquid-pump, each connected with said pipes, a gaseous-fluid reservoir connected with said compressor, a liquid-reservoir connected with said pump and pipes for connecting said respective reservoirs with the upper part of said separating vessel.

5. An ore-separating apparatus in which is combined a closed separating vessel, means for introducing thereto the materials to be separated, means located at different levels for discharging the particles of different specific gravities, pipes leading into said separating vessel, a gaseous-fluid compressor and a liquid-pump, each connected with said pipes, valves controlling the admission of gaseous fluid and liquid to said pipes, a gaseous-fluid reservoir connected with said compressor, a liquid-fluid reservoir connected with said pump and pipes for connecting said respective reservoirs with the upper part of said separating vessel.

6. An ore-separator in which is combined a closed separating vessel, means for introducing thereto the materials to be separated, independent sources of liquid and gaseous fluid supplies, independent conduits forming circular systems leading in closed circuits away from and back to said separating vessel, means for discharging the separated materials while the apparatus is in operation, means for independently forcing gaseous and liquid fluid circulations through said separating systems and suitable valves for controlling said circulations.

In testimony whereof I have signed this specification, in the presence of two subscribing witnesses, this 14th day of March, 1903.

HENRY A. ALLEN.

Witnesses:
D. H. FLETCHER,
CARRIE E. JORDAN.