

(No Model.)

2 Sheets—Sheet 2.

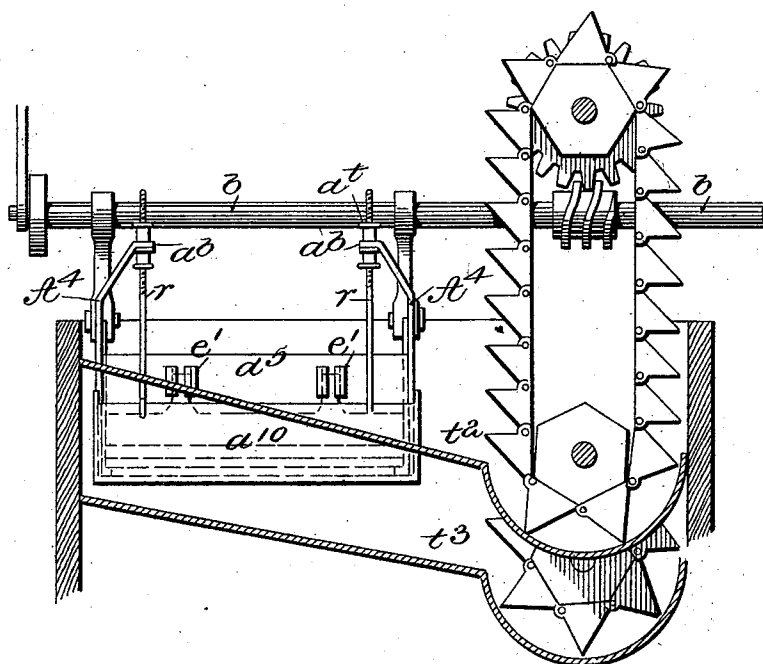
I. CHRIST.

SEPARATING APPARATUS FOR MINERAL SUBSTANCES.

No. 534,466.

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Fig. 3.



Witnesses

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SEPARATING APPARATUS FOR MINERAL SUBSTANCES.

SPECIFICATION forming part of Letters Patent No. 534,466, dated February 19, 1895.

Application filed April 7, 1894. Serial No. 506,692. (No model.)

To all whom it may concern:

Be it known that I, ISAAC CHRIST, a citizen of the United States, and a resident of the borough of Tamaqua, in the county of Schuylkill, in the State of Pennsylvania, have invented a new and useful Separating Apparatus for Mineral Substances, of which the following is a correct description.

The invention relates generally to the class of machines which are employed in the treatment of mine-products, for the purpose of separating the valuable from the worthless portions thereof; and it relates particularly to that class in which portions of the machinery in the operation thereof, are either wholly or partially submerged in water; the separation of the materials being due in part to the construction of the fixed portions of the apparatus; in part to the action of the movable portions of the machine; in part to the supporting power of the body of water, as it operates to partially float the lighter portions of the mineral substances, and thus elevate them to a plane which is higher than that of the heavier portions of such substances; and in part to the inertia or latent resistance of the body of water, in opposition to the movement through it, of the mineral receptacle, and its contents.

The object of the invention is to provide, at a moderate cost, a machine or apparatus of the general character above indicated, in which all the material to be treated shall be received in a primary or initial compartment, at one extremity of the mineral receptacle; in which the material shall be moved in a substantially horizontal plane, and from which all the material shall be discharged, at two or more points, at the opposite extremity of such receptacle.

The invention consists in various novel elements or combinations of elements, in a machine for separating and washing mineral substances, whereby the operation of separating the lighter material from the heavier, is continued automatically;—that is to say, without necessity for the presence of an attendant, to supervise and regulate the movement of the machine;—whereby the operation of the submerged parts may be modified and regulated by appliances which are operated from points above the level of the water, without

cessation or restriction of the movement of such submerged and concealed parts; whereby the material, as it is precipitated into the primary compartment of the separating-receptacle, is immediately subjected to the operation of the separating agencies,—and, as it is separated, is moved with a regular motion to its points of discharge at the opposite extremity of such receptacle; whereby a substantially horizontal layer or stratum of heavy material is continuously maintained in the lower portion of the separating-receptacle; whereby the substantially horizontal layer of heavy mineral which in the operation of the machine is continuously maintained in the lower portion of the separating-receptacle, may be varied in its vertical extent;—whereby the machine is adapted to discharge material of dissimilar dimensions; whereby the machine is adapted either to discharge a light material at an upper discharge-opening, and a heavy material at a lower discharge-opening, or to discharge a light material at an upper discharge-opening, and a mixed or medium-weight material at a lower discharge-opening; and whereby the machine is rendered, generally, wholly effective and reliable for the accomplishment of all the objects and purposes for which it is designed.

It will be understood that the apparatus, although designed, primarily, for the treatment of anthracite or other mineral coals, is adapted also to treat successfully, any mineral substances whatever.

In the accompanying drawings, which constitute a part of this specification:—Figure 1 represents a top plan view of a separating-apparatus in which my invention is embodied. Fig. 2 is a vertical sectional elevation, in the line $y-y$ of Fig. 1. Fig. 3 is a vertical sectional elevation, as in the line $z-z$ of Fig. 1,—the inclined upper screen or discharging-chute, having been detached.

The inclosing-tank T may, for the purposes of this invention, be of ordinary construction, and it may be supported in any usual or suitable manner. Its discharge-chute t^2 , receives the lighter and more valuable products of the mine, and conducts them to a receptacle from which they are discharged by means of elevating-machinery. A similar chute t^3 conducts slate and other heavy refuse to another

place of temporary deposit, where it is intercepted and removed through the action of another elevator.

The separating-receptacle A, which is composed of any suitable metal, is of the nearly rectangular form represented in Fig. 1, and is supported by and receives actuation from the crank-arms b' of a transverse-shaft b , which in turn receives motion from any suitable source of power. The sides a^2 , a^3 , and the rear end a^4 , of the receptacle, are of practically uniform vertical extent, but its front end a^5 , terminates upwardly at a point somewhat below the upper plane of the sides, and its lower extremity comes short by a substantially similar distance, of the lower plane of the sides of the receptacle.

Along the end a^4 , and along the sides a^2 , a^3 , of the receptacle, at the lower extremity thereof, is provided a continuous bearing or ledge a^6 , upon which is received the detachable perforated bottom-plate a^7 . At its front extremity, the bottom-plate a^7 , comes short, by a slight distance, of the front end a^5 , of the receptacle, and is supplemented by an adjustable discharging-receptacle or box-gate A^2 , which by means of strong pivot-pins a^8 , a^9 , is made fast,—for operation and support,—to the side-walls of the receptacle.

It will be seen that the bottom-continuation or supplemental discharging-receptacle A^2 , is curved downwardly, at its point of connection with the bottom-plate, and is then extended forward, to a point considerably beyond the vertical front end a^5 , of the receptacle, where it terminates in a close vertical plate a^{10} , by means of which, in connection with suitable operating-mechanism,—to be further referred to,—this bottom-extension or discharging-receptacle, becomes a supplemental discharging-chamber or third compartment which constitutes an important factor in the operation of the apparatus.

At a suitable distance from the rear end of the separating-receptacle, coincident vertical ways a^{11} , a^{12} , are provided in the side walls a^2 , a^3 , of the same to receive a transverse plate or diaphragm A^3 , which constitutes the inner wall of an initial compartment, or primary material-receptacle A^p , within which all the material to be separated and classified is, at the outset, deposited. This diaphragm or division-plate between the primary compartment and the secondary compartment, or main separating-chamber A^r , may be made extensible, or—by means which will readily occur to the mechanic,—it may, within short distances, be made adjustable, up or down, in its ways.

Upon the exterior surface of each side of the separating-receptacle A, are mounted the two arms A^4 , which extend upward and forward to a point a considerable distance above the upper extremity of the tank, where they are connected by means of a horizontal bar ab ; and which by their lower extremities are secured to the body of the receptacle, by

means of heavy rivets ar . The connecting-bars ab receive adjusting-spools as , and at , the former of which is adapted to the screw-threaded portion of the operating rod o for the extension plate e of the front end a^5 of the separating-receptacle, and the latter of which serves, in like manner, to adjust the rod r , by means of which the supplemental discharging-receptacle is elevated or depressed. The perforated coal-discharging chute a^{14} , which extends from the upper extremity of the front end-wall a^5 , to the upper extremity of the coal-chute t^2 , is, at its upper extremity, pivoted to the side-walls a^2 , a^3 , of the separating-receptacle, and is consequently subjected to the vertical reciprocating action thereof.

In the prosecution of the art and process of separating and classifying coal products, it has been found essential to provide means for the separation of the pure coal from the slate, and other refuse of like specific gravity; and, it has been found necessary to receive the commingled mass at one extremity of the separating-receptacle; and to move it by a regular movement, in a horizontal plane, and at a substantially uniform rate of speed, toward the opposite extremity of the receptacle,—subjecting the whole, throughout the operation, to the constant reciprocation of the receptacle in a vertical plane, in opposition to the inertia of the body of water in which the receptacle is immersed, and also in opposition to the inertia of the contained material itself.

In considering the description of the operation of the apparatus, it will be observed that all the foregoing requirements have, throughout, been carefully held in view. The machinery being in motion, the material to be separated falls into the primary compartment A^p , from which, the separating-receptacle being reciprocated, through the action of the arms b^2 , upon the crank arms b' of the actuating-shaft b , the coals, as they pass the diaphragm or division-plate, gradually separating from the refuse, and rising as,—through the resistance of the water, and the tendency of the slate and other heavy refuse to separate therefrom and assume a lower level,—they approach their outlet of escape at the crest of the discharge-chute a^{14} , the slate and other substances of similar specific gravity, at the same time moving steadily in a bottom stratum or layer of considerable solidity, toward, and through, and out of the supplemental discharging-receptacle.

If bone-coal or any other substance of like specific gravity, be present in any considerable quantity, it will in the reciprocation of the receptacle, assume a position intermediate of the pure coal and the slate; that is, it will be found below the somewhat loose body of pure coal, and above the heavier and comparatively solid layer of slate and the like, which, being largely composed of flat pieces, assumes a stratum-like form, the parts overlapping each other, like scales, although por-

tions of the deposit are continually moving through the receptacle, toward the point of ultimate discharge. The bone-coal, having this intermediate position, may readily be caused to escape either with the coal, at the upper discharge, or with the slate, through the lower discharge. By elevating the rods, the supplemental discharging-receptacle will be moved upward and inward, thus presenting greater resistance to the pressure of the material, elevating the line of separation, and correspondingly increasing the depth of the lower stratum. The bone-coal, or other material of like specific gravity, will then be discharged with the coal. By depressing the rods, in the spools, the supplemental discharging-receptacle will be moved downward and outward, facilitating the escape of the heavy material, and causing the bone-coal, or other substances of like specific gravity, to be discharged with such heavy material.

The adjustment of the supplemental chamber, or third compartment, A^2 , in its lowermost position facilitates the discharge of the lower stratum, or the lower strata of material, while its elevation correspondingly restricts such discharge,—so that it is possible, by means of the adjusting-spools, to regulate the discharge, as to kind, and also as to volume, with the utmost exactness. Similarly, the extension-plate e , upon the end-plate a^5 , may be employed to permit the discharge of material of comparatively small dimensions, only; or, in its highest adjustment, it may permit the discharge of material of any dimensions not greater than the space between the chute b , and the body a^{10} of the supplemental discharging-receptacle.

It will be apparent that through the provision of the extension-plate e , adjustable in the ways e' , upon the front end-plate a^5 , the separating-receptacle is adapted to assort and classify pure coal, or other materials,—discharging a small size only, through any desired period, and then material of greater dimensions.

It will be observed that the described extension-plate, upon the front end-plate of the reciprocating-receptacle; and the described bottom-extension, or supplemental discharging-receptacle, are together susceptible of a double adjustability, that is to say: when the extension-plate is at its greatest elevation, and when the pivoted bottom-extension or supplemental discharging-receptacle is at its greatest depression, the two parts may be moved toward each other, thus rapidly diminishing the passage between them. The conditions of adjustment being reversed, the direction of movement therefrom is correspondingly reversed, with a consequent opposite result.

It will also be observed that by reason of the location of the extension-plate upon the front or outer face of the fixed front end-plate a^5 , and within the angle formed by such front and the overlying pivoted chute a^{14} ,

lodgment of obstructing material upon the upper extremity of the plate is rendered impossible, and the plate is thus at all times freely adjustable in a vertical plane.

In an application, Serial No. 513,761, filed by me in the United States Patent Office on the 7th day of June, 1894, I described a fixed or non-reciprocating separating-receptacle, which in the arrangement of its chambers, and in the general construction of its bottom-plate, is similar to the receptacle herein above described; but I do not herein make claim to any of the elements or combinations of novelty which are claimed in that application.

The nature and objects of the invention having been thus explained and the construction and operation of an apparatus in which the invention is embodied having been set forth, what is claimed is—

1. In a separating-apparatus for mineral substances, a water-tank; a horizontally-arranged, vertically reciprocating separating-receptacle which embraces a close rear-wall; close or imperforate side-walls, of like vertical extent with the rear-wall; a front-wall which is shortened or cut-away in its upper portion, to form an outlet for the discharge of separated coal; which is shortened or cut-away at its lower extremity, to permit the outward movement of separated refuse; and which is provided with a perforated bottom-plate or grate which has a pivoted section which extends beneath and beyond the shortened or cut-away front-wall and which is movable in an arc, in a vertical plane; substantially as and for the purposes specified.

2. In a separating-apparatus for mineral substances, a reciprocating separating-receptacle which at one extremity is provided with a primary receiving-compartment or inlet-passage, the inner wall of which terminates, downwardly, at a point above the bottom of the receptacle, and thereby serves to establish the vertical extent and the upper plane of the body of heavier separated material or refuse; and which at its opposite extremity is provided with a pivoted extension of the bottom-plate or grate of the receptacle, which serves either to permit, or to restrict the discharge of the contained material; substantially as set forth.

3. In a separating-apparatus for mineral substances, the combination with a vertically-reciprocating separating-receptacle, of a fixed vertical end-plate; an independent, pivoted, grated discharging-chute, at the upper extremity of such end-plate; and an adjustable, vertically-arranged extension-plate which is movable upon the front or outer face of the fixed end-plate; substantially as and for the purposes set forth.

4. In a separating-apparatus for mineral substances, a reciprocating separating-receptacle which has a perforated or grated bottom-plate which is shorter than the body of the receptacle, but which at its front extremity is provided with a pivoted, recessed, adjustable

discharging-extension;—substantially as and for the purposes specified.

5. In a separating-apparatus for mineral substances, the combination with a vertically-reciprocating separating-receptacle, of a fixed imperforate end-plate; a pivoted grated discharging-chute, at the upper extremity of the end-plate; and a vertical extension-plate which is adjustable, up or down, upon the front face of the imperforate end-plate; substantially as and for the purposes specified.

6. In a separating-apparatus for mineral substances, a reciprocating separating-receptacle through which in the operation of the apparatus the substances are moved continuously in a horizontal plane, from the inlet to the outlet end thereof, and which is provided, at its discharging end, with a vertically-adjustable, pivoted, bottom-section, or supplemental discharging-receptacle, whereby the substances are made dischargeable at different elevations.

7. In a separating-apparatus for mineral substances which embraces a reciprocating separating-receptacle through which, in the operation of the apparatus, the substances are moved in a generally horizontal plane, the combination of a vertically-adjustable extension-plate, upon the front end-plate of the receptacle; with a vertically-adjustable bottom-extension, or supplemental discharging-receptacle, which is pivoted to the front extremity of the bottom-plate or screen of the receptacle;—the two adjustable parts being movable independently.

8. In a separating-apparatus for mineral substances; a reciprocating separating-receptacle in which, in the operation of the apparatus, the substances are moved in a practically horizontal plane; and which, at its discharging-extremity, is provided with a vertically-adjustable extension-plate, for varying the area of the primary outlet-opening; and which is provided also with a pivoted, vertically-adjustable bottom-extension or supplemental discharging-receptacle, for varying the elevation of the point of ultimate discharge, and also for varying the area of the primary outlet-opening; substantially as and for the purposes described.

9. In a separating-apparatus for mineral substances; a reciprocating separating-receptacle in which, in the operation of the apparatus, the substances are moved in a horizontal plane therethrough,—and which is provided, at its discharging-extremity, with a vertically-adjustable extension-plate which moves in a right line, in a vertical plane;—

and with a vertically-adjustable bottom-extension which, in being adjusted moves in an arc, in a vertical plane; substantially as and for the purposes specified.

10. In a separating-apparatus for mineral substances, a reciprocating separating-receptacle which at its outlet-extremity is provided upon its end-wall with a vertically-adjustable extension-plate, and which, at the front extremity of its bottom-plate, is provided with a pivoted bottom-extension or supplemental discharging-receptacle; the vertical extension-plate, and the pivoted bottom-extension, each being provided with threaded operating-rods which are movable in bearings, and are provided with adjusting-spools, whereby the adjustments are effected with exactness.

11. In a separating-apparatus for mineral substances, a reciprocating separating-receptacle which at its outlet-extremity, is provided upon its perforated bottom-plate, with an edge pivoted, adjustable, depressed, bottom-extension, or supplemental discharging-receptacle, which is movable in an arc, in a vertical plane, and which serves by its depression or cavity, and by its adjustability, to facilitate the discharge of substances therethrough.

12. In a separating-apparatus for mineral substances, a reciprocating separating-receptacle which is provided with a vertical diaphragm or division-plate which terminates, downwardly, above the plane of the bottom-plate of the receptacle; and serves to establish the division line between the lighter and the heavier mineral substances; and which is provided also with a pivoted, adjustable bottom-extension the front plate of which terminates, upwardly, in a plane above the lower extremity of the diaphragm or division-plate,—substantially as and for the purposes set forth.

13. In a separating-apparatus for mineral substances, a reciprocating separating-receptacle which is provided with a vertical diaphragm or division-plate which terminates, downwardly, above the plane of the bottom-plate of the receptacle, and serves to establish the division-line between the lighter and the heavier mineral substances; and which is provided also with a pivoted, adjustable bottom-extension which terminates, upwardly, in a plane above the grated bottom of the receptacle,—substantially as and for the purposes set forth.

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Witnesses:

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