Sept. 9, 1924. 1,508,176

A. FRANCE

COAL OR OTHER MINERAL WASHING APPARATUS

Filed Jan. 2, 1920

Fig. 1

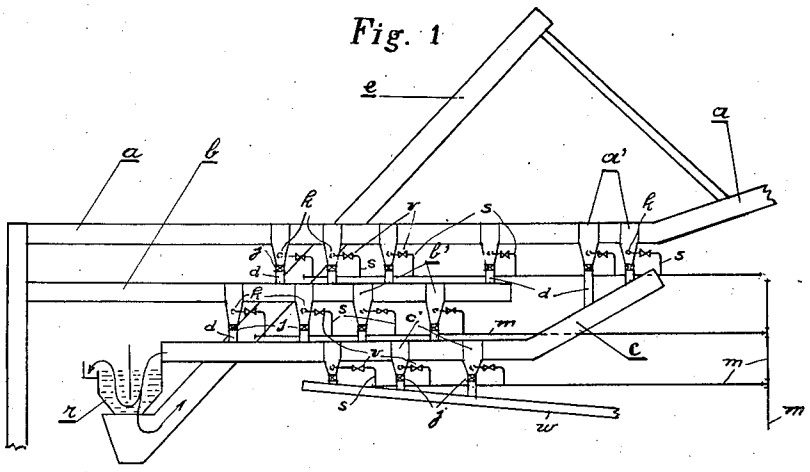


Fig 2

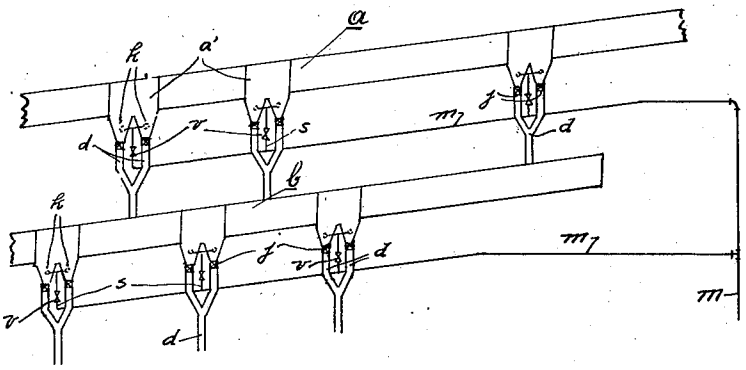
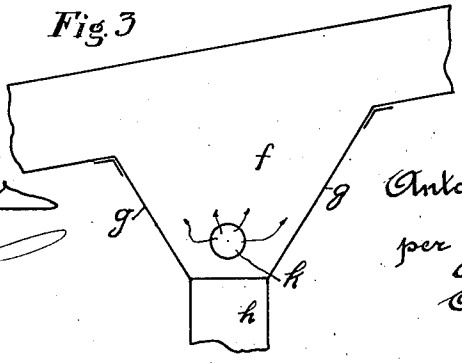


Fig. 3



Witnesses :

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UNITED STATES PATENT OFFICE.

ANTOINE FRANCE, OF LIEGE, BELGIUM.

COAL OR OTHER MINERAL WASHING APPARATUS.

Application filed January 2, 1920. Serial No. 349,119.

To all whom it may concern:

Be it known that I, ANTOINE FRANCE, a subject of the King of the Belgians, residing at Liege, Belgium, Rue St. Gilles 353, have invented certain Improvements in and Connected with Coal or Other Mineral Washing Apparatus, of which the following is a specification.

This invention relates to a method of washing coal and other minerals, by means of washing or sorting apparatus or separators arranged along troughs, for instance of the kind described in the specification of the Patent No. 1,197,932, and which is based on the classification by density of the mineral in the current of water which entrains the mineral along a trough of appropriate section and inclination.

The dense products which proceed slowly along the bottom of the trough are discharged by the washing or sorting apparatus, or separators, which are arranged below the bottom of the trough, at intervals adapted to permit of the classification being effected—that is, they are arranged in batteries.

In order to rewash the dense products discharged by the above mentioned washing or sorting apparatus or separators they are delivered to a second trough, where they are submitted to a similar treatment to the raw material in the first trough. Further, the dense products discharged by the washing or sorting apparatus of the second trough, may be rewashed in a third trough, and so on, the arrangement being thus in cascade.

In order further to improve the washing of particles which are difficult to separate owing to their tenuous or like form, and to enable the installation to be regulated or adjusted, to suit momentary variations in the arrival or feeding of the coal or in the composition of the same, the invention also comprises a reservoir for effecting the deposit of the products discharged into the lower trough by some of the separators of the upper troughs, for instance by one or more of the last separators of the last but one trough into the end portion of the lower trough together with the products discharged at the end of the said lower trough, and an elevator which returns the material deposited in the aforesaid reservoir to the head of the first trough to be submitted to another washing operation.

The number of washing or sorting apparatus provided in each trough may be varied to suit the degree of grading of the mineral required.

In the drawings: Fig. 1 shows a plant with troughs arranged in cascade formation, a reservoir and an elevator according to the invention, and Fig. 2 shows troughs with the washing units or separators in pairs arranged in batteries according to the invention; Fig. 3 is a diagrammatic illustration of a separator, showing the manner of producing the ascending currents.

The arrangement of separators with the hopper parts in pairs as shown in Fig. 2 of the accompanying drawing may also be used.

The number of cascades may be varied similarly to suit the degree of purity required.

The arrangement in batteries has the advantage, over other methods of washing, that each washing or sorting apparatus eliminates products of a determined equivalence of which the classification in the trough has been prepared by the water current and is completed by the action of the ascending currents of the preceding apparatus, whereby the efficiency of each apparatus is considerably increased.

The fact that the washing or sorting apparatus eliminates grains of a determined equivalence, conduces to the result that the section of the discharge aperture for the dense products diminishes, starting from the first apparatus, which results in a considerable reduction in the quantity of water circulated.

The arrangement of the separators in batteries, and of the troughs in cascade formation, results in reducing the necessity for the careful regulation of the ascending currents, hitherto necessary, in order to effect complete separation in first trough, by using ascending currents in the other troughs on a product which lends itself better to separation and that in apparatus of reduced section. Fig. 3 of the accompanying drawing shows, by way of example only, an arrangement for producing the ascending currents of water in the separators arranged along the bottom of the troughs. As illustrated, the separator may for instance consist of 4 plates, two of which f are vertical and flush with the sides of the trough, and the two others g being sloping, so as to form a pocket which gradually widens towards the

top, and is at the bottom provided with a discharge conduit *h*. The water from any suitable and adjustably controlled source of supply arrives through an inlet opening *k* suitably situated near the bottom or narrowest part of the pocket, and owing to the gradually widened horizontal section of the said pocket, produces ascending or upwardly directed streams as indicated diagrammatically by the arrows on the said Fig. 3.

The invention will now be further described with reference to Fig. 1 of the accompanying diagrammatic drawing, which illustrates an installation with three troughs. In the said figure, *a'* indicates separators of the kind previously referred to arranged in a battery along the first or upper trough *a*, and *b'* indicates similar separators arranged along the second trough *b*, while *c'* indicates the separators arranged along the third, i. e. in the present instance the lowest trough *c*. *d* designates the discharge conduit or opening in the base of the separators, provided with any suitable means *j* for its adjustment. The means for supplying water for the upward streams to the said separators, comprises water supply pipes *s* branched on a water-main *m* and leading to the inlet openings *k*, the supply being controllable by means of any suitable device such as a cock *v* or the like placed on the said supply pipes *s*. A launder or trough *w* is provided to receive and evacuate or lead away the materials discharged through the discharge openings of the separators *c'* of the lowermost trough *c*, and *r* indicates the reservoir for collecting the products delivered at the end of the said lowermost trough *c*. The first two troughs, *a* and *b*, deliver pure coal, the third *c*, re-washes the schist or slaty matter discharged by the first two washing units or separators *a'* of the first trough *a* and *b'* of the second trough *b*, and the delivery or product of the third trough *c* with the compound discharged by the last two units or separators of the second trough *b* are conducted into the reservoir *r* from which they are taken by an elevator *e* and returned to the head of the first trough *a*.

The re-washing, by means of the elevator *e* of the compounds discharged by the last set of units or separators of the last but one trough *b* is justified for the following reason: The compounds, withdrawn by some apparatus where no use is made of ascending currents, comprise particularly some very tenuous particles, and some small flat particles of so called schist or slaty material, the complete separation of which from the coal by means of ascending currents presents considerable difficulties in the regulation of the apparatus. By returning these compounds to the head of the trough to submit them to a fresh treatment, which operation may be repeated a number of times, it will be understood that the separation may be effected progressively in an efficient manner with grains having less than ½ m. m. diameter. This result may be attributed to the fact that there is produced in the water current a much thicker bed of dense products favorable to the separation and requiring ascending currents of more reduced velocity or which in some cases may have no substantial velocity.

The last trough re-washes the schist discharged by the first separators of the upper troughs—its influence being particularly manifested in the case of irregularity in the arrival or feeding of the coal or the composition of the same. The washing units or separators of the upper troughs normally discharge perfect schist. Then, if the quantity of schist diminishes, the velocity of the ascending currents in these units decreases according to the much greater free sectional area available for the descending current, consequently some grains of coal may fall through the slots.

The last trough only withdrawing the schist to be rewashed, may be considerably more confined than the upper troughs.

The thickness of the layer of schist may be also very considerable thus favoring the separation, and on the other hand the regulation of the apparatus is made in such fashion that a part only of the schist withdrawn into this trough is eliminated whereas the water current carries the remainder into the reservoir from which it is taken by the elevator. It will be seen that it is possible to obtain by the last trough a practically ideal separation.

The washed product returned by the elevator to the head of the first trough does not interfere, as it might be thought, with the classification in this trough, but assists in the creation of a thicker bed of dense products, and also facilitates the regulation in a remarkable manner.

One of the secondary consequences of the arrangement, is the putting into circulation of a reduced volume of water owing to the ascending currents being obtained in some of the apparatus of less section which permits of the required velocities being obtained with lower losses than those of some of the apparatus of the upper troughs.

I claim:

1. In plant for washing and separating minerals, the combination of: a plurality of sloping troughs for the separation of the minerals according to specific gravity by means of a conveying water current, arranged below one another; a plurality of separators extending downwardly from and arranged in series at intervals along the bottom of each trough, and each, except those of the lowest trough, delivering into

a lower trough; a communication between said separators and aforesaid troughs; controllable means for supplying water to said separators in upward streams for the treatment of the materials sinking from the lower portion of the troughs into such separators through the aforesaid communication; an adjustable discharge opening in the base of each separator; means for evacuating the materials discharged through such opening by the separators of the lowermost trough; means for collecting the materials delivered at the end of such lowermost trough; and mechanical means for removing the last-named materials from such point of collection and returning them to the top end of one of the uppermost troughs; all substantially as described.

2. In plant for washing and separating minerals, the combination of: a plurality of sloping troughs for the separation of the minerals according to specific gravity by means of a conveying water current, arranged below one another; a plurality of separators extending downwardly from and arranged in series at intervals along the bottom of each trough; a communication between said separators and aforesaid troughs; controllable means for supplying water to said separators in upward streams for the treatment of the materials sinking from the lower portion of the troughs into such separators through the aforesaid communication; an adjustable discharge opening in the base of each separator, the discharge openings of the separators depending from each trough, except the lowermost, delivering into a lower trough; means for evacuating the materials discharged through such opening by the separators of the lowermost trough; means for collecting the materials delivered at the end of such lowermost trough; and mechanical means for removing the last-named materials from such point of collection and returning them to the top end of one of the uppermost troughs; all substantially as described.

3. In plant for washing and separating minerals; the combination of: a plurality of sloping troughs for the separation of the minerals according to specific gravity by means of a conveying water current, arranged below one another; a plurality of separators extending downwardly from and arranged in series at intervals along the bottom of each trough; a communication between said separators and aforesaid troughs; controllable means for supplying water to said separators in upward streams for the treatment of the materials sinking from the lower portion of the troughs into such separators through the aforesaid communication; an adjustable discharge opening in the base of each separator; the discharge openings of the separators depending from each trough, except the lowermost, delivering into a lower trough; an evacuation trough arranged under the discharge openings of the series of separators depending from the lowermost of the aforesaid troughs for the separation of the minerals; a collecting tank provided with an overflow pipe and adapted to receive the materials delivered at the end of said lowermost trough; and bucket elevator forming a connection between said tank and the uppermost trough for the removal from the former of the materials contained therein and their conveyance to the top of the latter; all substantially as described.

In testimony thereof I signed hereunto my name in the presence of two subscribing witnesses.

ANTOINE FRANCE.

Witnesses:
J. GRAU,
CURTIS T. EVERETT.