June 5, 1934. L. HOYOIS 1,961,666

PROCESS AND APPARATUS FOR SEPARATING ORES

Filed July 18, 1928

Fig. 1

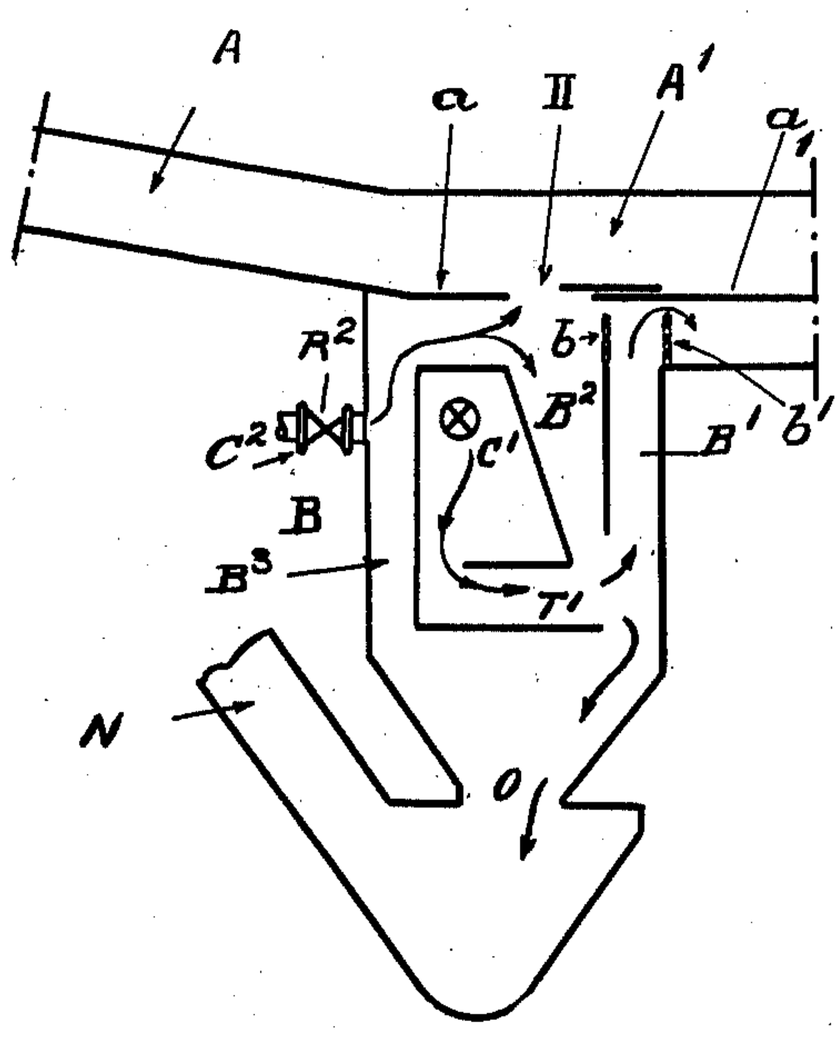
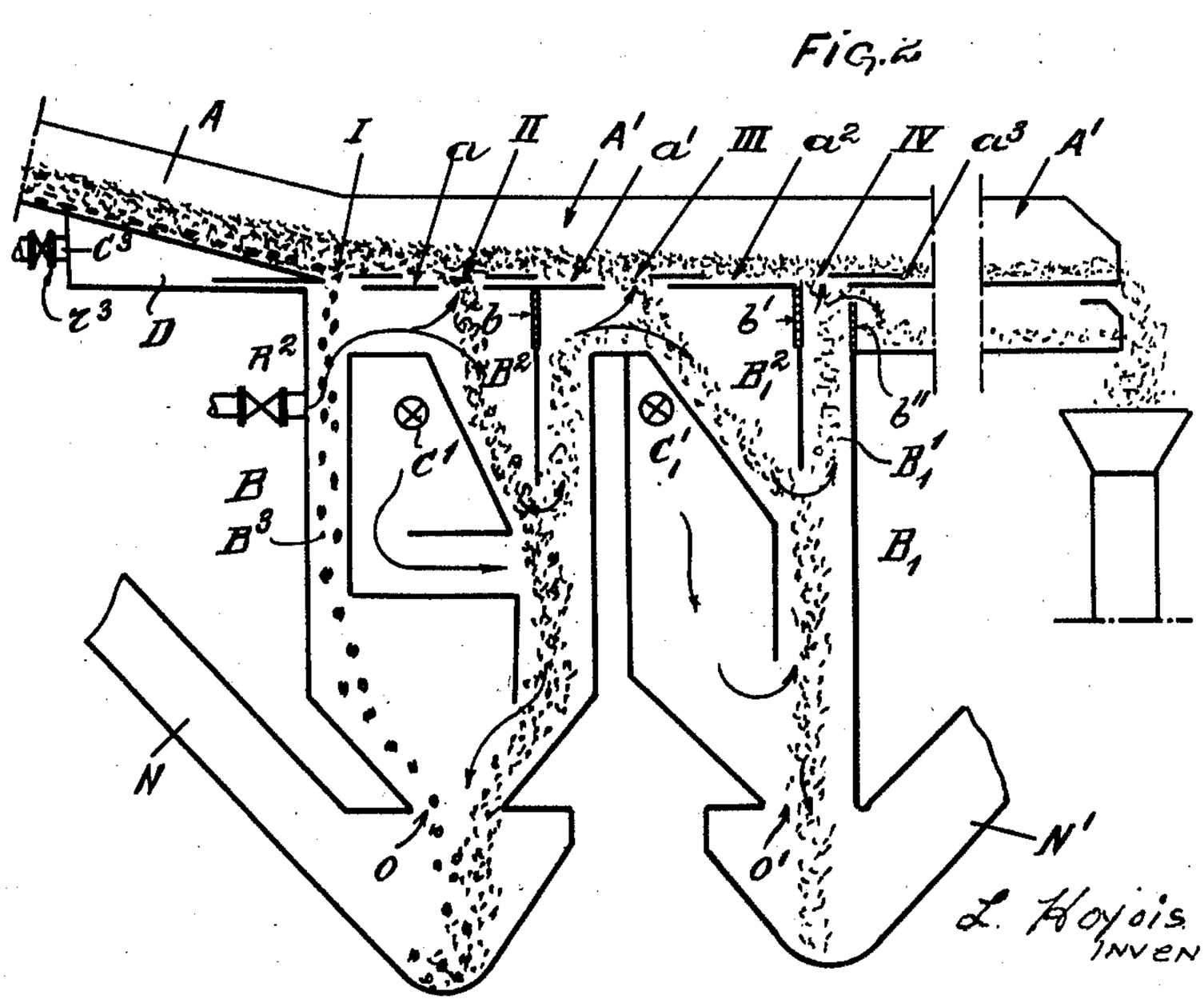


FIG. 2



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PROCESS AND APPARATUS FOR SEPARATING ORES

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5 Claims. (Cl. 209—18)

The present invention relates to the treatment of materials such as ores, coals and the like, and concerns particularly the treatment of materials containing grains of large sizes.

In prior patents of the same applicant, it has been proposed to treat ores, coals and like by subjecting the whole body or mass of material to a grading by density, by causing said body or mass to circulate as a movable washing bed over a stationary washing bed, after which the said body or mass is divided into categories or grades, and both the worthless products and the valuable products are removed and subsequently—with or without repeating the above mentioned treatment—the residual mass is in turn divided.

Such treatment was carried out in apparatus comprising, a feeding trough followed by a grading trough including a weir or overflow at the end thereof, in turn followed by a trough provided with adjustable discharge openings, and column apparatus intended for the recovery of valuable particles carried along with more worthless particles.

When bodies of materials mainly formed of grains of large sizes are to be treated, difficulties are experienced in applying the above mentioned treatment, resulting particularly from the sizes of the grains or pieces of the materials subjected to the treatment. In such cases, the discharge openings have comparatively large areas, so that it is no longer possible to limit to well defined grades the products passing out through the said openings.

The object of this invention is to provide a process and apparatus enabling materials in grains or pieces of large sizes to be treated and separated into well defined grades.

The invention consists—assuming the materials have been graded by carrying them in the form of a movable washing bed on a stationary washing bed,—to provide for the removal of the various layers through discharge openings formed in a suitable trough, in combination with—in order to insure at a given opening the discharge of a given grade of products—an adjustable liquid current the direction and the force of which are such as to prevent the escape of those grades of products of which, at the said opening, the removal is not desired.

The invention also consists, in apparatus including column apparatus adapted for the recovery of valuable products carried along with more worthless products and provided with suitable ascending currents, to provide means, such that the inherent characteristics of the said ascending currents are not affected by the adjustable liquid currents acting on the discharge openings.

The invention also consists, in the said apparatus, to provide for such an arrangement that the treatment can be applied without appreciable, or at least useless, consumption of liquid.

The invention further consists in certain other less essential features of the process and apparatus more fully explained in the following complementary description, relating to a particular example of the application of the invention to the treatment of bodies or masses of coals composed, for example, of a mixture of categories or grades from 20 to 80 millimeters.

In the accompanying drawing:

Fig. 1 is a diagram of an elementary apparatus.

Fig. 2 is a diagram of the complete apparatus for treating a body or mass of coals as above mentioned.

In Fig. 1, the elementary apparatus comprises an inclined trough A followed by a trough A^1 in which is arranged a diverting partition a^1 adapted to be moved vertically and horizontally to enable the opening II to be adjusted as desired. Beneath the trough A^1 is located a column apparatus B the outlet opening O of which is connected to the casing of an elevator N, enabling the separated products to be removed without any loss of water.

The ascending current in the column B^1 is fed and suitably regulated by means of the horizontal current T^1 derived from the supply C^1 fed from the constant level reservoir provided for the apparatus.

Assuming that a body or mass of raw coals, composed of pieces from 20 to 80 millimeters, has been fed into the upper end of the trough A, a movable washing bed circulating on a stationary bed will be obtained, the heaviest and largest pieces of shale occupying the bottom of the bed, the largest and lightest pieces of coal being at the top of the bed, with, between said two lower and upper layers, grains of intermediate sizes and densities.

The grading taking place very rapidly, the body or mass is completely graded when it reaches the trough A^1 and certain of the lower layers will pass out through the opening II, the latter being suitably adjusted for this purpose.

However, since the said opening is of large area, the products forming the layers over those just

mentioned will have a tendency to escape at the same time, which is not desirable.

In order to prevent such an escape, at a suitable point in the apparatus, and for example in a conduit B^3, there is provided a water supply C^2, controlled by the valve R^2, and there is further provided for example at b or b^1, a suitable partition the height of which is adjustable as desired.

Under these conditions, all the water entering the apparatus through the pipes C^1 and C^2, after the balance is obtained in the bottom of the elevator, can flow out only through the space left between the partition b or b^1 and the diverting plate a^1, and through the opening II in the trough A^1. It will be noted that after having regulated the water supply C^1 so as to obtain in the column B^1 the necessary ascending current for proper operation of the apparatus B, one may obtain, by suitably adjusting the height of the partition b or b^1 and the water supply C^2, an upward current passing through the opening II and suitable for preventing products that are to be retained in the trough A^1 from passing through said opening without any action on the inherent characteristics of the ascending current in the column B^1.

In Fig. 2, which represents a complete apparatus for treating coals in pieces from 20 to 80 millimeters, the above described apparatus is shown at B, but completed as explained hereafter and combined with another column apparatus B_1 approximately similar to the former.

In the trough A^1 following the feeding trough A, four diverting partitions are provided, namely: a, a^1, a^2 and a^3, which can be adjusted horizontally and vertically so as to adjust the discharge openings I, II, III and IV as desired. Two column apparatus B and B^1 are located beneath the trough A^1 and communicate respectively through the openings O and O^1 with the casings of the elevators N and N^1.

Partitions are provided at b, b^1 and b'', the partitions b and b^1 extended up to the corresponding diverting partitions a^1 and a^2 whereas the height of the partition or weir b'' can be adjusted as desired.

Water inlets are provided at C^1 and $C^1{}_1$ for supplying and regulating the ascending currents in the columns B^1 and $B^1{}_1$.

At the opening I above the column B^3 is located a box D provided with a water inlet C_3 controlled by the valve r_3 and adapted to provide for the formation of a liquid screen, through which pieces or grains of great density can pass, across the said opening I.

The water inlet C^2 controlled by the valve R^2 is provided as formerly in the column B^3.

Under these conditions, the water inlet C^1 and $C^1{}_1$ being suitably regulated so as to maintain the desired ascending currents in the columns B^1 and $B^1{}_1$, the liquid admitted through the inlets C^1, $C^1{}_1$ and C^2 can discharge only over the partition b'' and into the trough through the openings I, II, III and IV.

Proper adjustment of the height of the partition b'' and of the inlet C^2 enables the upward currents flowing through the openings I, II, III and IV into the trough A^1 to be regulated at will so that it will be possible to permit or prevent given grades of products to pass out through the said openings.

While flowing along the trough A^1 the movable bed loses its lower layers through the openings I to IV so that when it reaches the partition a^3 it is only composed of pure coal.

The heaviest shales separate out through the opening I and fall into the elevator N through the column B^3. At this opening, to the action of the current flowing from C^2, is added that of the tangential current coming from the box D and forming a very effective permeable screen, enabling the quantity and the minimum density of the shales escaping through the said opening to be regulated very easily.

The opening II gives passage to a mixture of grains of shales and of coals, received in the apparatus B in which the shales are separated and fall into the elevator N, while the grains of coal are raised towards the top of the apparatus B_1. In the apparatus B_1, to the mass coming from the apparatus B are added the products passing through the opening III and composed of coals and shales not separated out through the openings I and II.

The mixture is again divided in this apparatus, the coals being carried by the ascending current flowing in the column $B^1{}_1$ and discharged over the partition or weir b'' so as to meet the coals in the trough A^1 beyond the partition a^3.

The opening IV is provided for separating out the last pieces of shales which have missed the other diverting partitions and openings in the apparatus.

The products that are not raised by the current flowing in the column $B^1{}_1$ fall into the casing of the elevator N^1. The body of material collecting in the latter is composed mostly of intermediate products with shales and a small amount of coal. It is carried at the upper end of the trough A^1 and the shales contained therein finally pass into the apparatus B and are definitely discharged.

It is to be understood that modifications can be made in the details of the method and apparatus described without departing from their principles.

In the appended claims the term "plane communications" defines communications without appreciable thickness such as obtained by openings in sheet metal as in the bottom of a trough.

I claim:

1. An apparatus for treating bodies of materials such as ores coals and the like, in grains or pieces of large sizes, i. e. from 20 to 80 millimeters and more, comprising an inclined trough in which the materials are classified into superimposed layers, adjacent boxes suspended to said trough, each box divided into two compartments and the second compartment of each box communicating with the first compartment of the next box, plane large sizes communications between the trough and the first compartment of each box, and the second compartment of the last box communicating with a second receiving trough, water inlet means adapted to cause an independent ascending current in the second compartment of each box, water inlet means in the first box adapted to cause currents flowing towards and through the plane large sizes communications with the trough of treatment in the first and subsequent boxes and to cause water currents flowing in succession through the first and second compartments of the first box and so on successively through the successive boxes, and means to control the water discharge at the outlet of the second compartment of the last box of the series.

2. In an apparatus as claimed in claim 1, a vertically disposed passage in the first box of the series, a large sizes communication between the

said box and the trough of treatment just above the said vertical passage and means to form a liquid screen adapted to extend across the said large sizes communication.

3. A method for treating bodies of materials such as ores, coal and the like, in grains or pieces of larger sizes, i. e. from 20 to 80 millimeters and more which method consists in grading the materials in superimposed layers by carrying them by means of a liquid carrying current in the form of a movable washing bed flowing on a stationary washing bed, causing layers of the said movable bed to enter a liquid body by overcoming the action of the ascending part of an adjustable liquid current therein which part enters the liquid carrying current, carrying by the remaining part of said adjustable current and in a downward stream the whole of the pieces and grains entering said liquid body; in the lower part of said liquid body, by means of an independently adjustable liquid current, separating and moving away in a separate ascending current the lighter portion of the downward stream of materials and causing said separated lighter body to enter an adjacent liquid body, causing other layers of the movable bed to enter the last named liquid body by overcoming the action of the ascending part of the liquid current discharged from the ascending current therein and which part enters the liquid carrying current, uniting the entering materials and the materials discharged from the ascending current and carrying the whole in a downward stream by the remaining part of the liquid current discharged by the ascending current, in the lower part of the said last named liquid body and by means of an independently adjustable liquid current, separating the lighter portion of the last named downward stream of materials, carrying away the separated portion in a separate ascending current, and adjusting the flow of said current at the upper portion thereof.

4. In a method as claimed in claim 3, causing the movable bed to pass over an horizontally directed and adjusted screen of liquid whereby the heavier pieces of shales pass through said screen and vertically downwards to be directly eliminated.

5. An apparatus for treating bodies of materials such as ores, coals and the like in grains or pieces of large sizes, i. e. from 20 to 80 millimeters and more comprising an inclined trough in which the materials are classified into superimposed layers, a box suspended to the trough, said box divided into two compartments by a partition depending from the bottom wall of the trough, and the compartments communicating each other at the bottom edge of the partition, large sized communications formed by plane openings in the said bottom wall between the trough and the first compartment and the second compartment communicating at its upper end with a second receiving trough, water inlet means adapted to cause ascending currents in the second named compartment, and water inlet means adjustable independently from the former to cause currents flowing towards and through the large sized communications with the trough of treatment and to cause currents flowing downwardly through the first and then upwardly through the second compartment, and means to control the water discharge at the upper part of the second compartment.

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