

C. Q. PAYNE.
PNEUMATIC CONCENTRATING TABLE.
APPLICATION FILED AUG. 14, 1912.

1,068,162.

Patented July 22, 1913.

Fig. 1.

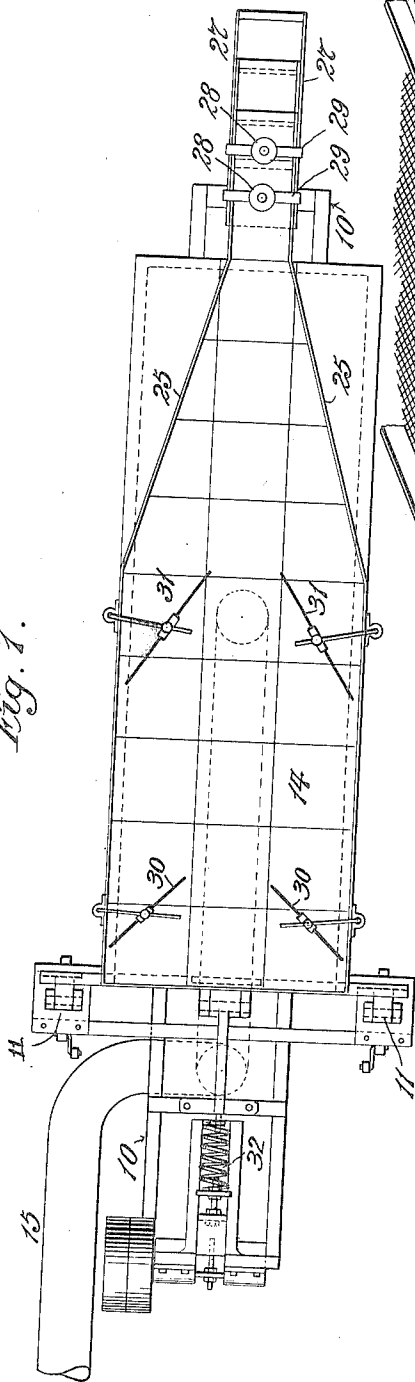


Fig. 3.

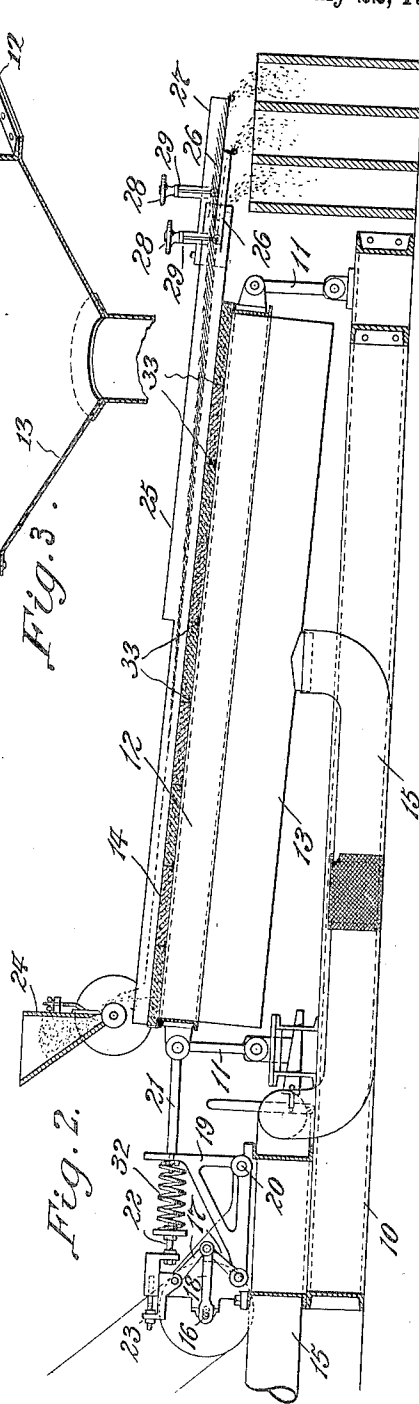
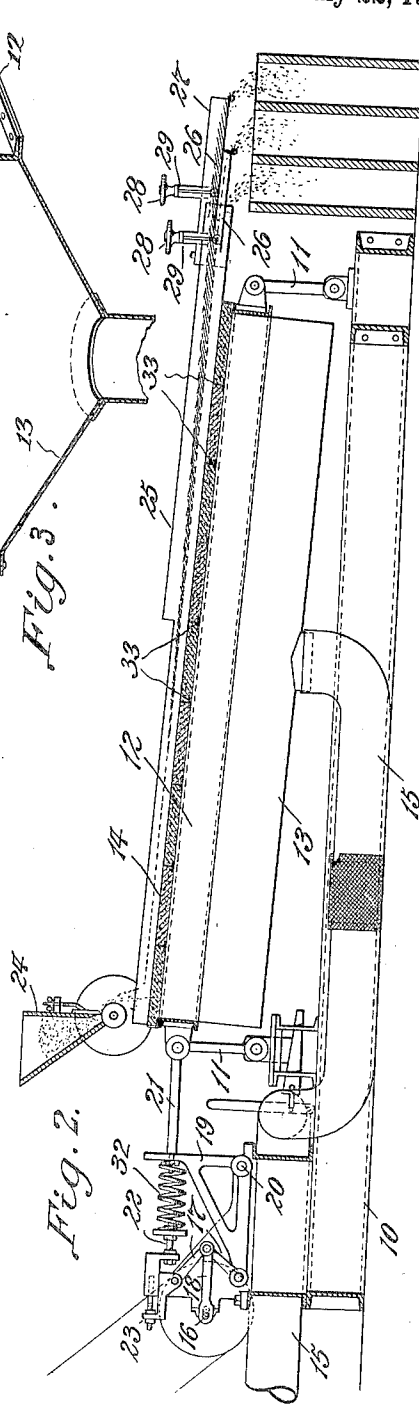


Fig. 2.



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PNEUMATIC CONCENTRATING-TABLE.

1,068,162.

Specification of Letters Patent.

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Application filed August 14, 1912. Serial No. 715,005.

To all whom it may concern:

Be it known that I, CLARENCE Q. PAYNE, a citizen of the United States of America, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Pneumatic Concentrating-Tables, of which the following is a full and true description.

My invention relates to improvements in that type of concentrating table which separates crushed ores, and other mineral aggregates in a dry state, by reason of differences in the specific gravity of their associated minerals when they are acted on by air under pressure, while being subjected to mechanical agitation.

It consists in the combination of a novel and improved form of table-top with improved means for separating minerals of different specific gravities, after they have been arranged in layers or strata by means of air pressure and mechanical agitation, upon the surface of said table-top.

While the pneumatic or dry table is able to secure good results in separating minerals of different specific gravities, especially after careful sizing, its usefulness has heretofore been much retarded by the difficulty of removing the separated products from the table in a clean condition after they have been arranged in distinct strata by the action of air currents and mechanical agitation, and also by the lack of durability of the pervious table-top upon which the separation of the ore-mixture takes place.

In an application filed coincidently with this and bearing Serial No. 715,006, filed August 14, 1912, I have described and claimed a novel medium for the pervious top of a pneumatic concentrating table, whereby greater durability, as well as more uniform effects, are secured, in the treatment of various ore-mixtures.

My present application is specifically concerned with a new and useful combination of means for removing the separated products from the table after they have been stratified, with aforesaid novel and durable table-top, whereby a more efficient and satisfactory

separation is obtained than has heretofore been possible.

In the accompanying illustration Figures 1 and 2 show in plan and sectional elevation, respectively, a concentrating table in which my invention is embodied. Fig. 3 shows a cross section of the table top.

In Figs. 1 and 2 the concentrating table is supported upon a foundation frame of channel-irons 10, 10, by means of three levers and brackets 11, 11. Two of these are placed at the head or feed-end of the table, and one at the discharge end, in order to secure a smooth reciprocating motion of the table without disturbing vibrations due to unevenly loaded supports. The frame of the table may be constructed of channel-irons 12. Below the frame of the table is a V-shaped sheet iron bottom 13, with square ends. This is closely riveted to the channel-iron frame so as to make air-tight joints.

The table-top 14 as shown in Figs. 2 and 3 is composed of porous silica plates, or a like mineral septum, through which air under pressure is made to pass. These plates are cemented together at their joints, and are held by light T irons 33 to the channel-iron frame of the table. Their upper surfaces thus form the top or deck of the table upon which the separation takes place. This form of table-top is shown somewhat more clearly in Fig. 3, by a cross sectional view.

Air is admitted to the under side of the concentrating table by means of a pipe 15, which is connected with a pressure fan, not shown in the drawings.

The table is given a suitable inclination in direction of its length, so as to cause the material fed upon the upper end to travel smoothly lengthwise, while it is given a shaking motion. The inclination may be varied by raising or lowering the base of the hinged-lever which supports the lower end of the table, but in general the inclination will not vary for the same class of material, and will be merely sufficient to permit the different minerals composing it to become well stratified as they travel down the table.

Any convenient "head-motion" mecha-

nism may be employed, such as that shown in Figs. 1 and 2. Here a shaft with an eccentric at its center 16, is made to operate toggle-levers 17, 17, by means of a connecting-rod or pitman 18. The free end of the toggle-lever 17 is connected with the angle-lever 19, which is pivoted at 20, and is connected to the table by means of the connecting-rod 21. To absorb the shock of the rapid reversal of the table, a spiral spring 32 is so placed between the angle-lever and a fixed abutment at the upper end of the head-motion frame as to form an extension of the connecting lever. The compression of the spiral spring can be varied by means of a suitable bolt and nuts 22. The amount of motion imparted to the table may also be varied within certain limits by means of the screw adjustment 23, which permits the upper abutment of the toggle-lever 17 to be moved horizontally. In general, the amount of motion given to the table will vary with the degree of fineness of the materials to be treated, but will usually amount to one half inch or one inch in total throw. The speed of the table, or number of shakes per minute, will vary in general between 200 and 300.

The table is fed at its upper end, and for its full width, in any convenient manner as shown in Fig. 2 by a feed-hopper 24, with a gate and feed roller. As the ore-mixture is caused to travel lengthwise of the table, the combined effect of the upward air-currents through the fine pores or openings of the table top, and the shaking motion of the table, causes the minerals of the ore-mixture to separate and to form distinct strata, or layers, the heavy mineral forming the lower layer, while the light mineral forms the upper layer. Diagonal guides or banking strips 30, 30, and 31, 31, may be employed to narrow and thicken the ore-sheet at intervals lengthwise of the table, in order to assist in stratifying its minerals by increasing their agitation. These "banking strips" do not accomplish the same purpose as riffles which are commonly used with wet tables, and whose function is to aid the separation by subdividing the ore-sheet. In my invention the separation is effected by "mass action," and it is thus broadly distinguished from that accomplished by shaking tables which use water as a medium of separation. In the latter case the use of riffles is of advantage.

At the lower end of the table diagonal guide-pieces 25, 25 may be so placed as to appreciably narrow the discharge line of the ore-sheet. These guides serve to thicken the ore-sheet gradually up to the discharge point, and thus to permit the separation of the layers, or strata, of different minerals to be conveniently made along superposed

levels, by means of the division plates 26, 26. The guides 25, 25, are extended in a parallel position a certain distance beyond the lower end of the table, and form, with a suitable bottom, a trough which carries the separated ore well beyond the lower edge of the table. This discharge-spout or trough has the extension pieces 27, 27, attached to its sides, and these carry the movable division-plates 26, 26, which are superposed. The front edges of the plates 26, 26, may be raised and lowered by the screw bolts and nuts 28, 28, which are supported by the brackets 29, 29.

For purposes of illustration, Fig. 2 shows in sectional view a layer of ore upon the table-top which contains a heavy mineral and a light mineral, which have been stratified in layers by the air-currents passing through the table-top, and by mechanical agitation due to the shaking motion of the table. The position of the light gangue mineral is shown by the shaded section at the upper part of the ore-sheet, and the heavy mineral by the unshaded portion below it. In order to remove clean concentrate and tailing from the table, the positions of the division-plates are so adjusted that the dividing line between the two mineral strata falls between the upper and lower division-plates. This space may be varied, and it permits compensation to be made for irregularities in the ore composition and in feeding. The product removed between the two division-plates constitutes a middling. That removed below the lower division-plate is the concentrate, or heavy mineral, while that removed above the upper division-plate is the tailing, or light mineral. The separation of the various products is thus made along superposed levels. The products of the separation are propelled forward by the shaking motion of the table, and are collected in separate chutes as indicated in Fig. 2. The middling product may be then returned to the same or a separate table for re-treatment. It thus becomes possible by means of superposed discharge openings, as described, to remove clean separated products from the table, and at the same time to maintain a large capacity of treatment.

The operation of my table is as follows: Air from a pressure fan is conveyed through the pipe 15 to the air box 13 below the table, and is then allowed to pass through the pervious table-top under a regulated pressure. At the same time, the table is given a rapid reciprocating motion by means of the head-motion mechanism, driven by a belt from an outside source of power. The material to be separated is fed in a dry state in a regulated stream from the hopper 24 across the full width of the table-top 14. Where the porous

silica plates, or similar mineral septum, are employed for the table-top, the material is first sized before it is fed upon the table, *i. e.*, it is passed over sizing screens in order to reduce the difference in the diameters of the particles to a predetermined ratio. This ratio will depend upon the difference in specific gravity between the heavy and light minerals in the ore-mixture which is to be separated. The greater the difference in specific gravity between minerals, the less closely need the material be sized before separation, and vice versa. While traveling down the inclined surface of the table, the combined action of the upward air currents and the mechanical agitation of the particles, due to the shaking motion of the table, causes the heavier particles to settle through the agitated mass, and form the bottom layer of the ore-sheet resting on the table-top. The lighter particles, on the other hand, work their way upward and form the top layer of the ore-sheet, as indicated approximately in cross section in Fig. 2. As the stratified minerals reach the lower end of the table, they encounter the guide pieces 25, 25, which narrow, and correspondingly thicken, the ore-sheet at its discharge end. In this way the dividing line between the concentrate and tailing is made comparatively short, and by removing a small amount of middling product at the junction between the strata, a large amount of clean concentrate and clean tailing can be removed by means of the superposed division plates, whose positions can be accurately adjusted. The middling product may be re-treated upon the same or a separate table after a preliminary crushing, which is necessary, in case the product contains a large amount of true middling, *i. e.*, attached particles which require further crushing to unlock them. In case the ore-mixture contains more than two minerals to be separated, it is possible to employ three or more division plates, or preferably to collect two of the minerals in a single group as a first step, and then re-separate the group upon a separate table.

My invention is clearly distinguished from that type of pneumatic concentrating table in which the different minerals are separated after being stratified, by spreading them out in thin bands upon the surface of a transversely inclined table, and which are discharged at different positions along the end and lower side of the table. It is also distinguished from that type of pneumatic concentrating table in which the stratified minerals are removed by the use of diagonally superposed riffles which are so placed as to guide the stratified minerals to different sides of the table. The tables of the above types require close attention and

careful adjustment in order to obtain good results in separation, for the reason that the division plane between the concentrate and tailing occupies a wide space on the table, and its position may be easily shifted owing to slight irregularities in operation. By my invention, on the contrary, the length of the division plane between the concentrate and tailing can be made extremely short, and its position can be maintained undisturbed with only a slight amount of vertical shifting due to variations in the composition of the ore-mixture. It is possible in this way to remove the separated products from a pneumatic concentrating table in a cleaner condition after they have been stratified than has heretofore been possible.

Having thus described my invention, I claim:

1. In a pneumatic concentrating table, a table-top porous to air under pressure, consisting of a plate of accreted mineral particles forming a mineral septum, in combination with means for feeding the material to be separated upon said table-top, means for passing air through said mineral septum, means for reciprocating said table-top, and means for separating the stratified minerals contained in the material along superposed levels, substantially as described.

2. In a pneumatic concentrating table, a table-top porous to air under pressure, consisting of a plate of accreted mineral particles forming a mineral septum, in combination with means for feeding the material to be separated upon said table-top, means for passing air through said mineral septum, means for reciprocating said table-top, guides placed diagonally to the line of travel of the feed-sheet along the table-top to thicken said sheet at its discharge point, and division plates along superposed levels to separate the stratified minerals contained in the material, substantially as described.

3. In a pneumatic concentrating table, a table-top consisting of a mineral septum porous to air under pressure, in combination with means for reciprocating said table-top while in an inclined position, means for feeding the material to be separated upon said table-top, means for passing air through said porous table-top, guides placed diagonally to the line of travel of the feed-sheet along the table-top, and division plates along superposed levels at the discharge edge of the table-top to remove the separated minerals contained in the crude material, substantially as described.

4. In a pneumatic concentrating table, a table-top porous to air under pressure, consisting of plates of accreted mineral particles forming the top of an inclosed box, in combination with means for passing air

from said box through the porous mineral
table-top, means for reciprocating said box
while in an inclined position, guides placed
diagonally to the line of travel of the feed
5 sheet along the table-top to thicken said
sheet at its discharge point, and division
plates along superposed levels to separate

the stratified minerals contained in the ma-
terial, substantially as described.

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