

F. O. STROMBORG.

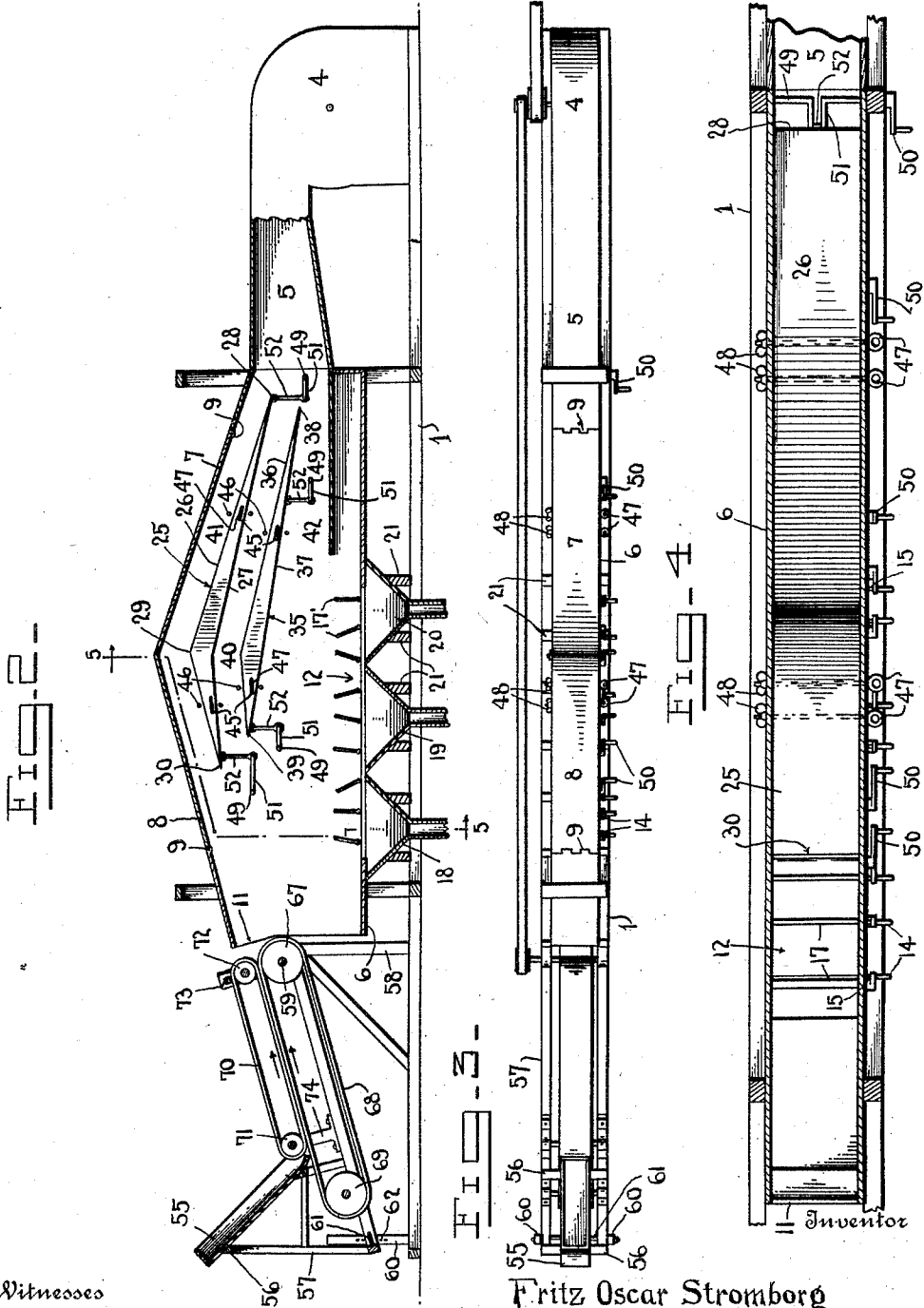
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1,078,520.

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To all whom it may concern:

Be it known that I, FRITZ OSCAR STROMBORG, a citizen of the United States, residing at Seattle, in the county of King and State of Washington, have invented certain new and useful Improvements in Ore-Separators; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to separators, and more especially to those employed for the separation of material while in its dry state and by the action of a blast of air operating on the falling material in a direction the reverse of that in which the material is delivered into the separator box, to blow the lighter particles backward toward the rear end of said box and to permit the heavier particles to be projected toward the front end of said box so that particles of different specific gravity will drop into different hoppers and the mass will be separated into grades.

The invention is designed more particularly as an improvement on the device covered in my United States Patent Number 1,042,836, issued October 29, 1912; and its details are set forth in the following specification and claims, and shown in the accompanying drawings wherein—

Figure 1 is a side elevation of this machine complete, taken from what I will call the rear side. Fig. 2 is a longitudinal sectional view, showing also a front side elevation of the fan casing, and Fig. 3 is a plan view of the machine in its position as seen in Fig. 2. Fig. 4 is a horizontal section through the separator box or casing, on an enlarged scale. Fig. 5 is a vertical section on the line 5—5 of Fig. 2. Figs. 6 and 7 are perspective details respectively of the upper and lower partitions. Fig. 8 is a perspective detail showing the means for adjusting one of the wings, and Fig. 9 is an enlarged vertical section through the handle of the crank shown in Fig. 8.

In the drawings the numeral 1 designates the bed or framework which in the present

case is illustrated as seated upon a floor 2 having therethrough an opening 3 for a purpose yet to appear, and at the front end of this bed is a fan 4 or other means for producing a blast of air which is delivered through the trunk 5 and into the separator box or casing 6. The top of the latter is preferably formed by two doors 7 and 8 hinged at 9 and connected to each other and to the sides of the casing by hooks 10 or other suitable means, thereby producing an angle at the center of the top of such casing, for a purpose to appear below. The rear end of this casing has an opening 11 through which the ore or other material to be acted upon is fed, and its bottom is also open as seen at 12. Above the opening in the bottom are disposed transverse shafts 13 which are journaled in the side walls of the casing and each of which has a crank handle 14 at its outer or front end as seen in Fig. 8. The hand piece of this crank handle is made in the shape of a pin 15 movably mounted in the outer end of the crank and projected normally inward by a spring 16 so that the tip of the pin will engage one of a series of holes 17 formed in the wall of the casing as shown, but when the hand piece is retracted to compress the spring the inner end of the pin will be disengaged from this hole and the crank may be set to engage the pin with some other hole. On the shaft 13 inside the casing is fixedly mounted a wing 17', and the arrangement is such that two or three of these wings are grouped above the open upper end of each of three hoppers 18, 19, and 20 as shown in Fig. 2. Said hoppers are by preference mounted on cross bars 21 whose ends rest on the sills of the bed 1 as seen in Fig. 1, so that the entire group of hoppers may be adjusted forward or backward beneath the bottom of the casing along the opening 3 and possibly to such an extent that their open upper ends will come under different wings as will be clear. Meanwhile each wing may be adjusted to any angle desired, by the crank handle and stop mechanism above described, or by any other suitable and equivalent adjusting device which

may be substituted therefor. I desire it understood that the adjusting means just described is simply typical of any which may be employed at this point, but the setting
 5 of the various hoppers at different distances from the inlet opening 11 is an improvement over my prior patent above referred to.

Within the casing are disposed several substantially horizontal partitions, and by
 10 preference I would have no less than two as shown herein, although there might be more. These may be of wood or metal, solid or hollow, and by preference they fill the entire space between the side walls of the casing
 15 and are sharpened at their front and rear edges so as to cut the blast of air forced through the trunk and deliver it in strata with as little resistance thereto as possible. In the present illustration the uppermost
 20 partition 25 is slightly longer than the lowermost partition 35 and has both its upper face 26 and lower face 27 inclined upward from its sharp front edge 28 to obtuse angles 29 about two-thirds of the way from
 25 its front to its rear edges, and thence inclined downward on converging lines to its sharp rear edge 30—the upper face 26 substantially paralleling the lower face of the doors 7 and 8 which constitute the top of the
 30 casing. The upper face 36 of the lower partition 35 is similarly formed, but its lower face 37 is substantially flat, although it has sharp front and rear edges 38 and 39 as shown. The construction and purpose is
 35 such that the channel 40 between the contiguous faces of the two partitions shall be of substantially one size throughout its length, when the partitions stand in their normal positions as best seen in Fig. 2, the
 40 same as the channel 41 above the uppermost partition is also of one size throughout its length, although both channels incline upward and are then inclined downward under the angle at the center of the casing. The
 45 space 42 below the flat lower face 37 of the lowermost partition, on the contrary, grows larger from the trunk 5 of the casing toward its outlet end where occurs the opening 11. By this construction it follows that a blast
 50 of air passing inward through the trunk 5 is cut by the sharp front edges of the partitions into a plurality of strata, whereof one stratum passes upward along the channel 41 and is directed toward and almost into the
 55 opening 11, another stratum passes along the channel 40 between its two partitions and is directed at a point a little below the opening 11 so that the material passing into the latter is struck forcibly by this blast of air, and the
 60 stratum of air below the front edge of the lowermost partition passes into a channel 42 which grows larger toward the rear end of the casing with the result that the air finds less and less resistance as it progresses and
 65 moves slower and slower across the upper

edges of the wings—all for a purpose hereinafter to appear.

While any suitable means may be employed for adjusting the positions of the partitions, I have illustrated one such means
 70 herewith and will describe it as follows, although I do not wish to be limited thereto. Through each partition near its front and rear edges are formed slots 45, and through
 75 the sides of the casing at proper points to register with the slots are formed upright series of holes 46. Through the latter and through the slots are passed eye-bolts 47
 80 whose eyes stand at one side of the casing as seen in Fig. 4 and serve as handles, while thumb nuts 48 are screwed onto their threaded ends which project beyond the
 85 other side of the casing, so as to hold the eye bolts in place and support the partitions in their adjusted positions. This device will answer for holding the partitions and for
 90 permitting them to be adjusted, but in order that it may not be necessary for the operator to get inside the casing to effect such adjustment I preferably make use of a crank
 95 shaft 49 journaled in the side walls of the casing near each end of each partition and somewhat below it as shown and having a crank handle 50 on its front end by means
 100 of which it may be turned, and I connect the crank 51 of each shaft by means of a pitman rod 52 with the adjacent end of the partition as best seen in Fig. 2. When the eye bolt in this end is withdrawn, the crank handle may
 105 be turned to rock the crank shaft and, through its pitman rod, to raise or lower this end of the partition as desired—after which the eye bolt will be reinserted in the proper pair of holes 46 and its thumb nut 48 applied to hold it in place.

The feed mechanism for this improved separator is also an improvement over my
 110 prior patent above referred to. By preference the material to be treated is dropped onto or delivered through a chute 55 which is carried by a suitable support 56 on a light
 115 framework 57 hinged at 57' to uprights 58 at the rear end of the bed 1, and said framework has bearings in which is journaled a shaft 59. The rear end of the framework is adjusted between other uprights or stand-
 120 ards 60 rising from the bed, by means of a pin or bolt 61 inserted in one of the series of holes 62 to sustain the outer end of the framework 57, as illustrated at the right of Fig. 1. By this or any equivalent means
 125 said framework may be adjusted vertically at its outer end, but here again I reserve the privilege of changing the details of construction, illustrated herewith as merely
 130 typical. Said shaft 59 is rotated by any suitable means as by a pulley 63 on one end thereof, connected by a belt 64 with a pulley 65 on one end of the shaft of the fan 4, and said fan may be driven by any suitable
 135

means such as a power belt 66. The essential feature is, however, that the shaft 59 shall stand near the hinge line for the light framework 57. This shaft carries a roller 67 around which moves a belt or apron 68 which leads to the rear over an idle roller 69 and constitutes a conveyer moving in the direction of the arrow in Fig. 2. Superimposed above the upper side of this apron is a second endless apron 70 which moves over rollers 71 and 72, and the latter is mounted in spring bearings 73 directly above the roller 67, whereas the other roller 71 is mounted over the belt 68 and in bearings 74 carried by the light framework at a suitable point, and stands forward of the lower end of the chute 55. It follows that material flowing down the latter passes under the rear roller 71 of the upper apron 70, and is carried forward between the two aprons and between the forward rollers 67 and 72; and if a large lump of material should be thus fed into the machine, the belt 68 will yield and the spring bearings 73 will permit the upper inner roller 72 to rise so that no injury will result to the feed mechanism. As shown, said mechanism delivers the material through the opening 11 to the rear end of the separator casing.

With the above construction of parts, the action of this machine is as follows: Power being applied through the belt 66 or otherwise, the fan 4 sets up a blast of air throughout the trunk 5 which is split by the sharp front edges of the partitions into strata passing over and beneath and between the partitions in the manner above described, and such stratum as passes along a channel which has an angle within its length is (theoretically) delivered from the rear end of said channel in what might be called a "cloud" which is rolling slightly reversely to its direction of travel, rather than proceeding straight along its course without the collateral influences of any currents in it which have been set up by the structure of the channel through which it passed. If the partitions be so adjusted that the channel grows smaller toward the rear end of the casing, the blast of air or stratum progresses faster and faster as it proceeds along said channel; conversely the reverse is true and a blast of air would progress slower and slower if the channel grew larger toward its rear end. I find, however, that the action of these strata of air upon the material being forced in through the opening 11 is precisely what is desired in a machine of this character. The rapidly moving belt 64 connected with the feed mechanism causes the material to be fed into said opening 11 at considerable velocity so that in effect it is tossed into the rear end of the casing and toward the rear edges of the partitions. Those particles which are large and heavy will ordi-

narly be thrown by this action into the intermediate hopper 19 or the front hopper 20—according as the various wings may be set. Those particles which have less specific gravity and perhaps greater size will feel the influences of the various strata of air more, and while they will be tossed with considerable velocity they will be retarded or deflected as they fall so that ordinarily they will drop into the intermediate hopper 19—again, according as the wings are set. Finally, those particles which are light in weight or small in size or both will almost invariably be blown backward toward the rear end of the casing, so that they will fall into the hopper 18. It will be at once obvious that the setting of the wings is an important factor in the successful operation of this device, as also the adjustment of the various partitions and the consequent variation in the size of the channels. However, the adjustment of the wings will ordinarily depend upon the material being fed, whereas the adjustment of the partitions will depend upon the volume of air and the climatic conditions existing; and both adjustments will need considerable experiment in order to teach the operator how best to apply them to the grades of ore being separated or to the kinds of grain or other material being treated in this machine. In fact, despite his experience it may become necessary to effect adjustments while the machine is in action, and this accounts for my preferred employment of means for setting the wings and adjusting the partitions from the exterior of the casing without necessarily stopping the motion of the machine. The parts are of the desired sizes, shapes, proportions, and materials and—as above suggested—I do not wish to be limited to the precise details of construction, especially of features herein typically shown only for purposes of illustration.

What is claimed as new is:

1. In a dry separator, the combination with a fixed horizontal casing having openings at its extremities and in its bottom, and hoppers beneath the latter, of feeding mechanism for tossing the material to be treated into the rear end of the casing, means for adjusting the angle at which said material is delivered, and means for delivering a blast of air into the opening in the front end of the casing.
2. In a dry separator, the combination with a fixed horizontal casing having openings in its bottom, hoppers beneath the openings, and means for adjusting the position of the mouths of said hoppers; of feeding mechanism for tossing the material to be treated into the rear end of the casing, means for adjusting the angle at which said material is delivered, means for delivering a blast of air within the casing and toward

said material, and means for varying the size and shape of the channel through which said blast flows, for the purpose set forth.

3. In a dry separator, the combination
5 with the casing having a series of hoppers communicating with its bottom at different points; of means for delivering a blast of air into the front end of said casing, mechanism for cutting said blast into strata,
10 means for tossing the material to be treated into the rear end of said casing on a line directed across the mouths of the hoppers and toward said air-strata, and means for adjusting the position of said mechanism to
15 vary the angle of this line to said strata.

4. In a dry separator, the combination with the casing having a series of hoppers communicating with its bottom at different points; of means for delivering a blast of
20 air into the front end of said casing, means for cutting said blast into strata, and mechanism for feeding the material to be treated into the rear end of said casing comprising a pair of endless aprons whose contiguous
25 sides contact with each other and move toward said casing, rollers supporting said aprons, that supporting the uppermost being mounted in spring bearings, a light framework supporting all such bearings,
30 and means for adjusting the angle of the framework to the direction of said strata of air.

5. In a dry separator, the combination with a casing; of a plurality of partitions
35 standing within said casing in approximate parallelism with each other and with the top wall of the casing, each having a slot through it near each end, the side walls of the casing having upright rows of holes
40 registering with said slots, a series of eye bolts whereof each passes through a pair of said holes and through the slot in the intervening partition, a thumb nut on the threaded end of said eye bolt, and means
45 for adjusting the position of said partition, for the purpose set forth.

6. In a dry separator, the combination with a casing having upright side walls and its top wall converging to an angle between
50 its front and rear ends, the latter being provided with openings, means for delivering a blast of air into the front opening, and means for tossing the material to be treated into the rear opening; of a series of hoppers
55 communicating with the bottom of the casing, and a plurality of partitions within said casing whereof the upper face of the uppermost partition normally parallels the top of the casing.

7. In a dry separator, the combination with a casing having upright side walls and its top wall converging to an angle between its front and rear ends, the latter being provided with openings, means for de-
65 livering a blast of air into the front open-

ing, and means for tossing the material to be treated into the rear opening; of a series of hoppers communicating with the bottom of the casing, and a plurality of partitions within said casing whereof the upper face
70 of the uppermost partition normally parallels the top of the casing and the lower face has an angle in its length differing from that in the upper face, and the upper face of the partition next below normally parallels the
75 lower face of the uppermost partition and its lower face is flat, for the purpose set forth.

8. In a dry separator, the combination with a casing having upright side walls and
80 doors at its top wall converging to an angle between its front and rear ends, the latter being provided with openings, means for delivering a blast of air into the front opening, and means for tossing the material to be
85 treated into the rear opening; of a series of hoppers communicating with the bottom of the casing, and a plurality of partitions within said casing whereof the upper face of the uppermost partition normally paral-
90 lels the doors at the top of the casing, and its lower face is out of parallel with its upper face, and means for adjusting said partition.

9. In a dry separator, the combination
95 with a casing having upright side walls and its top wall converging to an angle between its front and rear ends, the latter being provided with openings, means for delivering a blast of air into the front opening, and
100 means for tossing the material to be treated into the rear opening; of a series of hoppers communicating with the bottom of the casing, a plurality of partitions within said casing and independent means for adjust-
105 ing the front and rear ends of said partitions independently of each other whereby the blast of air may be split into various strata.

10. In a dry separator, the combination
110 with a fixed horizontal casing having openings at its extremities and in its bottom, hoppers beneath the latter, and means for adjusting the position of the mouths of said hoppers; of feeding mechanism for tossing
115 the material to be treated into the rear end of the casing, means for adjusting the angle at which said material is delivered, and means for delivering a blast of air into the opening in the front end of the casing and
120 cutting it into strata directed toward said material.

11. In a dry separator, the combination with a fixed horizontal casing having open-
125 ings in its extremities and in its bottom, hoppers beneath the latter, and means for adjusting the position of the mouths of said hoppers; of feeding mechanism for tossing the material to be treated into the rear end of the casing, means for adjusting the angle
130

at which said material is delivered, means
for delivering a blast of air into the open-
ing in the front end of the casing and cut-
ting it into strata directed toward said mate-
5 rial, and means for varying the size and
shape of the channels through which said
strata flow, for the purpose set forth.

In testimony whereof I have hereunto set
my hand in presence of two subscribing wit-
nesses.

FRITZ OSCAR STROMBORG.

Witnesses:

A. LARSON,

W. J. EVANS.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents,
Washington, D. C."
