L. N. MORSCHER.

GRADER.

APPLICATION FILED APR. 13, 1908.

1,023,750.

Patented Apr. 16, 1912.

3 SHEETS—SHEET 1.

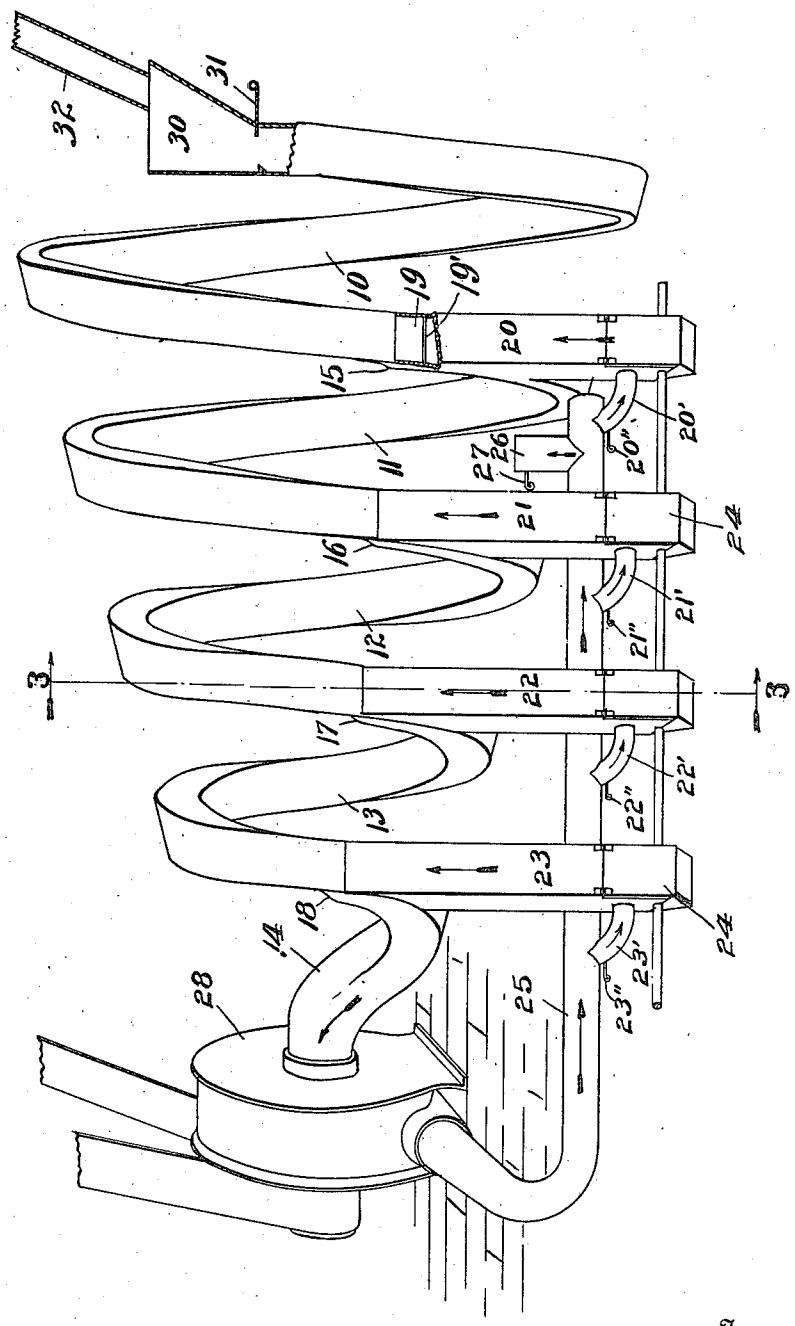

Fig. 1.

Witnesses,
Frank A. Fahle
Thomas W. McMeans

Inventor
Lawrence N. Morscher
By Bradford & Hood
Attorneys

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3 SHEETS—SHEET 2.

Fig. 2.

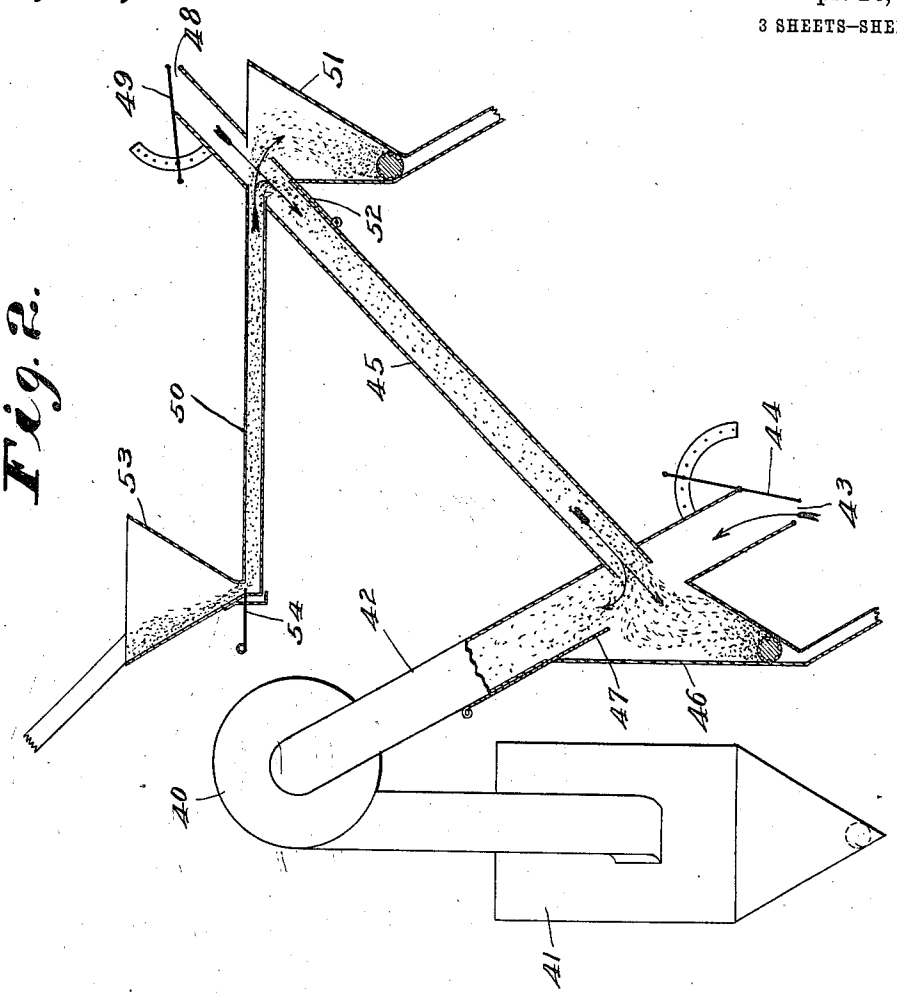
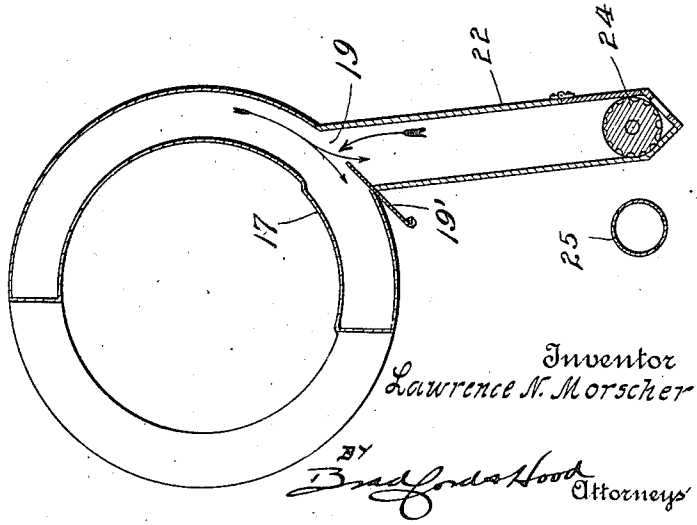


Fig. 3.



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3 SHEETS—SHEET 3.

Fig. 4.

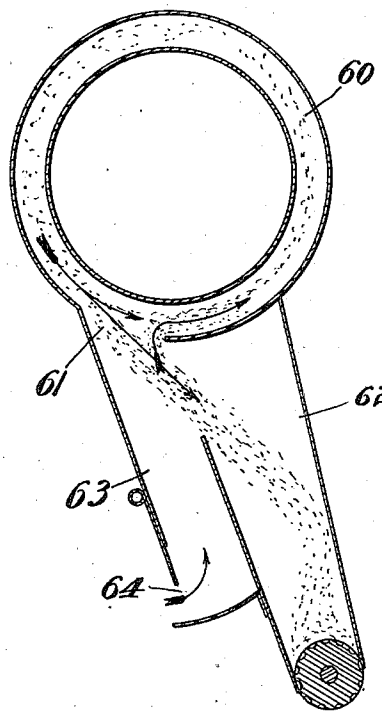


Fig. 5.

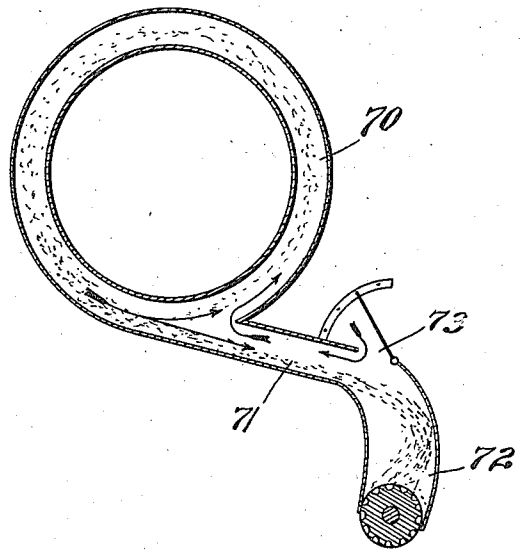
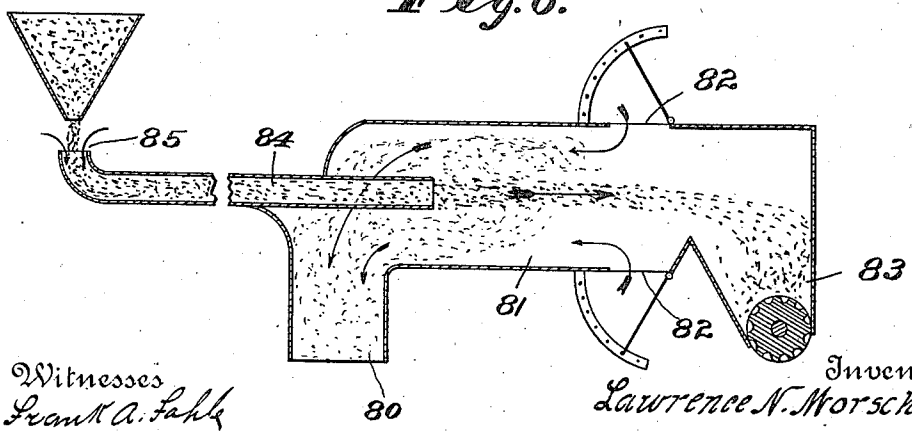


Fig. 6.



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Lawrence N. Morscher,
By Bradford & Hood
Attorneys

UNITED STATES PATENT OFFICE.

LAWRENCE N. MORSCHER, OF ENTERPRISE, KANSAS, ASSIGNOR TO HIMSELF AND WILLIAM J. EHRSAM, COTRUSTEES, OF ENTERPRISE, KANSAS.

GRADER.

1,023,750. Specification of Letters Patent. Patented Apr. 16, 1912.

Application filed April 13, 1908. Serial No. 426,734.

To all whom it may concern:

Be it known that I, LAWRENCE N. MORSCHER, a citizen of the United States, residing at Enterprise, in the county of Dickinson and State of Kansas, have invented certain new and useful Improvements in Graders, of which the following is a specification.

It has heretofore been customary to separate a mass of particles into different grades by subjecting a stream of the mass to one or more successive transverse blasts or streams of separating fluid, such as air, water, etc., the separation being dependent upon the difference in free falling velocity of the different particles of the mass and the force of the deflecting stream. In such an apparatus, or by such method, there is a lack of uniformity of grading due to the fact that, while the force producing the movement of the stream of particles is a constant force, the deflecting stream, owing to the necessary and unavoidable inequalities of the producing mechanism, varies materially in deflecting power, and, as the weight carrying power of a stream varies as the sixth power of its velocity and the force on a given surface varies as the second power of the velocity, comparatively minute changes in velocity of the deflecting stream cause material variations in the amount of deflection produced by such stream.

The object of my present invention, therefore, is to produce an apparatus wherein the velocity of the stream of the mass to be graded, and the velocity of the deflecting stream are produced by the same mechanism by means such that the ratio between the two velocities will remain constant irrespective of the fluctuations in said velocities. By such an arrangement any given particle in the mass stream will, when passing through a given space and acted on by the deflecting stream, be deflected a uniform amount so long as the ratio between the two velocities remains constant, because if the velocity of the particle be increased it will pass the range of the deflecting stream more quickly, and the deflecting stream, being correspondingly increased in the same ratio, will, while acting upon the particle a less time, be nevertheless capable of deflecting it a uniform amount owing to its increased deflecting power caused by its velocity.

Starting with the fundamental proposition that the ratio between the velocity of the mass stream and the velocity of the deflecting stream must remain constant irrespective of fluctuations in absolute velocities, many forms of apparatus may be produced to accomplish the desired results and it will be readily apparent that successive separations may be produced by similarly acting upon that portion of the mass stream deflected by the first deflecting stream.

The accompanying drawings illustrate diagrammatically devices embodying my invention.

Figure 1 is a perspective diagram of an apparatus embodying my invention and capable of producing four grades; Fig. 2 a diagram of a modified apparatus capable of producing three grades; Fig. 3 a diagrammatic section on line 3—3 of Fig. 1; and Figs. 4, 5 and 6 diagrams of modified forms of apparatus capable of accomplishing the desired results.

In Fig. 1, I have shown a helical tubular passage comprising the successive sections 10, 11, 12, 13 and 14 which gradually decrease in radius but increase in cross section, the increase in cross section being shown as produced, in the present structure at the points 15, 16, 17, and 18. Leading through the outer wall of the helix, preferably opposite each one of the cross-sectional increases 15, 16, 17 and 18, are openings 19, the size of each of which may be controlled by any suitable damper or valve 19′. Communicating with each of the openings 19 is a hollow leg 20, 21, 22, 23 which may be either closed at its bottom or may be provided with an automatically discharging closure 24 of any ordinary, well known form, the arrangement being such that any fluid stream admitted into the hollow legs will be prevented from egress except through the upper end through the corresponding passages 19 into the helical tubular passage for the mass to be graded. Leading into each of the legs 20, 21, 22, and 23 is a supply pipe 20′, 21′, 22′ and 23′, respectively, all of which are supplied from a main supply pipe 25 and each of which is provided with a damper or valve 20″, 21″, 22″ and 23″. Pipe 25 may also be provided with an additional outlet 26 controlled by suitable valve 27.

Any suitable means may be provided for producing the movement of the fluid stream to the pipes just described but I prefer

some means which will produce the stream in the helix in such manner that the mass of particles to be graded need not pass through the stream-producing means, and a convenient means for this purpose is an ordinary suction fan 28 to which the final section 14, of the helix, and the pipe 25 are connected, so as to produce streams through the conduits in the directions indicated by the arrows. Leading into the initial end of the helix is a feed hopper 30 controlled by suitable valve 31 and fed through a spout 32.

In operation the fan 28 is set in motion and a stream of particles to be graded is fed into hopper 30 so as to be carried through the helix by the air stream created by fan 28. When the stream of particles reaches the first opening 19, it will be met by an air stream coming through leg 20 and the relative force and velocity of this deflecting air stream will be regulated by a proper adjustment of valve 19′ and the corresponding valve 20″. When these adjustments have been properly made all of the particles of the mass stream except those having the greatest free falling velocity, will be deflected away from leg 20 and will continue through section 11 of the helix, the increased cross section thereof accommodating the increased volume due to the addition of the deflecting stream, while the particles which are not deflected will pass into the hollow leg 20 and be there collected. As the mass stream continues to move through the helix the centrifugal force of the particles will increase owing to the decreased radius of the helix and at each successive opening 19 a deflecting stream will be admitted and another separation produced in the manner already described, the several valves being suitably adjusted. After the valves have been once adjusted, for a given separation, ordinary fluctuations in the speed of the fan 28, causing fluctuations in velocities of the fluid stream through the helix and the deflecting stream through the hollow legs, will not affect or vary the ratio established between the fluid mass-carrying stream in the helix and the deflecting fluid streams in said legs so that there will be no variation in the grades separated by the apparatus.

In Fig. 2 I have shown a suction fan 40 which delivers into any ordinary dust collector 41. Leading into fan 40 is a tube 42 which, at its opposite end is provided with an inlet 43 controlled by a valve 44. Leading into tube 42 between fan 40 and the inlet 43 is a tube 45, and arranged opposite the discharge end of said tube 45 is a collecting hopper 46, the mouth of which is controlled by an adjustable valve 47. Tube 45 is provided at its outer end with an inlet 48 which is controlled by a valve 49, and leading into the tube 45 between inlet 48 and its discharge end, is a similar pipe 50 opposite the discharge end of which is arranged a collecting hopper 51 having a mouth controlled by an adjustable valve 52. Leading into tube 50 is a hopper 53 having a controlling valve 54.

In the operation of this device an air stream is established through the pipes 42, 45 and 50, and inlets 43, 48 and hopper 53 by the fan 40, and a stream of particles is fed into said hopper. As the mass stream passes from tube 50 into tube 45 it is met by the air stream entering through inlet 48 and those portions having the least free falling velocity will be deflected into the tube 45 while those particles having the greater free falling velocity will pass through the deflecting stream and into hopper 51, the desired separation being produced by a proper adjustment of the valves 49 and 52. When the mass stream passes from tube 45 into tube 42 there will be a second separation in the manner already described, and after the several valves are once adjusted ordinary fluctuations in speed of the fan 40, and consequent fluctuations in the velocity of the mass stream, will produce corresponding fluctuations in velocities of the deflecting streams and the ratios between the velocities of the mass streams and the deflecting streams will remain constant and the degree of separation or grading will also remain constant.

In order that the force of gravity may not have any material effect upon the operation of the apparatus, it is advisable that the velocities of the mass stream and the deflecting stream be much higher than the velocities obtainable by gravity through the same distances.

In Fig. 4, 60 indicates one turn of a spiral channel adapted to deliver tangentially through an opening 61 into a receiving leg 62. Arranged parallel with the leg 62 and joining the opening 61 is an air passage 63 having an adjustable inlet 64 the arrangement being such that the dust laden current is introduced through the spiral passage 60 and the heavier particles tend to take the direction indicated by one of the arrows through opening 61 across leg 63 and into leg 62 and the induction of the dust laden current in the passage 60 causes an induction of a deflecting current into and through leg 63 such deflecting current having a well defined direction before it enters the stream of heavy particles passing into leg 62 and the deflecting current of course bearing at all times a constant ratio to the dust laden current passing through the spiral 60, in the manner already described.

In Fig. 5 the spiral passage 70 is provided with a substantially tangential leg 71 which delivers into the receiving leg 72, an adjustable air inlet 73 being provided in

the leg 71 at some distance from the point of juncture with the spiral passage.

In Fig. 6 the current is introduced by suction at the point 80 from a chamber 81 provided with one or more air inlets 82 said chamber being provided at its farther ends with a receiving leg 83. Delivering into chamber 81 is a comparatively small passage 84 the inner end of which extends into chamber 81 beyond the outlet 80. The dust laden current is delivered by any suitable means into the open end 85 of the passage 84 so that, a current of air will be drawn into said open end 85 with the dust laden current and be moved therethrough with sufficient velocity to cause the heavier particles to pass on through the deflecting current entering the openings 82, as clearly indicated in the diagram.

I claim as my invention:

1. In a grader, the combination, of a suction fan, a helical particle-laden-stream-defining conduit leading thereinto and having a particle outlet arranged in the normal trajectory of the particles under the action of the suction fan at the point of such outlet, and also having an increase of cross section toward the fan, a deflecting-stream-defining conduit leading into the first conduit adjacent but outside the particle outlet and substantially at the aforesaid increase of cross section, a particle-receptacle arranged in the trajactory of particles projected through the particle opening and beyond the deflecting-stream conduit in such manner that particles may pass through the particle opening to the particle chamber without meeting solid obstruction, and a conduit leading from the suction fan to the deflecting-stream-defining conduit.

2. In a grader, the combination, of a suction fan, a particle-laden-stream-defining conduit leading thereinto and having a particle outlet arranged in the normal trajectory of the particles under the action of the suction fan at the point of such outlet, and also having an increase of cross section toward the fan, a deflecting-stream-defining conduit leading into the first conduit adjacent but outside the particle outlet and substantially at the aforesaid increase of cross section, a particle-receptacle arranged in the trajectory of particles projected through the particle opening and beyond the deflecting-stream conduit in such manner that particles may pass through the particle opening to the particle chamber without meeting solid obstruction, and a conduit leading from the suction fan to the deflecting-stream-defining conduit.

3. In a grader, the combination, of a suction fan, a helical particle-laden-stream-defining conduit leading thereinto and having a particle outlet arranged in the normal trajectory of the particles under the action of the suction fan at the point of such outlet, a deflecting-stream-defining conduit leading into the first conduit adjacent but outside the particle outlet, a particle-receptacle arranged in the trajectory of particles projected through the particle opening and beyond the deflecting-stream conduit in such manner that particles may pass through the particle opening to the particle chamber without meeting solid obstructions, and a conduit leading from the suction fan to the deflecting-stream-defining conduit.

4. In a grader, the combination, of a suction fan, a particle-laden-stream-defining conduit leading thereinto and having a particle outlet arranged in the normal trajectory of the particles under the action of the suction fan at the point of such outlet, a deflecting-stream defining conduit leading into the first conduit adjacent but outside the particle outlet, a particle-receptacle arranged in the trajectory of particles projected through the particle opening and beyond the deflecting-stream conduit in such manner that particles may pass through the particle opening to the particle chamber without meeting solid obstructions, and a conduit leading from the suction fan to the deflecting-stream-defining conduit.

5. In a grader, a helical particle-laden-stream-defining conduit decreasing in radius from the feed end, a plurality of deflecting-stream-defining conduits leading into said first mentioned conduit at successive points, and means for simultaneously producing a fluid stream in said several conduits and maintaining the ratios of velocities of the particle-laden-stream and the deflecting streams.

6. In a grader, a helical particle-laden-stream-defining conduits decreasing in radius and increasing in cross-section at successive points from the feed end, a plurality of deflecting-stream-defining conduits leading into said first mentioned conduit at successive points of increase of cross-section, and means for simultaneously producing a fluid stream in said several conduits and maintaining the ratios of velocities of the particle-laden-stream and the deflecting streams.

7. In a grader, a helical particle-laden-stream-defining conduit decreasing in radius from the feed end, a plurality of deflecting-stream-defining conduits leading into said first mentioned conduit at successive points, a suction fan connected with the discharge end of the first mentioned conduit, and a discharge conduit leading from said suction fan and discharging into the deflecting-stream-defining conduits.

8. In a grader, a helical particle-laden-stream-defining conduit decreasing in radius and increasing in cross-section at suc-

cessive points from the feed end, a plurality of deflecting-stream-defining conduits leading into said first mentioned conduit at successive points of increase of cross-section, a suction fan connected with the discharge end of the first mentioned conduit, and a discharge conduit leading from said suction fan and discharging into the deflecting-stream-defining conduits.

In witness whereof, I have hereunto set my hand and seal at Enterprise, Kansas, this fourteenth day of November, A. D. one thousand nine hundred and seven.

LAWRENCE N. MORSCHER. [L. S.]

Witnesses:
A. M. HENE,
W. R. WEEKS.