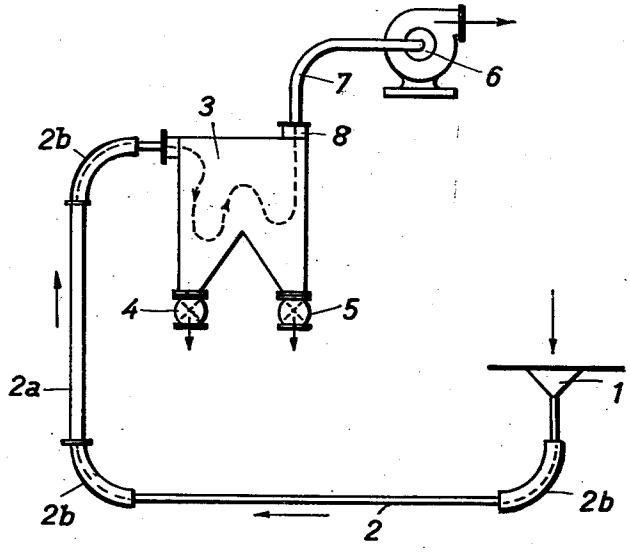
June 30, 1953 F. TANNER 2,643,769

METHOD AND APPARATUS FOR SEPARATING SOLIDS FROM GASES

Filed Dec. 16, 1949 4 Sheets-Sheet 1

FIG. 1



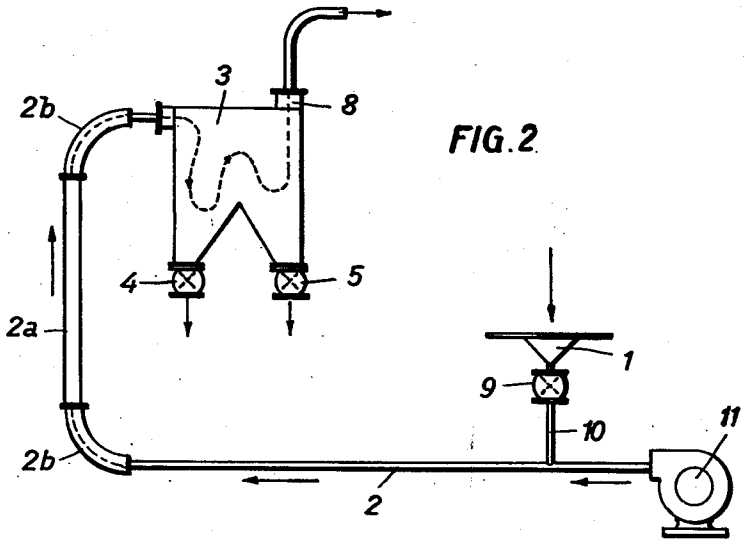


FIG. 2

INVENTOR:

Fritz Tanner

By E. P. Goepel

his Attorney

June 30, 1953 F. TANNER 2,643,769

METHOD AND APPARATUS FOR SEPARATING SOLIDS FROM GASES

Filed Dec. 16, 1949 4 Sheets-Sheet 2

FIG. 3

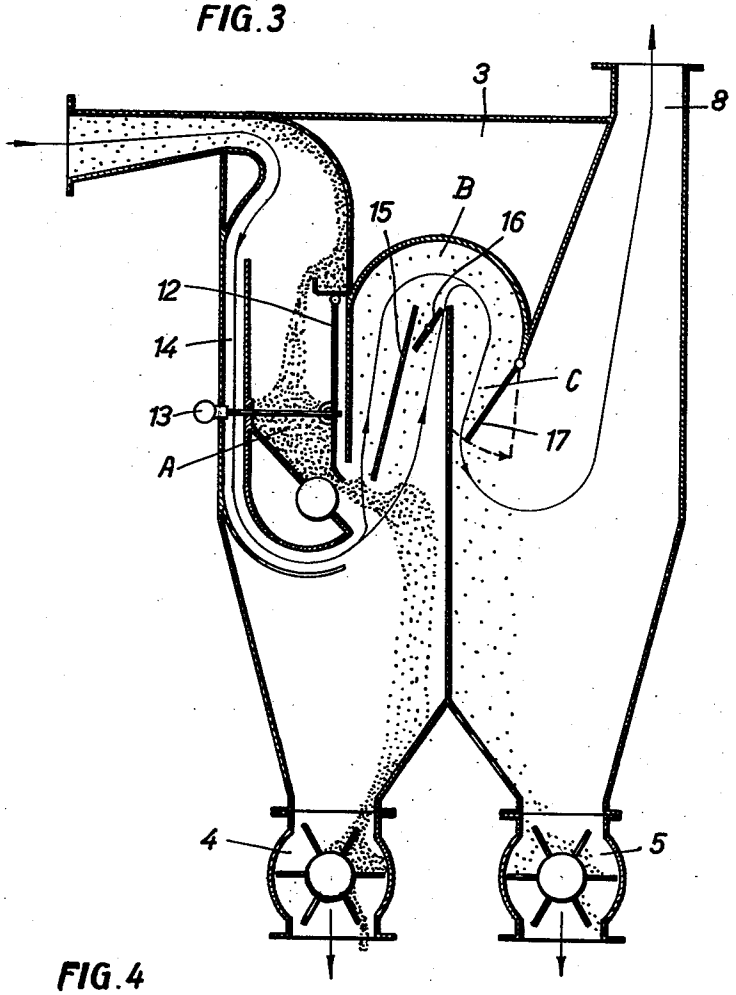
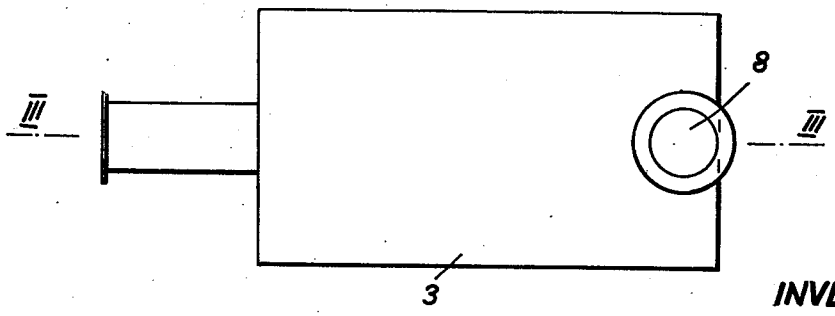


FIG. 4



INVENTOR:

Fritz Tanner

By E. P. Goepel

his Attorney

June 30, 1953 F. TANNER 2,643,769

METHOD AND APPARATUS FOR SEPARATING SOLIDS FROM GASES

Filed Dec. 16, 1949 4 Sheets-Sheet 3

FIG.5

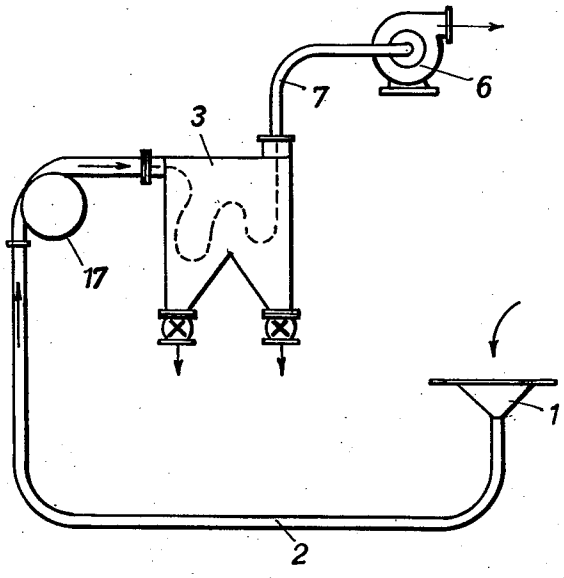
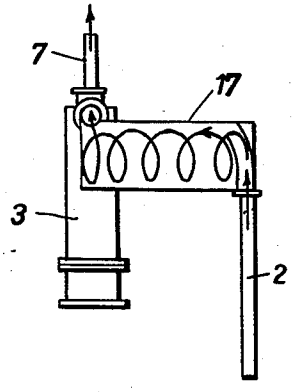


FIG.6



INVENTOR:

Fritz Tanner

By C. P. Goepel

his Attorney

June 30, 1953 F. TANNER 2,643,769

METHOD AND APPARATUS FOR SEPARATING SOLIDS FROM GASES

Filed Dec. 16, 1949 4 Sheets-Sheet 4

FIG. 7

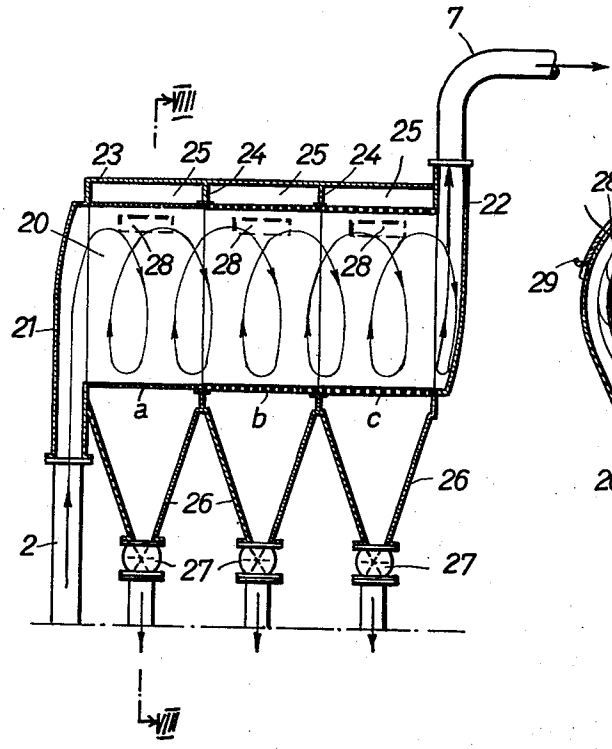
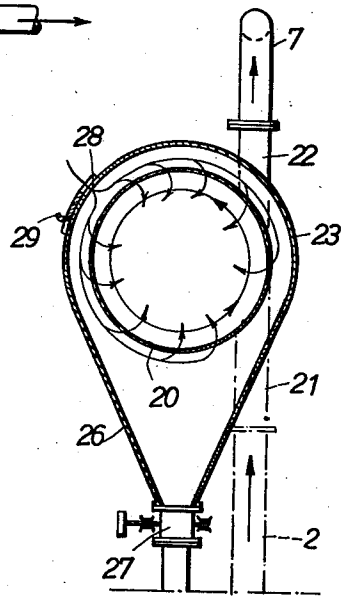


FIG. 8



INVENTOR:

Fritz Tanner

By C. P. Goepel

his Attorney

Patented June 30, 1953

2,643,769

UNITED STATES PATENT OFFICE

2,643,769

METHOD AND APPARATUS FOR SEPARATING SOLIDS FROM GASES

Fritz Tanner, St. Gallen, Switzerland, assignor to Gebruder Buhler, Uzwil, Switzerland

Application December 16, 1949, Serial No. 133,399
In Switzerland January 10, 1949

6 Claims. (Cl. 209—143)

1

In pneumatically transporting granular bulk material such as grains, a considerable weight of air or gases is delivered too, whereby the power required is substantially increased in comparison with mechanical transport means such as elevators or chain conveyors.

According to my present invention, the delivery air blast is utilized in a substantially higher degree than at present in that the delivery air in transport is used for classifying, grading and assorting the material transported. The kinetic energy inherent to the delivery air on its path of operation also may be used, e. g., for centrifugally aligning the material. In order to still further utilize the delivery air, the latter also may be used for the mechanical working of the material.

At present, separate machines are used in grain-grinding mills for assorting, viz. for separating grains or meals from the specifically lighter hull particles, germs, dust and the like, and also for mechanically treating wheat, oats, barley or other grains, viz. for hulling, husking, and decorticating, scouring and polishing, and the like.

The means for carrying out the method disclosed by my present invention, comprise a delivery conduit adapted to assort and, if desired, mechanically treat the material. For the purpose of delivering air of operation, a pressure-producing blower or a suction-producing blower may be disposed at the respective end of the path of transport.

The method according to my present invention shall be more fully explained with the aid of the accompanying drawings, in which various forms of the means for carrying out such method are schematically illustrated. In the drawings:

Fig. 1 shows a first example using the suction line of a blower,

Fig. 2 shows another example using the pressure line of a blower,

Fig. 3 illustrates, in a larger scale, a separator disposed in the transport line, in section on the line III—III of Fig. 4,

Fig. 4 is a top plan view of the separator,

Fig. 5 shows a further example using the suction line of a blower,

Fig. 6 a partial side elevation of Fig. 5,

Fig. 7 a longitudinal section through a centrifugal sifter, and

Fig. 8 a section on the line VIII—VIII of Fig. 7.

As shown in Fig. 1, the material to be transported and mechanically treated is introduced through the receiving hopper 1 into the line 2

2

and thus brought into the operative path of the transport air aspirated by the blower 6. The line 2 comprises a straight section 2a of particular construction and a plurality of bends 2b which are clad on the inside with a material suited for mechanically treating the material in transport, e. g. a coat of emery or hard cast material. A separator 3 built into the line 2 downstream of the last bend 2b, serves for sorting the material in transport. The specifically heavier parts produced in the mechanical treatment, are carried along by the air stream across the separator 3 and leave the same through a sluice gate 4. The specifically lighter parts (hull portions and the like) leave the separator through a sluice gate 5.

Fig. 3 shows the construction and mode of operation of separator 3, the air path being indicated by arrows. A slide gate 12 which is adjustable by means of a rod 13, serves for letting the material in transport accumulate at a point A so as to force the air into a duct 14 wherein it changes its direction in order to pass upwardly through the material flowing through gate 12, and to transport the specifically lighter parts into the separator passage B. Any heavy parts still entrained in the air blast past the gate 12 are retarded by means of partitions 15 and 16 disposed in said passage B, and drop into the sluice 4 together with the specifically heavier parts which drop directly from the material passing through gate 12. The partition 16 is formed as a butterfly valve, by means of which the air current in separator passage B may be throttled and its carrying capacity varied. The specifically lighter parts of the material drop from the separator passage C which is provided with a swing gate 17, into the sluice 5, while the air flowing out through the connection 8 carries off dust and other impurities into a pressure filter (not shown) for example, from which clean air is discharged. As shown in Fig. 1, a line 7 at one end is connected at 8 to the separator 3, and at the other end to the suction blower 6.

In contrast to the arrangement just described, the means shown in Fig. 2 operate with the aid of compressed air. The material to be transported and treated passes from the inlet hopper 1 through a sluice gate 9 and a line 10 into the pressure line 2 which comprises a straight section 2a and two bends 2b. The latter on the inside are coated with a material suited for mechanically treating the material in transport, e. g. with an abrasive material of the kind mentioned above in connection with the first form of my invention. The mechanically treated material then is sorted

in a separator 3 as in the first example shown in Fig. 1. After being discharged from separator 3 through a port 8, the dust-laden air may be blown through a pressure filter (not shown).

The delivery line 2 in Figs. 1 and 2, if required, may be provided with one bend 2b only and again, may be provided on the inside with an abrasive coating on its entire length.

In the example shown in Figs. 5 and 6, the material is mechanically treated in a drum 17 which is provided in the line 2 and possesses an abrasive coat on a portion of the inside surface or on the whole thereof.

The example shown in Figs. 7 and 8 is operated by an induced-draft fan (not shown) which, however, could be replaced by a forced-draft fan. The material to be transported and treated is fed through a suction line 2 into a horizontally disposed sifter 20 by way of a tangential inlet connection 21 disposed on one end face of the sifter. The latter is subdivided into three axial zones *a*, *b* and *c*, the inside wall of each zone on its entire circumference being perforated. The size of the perforations in each zone is different from that in the adjacent zone or zones and corresponds to the size of the particles to be sifted.

In Fig. 7, the size of the perforations increases from left to right so that the zone *a* serves for fine sifting, the zone *b* for intermediary sifting, and the zone *c* for coarse sifting. From the zone *c*, of sifter 20, the material is carried through a tangential outlet 22 disposed on the other end face of drum 20 into a section 7 which is connected to the induced-draft blower.

The zones *a–c* of sifter 20 are enclosed in a casing 23 which by means of partitions 24 is subdivided into three annular chambers 25 of which the lower portions open into conical outlets 26 which terminate in a sluice gate 27 each. The casing 23 is closed against the atmosphere, and comprises an aperture 28 for each zone *a–c*. The said apertures are adjustable by means of a slide 29 each.

The mode of operation of the arrangement described is as follows, it being assumed that the apertures 28 are closed entirely:

The material carried in the induced draft passes through the inlet 21 tangentially into the sifter 20. Under the influence of the centrifugal forces engaging the particles of the material by reason of the arising whirl, the said particles are thrown against the wall of sifter 20. The material on passing through the latter thus is successively sifted as regards to the fine, intermediate, and coarse particles, and the particles are not smashed or damaged through movable mechanical parts such as beaters or brushes. The separated fractions of the material pass through the perforated walls of the sifter zones *a–c* into the respective annular chambers 25 of casing 23 and, thus, may be discharged from the path of transport through the sluice gates 27. The transporting air, freed of material, is conducted to the suction side of the blower through the outlet 22 and may be exhausted to the atmosphere, e. g. after having passed through a pressure filter. When the material has not been entirely separated in the sifter, the residual is discharged together with the air from the sifter and may be separated on its way, i. e. by means of a separator disposed in line 7.

When the apertures 28 in casing 23 are opened, outside air is sucked into the various zones, since there is a subpressure in sifter 20. The amount of air entering through the apertures 28 may be regulated by means of the slides 29. The current produced by the air entering the annular chambers 25 is directed approximately radially inwards and opposes the centrifugal forces acting onto the particles. Only the particles having a kinetic energy greater than that of the incoming air stream, will therefore pass through the perforated walls of the zones *a–c* of sifter 20. The material thus not only is sifted as to the size, but also as to the specific gravity of its particles, and such sifting effect is regulable by varying the amount of air entering into the various sifter zones through the apertures 28, by means of the slides 29.

The sifter 20 may be made of perforated sheet iron, wire mesh, or filter cloth, according to the kind of material to be sifted.

According to the method described, the two different operations provided for treating the material are performed consecutively in one run. Special machines separated from the path of transport, as used in prior art for treating the material, which machines require much space thus are eliminated. The treatment of the material according to the method disclosed in the foregoing specification, requires less time of operation, and the arrangement according to my present invention requires less space than the prior-art methods and arrangements, and my invention more fully utilizes the energy of the transporting air and, thus, increases the economy of pneumatic transport.

What I claim as new and desire to secure by Letters Patent, is:

1. In an apparatus for pneumatically transporting loose bulk material, such as grains or seeds, having a tubular conduit for the reception of such material, and a discharge end, and means for passing air through said conduit, and a separator interposed in said conduit, said separator including the combination of a casing having an air inlet opening and an air outlet opening at its upper portion, a concave curved wall across the inlet opening and spaced therefrom in the path of the incoming air and material for separating the material from said air, means for collecting said material, said means having a restricted outlet for said material and forming with the material a seal against an air flow, the material passing out of said restricted outlet forming a veil of material when descending by gravity to the lower part of said casing, an air conduit in said casing separate from said collecting means extending vertically along said collecting means and below the same and having its inlet orifice in the upper part of said casing spaced from said concave curved wall for the air separated from said incoming material, and having its exit orifice below said restricted outlet of said material shaped to direct its air transversely across the said veil of material for blowing the lighter particles of the veil of material out of said casing, the heavier particles being permitted to descend to the lower part of said casing.

2. In an apparatus for pneumatically transporting loose bulk material, such as grains or seeds, having a tubular conduit for the reception of such material, and a discharge end, and means for passing air through said conduit, and a separator interposed in said conduit, said separator including the combination of a casing having an air inlet opening and an air outlet opening at its upper portion, a concave curved wall across the inlet opening and spaced therefrom in the path

of the incoming air and material for separating the material from said air, means for collecting said material, said means having a restricted outlet for said material and forming with the material a seal against an air flow, the material passing out of said restricted outlet forming a veil of material when descending by gravity to the lower part of said casing, an air conduit in said casing separate from said collecting means extending vertically along said collecting means and below the same and having its inlet orifice in the upper part of said casing spaced from said concave curved wall for the air separated from said incoming material, and having its exit orifice below said restricted outlet of said material shaped to direct its air transversely across the said veil of material for blowing the lighter particles of the veil of material out of said casing, the heavier particles being permitted to descend to the lower part of said casing, combined with a vertical partition wall substantially median of said casing, an inverted U-shaped wall above said partition and spaced therefrom to form a conduit for air and such material drawn thereby, the inlet end of said conduit being in proximity to the point of intersection of said air flow with said veil, to receive said air flow with the lighter particles entrained by said air, said inverted U-shaped wall guiding said air and lighter material from one side of said partition to the other side thereof for gravity descent along said partition, the air flow free from said material being reversed at the outlet end of said U-shaped wall in its direction before passing to the air outlet in the upper part of said casing.

3. The structure of claim 2, and an inclined wall in the path of the air and lighter material flow to impede heavier particles, between said partition and said collecting means.

4. The structure of claim 2, and a valve adjacent said partition and between said partition and said collecting means, for regulating the flow of air and lighter materials.

5. The structure of claim 2, and a valve hinged to one end of said inverted U wall at its outlet end for regulating the flow of air and lighter material in the conduit formed by said inverted U-shaped wall.

6. A method of separating loose bulk material such as grains and seeds from a stream of air used to transport such material, which consists in subjecting said stream of air conveying said material to an interposed separation of material from said air, in a continuous serpentine flow, by first subjecting the stream to centrifugal action to separate the material from said air, and collecting said material in an air seal like deposit having a restricted outlet portion to form a veil of material descending by gravity away from said deposit, said remaining air flowing independently of said deposits to below the same and guided to intersect said material veil to entrain the lighter particles of said material, then subjecting said flow of air with entrained lighter particles to a reverse curve of direction, and then subjecting said material entrained by said stream of air to a second reverse curve of direction opposite to the first reverse flow of direction, whereby said reverse flows of direction separate said lighter particles of material from said air to descend by gravity, with said air freed of said material exhausting to the air flow of the casing.

FRITZ TANNER.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
15,630	Ward	Aug. 26, 1856
245,584	Toulmin	Aug. 9, 1881
821,819	Neumann	May 29, 1903
852,558	Heisel	May 7, 1907
864,209	Stokoe	Aug. 27, 1907
1,116,485	Reddy	Nov. 10, 1914
1,442,275	Johnson	Jan. 16, 1923
1,484,208	Davis	Feb. 19, 1926
2,255,206	Duncan	Sept. 9, 1941
2,280,903	Ellison	Apr. 28, 1942
2,283,483	Arnold	May 19, 1942
2,502,916	Bar	Apr. 4, 1950

FOREIGN PATENTS

Number	Country	Date
39,168	Norway	June 23, 1920
121,486	Germany	June 19, 1901