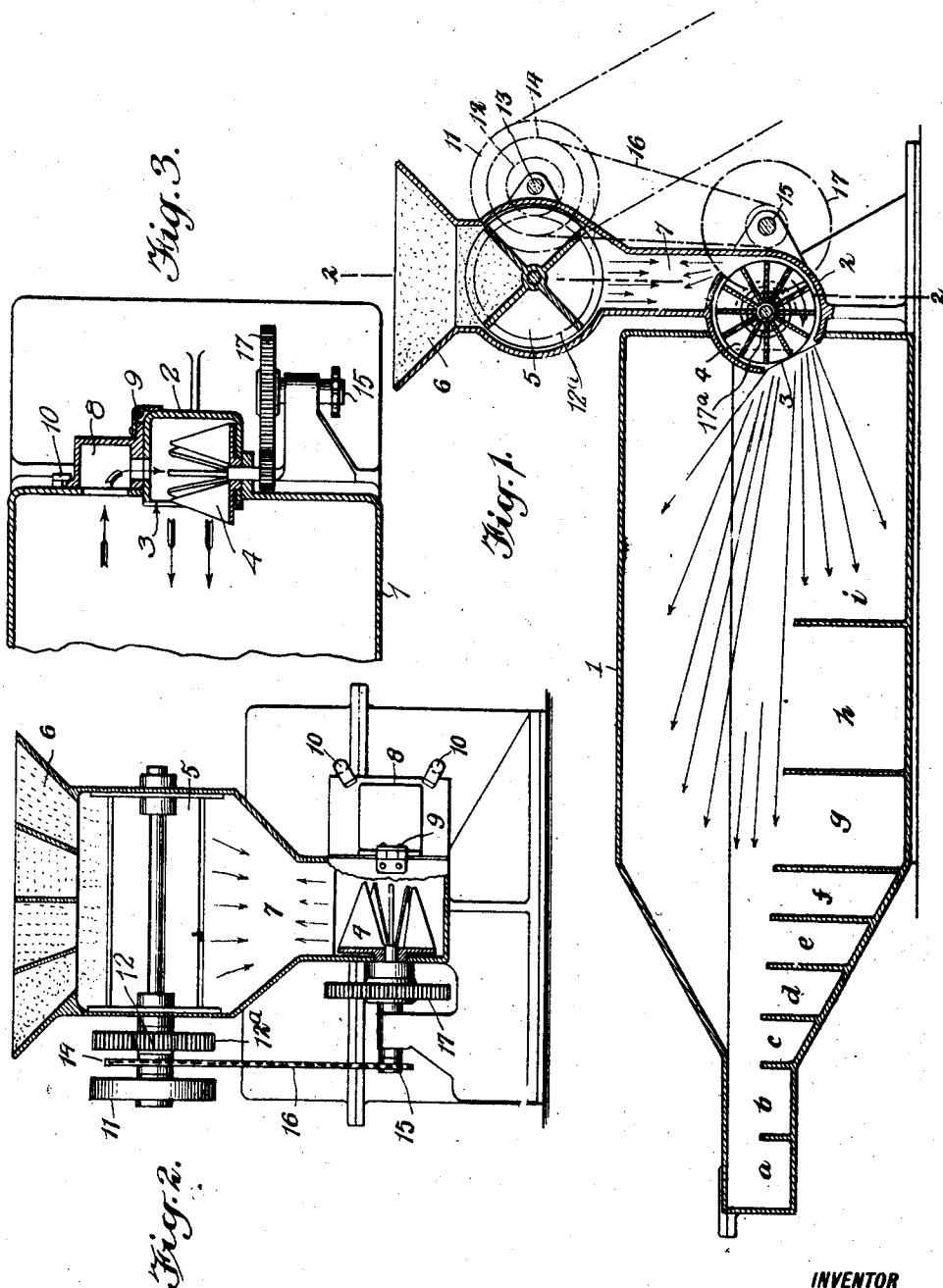


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E. SPRENGER
 METHOD AND APPARATUS FOR MIXING, GRADING, AND SORTING GRANULAR AND
 PULVERULENT MATERIAL
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INVENTOR
Emile Sprenger
 BY
Dean Furbank Albright & Horn
 ATTORNEYS

UNITED STATES PATENT OFFICE.

EMILE SPRENGER, OF GOLDACH, SWITZERLAND.

METHOD AND APPARATUS FOR MIXING, GRADING, AND SORTING GRANULAR AND PULVERULENT MATERIAL.

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This invention is applicable for the treatment of practically any kind of granular or pulverulent material, including for example hydraulic binding agents, cement materials, powdered gypsum lime, chemicals such as are used in the manufacture of colors and other substances, coal and for briquet manufacture. The mixing and sorting may be independent operations, or they may be concurrent operations as when several materials are first intimately mixed and then subjected to a separating or sorting action, whereby the mixture is divided up according to the degree of fineness of the particles.

I secure the grading or sorting of the pulverulent materials according to the varying degrees of fineness by using a blast of air or other gaseous medium which carries the finer and coarser or heavier particles different distances. As one important object of my invention I prevent the spent air or gaseous medium from contaminating the atmosphere; I avoid the trouble, expense and inconvenience of cleaning it or leading it away to a place where it is innocuous; and I avoid the very appreciable loss of material in the form of dust carried away the gaseous medium and which cannot be wholly recovered economically.

In carrying out my invention the material is treated in whole or in part by a centrifugal distributor or fan operating in a wholly enclosed space and arranged so that the suction due to the centrifugal apparatus draws the air or other gaseous medium from the chamber into which it blows it. That is to say, the air is in continuous circulation in a substantially closed cycle or system, and consequently there is no discharge of a stream of spent air or other gas and there is no loss of dust carried away by any such spent air or gas.

Fig. 1 is a vertical longitudinal section through one form of apparatus embodying my invention,

Fig. 2 is a vertical transverse section taken substantially on the line 2—2 of Fig. 1,

Fig. 3 is a horizontal section of part of the apparatus, taken through the fan shaft.

The apparatus shown in Figs. 1, 2 and 3 includes a box or chamber 1, serving as a receptacle to receive the mixed or graded materials and having fitted to one end thereof a housing or casing 2 for the centrifugal dis-

tributor or fan 3. The box or receptacle may be made of two parts, the upper part being removable or hinged to give convenient access to the interior thereof. The box may be of any desired cross sectional form as for instance rectangular, as indicated in Fig. 2, or it may be a cylindrical drum or receptacle of other shape.

Within the receptacle there are a plurality of transverse walls extending upwardly from the bottom to only a part of the height of the receptacle, and dividing the lower part into a series of compartments or sub-receptacles *a, b, c, d, e, f, g, h, i*, all open at the top. If desired the distance of these partitions from the distributor and from each other may be varied in accordance with the number of grades into which it is desired to sort the material. As shown the compartments are of different sizes and the partitions nearer the distributor are of less height than those at a greater distance therefrom. The difference in the sizes of the compartments may also be accomplished in part by a sloping of the whole or a portion of the floor of the receptacle. I do not wish to be restricted to any particular arrangement or formation of these compartments except that they be at varying distances from the distributor and that the space above them be open so that the heaviest particles may fall into the nearest compartment, and the other compartments at varying distances receive the particles correspondingly varying in size. The finest dust collects in the receptacle farthest from the distributor.

The centrifugal distributor may consist of a disk with vanes 4 rotatable about a horizontal axis and receiving the granular or pulverulent material from a feeder 5 and hopper 6 through a substantially vertical feed duct 7. If it is desired to merely sort or grade one material according to the fineness of the materials, only this one material may be placed in the hopper 6. If it is desired to mix different materials at the same time that the mixture is sorted or graded according to fineness, the hopper may have partitions sub-dividing it into compartments or may in effect be a multiple hopper. The rotary feed device 5 may be of any suitable character so as to deliver material from the hopper or from the several hopper sections or compartments and permit this material

or mixture of materials to drop through the feed duct to the distributor.

The casing 2 and the centrifugal distributor or fan 3 are so designed that a by-pass is formed and air or other gaseous medium withdrawn from the feed duct and blown into the receptacle 1 may return to the feed duct for recirculation through the distributor. As shown particularly in Figs. 2 and 3, the vanes do not extend all the way from the disk to the opposite side of the casing and are of substantially triangular form. Thus there is no danger of coarse particles of the material wedging between the wall of the casing and the distributor or fan blades. The air, returning from the receptacle past the fan, for recirculation through the latter, acts on the material in the lower portion of the feed duct 7 and agitates this material so as to effect a pretreatment of it or a partial mixing of the different kinds of material, if these be different kinds in the separate compartments of the hopper 6. The upward blast in the feed duct also tends to give a preliminary separation by retarding the lighter particles descending from the feeding device 5.

The final separation is effected by centrifugal apparatus, the blades of which throw the material into the receptacle 1, the various particles being projected to different distances according to their specific weights and varying degrees of fineness, or both. The process of sorting is thus effected in the box, and the materials are graded out in the compartments *a*, *b*, *c*, etc. It will be understood that if a plurality of different kinds of material be delivered from the hopper 6, there will be not only a sorting according to the fineness, in the receptacle 1, but there will also be a bringing together or mixing of the particles of each material with the corresponding size of particles of the other material or materials.

Gases other than air might be introduced and circulated without loss, and these gases might be of such character that they would have chemical action on the material, or might be gases devoid of oxygen so as to avoid oxidation of the materials. For this purpose the separator has a chamber 8 annexed thereto and a door 9 fastened by catches 10 for permitting access to this chamber at any time during working operations. If such gases are used they are introduced by means of a pipe into a chamber 8, annexed to the casing 2 of the centrifugal separator 3. Normally, however, the process is performed in an atmosphere of air contained in the chamber 1, casing 2, and chamber 8, the wall of the chamber 1 having

an opening to the chamber 8, laterally of the casing 2, and the latter having an opening to the chamber 8, in front of the ring of fan blades 4 whereby the granular material is projected into the chamber 1. A gentle circulation of air is set up by the centrifugal distributor, air passing out of the casing 2 into the chamber 1 and drifting back, laden with fine dust, along the walls and roof, to the opening leading to the chamber 8. From this chamber 8 the dust-laden air returns to the casing 2, entering the vortex within the ring of blades, and the dust which it carries is mingled with the material on which the blades are acting. The chamber 8 can be swung aside on a hinge 9, but is normally held against the chamber 1 by catches 10. Any suitable power mechanism may be employed for operating the distributor and rotary feeding device. Merely as an example I have illustrated a driving pulley 11, the shaft 13 of which actuates the feeder 5 by means of intermeshing gears 12 and 12^a. The centrifugal distributor is driven by power transmitting mechanism including a sprocket 14, a chain 16, a sprocket 15, a gear 17 and a pinion 17^a. The pulley 11 may be driven by any suitable prime mover or manually, depending upon the size of the machine.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. Apparatus for mixing and grading granular materials, comprising in combination a horizontal grading chamber having an outlet aperture at one end thereof, a centrifugal distributor, a casing for said distributor having a delivery aperture facing a portion of the distributor circumference and opening into said chamber, a feed aperture facing another portion of the distributor circumference, and an intake aperture facing one side of the distributor, and a box open to the outlet aperture of said chamber and to the intake aperture of said casing.

2. The method of mixing and grading granular materials, consisting in imparting circulation to a substantially closed system of gaseous medium in a path in all parts of which the medium is capable of carrying solid particles in suspension, and delivering the materials to the stream of gaseous medium at one part of said path, from which all the particles are carried by the gas in one direction and to which the finer particles are returned in the opposite direction.

EMILE SPRENGER.