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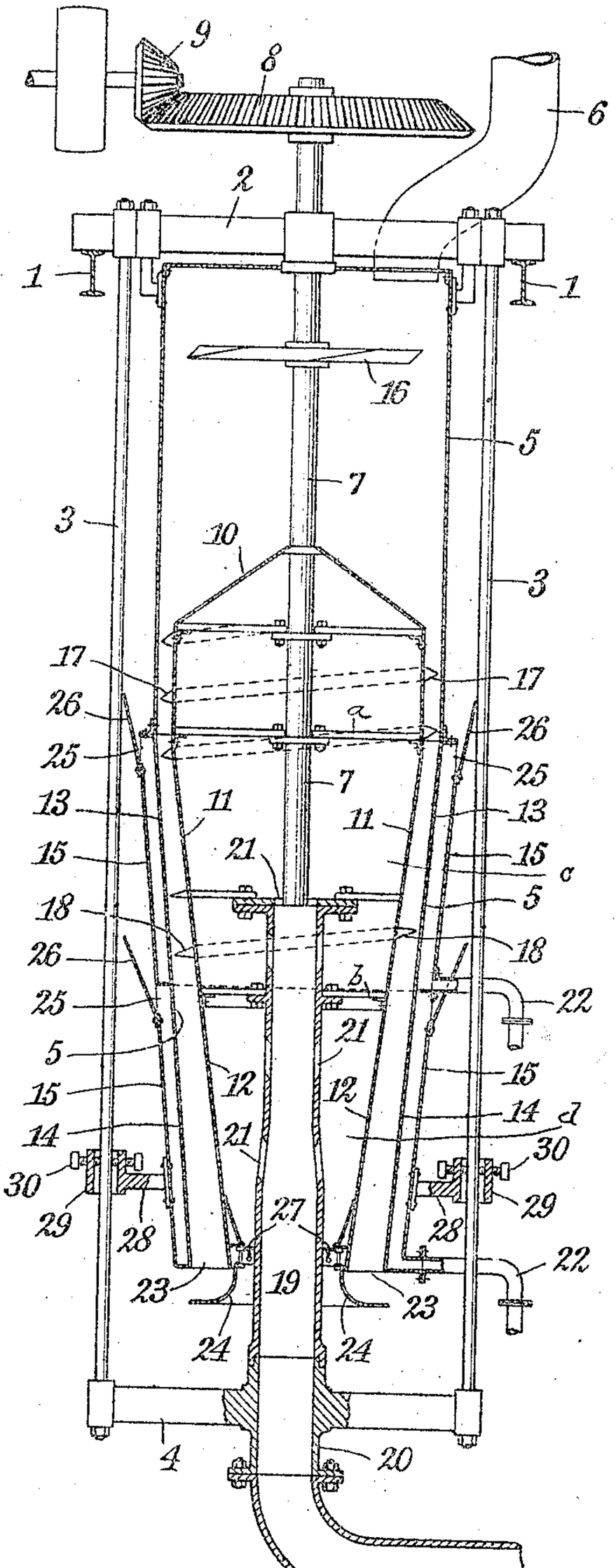

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To all whom it may concern:

Be it known that I, STEFAN VON GRABSKI, a subject of the German Emperor, and residing at Kruschwitz, Province of Posen, Empire of Germany, have invented certain new and useful Improvements in Separators, of which the following is a specification.

My invention relates to separators, and particularly to separators for separating liquid from solid materials.

For separating liquid from solid materials apparatus has been known heretofore, in which the material is conveyed between porous or reticulated walls, the material being generally fed by a screw conveyer. In the well-known devices of this kind suction acts in the casing which surrounds the perforated cylinders and said casing is generally divided into several compartments, so that the liquid constituents of the material are sucked through the perforated walls and conveyed from the casing, whereas the solid constituents remain between the perforated walls and are finally conducted away separately. Now whereas in this known constructional form of the device the solid material obtained contains considerable quantities of liquid constituents, an important object of my invention is to provide a separator from which dry or almost dry material is obtained, by far the largest portion of all the liquid constituents being separated; in contradistinction to known devices of this kind, I separate the liquid constituents from the solid under the pressure of air which is driven in jets through the perforated casings from within or from without, so that the liquid constituents are separated and carried away mechanically by these jets of air and pass through the perforated walls to the outer casing which is preferably likewise subdivided and are conducted hence, whereas the solid constituents leave the apparatus at the bottom end more or less dry, possibly after being treated several times, if necessary with air at different degrees of pressure. The employment of this flowing air supplied under pressure in the separator provided in well-known manner with porous, perforated or reticulated walls necessitates, however, a special formation of the device. When solely suction separates the liquid constituents the space or chamber between the perforated walls is of equal size from the inlet to the outlet. When flowing compressed air is employed however, such a construction is not admissible, because in all phases of working, even near the place of discharge, sufficient resistance must always be presented to the air in order that it may not flow uselessly and without doing work through the masses between the perforated walls. Now since in the last phases of the period of working the material is already liberated for the most part from its liquid constituents, this resistance necessary for the performance of work must be obtained in another manner, and, according to my invention, by the chamber or space between the perforated walls for the passage of the material being enlarged from the inlet toward the outlet, so that in proportion as liquid is removed from the material the cross-section of the material is increased and a resistance approximately equal in all the phases is offered to the passage of the air. This resistance may be different, however, particularly when air of different degrees of pressure is employed.

In order that my invention may be clearly understood I will now explain the same with reference to the accompanying drawing in which one constructional form is represented in elevation, partly in section, by way of example.

Referring to the drawing, girders 1 carry a cross-bar 2 connected by rods 3 with a cross-bar 4, so that a firm frame is made for supporting the entire separator. This comprises a fixed cylinder or casing 5, carried by the cross-bar 2, and the material, *e. g.* saccharine material, is supplied through a pipe 6 for example to this cylinder. In this cylinder is arranged an axle 7 which is rotated slowly by means of gear-wheels 8, 9. On the axle is a casing or inner cylinder 10 which participates in its rotation and at the parts 11, 12 is perforated. This inner rotary cylinder is preferably divided by a partition or partitions *a b* into separate chambers *c d* and the perforations 11 open from the chamber *c* and the perforations 12 open from the chamber *d*. The parts 13, 14 of the outer cylinder 5 opposite these perforated parts are perforated and surrounded by another stationary casing or outermost cylinder 15. Between the perforated walls 11 and 13 and 12 and 14 is an annular space or chamber, through which the mass introduced at the top end of the cylinder 5 is fed. For feeding this mass and particularly for regulating the rate at which the machine works end-

less screw-like conveyer-bodies are arranged on the axle 7. Such a body 16 is attached to the upper part of the axle, another 17 is on the upper, non-perforated portion of the inner casing 10 and a third 18 is arranged on the non-perforated wall between the two perforated walls 11 and 12. Since these endless screw-like conveyer bodies or conveyers, particularly 17 and 18, extend almost to the periphery of the cylinder 5 the material is substantially fed only according as the axle 7 is rotated.

At its bottom end the axle is attached to a pipe 19 which participates in the rotation of the axle and constitutes a part thereof. This pipe is in open relation with a stationary pipe 20 integral with the cross-bar 4 and is provided with holes or openings 21. Compressed air is admitted through the pipe 20 and can flow through holes 21 into the interior of the revoluble casing 10.

My improved separator operates as follows: The material supplied through pipe 6 passes into casing 5 and is fed downwardly by the blade 16 and the conveyers 17, 18 at the velocity desired at any time and passes into the space or chamber between the perforated walls 11, 13, and 12, 14. Since the interior of the revoluble casing 10 is filled with compressed air, for example, and this can normally only escape through the perforated walls 11, 13 and 12, 14, and as this path is more or less blocked by the material located between these walls, the compressed air can only pass outwardly if it carries with it the liquid constituents of the material, whereby these constituents arrive into the outermost casing 15 surrounding the perforated walls 13, 14, whereas the solid constituents, *e. g.* sugar crystals, which cannot pass through the perforated walls 11, 13, 12, 14, remain in the space between these walls and are pushed further downward under the influence of the conveyers, so that the compressed air flowing through the perforated walls constantly meets with new surfaces of the material and this is entirely liberated from any adhering liquid, *e. g.* molasses.

The liquid collected in the casing 15 is drawn off through pipe 22. The solid constituents, *e. g.* sugar crystals, on the contrary, descend between the perforated walls and finally pass out at 23 at the bottom of casing 10. In order that the sugar crystals or the solid constituents of the material can leave the apparatus only in proportion to the rate of working controlled by the conveyers the outlets 23 are partially covered by an outwardly bent, adjustably arranged, circular metal plate 24 in such manner that this plate or cover acts as a support for the column of solid constituents over it and consequently prevents their falling out directly.

In the constructional example represented in the drawing a twofold treatment of the material, *e. g.* sugar crystals, is intended by the superposed arrangement of the perforated walls 11, 12, and 13, 14. When the material enters into the space or chamber between the upper perforated walls 11, 13 it still has its full percentage of molasses, whereas between the lower perforated walls 12, 14, the molasses is to a very great extent separated from the sugar crystals so that these situated between the perforated walls 12, 14 have a greater porosity. Now in order that the compressed air supplied through the common pipe 19 does not flow exclusively through the perforated walls 12, 14, but to a like extent through the perforated walls 11, 13, the space or chamber inclosed by the perforated walls of the casings 5 and 10 is enlarged toward the place of discharge, so that by enlarging the radial depth of the material the permeability for the compressed air is equalized. It may, however, be preferable to make within the casing 10 two or more separated compartments, of which each is provided with a perforated wall and has a special air supply pipe, when compressed air of different degrees of pressure can be employed. The compressed air passing through the perforated walls and into the outermost casing 15 can escape from this through apertures 25. Preferably these apertures are provided with shields or a curb 26 so that any particles of liquid or molasses carried away are caught and possibly returned into the casing 15.

The small quantity of liquid which possibly flows down the inside of the perforated walls 11 and 12 is collected in the lower part of casing 10 and can here be run off through a closure 27 influenced by hand or automatically. For exactly adjusting the outermost casing 15 and the perforated walls 13, 14, particularly with a view to preventing the conveyers 17, 18 rubbing or grinding too severely at the perforated walls, the casing 15 is provided with brackets or arms 28 which surround the rod 3 with a sleeve 29. The casings 15 and 5 can then be adjusted sufficiently by means of screws 30, of which four are preferably arranged at each side, in order to remove the mentioned drawback.

In the event of a plurality of compressed air supply pipes being necessary when several compartments are provided in the casing 10, these pipes will preferably be arranged concentrically, or side by side however, and be surrounded by a common pipe attached to the axle 7, the compressed air being enabled to pass through suitably arranged apertures to the various compartments.

In the above description and in the drawing it has been supposed that the compressed air admitted through the pipe 20 completely fills the space in the casing 10 or each com-

partment in the same. The separator may, however, be made by providing annular tubes, the diameter of which is almost equal to the diameter of the appertaining perforated wall, and possessing at their outer peripheries simple holes or nozzles which, owing to the connection with the compressed air supply pipe, enable the compressed air to emit in fine jets directly against the perforated walls. In the latter instance the employment of several degrees of pressure is possible without providing special compartments in the casing 10. Instead of employing compressed air or other propellant, it is to be understood that in all cases suction may be employed, air being sucked away within or without by a suitable device. Likewise, it is by no means necessary that the compressed air be supplied only from below, as is supposed in the separator illustrated, but on the contrary this may take place from above or from above and below, without departing from the spirit and scope of my invention. Finally the air sucked away or the compressed air may be heated before it enters the machine, in order more or less to dry the solid material remaining between the perforated walls, besides separating the liquid constituents, which may be of importance, for example, when depriving peat of water attaching to it.

The same device can also be used for drying lime-mud such as remains behind in somewhat large quantities in the carbonation process in sugar works. In this event also the mud would be conveyed between perforated walls and the compressed air entering from without or within would preferably be heated previously. If necessary, instead of air hot gases or furnaces and the like could be employed, the water contained in the mud being principally vaporized by the heat of the medium and the material being thus dried.

I claim:

1. A separator for separating liquid from sugar or other solid material comprising a hollow outer cylinder provided with an inlet for the material to be treated and with fine openings in its side wall for the passage of liquid, a hollow inner cylinder disposed in said outer cylinder and forming an annular chamber between them, said inner cylinder being provided with fine openings in its side wall opposite the openings in said outer cylinder; said cylinders being so shaped relatively that said annular chamber is gradually enlarged toward its delivery end, means for forcing the material through said annular chamber, means for rotating one of said cylinders and a pipe for supplying air under pressure to said inner cylinder.

2. A separator for separating liquid from sugar or other solid material comprising a hollow outer cylinder provided with an inlet for the material to be treated and with fine openings in its side wall for the passage of liquid, a hollow inner cylinder disposed in said outer cylinder and forming an annular chamber between them, said inner cylinder being provided with fine openings in its side wall opposite the openings in said outer cylinder, said cylinders being so shaped relatively that said annular chamber is gradually enlarged toward its delivery end, means for forcing the material through said annular chamber, means for rotating one of said cylinders, a pipe for supplying air under pressure to said inner cylinder and an outermost cylinder surrounding said cylinders for receiving the liquid blown through the walls of the outer cylinder.

3. A separator for separating liquid from sugar or other solid material comprising a hollow outer cylinder provided with an inlet for the material to be treated and with fine openings in its side wall for the passage of liquid, a hollow inner cylinder disposed in said outer cylinder and forming an annular chamber between them, said inner cylinder being divided into compartments and provided with fine openings in its side wall opposite the openings in said outer cylinder; said cylinders being so shaped relatively that said annular chamber is gradually enlarged toward its delivery end, means for forcing the material through said annular chamber, means for rotating one of said cylinders and a pipe for supplying air under pressure to the compartments of said inner cylinder.

4. The combination of a frame, a rotary shaft supported in said frame and comprising in part a pipe provided with lateral openings, a pipe connected with said hollow shaft for supplying air under pressure, a hollow rotary cylinder attached to said shaft and provided with fine openings in its side wall, a perforated stationary cylinder surrounding said rotary cylinder and forming an annular chamber between them, means for supplying material to said stationary cylinder, a spiral conveyer on the exterior of said rotary cylinder for forcing said material through said annular chamber, means for collecting the liquid driven through the wall of the outer cylinder, and means for rotating said rotary cylinder.

5. A separator for separating liquid from sugar or other solid material comprising a hollow outer cylinder provided with an inlet for the material to be treated and with fine openings in its side wall for the passage of liquid, a hollow inner cylinder disposed in said outer cylinder and forming an annular chamber between them, said inner cylinder being provided with fine openings in its side wall opposite the openings in said outer cylinder; a plate disposed below the opening of said annular chamber and adapted to serve as a support for the column of material in

said chamber, means for forcing the material through said annular chamber, means for rotating one of said cylinders and a pipe for supplying air under pressure to said inner cylinder.

6. A separator for separating liquid from sugar or other solid material comprising a hollow outer cylinder provided with an inlet for the material to be treated and with fine openings in its side wall for the passage of liquid, a hollow inner cylinder disposed in said outer cylinder and forming an annular chamber between them, said inner cylinder being provided with two sets of fine openings disposed at different heights in its side wall opposite the openings in said outer cylinder; means for supplying material to said outer cylinder, separate spiral conveyers disposed at different heights on the exterior of said inner cylinder between said sets of openings for forcing said material through said annular chamber, means for rotating one of said cylinders, and a pipe for supplying air under pressure to said inner cylinder.

7. The combination of a frame, a rotary perforated hollow shaft, a pipe connected with said hollow shaft for supplying air under pressure, a hollow rotary cylinder attached to said shaft and provided with fine openings in its side wall, a perforated stationary cylinder surrounding said rotary cylinder and forming an annular chamber between them, means for supplying material to said stationary cylinder, a blade on said shaft within said stationary cylinder above said rotary cylinder, a spiral conveyer on the exterior of said rotary cylinder, and means for rotating one of said cylinders.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

STEFAN VON GRABSKI.

Witnesses:

HENRY HASPER,

WOLDEMAR HAUPT.