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CENTRIFUGE

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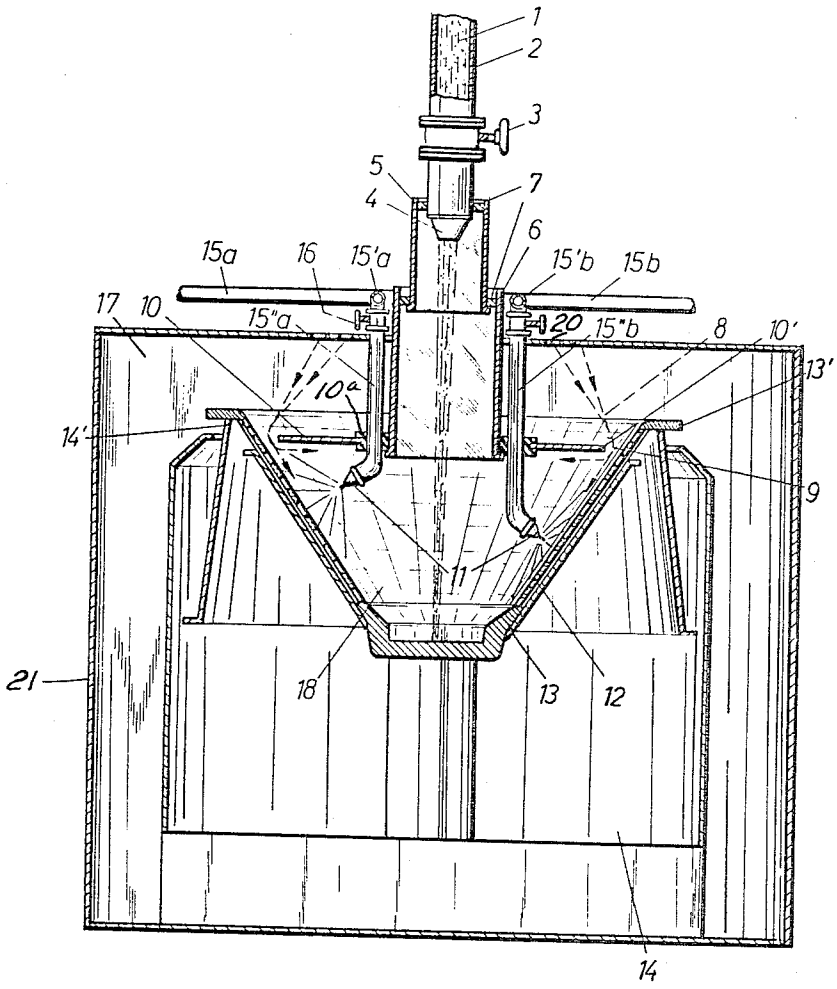

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CENTRIFUGE

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This invention relates to a centrifuge and refers more particularly to a centrifuge used for the continuous separation of mixtures of solids and liquids, particularly sugar.

Prior art centrifuges of this type have a drum driven about a vertical axle, the drum extending outwardly upwards and having a closed bottom for the mixture being treated. Conduits for the mixtures as well as for the washing liquid are located above the drum. An inner wall extending up to the upper edge of the drum separates the interior thereof into two concentrical annular chambers, whereby the inner chamber receives the liquid separated from the mixture and flowing through special openings, while the outer chamber receives the solid particles passing over the edge of the drum.

Centrifuges of this type, particularly sugar centrifuges operating according to the so-called thin layer process, require that the solid particles be washed or coated during the treatment. The washing or coating liquid is transmitted to the drum through suitably located conduits and is sprayed through nozzles mounted upon the ends of the conduits, in the form of the finest mist upon the solid particles moving in a thin layer toward the upper edge of the drum. The purpose of this procedure is to limit the consumption of the washing liquid and to prevent extensive dissolving of the solid or sugar crystals. However, the use of the finely sprayed washing liquid causes drawbacks in the operation of the centrifuge which result in separated products of poorer quality. These drawbacks are produced essentially by the appearance of a rotating mist in the drum which is carried by air currents flowing outwardly from the interior and reaches the outer chamber over the upper drum edge along with solid particles moving upon the drum walls, whereupon the mist settles in the outer chamber.

Prior art centrifuges having conduits for the mixture which are located below the drum, also develop an outwardly directed air flow along conical drum surfaces, since outer air can penetrate centrally into the drum. This air flow draws moisture with it, and the moisture along with the separated solid particles penetrates into the outer chamber containing the solids.

Finally, in prior art there are centrifuging devices for the washing of sugar, wherein a transporting worm for the transportation of sugar is provided in a cylindrical drum with several conduits for the washing or coating liquid projecting into the upper portion thereof. In such constructions as well, outer air can freely flow into the central portions of the centrifuge drum, so that an air current is produced with flows in the same direction as the separated solid particles toward the upper edge of the drum and which carries a substantial amount of the liquid or moisture into the chamber wherein the solid particles are collected.

An object of the present invention is to provide a centrifuge for the continuous separation of mixtures of solids and liquids, particularly a sugar centrifuge, which does not have the drawbacks of prior art constructions.

Another object of the present invention is to provide a centrifuge of the described type which produces a perfect separation of the mixture.

Other objects of the present invention will become apparent in the course of the following specification.

The objects of the present invention may be realized by improving a prior art centrifuge of the described type by guiding the conduits for the mixture and the coating liquid through an air-tight drum cover the outer circumference of which extends close to the upper wall of hte drum, the cover and the drum wall forming a narrow annular slit for the passage of the solid particles as well as for the air current flowing in the opposite direction. This arrangement consisting of the simplest possible means, provides a centrifuge wherein no liquid particles or liquid mist can under any circumstances penetrate over the upper wall edge into the chamber for the solid particles. The air-tight drum cover makes it possible for air to penetrate into the interior of the drum only through the annular slit; the air leaves it along with the liquid passing through the drum openings and finally reaches the chamber wherein the liquid is collected. Thus a certain amount of under pressure is produced within the rotary drum which creates in the narrow annular slit for the passage of solids, a flow of air in the opposite direction, namely, from the outside toward the interior.

In accordance with a further feature of the present invention the air-tight drum cover comprises an annular sheet metal disc through which the conduits for the washing liquid extend and which is located directly below the upper edge of the drum, and a central cover pipe connected with the disc and extending upwardly to the feed pipe for the mixture. This construction results in a hood-like drum covering the centrally located cover pipe of which encloses on all sides the spray of the mixture being centrifuged which emerges from the feed pipe. The annular disc makes it possible for the current of air passing through the annular slit to flow horizontally toward the interior and to approach substantially spirally the drum axle. This will keep the sprayed water which may have been deposited upon the under surface of the metal sheet, away from the annular slit, so that any passage of the sprayed liquid through the annular slit is securely prevented. The diameter of the central cover pipe can be so selected that any condensation water which could be deposited thereon, can fall only as drops upon the bottom.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawing showing by way of example only, a preferred embodiment of the inventive idea.

The sole figure of the drawing illustrates diagrammatically and in section a centrifuge constructed in accordance with the principles of the present invention.

The sugar centrifuge shown in the drawing comprises a central pipe 2 for feeding a mixture consisting of sugar crystals and syrup. The pipe 2 carries a valve 3 by means of which the supply of the mixture can be conveniently regulated. The lower end of the pipe 2 carries a nozzle 4 through which the mixture can freely drop into the interior of the centrifuge. The nozzle 4 is enclosed by a tube 5 which is preferably made of a transparent material. The tube 5 is connected to another pipe 6. Sealing rings 7 are interposed between the tube 5 on the one hand, and the nozzle 4 and the pipe 6 on the other hand, to provide an air tight connection, so that no air can join the mixture being ejected. An annular cover disc 10 which may consist of sheet metal or of a transparent material, is fixed to the lower end of the pipe 6 by a flange 10*a*. The outer circumference 10' of the disc 10 is located close to the perforated wall 12 of the conical centrifuging drum 13. The drum 13 extends upwardly outwardly and is rotatable by any suitably means not shown in the drawings about its central vertical axis.

A narrow annular slit 9 is provided between the drum wall 12 and the outer circumference 10' of the disc 10 which is preferably located directly below the upper edge 13' of the drum. The width of the slit 9 should be only

such that the solid particles moving upwardly upon the rotating drum, will be able to pass through the slit without hindrance. The drum 13 is closed air-tightly at all its other sections by the central tube 5, the central pipe 6 as well as the cover disc 10.

The drum 13 has a closed mixture-receiving bottom and is enclosed by an inner wall 14' which extends to the upper drum edge 13'. The wall 14' forms a separation between two concentrical annular chambers 14 and 17 surrounding the drum. The inner chamber 14 receives the liquid separated from the mixture and flowing through the perforations of the wall 12 of the drum 13. The outer chamber 17 receives solid particles passing over the edge 13' of the drum. The solid particles are subjected to a washing or coating before they reach the chamber 17. Several spraying nozzles 11 are provided for that purpose within the inner chamber 18 of the drum 13. The nozzles 11 are connected with feed pipes 15''*a* and 15''*b* which are carried by the flange 10*a*. A washing liquid is fed through these pipes and is sprayed by the nozzles 11 in the form of a fine mist upon solid particles moving upon the drum wall 12. The liquid passes through the perforations in the wall 12 into the chamber 14 located below the wall. Air located inside the drum 13 will be taken along by the liquid so that a certain amount of underpressure is developed in the chamber 18. The air-tight seals of the tube 5, the pipe 6 and the disc 10 prevent the flow of air into the central portion of the interior of the drum; therefore, there is an inwardly directed flow of air through the openings 20 of the outer casing 21 and into annular slit 9 and the interior of the drum 13, as indicated by arrows 8 in the drawing. This flow of air prevents the flow of liquid or liquid mist along with the solid particles moving outwardly over the upper edge 13' of the drum. This arrangement provides a perfect separation of the liquid and solid particles.

The operation of the centrifuge is apparent from the above description.

If it is desired that the separated solid particles be particularly dry, the cover disc 10 may be made smaller and may be placed more deeply inside the drum 13 than the location shown in the drawing, so that approximately the upper quarter of the drum will remain available for the drying of the solid particles.

Usually only one washing medium is used, the washing liquid being transmitted through the pipe 15*a*, the annular conduit 15'*a*, and the pipe 15''*a* to the nozzle 11.

However, sometimes it is desirable to provide two or more washing media, possibly at different levels from the bottom of the centrifuge. In that case two or more conduits are required. By way of example, the drawing illustrates two pipes 15*a* and 15*b* which lead to nozzles 11 located at different heights from the bottom. By way of example, the lower nozzle or nozzles can spray hot syrup, while the upper nozzle or nozzles may spray water. Preferably, the pipes 15''*a* and 15''*b* are provided with valves 16 operated from the outside so as to regulate the supply of liquids used for spraying purposes.

It is apparent that the example described above has been given solely by way of exemplification and not by way of limitation and that it is subject to many variations and modifications without departing from the scope of the present invention. All such variations and modifications are to be included within the scope of the present invention.

What is claimed is:

1. A centrifuge comprising a central vertical pipe, a nozzle carried by the lower end of said pipe, a tube air-tightly enclosing said nozzle, a second pipe air-tightly connected to the lower end of said tube and extending below said tube, an annular cover disc fixed to the lower end of said second pipe, a rotary centrifuging drum having a perforated conical side wall and a closed bottom, said side wall enclosing and being uniformly spaced from the outer circumference of said disc to form an annular slit between said disc and said drum side wall, an inner wall forming an annular liquid-receiving chamber enclosing said drum and communicating with the perforations thereof, means forming an outer solids-receiving chamber enclosing said inner wall and communicating with said slit, at least one spraying nozzle extending into said drum for delivering a fine mist of wash liquid against the drum side wall, and means causing a flow of air through said annular slit in a direction towards the closed bottom of the drum for preventing the wash liquid mist from flowing upwardly and out of the drum through the annular slit.

2. A centrifuge in accordance with claim 1, further comprising a feed pipe connected with said spraying nozzle and extending through said disc, and a valve carried by said feed pipe.

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