

UNITED STATES PATENT OFFICE

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ROTARY HEAT EXCHANGER

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1 Claim. (Cl. 257—55)

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The present invention relates to improvements in rotatable drums for treatment, such as drying, heating, dry-distillation or cooling; of piece-shaped material of different kinds by means of heated or cooled loose balls which are brought into direct contact with the material to be treated during the rotation of the drum.

The invention will be readily understood as this description proceeds, reference being made to the accompanying drawings in which:

Fig. 1 shows an axial sectional elevation through a rotatable drum for treatment of materials of different kinds by means of heat carrying balls in counter-current flow through the drum; and

Fig. 2 shows an axial sectional elevation through one end of a rotatable drum of the same kind as in Fig. 1, and details of a device for tightening against air penetration or gas leakage.

In the drawing numeral 1 designates a cylindrical drum for heat treatment, rotatable upon the roller supports 6, around the horizontal axis $x-x$; 2 and 3 designate centrally arranged, stationary parts of the drum end walls, said parts forming supports for inlet conduits 4 and 11 and outlet conduits 5 and 12 respectively for heat carrying balls and for material to be treated. The support 2 also has an outlet conduit 18 for steam or gas developed during the heat treatment process.

In Fig. 1 is illustrated how the heat carrying balls are separated from the material to be treated. Balls 9 are charged into the drum through the inlet conduit 4, and due to the rotation of the drum the balls are there mixed with the material to be treated 10. Secured to the inside circumference of the drum are one or more grate-like catching members 7, the openings of said catching members having such a size that fine-grained material in the drum can pass through while the balls will be caught and pushed ahead of the catching member. Each of said catching members has such an inclination or shape that the balls cannot roll off before the catching member has reached, due to the rotation of the drum, a certain point in the upper half of the drum. Beginning to roll off at said point, the balls fall into a funnel 8 and are discharged through the outlet conduit 5.

In Fig. 1 is also illustrated how the material to be treated, said material supposed to be more or less fine-grained, is discharged from the drum. The material 10 is charged to the drum through the inlet conduit 11, and due to the rotation of the drum, the material is there mixed with the

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heat carrying balls. In the circumference of the drum, adjacent a partition wall 16, are screen openings 13 having a size that allows the fine-grained material but not the balls to slip through.

The material that slips through is collected in a widened section of the drum 17 from which it passes into pockets 15 located in a more widened section of the drum. Said pockets are so shaped that the material caught in one is lifted, and cannot pour out before the pocket has reached a certain point in the upper half of the drum, at which point the material begins to pour out, and falls into a funnel 14, and is discharged through the outlet conduit 12. The arrow 19 shows the direction of material flow, and the arrow 20 the direction of flow of heat carrying balls.

In Fig. 2, numeral 3 designates a centrally arranged stationary support in an end wall of a heat treatment drum, said part together with a neck 21 fitted to the movable part of the end wall of the drum forming a labyrinth for preventing air penetration or gas leakage. By a steam conduit 22 the labyrinth box can be set under steam pressure for improved tightening. The gas and steam outlet conduit is supposed to be arranged in the support 3 instead of in the support 2 as shown in Fig. 1.

30 What is claimed is:

A device for the treatment of piece-shaped material by means of balls which are brought into direct contact with the material during its operation; said device comprising a cylindrical drum rotating about a substantially horizontal axis, an annular end wall defining a central opening at each of the opposite ends of said drum, a fixed support fitting into the central opening of each of said end walls, a stationary inlet conduit for the balls extending into said drum through one of said fixed supports, an upwardly open stationary outlet conduit for the balls extending out of said drum through the other of said stationary supports, at least one grate-like catching member secured to and projecting inwardly from the inner surface of the side wall of said drum adjacent the end wall of the latter into which said other stationary support fits, the openings of said catching member having such size in relation to the size of the balls and the size of the pieces of material that, when said catching member, during rotation of said drum, is moved through the balls and material, the balls are prevented from passing through said openings while the material passes freely through

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said openings, said catching member being inclined away from the radial in a direction opposite to the rotation of said drum so that during the rotation of the latter the balls are first lifted and then discharged from the catching member into said upwardly open outlet conduit when said catching member is disposed substantially above the latter, a stationary inlet conduit for the material leading into said drum through said other stationary support, a transverse partition wall arranged in said drum adjacent to and spaced from the end wall into which said one stationary support fits, the portion of the side wall between said partition and the adjacent end wall having a diameter larger than the remainder thereof, an upwardly open outlet conduit for the material extending out of the section of the drum between said partition and said adjacent end wall and through said one stationary support, an outer shell of a diameter less than that of said large diameter portion of the side wall extending around and spaced from said side wall of the drum and opening endwise through said

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partition into said section of the drum between said partition and said adjacent end wall, openings in said side wall communicating radially with the space enclosed by said outer shell for passing material into said space, and pocket forming members between said partition and said adjacent end wall and secured to the side wall for raising material passed through said openings into said space and hence into said drum section and discharging such material into said outlet conduit for the material.

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