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[54] **ROTARY DRUM FOR THE HEAT TREATMENT OF STRONGLY EROSIVE MATERIAL**

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[51] **Int. Cl.** **F27b 7/14**

[58] **Field of Search** .... 432/103, 106, 108, 110, 432/118; 259/3, 81 R

[56] **References Cited**

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[57] **ABSTRACT**

A plurality of lifting blades comprising scoop edges and flat feet are replaceably affixed to the internal drum wall. A pair of wear plates lining the internal drum wall have opposed edges parallel to the drum axis that are spaced apart and lie under each lifting blade foot. A rib extending from the underside of each lifting blade foot, parallel to the drum axis, lies between the opposed edges of the pair of wear plates and abuts against the internal drum wall.

10 Claims, 2 Drawing Figures

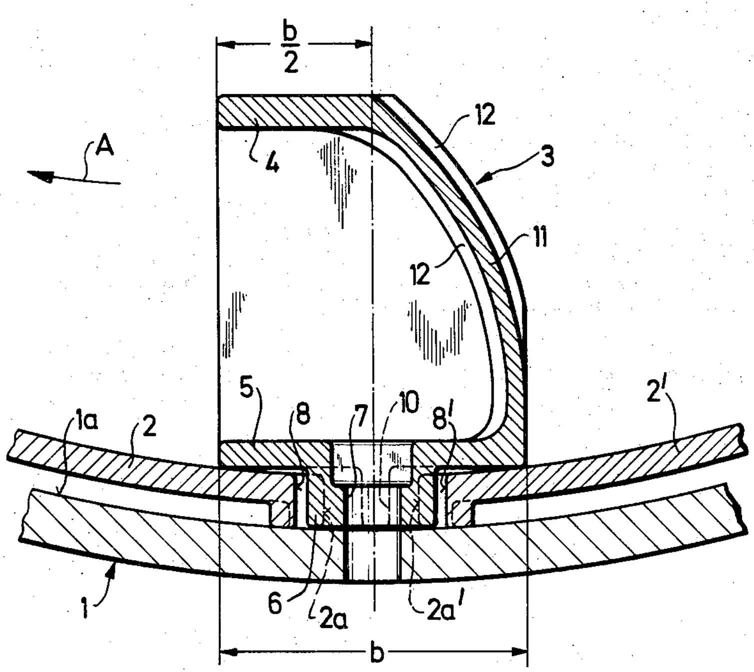


Fig. 1

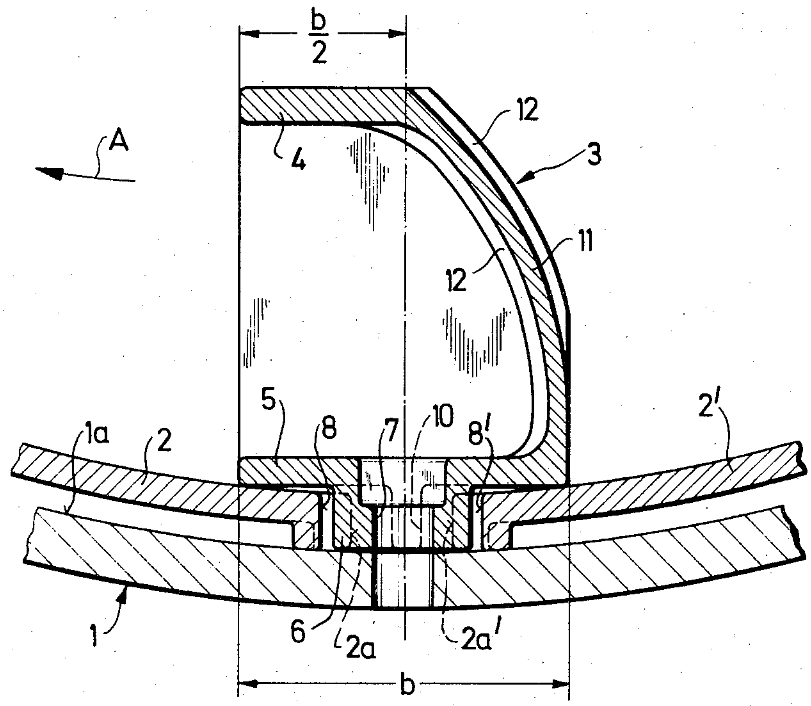
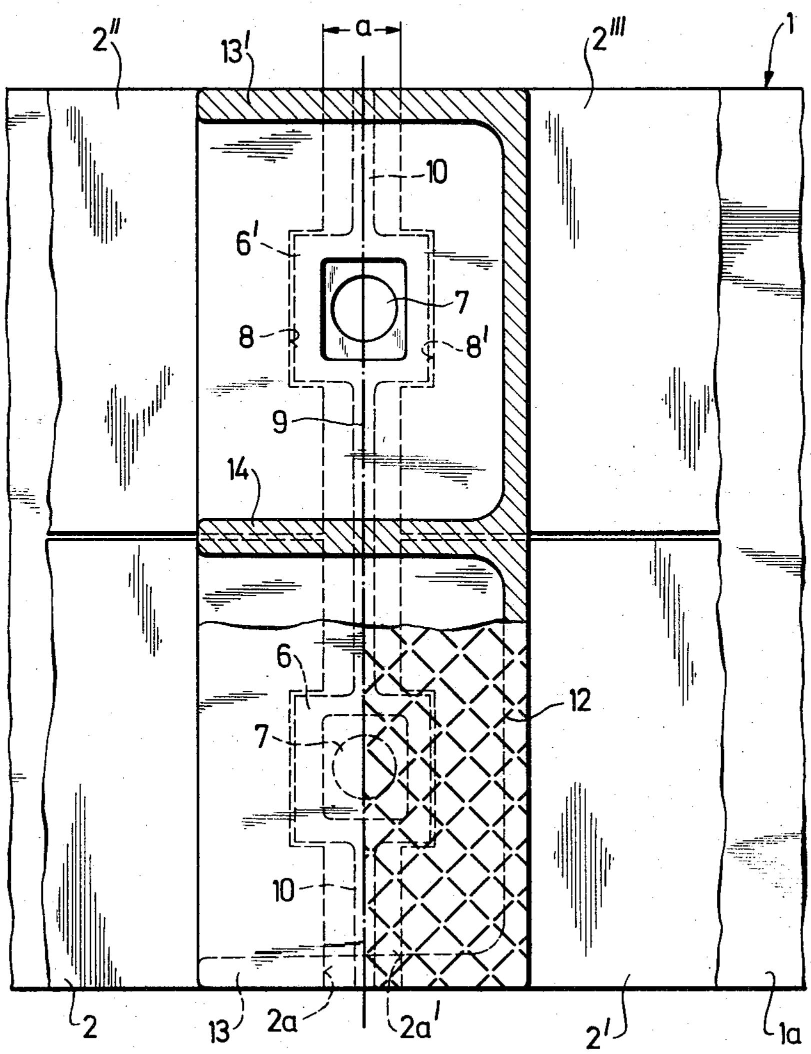


Fig. 2



ROTARY DRUM FOR THE HEAT TREATMENT OF STRONGLY EROSIVE MATERIAL

BACKGROUND OF THE INVENTION

This invention relates to a rotary drum for the heat treatment of strongly erosive material, with a number of lifting blades replaceably affixed to the internal drum wall and comprising scoop edges, wherein the flat feet of the blades on the internal drum wall also fix in place adjacent wear plates which extend between the lifting blades and have recesses for correspondingly shaped projections which extend from the lifting blade feet and lie against the internal drum wall.

During operation, rotary drums of this type are traversed by a hot gas stream, intended to produce the required heat treatment by heat exchange between the stream of gas and the material being treated. In order to produce intimate contact between the gas and the individual particles of material it is important that the material being treated be fed through the drum in as loose a condition as possible. For this reason the material is raised by the lifting blades and conveyed axially through the drum in the form of a cloud.

Because of their constant contact with the erosive material, the lifting blades and their interposed wear plates are subjected to more or less intensive wear, so that these parts have to be replaced from time to time.

Rotary drums are known wherein the lifting blades are provided with integral feet so formed that in their extension in the peripheral direction of the drum these feet at the same time constitute the wear plates. A serious defect of these known constructions is that in practice the wear plates are not subject to such heavy erosion or wear as the actual lifting blades, but when replacement of the lifting blades becomes necessary, the wear plates have to be replaced with them at the same time, which represents a considerable waste of material.

A rotary drum of the type initially mentioned has also been developed in which separate lifting blades and separate wear plates are provided. In this construction the wear plates have in their central area an aperture through which projects a correspondingly shaped portion of a lifting blade foot, so that when the lifting blade foot, which in this case is flat, is affixed to the internal drum wall, the corresponding wear plate is affixed at the same time. With this construction the lifting blade can be replaced independently of the wear plates. Because of the flat shape of their feet, the lifting blades are largely independent of the diameter of the drum.

SUMMARY OF THE INVENTION

The invention is mainly directed to the problem of providing a rotary drum whereby the last-mentioned construction can be still further improved.

According to the invention this problem is solved in that opposite each other under each blade foot and spaced apart are the ends of two wear plates which are adjacent each other in the peripheral direction of the drum, and in that at the underside of each blade foot there is provided a rib between the said plate ends, running generally parallel to the longitudinal axis of the drum and abutting against the internal drum wall.

The disposition and hence the fixation of the ends of wear plates adjacent each other in the peripheral direction, beneath the blade foot in accordance with the invention provides an extremely simple method of fixation of the wear plates on the internal drum wall. In the installation and removal of wear plates it is very often sufficient merely to loosen the blade feet, so that the wear plates, with their corresponding ends, need only be slid under the blade feet, and hence complete removal of the lifting blades is not necessary in this case.

A further advantage of the rotary drum construction in accordance with the invention lies in the provision of the rib under the blade foot. Since with the disposition of flat blade feet on the curved wear plates there may be some loss of seal through which can pass very fine material being treated, the ribs ensure that this fine material which has passed through cannot reach below the lifting blade or under its foot, which would then result in a movement opposite to the normal direction of material movement, i.e. in the absence of the ribs this fine material would flow back in an undesired manner.

Again in the construction provided by the present invention the lifting blades are in their shape and size largely independent of the diameter of the rotary drum being used, so that the stocking of spare lifting blades for a number of rotary drums of differing diameters is considerably simplified.

For lifting blades whose longitudinal axis is generally parallel with the longitudinal axis of the drum, and which depending on their length have one or more projections on the blade foot, it is desirable for the rib to extend over the whole length of the blade foot in the area of the central longitudinal plane thereof, the rib being made integral with the projection or projections.

A further beneficial form of the invention is produced when at its rear longitudinal side the foot of each lifting blade turns into a blade wall bent in the direction of rotation of the drum, said blade wall being immediately adjacent the blade scoop edge pointing in the direction of drum rotation, and when the scoop edge lies generally parallel with the lifting blade foot. A lifting blade of this form can be made by the shell moulding process, wherein the metal model is covered with a plastic coating. As compared with the usual sand moulding process this produces greater surface hardness and greater dimensional accuracy, which are of particular advantage for the highly stressed scoop edge; in this method of manufacture the formation of shrinkage holes is also considerably reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-section through a rotary drum as provided by the invention, showing a lifting blade, and wear plates disposed therebelow;

FIG. 2 is a partly sectioned plan view of the lifting blade and wear plates of FIG. 1.

DESCRIPTION OF THE PREFERRED ENBODIMENT

The rotary drum **1**, of which only a small part is shown in cross-section in FIG. **1**, rotates in the direction of arrow A about its longitudinal axis (not shown). This rotary drum **1** is used especially for the heat treatment of material which has strongly erosive properties. For this reason and as a protection against excessive thermal stresses the internal drum wall **1***a* is provided with generally identically formed wear plates 2, 2′, 2″, 2‴ which lie against the internal drum wall and are matched to the internal diameter of rotary drum 1. The internal drum wall 1*a* is also provided with a number of blades 3 (of which only one is shown, to simplify the representation) which are spaced at intervals in the peripheral direction of the drum 1 and are replaceably affixed to the internal drum wall 1*a* so that their scoop edges point in the direction of drum rotation (arrow A). The lifting blades 3 have a straight flat foot 5, and by means of a reinforcing projection 6, 6′ lie against the internal drum wall 1*a*. The individual lifting blades 3 can for example be releasably affixed to the drum 1 with the aid of bolts (not shown). For this purpose each reinforcing projection 6, 6′ has a corresponding bore 7.

In order that the reinforcing projections 6, 6′ of the lifting blades may lie against the internal drum wall 1*a*, the wear plates 2, 2′, 2″, 2‴ are provided with corresponding recesses 8, 8′ through which project the projections 6, 6′. As shown especially in FIG. 1, the fixation of the lifting blades 3 also provides fixation of the wear plates.

If FIG. 2 is now considered, one may note that beneath each blade foot 5 lie opposite each other, and spaced apart by a distance *a*, the ends 2*a*, 2*a*′ of wear plates 2, 2′ which are adjacent in the direction of the drum periphery, and that the apertures 8, 8′ of the wear plates are open at the end. It is sufficient if these recesses 8, 8′ are made merely deep enough for the wear plates to have sufficient lateral hold to prevent their displacement in the direction of the lifting blade longitudinal axis 9. In this connection it should also be noted that depending on the length of the blade one or more reinforcing projections 6, 6′ can be provided on the underside of the blade foot 5, and that in the longitudinal direction of the lifting blade 3 a number of wear plates can be affixed beneath each blade foot 5. In the embodiment shown (FIG. 2) the lifting blade foot 5 has two reinforcing projections 6, 6′, and the ends of a total of four wear plates 2, 2′, 2″ and 2‴ are affixed below the blade foot 5; the wear plates 2, 2″ and 2′, 2‴ which are adjacent in the longitudinal direction of blade 3 lie closely against each other, and each pair of ends (e.g. 2*a* and 2*a*′) which are adjacent in the drum periphery direction have a corresponding reinforcing projection 6 or 6′.

At the underside of each lifting blade foot there is also provided a rib 10 located between the two wear plate ends and running generally parallel to the longitudinal axis of the drum, the rib lying against the internal drum wall 1*a*. This rib 10 prevents any fine material getting through below the blades 3 during operation of the drum 1, and travelling back against the general feed direction as the drum moves.

This rib extends over the entire length of the lifting blade foot 5 in the area of the longitudinal central plane thereof, and is integral with the reinforcing projections 6, 6′.

The wear plates 2, 2′, 2″ and 2‴ need only be loosely laid below the blade foot 5 to provide adequate attachment to drum wall 1*a*. The other ends of the wear plates are naturally also fixed in like manner below corresponding lifting blades 3, adjacent to ends of other wear plates peripherally of the drum.

As may also be seen from FIG. 1, the foot 5 of the lifting blade 3 at its rear longitudinal side becomes a blade wall 11, curved in the direction of drum rotation (arrow A), which is immediately connected to the scoop edge 4 of blade 3, pointing in the direction of drum rotation. The scoop edge 4 thus lies generally parallel with the lifting blade foot 5. This construction of the lifting blade 3 enables it to be made by the shell moulding process, so that better dimensional accuracy and greater surface hardness can be obtained, especially for the highly stressed scoop edge, and so that also the formation of shrinkage cavities is almost precluded.

Measured in the drum periphery direction, the width of the scoop edge 4 is preferably about half the width of the blade foot 5, with the leading edges of scoop edge 4 and of blade foot 5, in the drum rotation direction, lying one vertically above the other.

Improved resistance to wear is also provided if the scoop edge 4 has a greater thickness than the curved blade wall 11.

The curved blade wall 11 acquires increased rigidity if its surface, as shown, has on the inside and outside integrally formed profilings 12.

The lifting blades 3 can be made with open sides. For effective operation and improved life of the lifting blades 3 it will, however, generally be desirable that the blades be bounded by side walls 13, 13′. To improve their stability the lifting blades 3 can also have at least one reinforcing intermediate wall 14 between the side walls 13, 13′.

What we claim is:

1. A rotary drum for the heat treatment of strongly erosive material, comprising a plurality of wear plates lining the internal drum wall, which are arranged around the circumference of the drum, and a plurality of lifting blades each of which is replaceably secured to the internal drum wall between the opposing ends of two adjacent wear plates, and each of which has a foot that extends above both adjacent wear plates to retain the wear plates in position and is provided with a rib that extends parallel to the drum axis and abuts against the internal drum wall between the adjacent wear plates, to prevent fine material from flowing backward under the lifting blade.

2. A rotary drum according to claim 1 wherein each lifting blade foot has at least one projection secured to the internal drum wall, with which the rib is integral, and which lies in two opposed recesses in the opposed edges of two wear plates.

3. A rotary drum according to claim 1 wherein at least two pairs of wear plates have opposed edges parallel to the drum axis that are spaced apart and lie under each lifting blade foot.

4. A rotary drum according to claim 1 wherein a blade wall, curved in the direction of drum rotation, is formed integral with the trailing edge of each lifting blade foot and also integral with a scoop edge of the lifting blade, extending in the direction of drum rotation.

5. A rotary drum according to claim 4 wherein the scoop edge is generally parallel with the lifting blade foot.

6. A rotary drum according to claim 5 wherein the leading sides of the scoop edge and the lifting blade foot lie substantially in the same radial plane, but the width of the scoop edge is only about half the width of the lifting blade foot, measured in the direction of drum rotation.

7. A rotary drum according to claim **4** wherein the thickness of the scoop edge is substantially greater than the thickness of the curved blade wall.

8. A rotary drum according to claim **4** wherein the curved blade wall has profilings integrally formed on its surface.

9. A rotary drum according to claim **1** wherein the

lifting blades have side walls substantially perpendicular to the drum axis.

10. A rotary drum according to claim **9** wherein each lifting blade has, between two side walls, at least one intermediate reinforcing wall perpendicular to the drum axis.

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