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Whitaker

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[54] **ELONGATED ROTARY DRUM SHELL CONSTRUCTION**

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[52] **U.S. Cl.** **432/103;** 432/105; 165/81; 165/169; 432/251

[51] **Int. Cl.**[2] **F27B 7/00**

[58] **Field of Search** 432/60, 228, 103, 105, 432/112, 245, 251, 118, 104; 165/81, 89, 169; 110/14

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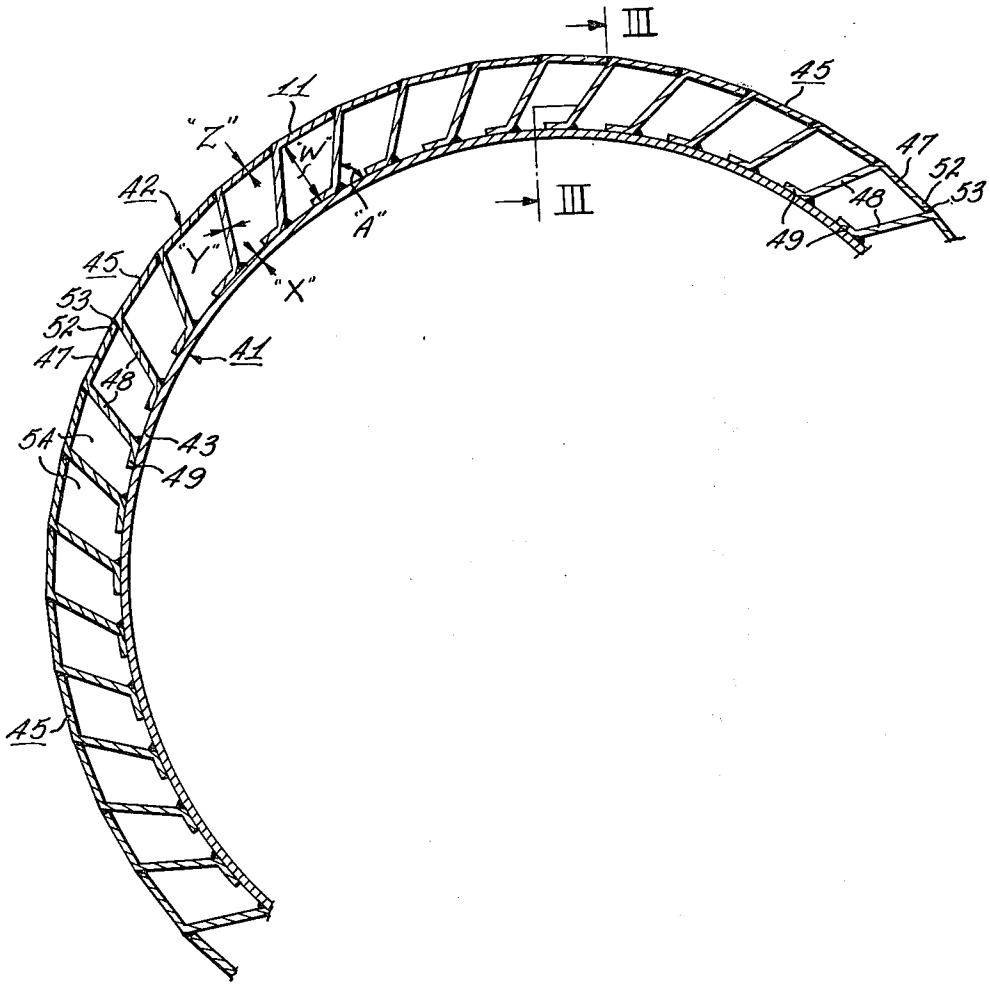
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[57] **ABSTRACT**

A cylindrical rotary drum arrangement which provides adequate longitudinal strength for a given weight and permits the inner shell to expand relative to the outer shell by utilizing angular separators between the inner and outer shells. The angular separators act as springs between the outer and inner shells permitting relative rotation between the shells to occur and also permit expansion of the inner shell relative to the outer shell.

6 Claims, 4 Drawing Figures



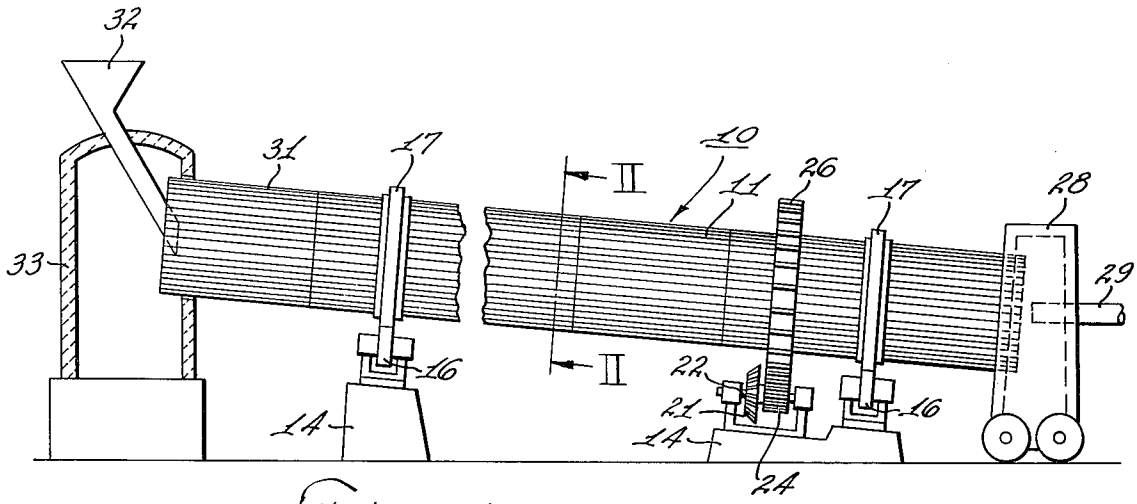


Fig.-1

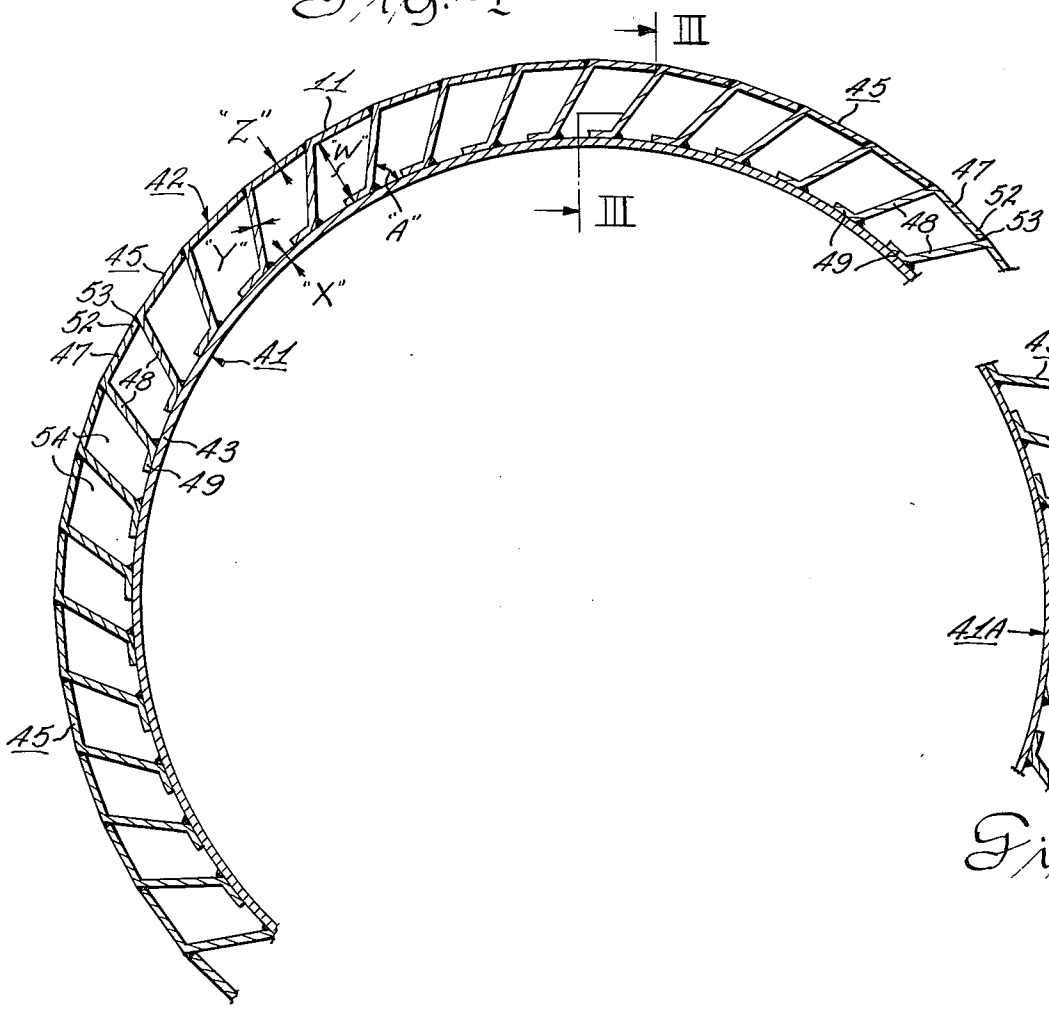


Fig.2

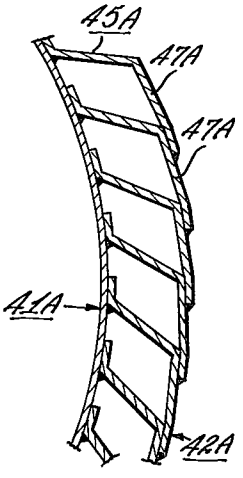


Fig.4

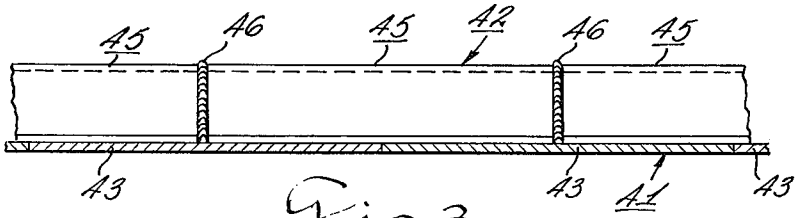


Fig.3

ELONGATED ROTARY DRUM SHELL CONSTRUCTION

BACKGROUND OF THE INVENTION

The present invention relates to rotary drums, especially those used extensively in kilns, mills, coolers, dryers, mixing drums, etc., wherein large equipment and/or special heat transfers are required.

In the past it has been customary to construct large rotary drums of relatively thick plate so that sufficient structural strength could be provided to support both the weight of the drum itself and also the weight of the material being processed. In addition, the plate of which these rotary drums were constructed had to be sufficiently heavy to withstand the stress caused by the heat within the drum.

SUMMARY OF THE INVENTION

The present invention is an improved construction for large elongated cylindrical rotary drums. A thinner inner and outer shell arrangement is provided utilizing angular separators between the shells which act as springs. The arrangement increases the longitudinal strength for a given weight and permits the inner shell to expand relative to the outer shell. The angular separators between the shells act as springs so that relative rotation between the outer and inner shells can occur. The arrangement permits the use of thinner materials for a given heat flow condition. Because of the thinness of the inner shell, the temperature gradient across the shell can be increased without undue thermal shock. The open areas or channels between the inner and outer shells can be utilized for heating, cooling, flow passages and also for noise abatement.

It is a general object of the present invention to provide an improved construction arrangement for large elongated cylindrical rotary drums.

A further object of the present invention is to provide an improved cylindrical rotary drum having an improved arrangement of the inner and outer shells.

A still further object of the present invention is to provide an improved cylindrical rotary drum having inner and outer shells constructed in a manner to provide for relative rotation of the outer shell relative to the inner shell.

Yet another object of the present invention is to provide an improved cylindrical rotary drum having inner and outer shells separated by angular separators that act as springs.

A still further object of the present invention is to provide an improved cylindrical rotary drum having inner and outer shells of relatively thin material, which design for any heat flow condition reduces the possible effect of thermal stress.

Another object of the present invention is to provide an improved cylindrical rotary drum having relatively thin inner and outer shells separated by angular separators, the opening being available for heating, cooling, sound abatement and/or flow passages.

DESCRIPTION OF THE DRAWING

FIG. **1** is a side view partially in section of a rotary kiln embodying the invention;

FIG. **2** is a view in section taken in a plane represented by the line II—II in FIG. **1**;

FIG. **3** is a fragmentary longitudinal view of the kiln drum shown in a plane represented by the line III—III in FIG. **2** showing a few of the outer shell sections as they appear welded in end-to-end relationship; and

FIG. **4** is a fragmentary sectional view of the kiln showing a modified arrangement of the inner and outer shells.

DESCRIPTION OF THE INVENTION

Referring now to the drawings, there is shown a rotary kiln **10** comprising a rotary drum **11** that is supported for rotation on a foundation **14.** Rollers **16** carried on the foundation **14** engage riding rings **17** mounted about the exterior of the drum **11.** Rotation of the drum **11** is accomplished by power (not shown) that is connected to drive a bevel gear **21** affixed to a shaft **22.** A pinion **24** affixed to the shaft **22** is disposed in meshed driving engagement with a bull gear **26** mounted on the exterior of the drum **11.** The lower or right end of the kiln **10** is provided with a discharge hood **28** through which a firing system **29** extends. The upper or left end of the kiln **10** is provided with a preheater unit **31.** Material to be heated in the kiln is supplied to the feed or left end of the kiln by means of a hopper **32** that extends downwardly through a hood **33.**

The rotary drum **11** of the kiln **10,** as best shown in FIG. **2,** comprises an inner shell **41** and an outer shell **42.** The inner shell **41** is fabricated of rolled relatively thin plates **43.** The outer shell **42** is formed of a plurality of longitudinally extending sections **45** which may be of suitable mill lengths arranged in abutting relationship. The longitudinally abutting sections **45** are butt-welded together as at **46,** FIG. **3,** to form a single longitudinal length which extends the entire length of the drum **11.** Each of the sections **45** is identical and comprises an outer skin portion **47** cantilevered to the right from an angular leg or separator **48.** The opposite or inner end of the separator **48** is provided with a foot or base portion **49** which extends in a direction opposite to the direction in which the skin portion **47** extends. Each section **45** is secured to the surface of the plates of the inner shell **41** as by being welded thereto. It will, of course, be recognized that in lieu of the welding other securing methods may be utilized if so desired. The free end **52** of a section **45** is arranged to abut the top of an adjacent section **45** and is secured to the adjacent section by being welded thereto as at **53.**

The longitudinally extending sections **45** cooperate to define a longitudinal passageway **54** that can be utilized as a heating or cooling duct or as flow passages or as sound barriers.

With the arrangement described, the inner shell **41** of thickness X can rotate with respect to the outer shell **42** of thickness Z. The physical dimension thickness X, Y, and Z and the angle A in conjunction with the spacing W for a given material are the controlling dimensions which establish stiffness and strength. The construction allows for varying the physical dimensions of the sections at any given longitudinal area of the drum. For example, the dimensions X, Y and Z of the sections **45** in the area of the riding rings **17** may be made heavier to withstand the physical rolling stress imparted to the drum at these areas. The preheater unit **31** can be made of sections **45** whose dimensions X, Y and Z differ from the dimension of the section **45** at the discharge end of the kiln.

The angular or zee configured separators **48** permit the inner shell **41** to expand relative to the outer shell **42.** As the inner shell expands, radially outwardly acting forces are developed, which forces are taken up by

the separators and transmitted to the outer shell **42**. The angular separators **48** act as a spring between the shells so that the radial outward forces are changed in direction to angularly acting forces. This causes the inner shell **41** to rotate in a counterclockwise direction relative to the outer shell **42** thereby maintaining the outer shell stabilized.

In FIG. **4**, a modification of the invention is disclosed in that the outer leg or skin portion **47A** of the sections **45A** overlap the outer legs of adjacent sections. The overlapping skin on leg portion **47A** is welded to the adjacent top surface of a section **45A** to provide simplified construction.

With the arrangement for a kiln construction as herein disclosed, a considerable reduction in weight for a given size of kiln can be realized without sacrificing strength. The thinner sections also reduce the possible effects of thermal stress. In high stress areas stiffness can be increased where necessary. Because of the thinness of the inner shell, the temperature gradient across the shell can be increased without undue thermal shock.

The invention herein disclosed also permits a multiple layer arrangement of three or more concentric shells to provide an increase in longitudinal strength and stiffness and allow greater inner shell expansion. In a multiple layer arrangement the shell will have a larger moment of inertia through its central axis which will greatly increase the strength in the longitudinal direction and still permit a reduction in material weight.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a kiln having an elongated rotary drum comprising:

an elongated cylindrical inner shell;

an elongated cylindrical outer shell surrounding said inner shell in coaxial relationship; and,

a plurality of circumferentially spaced apart angular separators operably connected between said inner and outer shells having end connections with said inner and outer shells to provide for an angular connection between said shells, said separators having means to distort angularly so that relative rotation between said inner and outer shells will occur to dissipate radial outwardly acting forces from said inner shell due to expansion of said inner shell.

2. A kiln according to claim **1** wherein said angular separators are each formed with two substantially parallel inner and outer legs and an inclined web therebetween, one of said legs operating to form a portion of the outer shell and the other of said legs operating as a base which is welded to said inner shell.

3. A kiln according to claim **2** wherein said angular separators are arranged in circumferential relationship about said inner shell in a manner that said outer legs of each separator abuts an outer leg of an adjacent separator and said abutting legs are welded together to form the outer shell of said drum.

4. A kiln according to claim **3** wherein said leg of each of said separators which form a portion of the outer shell is longer in length than the assoociated leg which forms the base of said separator.

5. A kiln according to claim **4** wherein said longer leg of said separator extends from one end of said web in a direction away from the web and the other leg which forms the base of said separator extends from the other end of said web but in a direction opposite to the direction in which said longer leg extends.

6. A kiln according to claim **5** wherein said angular separator is an extruded member.

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