Oct. 29, 1957 N. PITT 2,810,968

CELLULAR DRIER

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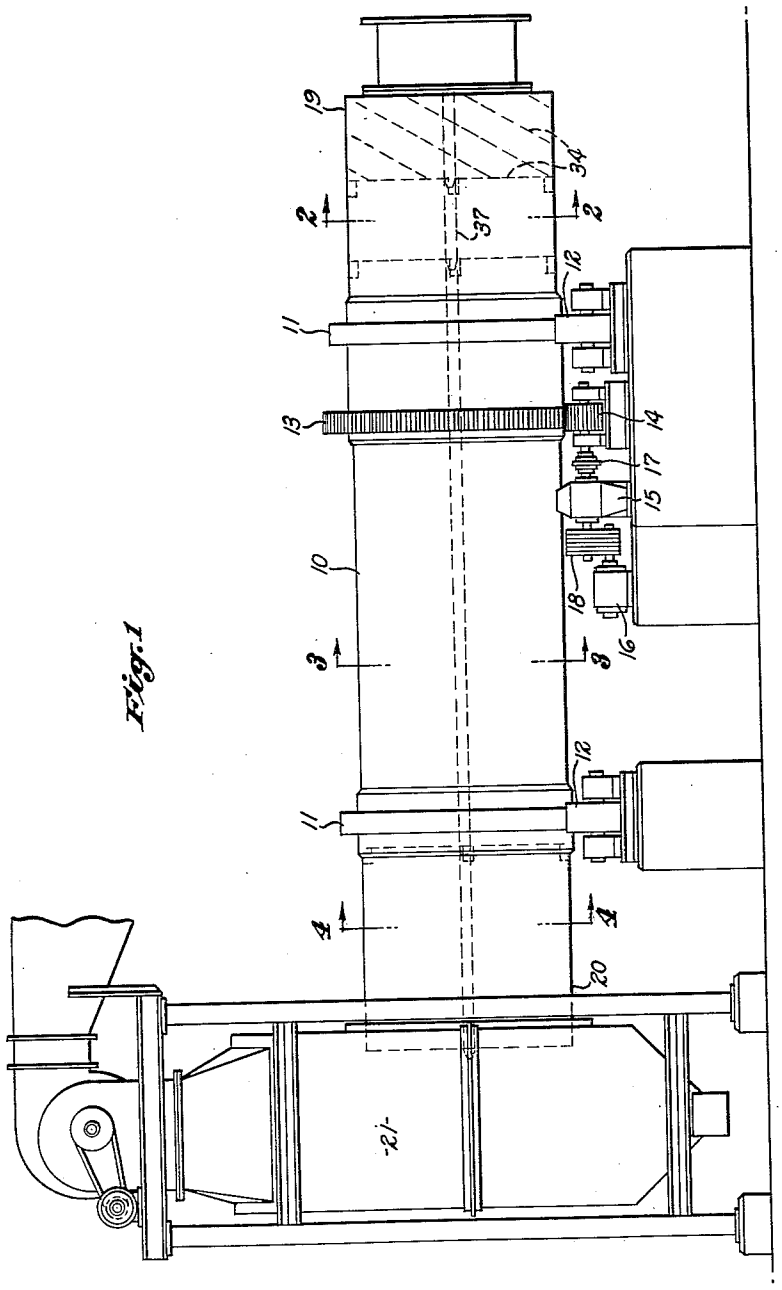


Fig. 1

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Fig. 2

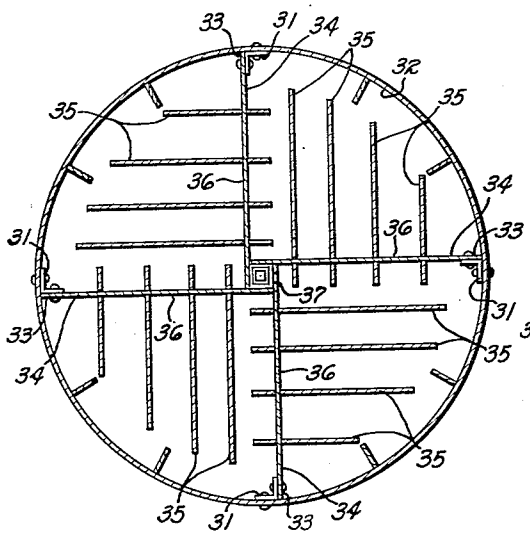


Fig. 3

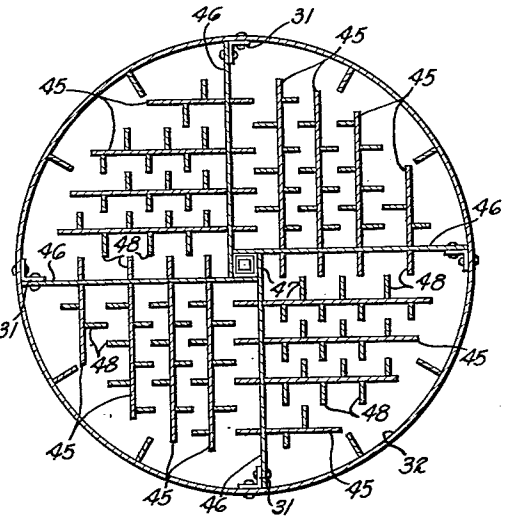


Fig. 5

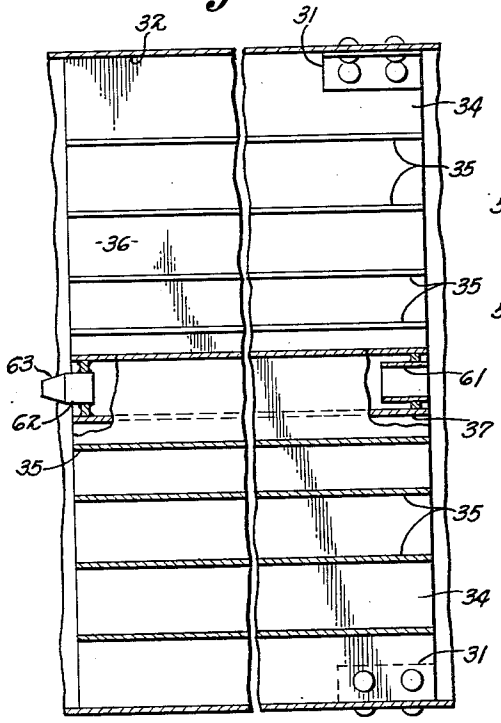
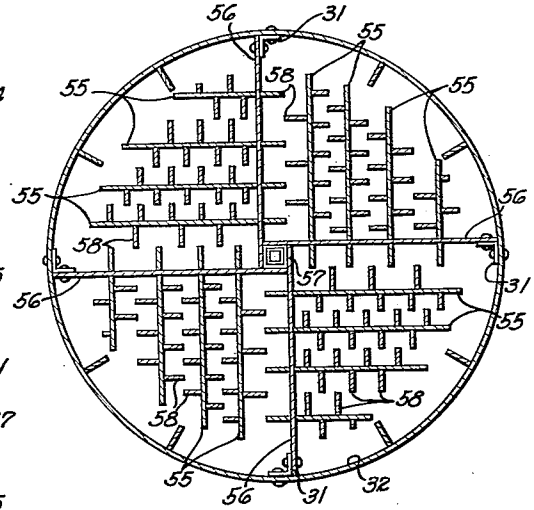


Fig. 4



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Fig. 6

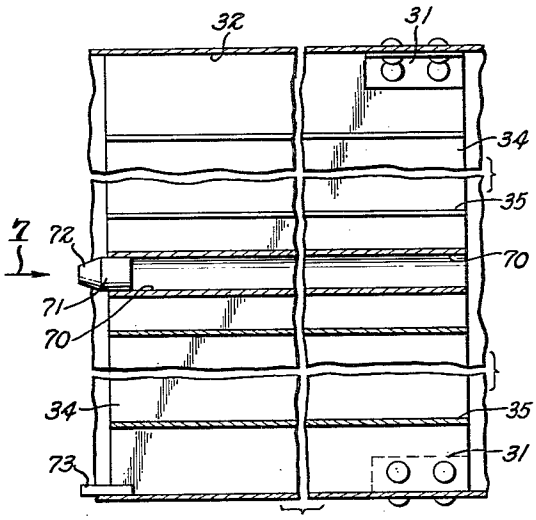


Fig. 7

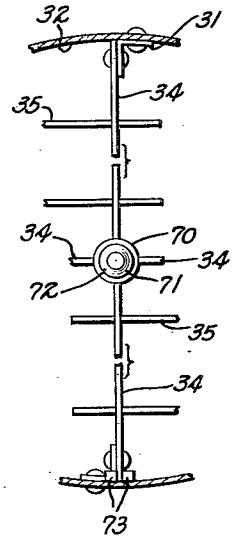


Fig. 8

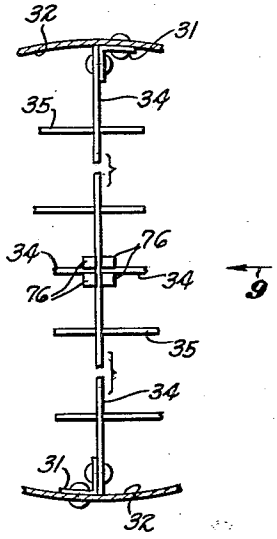
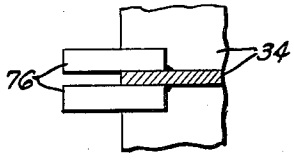


Fig. 9



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CELLULAR DRIER

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Application September 16, 1954, Serial No. 456,502

8 Claims. (Cl. 34—109)

The present invention relates to a new and improved type of cellular rotary drying apparatus.

Rotary driers as a class are, of course, well known at the present time and are widely used for drying a variety of materials. Early in the development of apparatus of this category it was determined that improved drying action could be obtained by placing a plurality of lifts around the interior of the rotary drying shell. Equipment employing such lifts has proved relatively satisfactory for many applications. However, it has been determined that further improved drying action could be obtained by forming a plurality of baffle-defined cells within the drying shell proper.

A number of devices of this latter category have been manufactured in the past. In the earliest of these constructions, all of the baffles were rigidly fixed to one another and to the drying shell. This rigid construction was found to possess a number of marked disadvantages. First, when the shell was heated during use, there was apt to be buckling of the fixed baffle sections due to expansion caused by the hot gases employed during the drying operation. Further, when the rotary driers employing such constructions were used with concurrent drying gas flow, the gas at times became loaded with moisture which, particularly on cold days, tended to precipitate in the outlet end of the drying shell. This precipitation tended to cause corrosion upon the baffles within this portion of the drying shell. Further, fixed baffles within these drying constructions could not be replaced easily and conveniently, once they were worn out by abrasion of the material being treated within the drier proper. Also, they could not be conveniently cleaned to remove various deposits of materials.

In order to overcome these disadvantages of the drier constructions utilizing fixed cellular baffles, a number of rotary driers have been created in such a manner that the drying shell can be split open longitudinally, exposing the entire baffle arrangement used. This type of construction has the decided disadvantage that the tires and the gearing employed have to be formed in such a manner that they can be opened along with the drying shell. Further, in order to open such drying shells, they must be either removed from the trunnions employed with the apparatus, or specialized equipment must be employed to prevent rotation of this shell. With this split type of construction, it is, however, possible to clean and replace the various baffle sections employed. The other disadvantages indicated above, such as those related to buckling and the like, are not effectively overcome by the split type of construction herein described.

It is an object of the present invention to produce a new and improved type of cellular rotary drying apparatus which overcomes the defects of the foregoing and related prior art constructions. A further object is to teach the production of extremely effective cellular rotary driers of a type capable of long service in which the individual baffle sections can be removed and cleaned or replaced as desired. Further objectives of the invention, as well as the advantages of it, will be apparent from the balance of this specification, including the appended claims and the accompanying drawings, in which:

Fig. 1 shows a side view of a rotary drier constructed in accordance with this invention;

Fig. 2 is a cross-sectional view of the drier of Fig. 1, taken at line 2—2;

Fig. 3 is a cross-sectional view of the drier of Fig. 1, taken at line 3—3;

Fig. 4 is a cross-sectional view of the drier of Fig. 1, taken at line 4—4;

Fig. 5 is a longitudinal sectional view of a drying section employed with the invention;

Fig. 6 is a longitudinal section view of a modified drying section employed with the invention;

Fig. 7 is a partial end view of the drying section of Fig. 6, taken in the direction of the arrow 7 shown in Fig. 6;

Fig. 8 is a partial sectional view of a third modified drying section of the present invention taken in the same direction as the view shown in Fig. 7; and

Fig. 9 is a partial sectional view of the section shown in Fig. 8 taken in the direction of the arrow 9 shown in Fig. 8.

For convenience, like numerals are used to designate like parts in all figures.

Briefly, the above and related objects of the invention are achieved by forming a rotary drier in which a plurality of baffle sections covering the entire cross-section of the drying shell are placed removably within this shell. Preferably, these sections decrease in what may loosely be termed "coarseness" from the inlet to the outlet of the device. Further, these sections are preferably loosely joined to one another so that each section may expand during the use of the apparatus without buckling and corroding. Because of the removable nature of the sections used, they can conveniently be taken from the drying shell and cleaned or replaced as the necessity dictates.

The invention is best further described with reference to the drawings. In Fig. 1, it is seen that the drier of the invention consists of a drying shell 10 having supporting means 11 resting upon trunnions 12. A gear 13 surrounding the shell 10 coacts with a smaller drive gear 14 connected to a speed reducer 15 and a motor 16 by a flexible coupling and belt means 17 and 18, respectively, so as to turn the entire drying assembly. For convenience the end 19 of the shell 10 is designated the inlet or feed end, while the end 20 is designated the outlet or discharge end. Conventional separating means 21 are illustrated as attached to the end 20.

The portion of the shell 10 adjacent to the end 19, in accordance with a preferred embodiment of the invention, is filled with a plurality of baffles 34, such as are shown in Fig. 2 of the drawings, stacked end to end longitudinally. These baffles 34 are formed in separate sections and are temporarily attached, as by bolts or spot welds, to lifts 31 permanently joined to the interior wall 32 of the shell 10 at a sufficient number of points 33 so as to provide adequate support. Thus, the number of supporting spots will vary with the size of these sections as well as with the weight of the material being treated. Four peripheral attaching points, as shown, are adequate for practically all baffle sections.

An important part of the present invention is that the baffles employed are formed of individual sections of such a size that they can easily and conveniently be handled. These sections may contain relatively coarse baffles such as the baffles 34 in Fig. 2 which consist of a series of arms 35 attached perpendicularly to radial spokes 36 extending from a central hub 37. In the preferred con-

struction, the center section of the tunnel is filled with baffles **44**, as shown in Fig. 3. Here a series of arms **45** are attached to radial spokes **46** extending from a central hub **47**. These baffles **44** differ from those shown in Fig. 2 in that a plurality of lugs **48** are attached at right angles to the arms **45**. As shown in Fig. 4, the baffles **54** near the outlet end **20** differ from the baffles **44** in that the lugs **58** are more closely spaced upon the arms **55** than the lugs **48** are spaced upon the arms **45**. Radial spokes **56** are attached to a central hub **57** in the same manner in which the spokes **46** are attached to the central hub **47**.

It is to be understood that all of the baffles or baffle sections employed are preferably attached to the lifts **31**, or to the shell wall itself, in the manner indicated above, so that they can be removed relatively easily. For this reason no attempt is made to specifically discuss the attachment of the baffles **44** and **54**. In order for there to be satisfactory distribution of material within the drier, only the radial spokes **36**, **46** and **56** project as far as the tunnel wall.

The central hubs **37**, **47** and **57** employed with the invention can, of course, assume a variety of shapes. It is preferred to form them, as shown in Fig. 5 of the drawing, with a nonround female socket **61** at one end and a complementary male boss **62** projecting from the other extremity. If desired, the boss **62** can be tapered as at **63** to aid in positioning. When rearward sockets are employed, it is frequently possible to omit bolting or otherwise temporarily attaching the radial spokes of the center baffle sections to the wall of the drying tunnel. This has the decided advantage of permitting rapid disassembly for cleaning purposes. For convenience of illustration, the drying section of Fig. 5 has been made to correspond to the baffles shown in Fig. 2.

If desired, the individual drying sections employed can utilize, instead of the boss and socket arrangement shown in Fig. 5, a related arrangement such as is indicated in Figs. 6 and 7. Here, the center of the baffle section is formed of a round piece of material such as a pipe **70**, into one end of which there projects a cylinder **71**, terminating externally of the drying section in a tapered projection **72**. When a plurality of baffle sections formed as is indicated in this figure are used, the projections **72** upon the shells are placed internally within corresponding pipes **70** on the following shells.

In order to prevent rotation between the individual drying sections, two bars or arms **73** are attached to the baffle **34**, in such a manner that they are adapted to slip over an adjacent baffle placed upon another drying section. Wtih a construction of the type shown in Figs. 6 and 7, it is preferred to allow sufficient space between the baffle sections so that expansion during use does not cause any baffle section to buckle within the drying shell. Further, with the construction shown in these figures, only the terminal baffle sections need be fastened to the drying shell, although other such sections may be fastened to the shell if an extremely ridged construction is desired.

In Figs. 8 and 9, another modified construction of the type shown in Figs. 6 and 7 is illustrated as containing four bars or arms **76**, positioned centrally between the baffles **34** in such a manner as to project from these baffles and in use fit in a similar manner around the equivalent baffles on an adjacent drying baffle section so as to prevent rotation of this section. Obviously, the above remarks with regard to attachment spacing, also apply to this modification of the invention.

Those skilled in the art will realize the present invention is capable of further modification within the scope of the instant disclosure. For example, baffle sections of the same type can be employed throughout the length of the drying tunnel. While this is not as satisfactory as the preferred construction illustrated because the baffle spacing is not graduated to the degree of dryness of the material treated, it is, nevertheless, satisfactory for many purposes. Also, all manner of baffle configurations can be employed with the invention. These configurations include perforated, spiral and ribbon constructions. Such modifications are to be considered as part of the present invention insofar as they are defined by the appended claims.

I claim as my invention:

1. A new and improved rotary drier which comprises: a drying shell having inlet and outlet ends; trunnion means rotatably supporting said shell; drive means for rotating said shell; a plurality of baffle sections positioned adjacent to one another within said shell, each of said baffle sections comprising a central core with a plurality of baffles extending outward therefrom, each of said baffle sections being axially movable within said drying shell and through one of said ends of said drying shell, said baffle sections increasing in closeness of the baffle placement from the inlet end to the outlet end of said shell; means for attaching said drying shell to at least one of said baffle sections in driving relationship; and means for attaching each of said baffle sections to the adjacent baffle section in driving relationship.

2. A new and improved rotary drier comprising: a drying shell having inlet and outlet ends; means rotatably supporting said shell; drive means for rotating said shell; a plurality of removable baffle sections having baffles dependent from central hubs positioned within said shell adjacent to one another, said hubs being provided with mating square coaxial sockets and plugs fitting together so as to prevent rotation of said sections relative to one another, said baffle sections increasing in closeness of the baffle placement from the inlet end to the outlet end of said shell, and extending throughout substantially the entire cross-section of said shell; and means for attaching said drying shell to at least one of said baffle sections in driving relationship.

3. A new and improved rotary drier which comprises: a drying shell; means rotatably supporting said shell; drive means for rotating such shell; a plurality of removable baffle sections having the baffles, dependent from central hubs positioned within such shell, adjacent to one another, said hubs being provided with complementary round portions fitting together and arm means fixed to said sections to prevent rotation of adjacent sections relative to one another; and means for attaching said drying shell to at least one of said baffle sections in driving relationship.

4. A new and improved rotary dryer comprising: a drying shell; means rotatably supporting said shell; drive means for rotating said shell; a plurality of removable baffle sections positioned adjacent to one another within such shell; arm means attached to each of said sections to prevent rotation of adjacent sections relative to one another; and means for attaching said drying shell to at least one of said baffle sections in driving relationship.

5. A new and improved rotary drier which comprises: a drying shell having an inlet end and an outlet end; means rotatably supporting said shell; drive means for rotating said shell; a plurality of baffle sections positioned within said shell, adjacent to one another throughout the length of said shell, each of said baffle sections being axially movable within said drying shell and through one of said ends of said drying shell, the baffle sections at each end of said shell being attached to said shell; and means positioned upon each of said sections for preventing rotation of adjacent baffle sections relative to said shell.

6. A device as defined in claim 5, wherein said means for preventing rotation comprises arm means located upon each of said baffle sections for engaging an adjacent baffle section.

7. A new and improved rotary drier comprising: a drying shell; means rotatably supporting said shell; drive means for rotating said shell; a plurality of baffle sections positioned adjacent one another within said shell, each of said baffle sections being axially movable within said shell and through one end of said shell, each of said baffle sec-

tions comprising a plurality of baffles dependent from a central hub, said hubs being provided with coaxial, telescoping, non-round portions for engaging complementary portions of adjacent hubs so as to prevent rotation of said baffle sections relative to one another; and means for attaching said drying shell to at least one of said baffle sections in driving relationship.

8. A device as defined in claim 5, wherein said means for preventing rotation comprises a central hub and a complementary boss coaxially positioned at opposite ends of said baffle sections, said bosses telescopingly engaging adjacent hubs in driving relationship.

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