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(11) **EP 1 344 009 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention  
of the grant of the patent:  
**22.11.2006 Bulletin 2006/47**

(21) Application number: **01270740.2**

(22) Date of filing: **06.12.2001**

(51) Int Cl.:  
**F26B 11/12<sup>(2006.01)</sup> F26B 11/16<sup>(2006.01)</sup>**

(86) International application number:  
**PCT/DK2001/000809**

(87) International publication number:  
**WO 2002/048628 (20.06.2002 Gazette 2002/25)**

(54) **ANNULAR DRYING ELEMENT, METHOD AND USE HEREOF AND DRYING APPARATUS**

RINGFÖRMIGES TROCKNUNGSELEMENT, VERFAHREN DAFÜR UND VERWENDUNG DAVON  
SOWIE TROCKNUNGSVORRICHTUNG

ELEMENT DE SECHAGE ANNULAIRE, PROCEDE ET UTILISATION ASSOCIES ET DISPOSITIF  
DE SECHAGE

(84) Designated Contracting States:  
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU  
MC NL PT SE TR**

(30) Priority: **12.12.2000 DK 200001858**

(43) Date of publication of application:  
**17.09.2003 Bulletin 2003/38**

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## Description

**[0001]** The invention concerns an annular drying element for mounting on a rotor axle in a drying apparatus, and where the drying element comprises at least two annular plate elements, a first and a second plate element, where at least the first plate element is configured with a number of through-going openings in the plate.

**[0002]** The invention also concerns a drying apparatus for heating or cooling of moist, comminuted material of animal, vegetable or chemical origin, comprising a stationary housing and a rotatable rotor, comprising a number of annular drying elements, each comprising at least two annular plate elements with means for the transport of a medium for heating or cooling hereof and for leading away possible condensation, and where at least the one plate element is configured with a number of through-going openings extending from the one side of the plate to the other side of the plate.

**[0003]** The invention also concerns a method and use of the method and of the annular drying element.

**[0004]** A drying element of the kind disclosed in the introduction is known, for example, from WO 98/15791. With drying elements of this kind, a large heating area is provided at the same time that a good stirring and transport of the product being processed is achieved, where said product can be products containing fat or oil, abattoir waste, biological materials of various character such as fishmeal, brewery waste and similar materials of animal, vegetable or chemical origin. The drying elements constitute a form of heat exchanger and are used for indirect heating or cooling of said products.

**[0005]** However, there is the risk with such an annular drying element that the cavity which is formed between the two plate elements is not sufficiently tight, and is thus not able to withstand the pressures which arise during the introduction of steam etc.

**[0006]** The object of the present invention is thus to provide a drying element which is pressure-tight, and where this pressure-tightness is ensured during the actual production, and where there is also achieved the suitable opening for ensuring a flow of the product in the machine in which the annular drying element may have been placed.

**[0007]** This is achieved by an annular drying element of the kind disclosed in the preamble of claim 1, where the plate element with said openings is placed opposite the non-perforated surface of the adjoining plate element, and that the plate elements are connected to one another by welds at the edges of the openings, and that the non-perforated surface lying in the bottom of an opening is pierced to provide breaking-throughs in the adjoining plate element, said breaking-throughs being demarcated by an outward swaging along the full periphery of the breaking-throughs to provide the annular drying element with through-going hole extending from the one side to the other side of the drying element, and in that the plate elements are joined together at an outer edge by welding.

**[0008]** The idea with an annular drying element is thus that two substantially identical plate elements are assembled against each other by welding together at the periphery and at the inner circumference, whereby a pressure-tight assembly is achieved. Welds are also effected along the whole of the peripheries of the openings, so that this welding fastens partly against the opening edge of the first plate and partly against the adjoining non-perforated surface of the opposite plate element. There is hereby provided a pressure-tight element, and where perforations are subsequently carried out corresponding to the earlier openings, inasmuch as a perforation here shall only take place through a single plate.

**[0009]** Hereby a suitable contact surface of the one plate element against the other is achieved, in that the upper edge of this outward swaging will thus lie against the non-perforated area of the adjoining surface, and where the height of the swaging thus comes to define the space which must exist between the two plate elements.

**[0010]** By providing an annular drying element according to the invention, a good stirring together of the substance is achieved and the surface of the heat exchanger is increased.

**[0011]** By providing an annular drying element according to the invention, and as disclosed in claim 2 and 3, an expedient and simplified production of the annular drying element is achieved, and there is achieved a very strong and rigid construction which can withstand a high pressure, which makes it possible for steam at a high temperature to be used as heating medium.

**[0012]** The tube pieces are preferably configured as disclosed and characterised in claim 5, i.e. with circular cross-section profiles, which among other things make it possible to use tubes of standard production which are cut off in the desired lengths. The tube pieces can have a length as disclosed in claim 6. When use is made of such a length, this corresponds to the thickness of the element, and whereby the possibility is provided of using scraper elements in the drying apparatus which scrape the drying elements clean which, for example, can be relevant at that end where the product is the most moist or in the zone where the product is most viscous. However, it is also possible for the tube pieces to be of a diameter as disclosed in claim 7, whereby the possibility is achieved of being able to vary the drying element in cases where larger openings or smaller openings are required.

**[0013]** The invention also concerns a drying apparatus as disclosed in the preamble to claim 8, and also where the plate element with openings is arranged with said openings opposite breaking-throughs of the adjoining plate element, said breaking-throughs being demarcated by an outward swaging provided by welding along the full periphery of the breaking-throughs, for the provision of an annular drying element with through-going holes, extending from the one side to the other side of the drying element, and in that the plate elements are further joined

together at an outer edge by welding.

**[0014]** By means of such an apparatus, the earlier used advantages are achieved during use of the annular drying element in said drying apparatus.

**[0015]** The claims 9-12 disclose expedient example embodiments of the drying apparatus.

**[0016]** The invention also concerns a method as disclosed in claim 13.

**[0017]** The invention will now be explained in more detail with reference to the drawing, where

- fig. 1 shows a first embodiment of the drying element according to the invention,
- fig. 2 shows a section along the line II-II in fig. 1,
- fig. 3 shows the section shown in fig. 2, where perforations are effected through the openings,
- fig. 4 shows a plate element for the production of an annular drying element according to the invention,
- fig. 5 shows an example embodiment, and where tube pieces are placed in the holes,
- fig. 6 shows a second embodiment of a drying element according to the invention,
- fig. 7A shows a section in fig. 6 seen in the direction VII-VII and shown on a larger scale,
- fig. 7B shows that shown in fig. 7A and with tube pieces mounted in the holes,
- figs. 8A and 8B show an axial cross-section through the drying apparatus according to the invention.

**[0018]** Fig. 1 shows an annular drying element 15 seen from the front, where the foremost plate element, i.e. the first plate element 16' is shown. The plate elements are circular with an outer and an inner diameter, and where along the outer edge 18 they are welded against each other to form a tight closure, and where along the inner edge, the so-called annular base part 17, they are similarly welded together and surround an axle.

**[0019]** In the annular plate part itself, a number of openings 25 are provided. These openings 25 are preferably cylindrical and, where the first plate element 16' is concerned, they will be placed opposite the unbroken surface 51 of a second plate element 16", i.e. in the areas be-

tween the openings 25 in the second plate element 16".

**[0020]** The two plate elements 16', 16" are also welded along the periphery of the opening 25 in the provision of a weld 52 along the whole of the edge 53 of the opening. The non-perforated surface in the bottom of such an opening is shown by the reference number 51.

**[0021]** Fig. 2 shows a section along II-II in fig. 1, and shows the first plate element 16' welded against the second plate element 16". The distance between the two elements corresponds to the height of the outward swaging 55, which demarcates the openings 25 provided in both of the plate elements. The geometry of the swaging appears almost crater-like, both in cross-section and in the plan view. Between the two plate elements 16', 16" there is thus formed an annular opening 23 in which steam and the like is retained under pressure.

**[0022]** As mentioned, the two plate elements are welded together by welds 52 along all of the annular openings 25, so that the opening edge 53 of the swaging 55 is in abutment against the non-perforated surface 51 of the second plate element. A piercing will be carried out later, the so-called breaking-through, corresponding to the centre and at the same centre distance of these welded areas, in the provision of a through-going hole 54 such as will be seen in fig. 3. The through-going hole 54 is thus essentially smaller than the opening 25.

**[0023]** Fig. 4 shows a section through a plate element before this is brought into contact against a second plate element in the formation of an annular drying element 15.

**[0024]** Fig. 5 shows an example of a second embodiment according to the invention, with a section through the annular drying element. The drying element consists of two identical, plane, annular disks or plate elements of steel plate. The annular disks or plate elements are e.g. 2m in diameter and have a number of holes 25, e.g. 42. The two plate elements are coupled together, i.e. they are joined together at the outer edge 18 by means of an annular steel band 19 and an annular weld 20. At the inner edge/the foot part, the plate elements are provided with an annular base piece on each plate element. The plate elements have a thickness in the order of 4-20mm. In all of the openings 25, a tube piece 26 is inserted and welded fast to both plate elements, so that the tube pieces 26 constitute stays between the plate elements. In the example shown, the stays are four-inch tube pieces.

**[0025]** The tubular stays 26 are robust and are welded securely to the two plate elements, so that between these there appears a chamber 22 for a heating medium, for example steam, under a pressure of 10 bar, said chamber having an annular opening 23 for the supply of steam and the discharge of exhaust steam and condensation in a commonly known manner.

**[0026]** The foot pieces 17, which as shown in the drawing extend out on each side of the plate element, are arranged to be welded directly together with the adjacent elements, and hereby constitute a tube element which surrounds the rotor axle in the drying apparatus. In the example, the axes of the tubular stays 26 are parallel

with the axis 30 of the drying element, and the tubular stays are of such a length that they correspond substantially to the thickness of the element. However, the tubular stays will be able to extend out over the surface of the element, and they will also be able to be cut off non-parallel with the element's plate and at an inclined angle hereto, possibly with another shape so that the projecting tubular stays constitute vane elements, carriers or stirring elements which have influence on the stirring of the material which is dried in the apparatus.

**[0027]** The tubular stays and herewith the openings 25 are arranged in two circles 28 concentric with the outer edge 18 of the drying element, and staggered in relation to one another so that a substantially uniform distribution of the through-going holes 54 is achieved and, where tubular stays are provided, also a uniform distribution of the annular stays across the element, whereby it is achieved that the free plate area between the tubular stays does not become too large. This is of significance with regard to how great a steam pressure can be applied to the element without too great a deflection of the plate material arising between the tubular stays.

**[0028]** Fig. 6-7 show an example where use is made of a drying element 15 of the same size, but where a larger number of smaller tubular stays are used, i.e. 90 stays distributed over three concentric circles 28, where the tubular stays are three-inch stays.

**[0029]** Fig. 7A is a section along the line VII A in fig. 6, and before a piercing is carried out in the provision of the holes 54. Fig. 7B shows the same as in fig. 7A after the piercing has been carried out, and where tube pieces have been inserted in the holes.

**[0030]** According to the invention, regardless of the material to be processed in a drying apparatus, i.e. regardless of the consistency of the material, its moistness, grain size etc., it is thus possible to dimension the drying elements in an optimum manner by selection of the size of the through-going holes, and in the cases where tubular stays are used, by selecting the number of these and also their size, configuration and positioning, so that the resulting drying apparatus has an optimal energy consumption without any sacrifice in the quality of the apparatus with regard to lifetime and operational reliability.

**[0031]** Fig. 8A and 8B show an axial cross-section through a drying apparatus according to the invention. The centre axis 30 of the rotor is indicated, and above this is seen the central pipe 11 for the supply of steam for heating and removal of condensate, which is carried out in a commonly known manner. A number of annular drying elements 15 of the type discussed earlier in connection with fig. 1-7 are built up of plate elements, and via their foot pieces 17 are welded together in an annular manner around the central pipe 11. The drying elements can be supplied with steam for heating via the stub connections 35.

**[0032]** The central pipe 11 is shown terminated at the one end with an axle journal 37 in a commonly known manner, and sealed off by the wall 32 of the housing 2.

The drying apparatus is otherwise built up in a commonly known manner and is therefore not explained in detail.

**[0033]** As explained earlier, each of the annular drying elements 15 comprise a number of through-going openings in the axial direction, and said openings can be provided with tubular stays 26. In the drying apparatus according to the invention, all of the annular drying elements 15 are welded together at the annular foot pieces 17 in such a way that the through-going openings 25 lie axially in line, so that holes lying opposite have the same centre axis. It is hereby possible to mount axial, elongated elements 31 through the openings, e.g. in the form of hollow tubes as shown in the figures. The elements 31 are at least of a length which enables them to span over the space between two adjacent drying elements 15, preferably over three adjacent drying elements.

**[0034]** The elements 31 can be tubular as shown, and can be divided into holding parts 31 A for engagement with the drying elements 15, and in lifting parts 31 B which can be configured in any desirable manner so that they constitute a lifting element. The areas 31 B can, for example, be polygonal or directly U-shaped, so that the product to be processed is lifted during rotation. The elements 31 are preferably fastened to the first of the annular drying elements 15 by welding 31 E. The elements 31 are preferably standard tubes with a diameter with which they substantially fill out the tubular stays 26. A cover 33 can be provided in the end wall 32 of the housing, fastened for example with bolts 34. When the cover is removed, it is possible to insert or remove drying elements 31 in or from the rotor, in that by rotation of the rotor the openings in the drying elements 15 can be brought in line with the opening which lies under the cover. The insertion of an element 31 is indicated sketch-wise.

**[0035]** In the example shown, elongated elements 31 are placed in some of the outermost openings 25 and in some of the innermost openings, but not in the centremost openings. The number of elongated elements and where they are placed depends on the degree to which it is desired to increase the stirring.

**[0036]** In the examples shown, four elements 31 displaced 90° are inserted in the outermost openings 25, and four elements similarly displaced 90° in the innermost openings, i.e. eight elements in all.

**[0037]** It will be obvious to a person skilled in the art that the number of elements 31 and their positioning depends on many different factors, e.g. the type of product to be processed, the manner in which it is desired to be handled, how the rotor is arranged and dimensioned etc.

**[0038]** Fig. 8A shows an embodiment of the invention where at the one end all of the elongated tube elements 31 are welded together by welds 31 d with a manifold 39, which comprises a distribution chamber 40 and a supply pipe 41 for steam. The opposite ends of the elements 31 are blanked off by closures 31c. With steam heating, condensation is formed which can be led away in the same direction as that in which the steam is introduced. This

can be effected, for example, by inclining the drying apparatus slightly towards the manifold 39, e.g. a slope of a few degrees, so that the condensation can return to the manifold 39 of its own accord.

## Claims

1. Annular drying element (15) for mounting on a rotor axle in a drying apparatus, and where the drying element comprises at least two annular plate elements, a first (16') and a second plate element (16''), where at least the first plate element (16') is configured with a number of through-going openings (25) in the plate, **characterised in that** the plate element (16') with said openings (25) is placed opposite the non-perforated surface of the adjoining plate element, and that the plate elements are connected to one another by welds at the edges of the openings, and that the non-perforated surface lying in the bottom of an opening is pierced to provide breaking-throughs in the adjoining plate element, said breaking-throughs being demarcated by an outward swaging (55) along the full periphery of the breaking-throughs to provide the annular drying element with through-going hole extending from the one side to the other side of the drying element, and **in that** the plate elements are joined together at an outer edge by welding.
2. Annular drying element according claim 1, **characterised in that** tube pieces (26) are inserted in the holes (54).
3. Annular drying element according to claim 2, **characterised in that** the tube pieces (26) are positioned so that their longitudinal axes are parallel with the axis (30) of the drying element.
4. Annular drying element according to claim 2-3, **characterised in that** the tube pieces (26,27) are secured as stays between the plate elements which are configured with holes (54) corresponding to the tube pieces (26).
5. Annular drying element according to claim 2-4, **characterised in that** the tube pieces (26) have circular cross-section profiles, and that the holes (54) in which they are preferably mounted by welding are similarly circular.
6. Annular drying element according to claim 2-5, **characterised in that** the tube pieces (26) have a length which corresponds substantially to the thickness of the element (15).
7. Annular drying element according to claim 2-6, **characterised in that** use is made of pipe pieces (26)

with different diameters.

8. Drying apparatus for the heating or cooling of moist, comminuted materials of animal, vegetable or chemical origin, comprising a stationary housing (32) and a rotatable rotor comprising a number of annular drying elements (15), according to claim 1 each comprising at least two annular plate elements (16', 16'') with means for the delivery of a medium for heating or cooling said materials, and for the leading away of possible condensation, and where at least the one plate element is configured with a number of through-going openings (25) extending from the one side of the plate to the other, **characterised in that** the plate element (16') with openings (25) is arranged with said openings opposite breaking-throughs of the adjoining plate element (16''), said breaking-throughs being demarcated by an outward swaging (55) provided by welding along the full periphery of the breaking-throughs, for the provision of an annular drying element with through-going holes (54), extending from the one side to the other side of the drying element (15), and **in that** the plate elements (16', 16'') are further joined together at an outer edge (18) by welding.
9. Drying apparatus according to claim 8, **characterised in that** the drying elements (15) are positioned on the rotor (11) in such a manner that at least one through-going hole (54) is lying axially opposite corresponding through-going holes in an adjacent element, and that in said holes (54) there is inserted at least one elongated element (31) with a length which corresponds at least to the distance between the drying elements.
10. Drying apparatus according to claim 9, **characterised in that** the element (31) is divided into areas for engagement with a drying element, and in intermediate areas for positioning between the drying elements, and arranged for the lifting/stirring of the product in the apparatus.
11. Drying apparatus according to claim 9-10, **characterised in that** each element (31) is mechanically fastened to a drying element by e.g. welding.
12. Drying apparatus according to claim 9-11, **characterised in that** at least one of the elements (31) has a through-going cavity arranged for the introduction of a medium for heating or cooling, e.g. steam for heating.
13. Method for the production of an annular drying element (15) for mounting on a rotor axle in a drying apparatus, and where the drying element comprises at least two annular plate elements, a first (16') and a second plate element (16''), where at least the first

plate element (16') is configured with a number of through-going openings (25) in the plate, **characterised in that** the plate element with said openings (25) is placed with the openings opposite the non-perforated surface (51) of the adjacent plate element, and that the plate elements (16', 16'') are connected to one other by welding (52) along the edge (53) of the openings for the provision of an outward swaging (55), and that the non-broken through surface (51) lying in the bottom of an opening (25) is pierced so that the breaking-throughs are demarcated by the outwards swaging (55) to provide through-going holes (54) in the annular drying element, extending from the one side to the other side of the drying element (15), and further joining together the plate elements (16', 16'') at an outer edge (18) by welding.

#### Patentansprüche

1. Ringförmiges Trocknungselement (15) zum Befestigen an einer Rotorachse in einer Trocknungsvorrichtung, das zumindest zwei ringförmige Plattenelemente aufweist, ein erstes (16') und ein zweites Plattenelement (16''), von denen zumindest das erste Plattenelement (16') mit einer Anzahl durchgehender Öffnungen (25) in der Platte ausgebildet ist, **dadurch gekennzeichnet, dass** das Plattenelement (16') mit den Öffnungen (25) der nicht-perforierten Oberfläche des anliegenden Plattenelementes gegenüberliegend angeordnet ist, und dass die Plattenelemente durch Schweißnähte an den Rändern der Öffnungen verbunden sind und dass die nicht-perforierte Oberfläche gelocht ist, die in dem Grund einer Öffnung liegt, um Durchbrüche in dem anliegenden Plattenelement vorzusehen, wobei die Durchbrüche nach außen ein Gesenk (55) dem vollständigen Umfang der Durchbrüche entlang abgegrenzt sind, um das ringförmige Trocknungselement mit durchgehenden Löchern (54) zu versehen, die sich von einer Seite zu der anderen Seite des Trocknungselementes erstrecken, und dass die Plattenelemente an einem Außenrand durch Schweißen miteinander verbunden sind.
2. Ringförmiges Trocknungselement nach Anspruch 1, **dadurch gekennzeichnet, dass** Rohrstücke (26) in den Löchern (54) eingefügt sind.
3. Ringförmiges Trocknungselement nach Anspruch 2, **dadurch gekennzeichnet, dass** die Rohrstücke (26) derart angeordnet sind, dass ihre Längsachsen parallel zu der Achse (30) des Trocknungselementes vorgesehen sind.
4. Ringförmiges Trocknungselement nach Anspruch 2 bis 3, **dadurch gekennzeichnet, dass** die Rohr-

stücke (26, 27) als Verbindungsstücke zwischen den Plattenelementen gesichert sind, die mit Löchern (54) ausgebildet sind, die den Rohrstücken (26) entsprechen.

5. Ringförmiges Trocknungselement nach Anspruch 2 bis 4, **dadurch gekennzeichnet, dass** die Rohrstücke (26) kreisförmige Querschnittprofile aufweisen, und dass die Löcher (54), in denen sie bevorzugt durch Schweißen befestigt sind, gleichermaßen kreisförmig vorgesehen sind.
6. Ringförmiges Trocknungselement nach Anspruch 2 bis 5, **dadurch gekennzeichnet, dass** die Rohrstücke (26) eine Länge aufweisen, die im Wesentlichen der Dicke des Elementes (15) entspricht.
7. Ringförmiges Trocknungselement nach Anspruch 2 bis 6, **dadurch gekennzeichnet, dass** Rohrstücke (26) mit unterschiedlichen Durchmessern verwendet werden.
8. Trocknungsvorrichtung zum Heizen oder Kühlen von feuchtem, zermahlenem Material, tierischen, pflanzlichen oder chemischen Ursprungs, mit einem stationären Gehäuse (32) und einem drehbaren Rotor, der eine Anzahl ringförmiger Trocknungselemente (15) nach Anspruch 1 aufweist, welche jeweils zumindest zwei ringförmige Plattenelemente (16', 16'') mit der Einrichtung für die Beförderung eines Mediums zum Heizen oder Kühlen des Materials, und für das Fortleiten möglicher Kondensation aufweisen, und bei denen zumindest das eine Plattenelement mit einer Anzahl durchgehender Öffnungen (25) ausgebildet ist, die sich von einer Seite der Platte zu der anderen erstrecken, **dadurch gekennzeichnet, dass** das Plattenelement (16') mit Öffnungen (25) mit den Öffnungen Durchbrüchen des anliegenden Plattenelementes (16'') gegenüberliegend angeordnet ist, und die Durchbrüche nach außen durch ein Gesenk (55), welches durch Schweißen entlang des vollständigen Umfangs des Durchbruchs bereitgestellt ist, für das Vorsehen eines ringförmigen Trocknungselements mit durchgehenden Löchern (54) abgegrenzt sind, die sich von einer Seite zu der anderen Seite des Trocknungselementes (15) erstrecken, und dass die Plattenelemente (16', 16'') ferner an einem Außenrand (18) durch Schweißen miteinander verbunden sind.
9. Trocknungsvorrichtung nach Anspruch 8, **dadurch gekennzeichnet, dass** die Trocknungselemente (15) an dem Rotor (11) derart angeordnet sind, dass zumindest ein durchgehendes Loch (54) entsprechenden durchgehenden Löchern in einem benachbarten Element axial gegenüberliegt, und dass in den Löchern (54) zumindest ein längliches Element (31) mit einer Länge eingefügt ist, die zumindest dem

Abstand zwischen den Trocknungselementen entspricht.

10. Trocknungsvorrichtung nach Anspruch 9, **dadurch gekennzeichnet, dass** das Element (31) in Abschnitte zum Eingriff mit einem Trocknungselement und in Zwischenbereiche zur Anordnung zwischen den Trocknungselementen aufgeteilt und für das Anheben/Umrühren des Produktes in der Vorrichtung ausgebildet ist.
11. Trocknungsvorrichtung nach Anspruch 9 bis 10, **dadurch gekennzeichnet, dass** jedes Element (31) an einem Trocknungselement mechanisch beispielsweise durch Schweißen befestigt ist.
12. Trocknungsvorrichtungen nach Anspruch 9 bis 11, **dadurch gekennzeichnet, dass** zumindest eines der Elemente (31) einen durchgehenden Hohlraum aufweist, der für die Einführung eines Mediums zum Heizen oder Kühlen, beispielsweise Dampf zum Heizen, ausgebildet ist.
13. Verfahren zur Herstellung eines ringförmigen Trocknungselementes (15) zum Befestigen an einer Rotorachse in einer Trocknungsvorrichtung, und bei dem das Trocknungselement zumindest zwei ringförmige Plattenelemente aufweist, ein erstes (16') und ein zweites Plattenelement (16''), wobei zumindest das erste Plattenelement (16') mit einer Anzahl durchgehender Öffnungen (25) in der Platte ausgebildet wird, **dadurch gekennzeichnet, dass** das Plattenelement mit den Öffnungen (25) mit den Öffnungen der nicht-perforierten Oberfläche (51) des benachbarten Plattenelementes gegenüberliegend angeordnet wird, und dass die Plattenelemente (16', 16'') durch Schweißen (52) dem Rand (53) der Öffnungen entlang für das Vorsehen eines nach außen weisenden Gesenks (55) miteinander verbunden werden, und dass die nichtunterbrochene Oberfläche (51) gelocht wird, die in dem Grund einer Öffnung (25) liegt, so dass die Durchbrüche nach außen durch die Gesenke (55) abgegrenzt werden, um durchgehende Löcher (54) in dem ringförmigen Trocknungselement vorzusehen, die sich von einer Seite zu der anderen Seite des Trocknungselementes (15) erstrecken, und dass ferner die Plattenelemente (16', 16'') an einem Außenrand (18) durch Schweißen miteinander verbunden werden.

## Revendications

1. Élément de séchage annulaire (15) destiné au montage sur un axe de rotor dans un appareil de séchage, et où l'élément de séchage comprend au moins deux éléments de plaque annulaires, un premier (16') et un second (16'') éléments de plaque, où au

moins le premier élément de plaque (16') est configuré avec un certain nombre d'ouvertures de passage (25) dans la plaque, **caractérisé en ce que** l'élément de plaque (16') avec lesdites ouvertures (25) est placé en face de la surface non perforée de l'élément de plaque contigu, et **en ce que** les éléments de plaque sont connectés l'un à l'autre par des cordons de soudure sur les bords des ouvertures, et **en ce que** la surface non perforée située au fond d'une ouverture est percée pour former des trouées de passage dans l'élément de plaque adjacent, lesdites trouées de passage étant délimitées par un estampage vers l'extérieur (55) tout le long de la périphérie des trouées de passage de façon à pourvoir l'élément de séchage annulaire d'un trou traversant (54) s'étendant d'un côté à l'autre côté de l'élément de séchage, et **en ce que** les éléments de plaque sont joints ensemble sur un bord extérieur par soudure.

2. Élément de séchage annulaire selon la revendication 1, **caractérisé en ce que** des pièces de tube (26) sont insérées dans les trous (54).
3. Élément de séchage annulaire selon la revendication 2, **caractérisé en ce que** les pièces de tube (26) sont positionnées de telle sorte que leurs axes longitudinaux sont parallèles à l'axe (30) de l'élément de séchage.
4. Élément de séchage annulaire selon les revendications 2 et 3, **caractérisé en ce que** les pièces de tube (26, 27) sont fixées à la façon d'étais entre les éléments de plaque qui sont configurés avec des trous (54) correspondant aux pièces de tubes (26).
5. Élément de séchage annulaire selon les revendications 2 à 4, **caractérisé en ce que** les pièces de tube (26) ont des profils de section transversale circulaires, et **en ce que** les trous (54) dans lesquels elles sont préférablement fixées par soudure sont semblablement circulaires.
6. Élément de séchage annulaire selon les revendications 2 à 5, **caractérisé en ce que** les pièces de tube (26) ont une longueur qui correspond substantiellement à l'épaisseur de l'élément (15).
7. Élément de séchage annulaire selon les revendications 2 à 6, **caractérisé en ce qu'il** est fait emploi de pièces de tube (26) de différents diamètres.
8. Appareil de séchage destiné au chauffage ou au refroidissement de matières humides désagrégées d'origine animale, végétale ou chimique, comprenant une enveloppe fixe (32) et un rotor tournant comprenant un certain nombre d'éléments de séchage annulaires (15) selon la revendication 1, cha-

cun comprenant au moins deux éléments de plaque annulaires (16', 16'') avec un moyen pour la fourniture d'un milieu de chauffage ou de refroidissement desdites matières, et pour emmener une possible condensation, et où au moins un élément de plaque est configuré avec un certain nombre d'ouvertures traversantes (25) s'étendant d'un côté de la plaque à l'autre, **caractérisé en ce que** l'élément de plaque (16') avec des ouvertures (25) est disposé avec lesdites ouvertures en face des trouées de passage de l'élément de plaque contigu (16''), lesdites trouées de passage étant délimitées par un estampage vers l'extérieur (55) obtenu par soudure le long de la périphérie complète des trouées de passage, pour l'obtention d'un élément de séchage annulaire avec des trous traversants (54), s'étendant d'un côté jusqu'à l'autre côté de l'élément de chauffage (15), et **en ce que** les éléments de plaque (16', 16'') sont joints ensemble sur un bord extérieur (18) par soudure.

9. Appareil de séchage selon la revendication 8, **caractérisé en ce que** les éléments de séchage (15) sont positionnés sur le rotor (11) de telle manière qu'au moins un trou traversant (54) est situé axialement en face de trous traversants correspondants dans un élément adjacent, et **en ce que** dans lesdits trous (54) il est inséré au moins un élément allongé (31) avec une longueur qui correspond au moins à la distance entre les éléments de séchage.
10. Appareil de séchage selon la revendication 9, **caractérisé en ce que** l'élément (31) est partagé en zones pour l'engagement avec un élément de séchage, et en zones intermédiaires pour le positionnement entre les éléments de séchage, et disposées pour soulever/agiter le produit dans l'appareil.
11. Appareil de séchage selon les revendications 9 et 10, **caractérisé en ce que** chaque élément (31) est assujéti mécaniquement à un élément de séchage, par exemple par soudure.
12. Appareil de séchage selon les revendications 9 à 11, **caractérisé en ce qu'**au moins l'un des éléments (31) présente une cavité traversante arrangée pour l'introduction d'un milieu de chauffage ou de refroidissement, par exemple de la vapeur pour le chauffage.
13. Procédé pour la production d'un élément de séchage annulaire (15) destiné à être monté sur un axe de rotor dans un appareil de séchage, et où l'élément de séchage comprend au moins deux éléments de plaque annulaires, un premier (16') et un second (16'') élément de plaque, où au moins le premier élément de plaque (16') est configuré avec un certain nombre d'ouvertures traversantes (25) dans la plaque, **caractérisé en ce que** l'élément de plaque

avec lesdites ouvertures (25) est placé en face de la surface non perforée (51) de l'élément de plaque adjacent, et **en ce que** les éléments de plaque (16', 16'') sont connectés l'un à l'autre par une soudure (52) le long du bord (53) des ouvertures pour la fourniture d'un estampage vers l'extérieur (55), et **en ce que** la surface transversale intacte (51) se trouvant au fond d'une ouverture (25) est percée de sorte que les trouées de passage sont délimitées par l'estampage vers l'extérieur (55) pour fournir des trous traversants (54) dans l'élément de séchage annulaire, s'étendant d'un côté à l'autre côté de l'élément de séchage (15), et joignant de plus ensemble les éléments de plaque (16', 16'') sur un bord extérieur (18) par soudure.

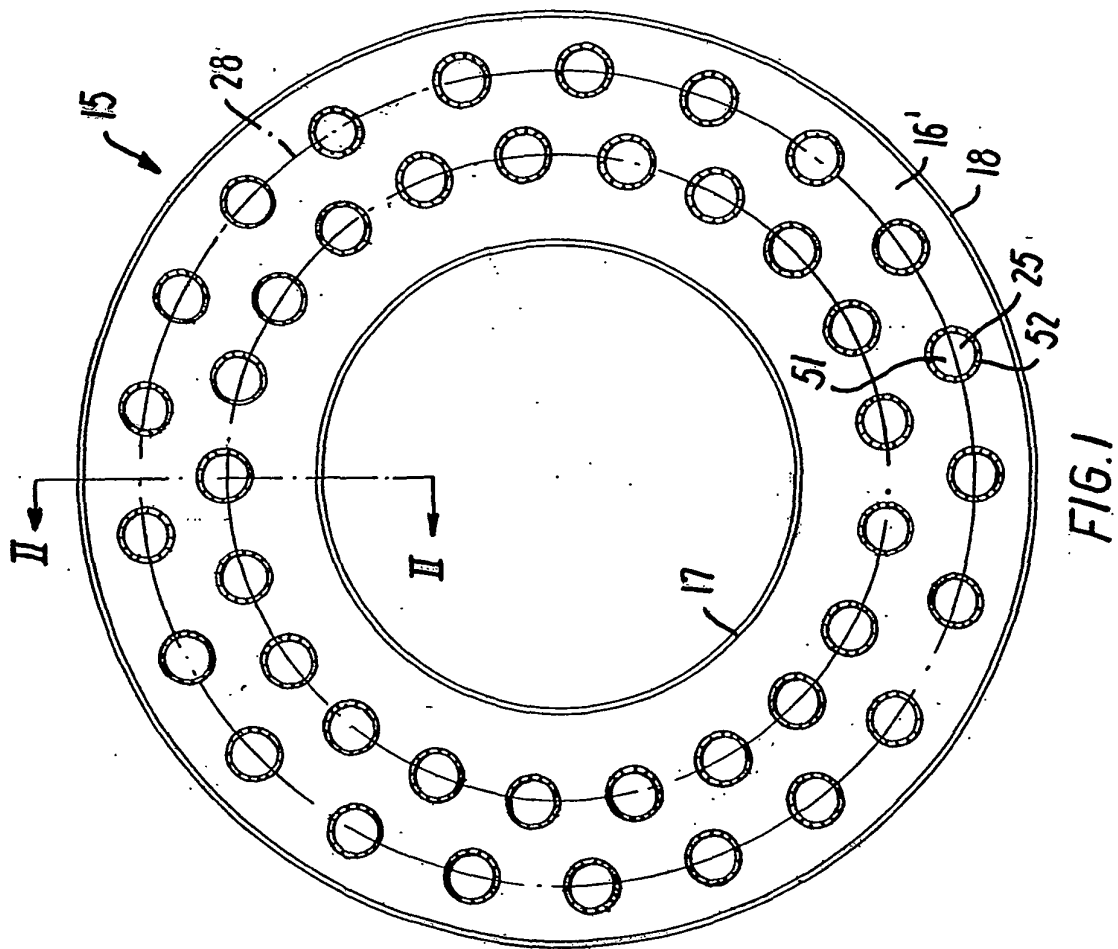


FIG. 1

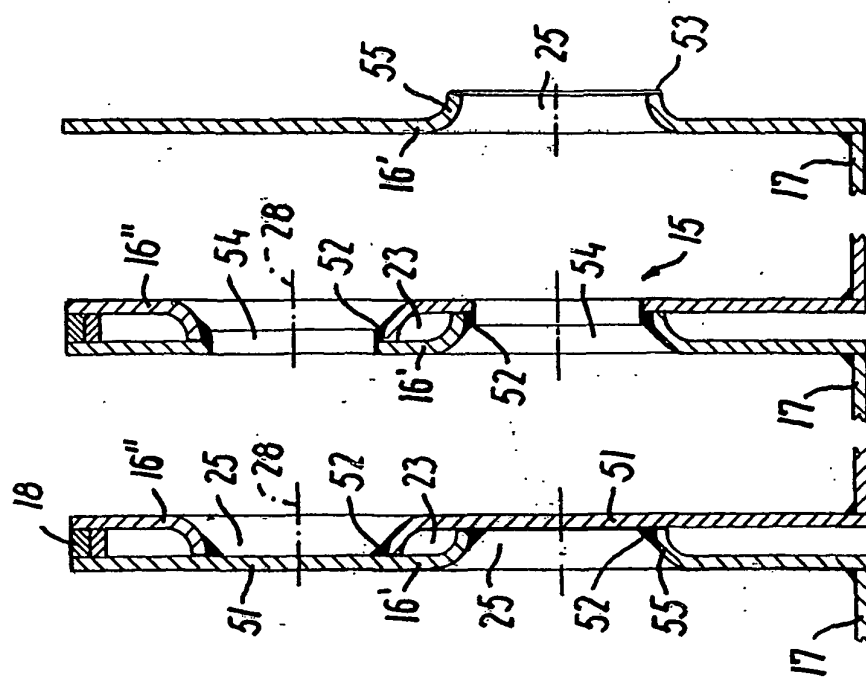


FIG. 2

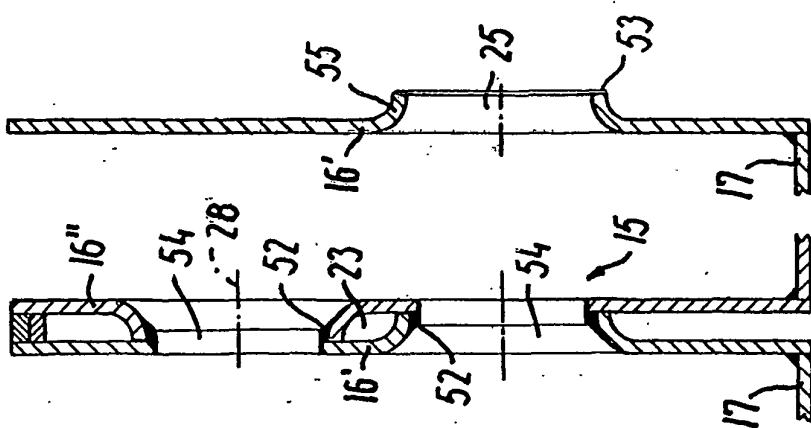


FIG. 3

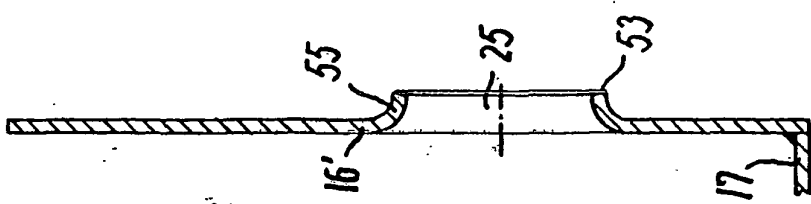


FIG. 4

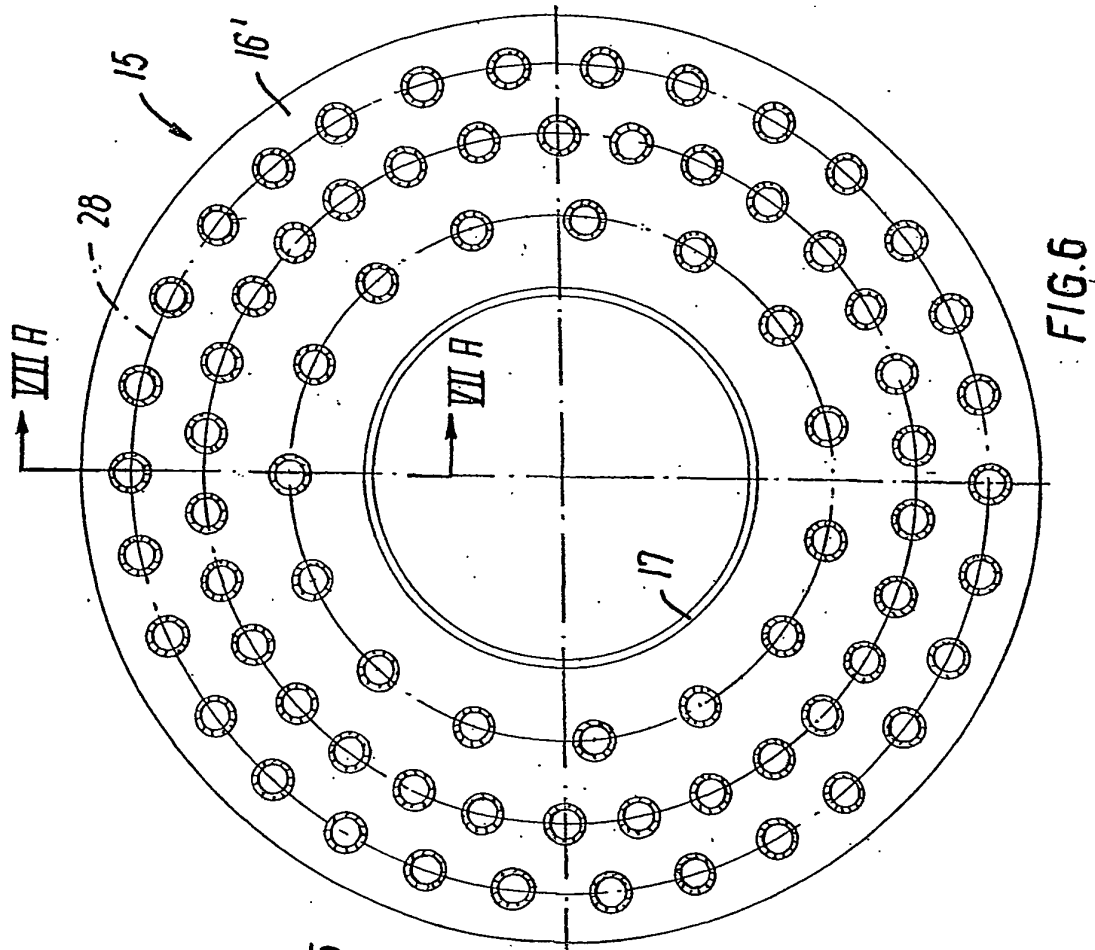


FIG. 6

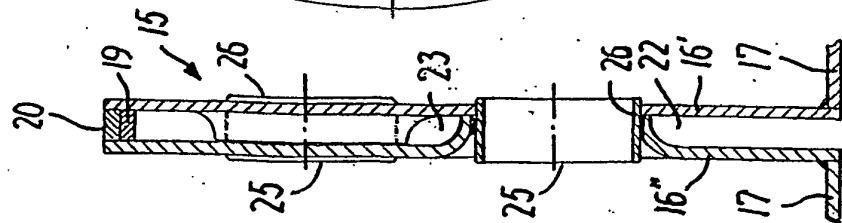


FIG. 5

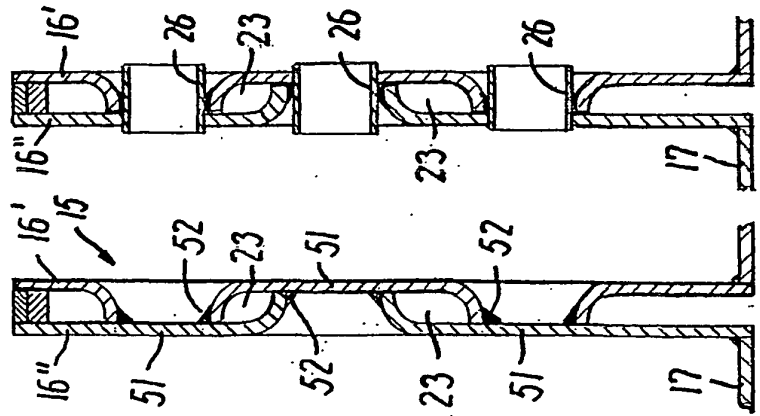


FIG. 7A FIG. 7B

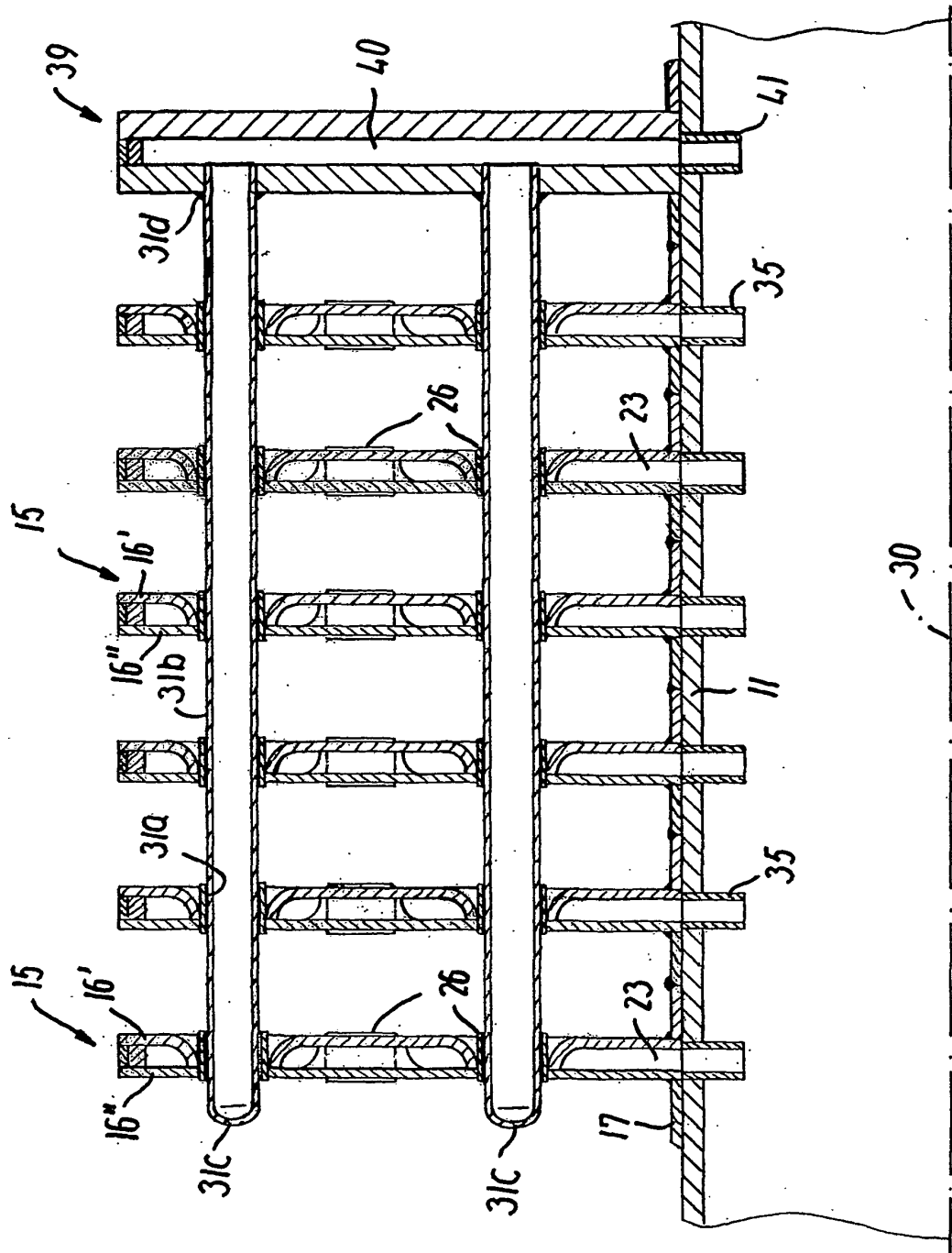


FIG. 8A

