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(54) **Tandem steam-water separator.**

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Description

This invention relates to a separator for receiving a mixture of steam and water, separating the steam from the water in two stages and discharging the steam and the water from separate outlets. Such a separator is known from GB-A-2 126 499.

In natural circulation vapour generators, mixtures of water and steam rise in heated steam-generating tubes and discharge into a steam-water separator disposed in an elevated position above the tubes and usually in a steam drum. The separators operate to separate the water from the steam, with the latter being removed through openings of the upper portions of the drum and the former being recirculated through downcomers to the boiler and back to the steam generating tubes to complete the natural circulation loop.

In these types of arrangements, it is essential that an efficient separation of the steam from the water be effected with minimal pressure loss in order to furnish steam of the required purity to the point of use, and steam-free water to the circulation system. Also, the separators must operate under high steam and water loading and must have sufficient flow area to minimize pressure loss and still achieve separation. Further, there must be low carryover over a wide range of steam and water flow conditions.

Known steam separators are of the type in which a rising mixture of steam and water is guided into a swirling motion from which water is radially discharged by the centrifugal forces generated therein. Such separators can have one or two separator stages. Multi-stage steam separators are disclosed in GB-A-2,126,499 and DE-C-931,170. In these separators, a second separator stage is disposed directly over the first stage to receive steam-water mixture from which some water has already been removed.

The present invention is directed at a steam water separator having lower and upper separator stages wherein the lower stage comprises a first riser for receiving a steam water mixture and for directing said mixture to an upper section thereof formed with a plurality of discharge slots, and discharge passages in registry with the slots and extending laterally therefrom to direct said mixture from the riser towards a shell surrounding the discharge passages, whereby water from said mixture collects on the shell and remaining mixture continues to rise therefrom, means being provided for directing said remaining mixture to the upper separator stage disposed over the first stage, the upper separator stage comprising a second riser for receiving said remaining mixture and directing same to an upper section thereof. A separator with this construction is disclosed in GB-A-2,126,499. According to the invention, the upper section of the second riser is formed with a plurality of discharge slots, and discharge passages in registry with the slots, which passages extend laterally from the slots to direct said mixture from the second riser towards a shell surrounding the discharge passages; and the discharge passages comprise a plurality of open-ended conduits uniformly angled relative to radii passing through the respective slots from which they extend. Further, in at least one of the separator stages the conduits comprising the discharge passages are divided internally with horizontal partitions to form in each conduit a plurality of steam-water mixture paths, one above the other, and the respective riser path is partitioned to form a plurality of vertical paths, corresponding in number with the number of paths in the conduits, with each path of the riser coupled only with the paths of the conduits which occupy the same relative vertical position. The two separator stages can thus operate in tandem.

In a steam-water separator of the invention liquid can be separated from vapour at a relatively low pressure loss, but the separator can nevertheless operate under high steam and water loading. The separator permits a relatively low carryover over a wide range of steam and water flow conditions, yet is of a simple, efficient and inexpensive design.

Embodiments of the invention will now be described by way of example and with reference to the accompanying drawings wherein:

Figure 1 is a vertical sectional view of a first embodiment of the steam-water separator of the present invention;

Figure 2 is a cross-sectional view taken along the line 2-2 of Figure 1;

Figure 3 is a cross-sectional view taken along line 3-3 of Figure 2;

Figure 4 shows schematically a second embodiment of the invention;

Figure 5 is a cross-sectional view taken along the line 5-5 in Figure 4;

Figure 6 shows a modified discharge member in plan view;

Figure 7 shows a vertical section view of a portion of the riser and discharge device of Figure 6 taken along the line 7-7 thereof; and

Figure 8 is a thumb-nail sketch of a fuller view of the riser of Figure 7.

Referring to Figs. 1-3 of the drawings, the reference numeral 10 refers in general to the steam-water separator of the present invention. The separator 10 includes a first stage riser 12, which is adapted to receive a steam-water mixture from a riser or tube (not shown) or from a steam drum (not shown) which can be a part of a natural circulation steam generator, or the like. The riser 12 extends

within an upright cylindrical shell 14 in a coaxially spaced relationship.

A top plate 16 extends over the upper end of the riser 12 and a plurality of slots 18 are formed through the upper wall portion of the riser. A plurality of arcuate arms 20 are connected to the riser 12 in registry with the slots 18, respectively, with the free ends of the arms being open to permit the steam-water mixture to discharge therefrom in a substantially tangential direction relative to the inner wall of the shell 14. It is understood that a support structure (not shown) can be provided within the shell 14 for supporting the riser 12 within the shell in the coaxial position shown.

A second stage riser 24 is provided in the upper portion of the shell 14 in a spaced relation to the riser 12. The riser 24 is supported relative to the shell 14 by a horizontally extending splash ring 26 having a drip ring 28 extending downwardly from the lower portion thereof and adapted to receive the mixture rising in the shell from the first stage separator formed by the riser 12 and the arms 20.

A top plate 30 extends over the upper end of the riser 24 and a plurality of slots 32 are formed through the riser. A plurality of arcuate arms 34 are connected to, and extend outwardly from, the riser 24 in registry with the slots 32. The free ends of the arms 34 are open to permit the steam-water mixture to discharge therefrom in a substantially tangential direction relative to the inner wall of the shell 14.

A plurality of water relief holes 36 extend through a portion of the shell 14 between the arms 20 and the splash ring 26. A series of drain openings 38 are provided around the shell 14 immediately above the splash ring 26. A series of spaced discharge slots 40 are provided in the upper end portion of the shell 14.

In operation, the mixture of steam and water entering the lowers end portion of the riser 12 rises upwardly and then passes radially outwardly from the riser through the slots 18 and into arcuate arms 20 where it is directed tangentially against the inner wall of the shell 14. This creates a vortex, or swirling, stream of fluid with the resulting centrifugal forces causing a portion of the mixture, which is largely steam, to travel away from the inner wall of the shell 14 and towards the centre of the swirling steam and pass upwardly, by virtue of its buoyancy, into the upper portion of the shell 14. The water portion of the mixture collects on the inner wall of the shell 14 and a portion of this water flows down the wall by gravitational forces and is collected in the steam drum or in any other known manner. The remaining portion of the water collecting on the inner wall of the shell 14 rises upwardly slightly along the inner surface of the shell above the tops of the arms 20 due to the kinetic energy in the jet streams of the steam-water mixture discharging from the arms. This portion of water discharges from the water relief holes 36 and then falls by gravity downwardly into the steam drum, or the like.

The remaining portion of the mixture, which is largely steam, rises upwardly in the shell 14 and is directed into the lower end portion of the riser 24 by the splash ring 26 and the drip ring 28. The mixture then passes radially outwardly from the riser 24 through the slots 32 and through the arcuate arms 34. This causes an additional separation of the steam from the water, with the steam discharging through the slots 40 whereby it leaves the separator for further treatment. The water portion of the mixture collects on the upper inner wall of the shell 14 and passes downwardly through the drain openings 38 where it is collected in the steam drum, or the like.

As a result of the tandem separation achieved by the first and second separator stages thus described, several advantages result. For example, the steam-water separator is achieved at relatively low pressure loss and low carryover over a wide range of steam and water flow conditions. Also, the separator 10 can operate under high steam and water loading while maintaining the low pressure loss. Finally, the separator of the present invention is of a simple, efficient design and is relatively inexpensive to fabricate.

In a second embodiment of the invention shown in Figs. 4 and 5 the shell 14 is terminated a short way above the discharge member 20 in an open end and the water relief holes of the previous embodiment are omitted. Furthermore, the splash ring 26 extends radially to a depending skirt 42 which surrounds the top end of the shell 14. A further cylindrical member 44 of greater diameter than the skirt 42 surrounds the discharge member 34 and extends downwards to overlap the said skirt 42. Members 44 and 42 comprise shrouds which trap any water which is separated from the steam-water mixture as a consequence of its centrifugal motion when it emerges from the discharge means 20, 34. The swirl kinetic energy is absorbed on the inner walls of members 42, 44 and the water drops under gravitational force to the base of the steam drum.

As is best seen from Figure 5, within and at the base of the shell 14 there is disposed a plurality of radial fins or plates 46. These plates extend for a short way up the shell from the base thereof and serve to remove any swirl kinetic energy from the water which drains downwards from the inner walls of the shell and from the discharge device 20. The fins or plates 46 are uniformly perforated (47) to assist in the removal of the said swirl kinetic en-

ergy.

Shell 14 has a bottom axial end wall formed by an inverted dish-shaped member 48 on which the fins 46 are mounted. The member 48 is also perforated over its whole surface with perforations 50 to allow drainage of water from the separator.

Riser 12 is fitted internally along its axial length with a pair of helical ribs 52, 54. These ribs act as baffles and provide the steam-water mixture with pre-spin before it enters the first stage discharge member 20.

In a further modification shown in Figure 6 the individual arms 20, 34 of the discharge members, or of at least one of the discharge members, are straight along a substantial part of their length instead of being curved or spiral-shaped as in Figures 2 and 3. These arms are disposed substantially tangentially to their root diameter. The ends of the arms are curved all in the same direction so as to discharge the steam-water mixture in a direction substantially tangential to the inner wall of the shell 14 or shroud 44, as the case may be.

The respective riser and discharge devices 20, 34 also have the features shown in Figures 7 and 8, wherein Figure 8 is a purely schematic illustration of the structure shown in detail in Figure 7. Each arm of the respective discharge device is fitted with a plurality of horizontal separators 56A-56C spaced apart in the vertical direction so as to divide the hollow interior into a series of substantially equally dimensioned passages 58A-58D arranged one above the other. The separators 56A-56C are each joined to a respective one of a number of nested vertically disposed cylindrical coaxial separators 60A-60C mounted in the respective riser 12, 28. Thus the inner coaxial separator 60C defines a cylindrical passage 62D which communicates with the top compartment in each of the arms of the discharge device 20, 34 and the other two coaxial separators 60A, 60B define annular passages 62A-62C each of which communicates with respective corresponding passages in the said arms, each passage thereby defining a path which is isolated from the paths defined by the other passages.

As the mixture rises in the riser, the kinetic energy contained by the separated water droplets carries the latter upwards to the upper surfaces of the discharge device. In the absence of the above-described modification, the water has a tendency to mainly collect at the top of the device and be discharged at a higher level than the separated steam and so become re-entrained with the steam as the latter rises. By dividing the separator into a plurality of separate paths, the separated water remains in each path, collecting at the ends of the passages as shown at 64A-64D. The consequent discharge of water from the discharge devices at lower levels improves the overall performance characteristic of the separator.

Claims

1. A steam water separator (10) having lower and upper separator stages wherein the lower stage comprises a first riser (12) for receiving a steam water mixture and for directing said mixture to an upper section thereof formed with a plurality of discharge slots (18), and discharge passages (20) in registry with the slots and extending laterally therefrom to direct said mixture from the riser towards a shell (14) surrounding the discharge passages, whereby water from said mixture collects on the shell and remaining mixture continues to rise therefrom, means being provided for directing said remaining mixture to the upper separator stage disposed over the first stage, the upper separator stage comprising a second riser (24) for receiving said remaining mixture and directing same to an upper section thereof,
   CHARACTERISED IN THAT
   the upper section of the second riser is formed with a plurality of discharge slots (32), and discharge passages (34) in registry with the slots, which passages extend laterally from the slots (32) to direct said mixture from the second riser towards a shell (44) surrounding the discharge passages (34),
   IN THAT
   the discharge passages (20,34) comprise a plurality of open-ended conduits uniformly angled relative to radii passing through the respective slots (18,32) from which they extend,
   AND IN THAT
   in at least one of the separator stages the conduits comprising the discharge passages (20,34) are divided internally with horizontal partitions (56) to form in each conduit a plurality of steam-water mixture paths (58), one above the other, and the respective riser path is partitioned to form a plurality of vertical paths (62), corresponding in number with the number of paths (58) in the conduits, with each path (62) of the riser (12,24) coupled only with the paths (58) of the conduits which occupy the same relative vertical position.

2. A separator according to Claim 1 CHARACTERISED IN THAT the same shell (14) extends around the first and second separator stage risers.

3. A separator according to Claim 2 CHARACTERISED IN THAT a plurality of openings (36) are formed in said shell to permit radial dis-

charge of water between the separator stages.

4. A separator according to Claim 3 CHARACTERISED IN THAT at least a portion of the openings (36) in the shell (14) are located above the level of the discharge passages (20) of the first separator stage.

5. A separator according to Claim 3 or Claim 4 CHARACTERISED IN THAT one or more shrouds surround the openings (36) for intercepting the radial discharges of water, whereby the trapped water flows vertically downwards so as to fall from the shroud with little or no radial or swirl velocity.

6. A separator according to any preceding Claim CHARACTERISED IN THAT the directing means comprises a coaxial drip ring (28) depending from the second stage riser (24) towards said discharge passages (20) associated with the first stage riser, and a splash plate (26) isolating the discharge passages (34) of the second separator stage from the discharge passages (20) of the first separator stage.

7. A separator according to any preceding Claim CHARACTERISED IN THAT the discharge passages (20,34) of at least one of the separator stages comprises a plurality of spiral conduits.

8. A separator according to any of Claims 1 to 6 CHARACTERISED IN THAT the discharge passages (20,34) of at least one of the separator stages comprises a plurality of substantially linear tangential conduits.

9. A separator according to Claim 8 CHARACTERISED IN THAT the tangential arms are incursive at their open-ends.

10. A separator according to any preceding Claim CHARACTERISED IN THAT at least said first riser (12) comprises a cylindrical tube fitted internally with helical baffle means (52,54) to rotate the steam-water mixture as it passes up the riser and before it enters the respective discharge passages (20).

11. A separator according to any preceding Claim CHARACTERISED IN THAT water anti-vortex means are provided at the base of the separator whereby the velocity of discharged water has components only in the vertical plane.

12. A separator according to Claim 11 CHARACTERISED IN THAT the anti-vortex means comprises a flow diffuser at the bottom end of the shell and/or vertical radial plates.

13. A separator according to Claim 12 CHARACTERISED IN THAT the anti-vortex means comprises a flow diffuser in the form of a dish-shaped perforated annular member, and radial plates perforated so as to facilitate the removal of the kinetic energy in the water exiting from the separator due to the swirl imparted to the mixture as the latter passes through the risers and discharge means.

14. A separator according to any preceding Claim CHARACTERISED IN THAT the partitions in the respective riser (12,24) comprise concentric tubes (60); and the partitions in the respective discharge passages (20,34) comprise horizontal plates (56).

Patentansprüche

1. Tandemabscheider (10) für ein Dampf-Wasser-Gemisch mit einer unteren und einer oberen Abscheiderstufe, wobei die untere Abscheiderstufe eine erste Steigleitung (12) für die Aufnahme eines Dampf-Wassergemisches und zum Lenken des Gemisches in einen oberen Abschnitt der unteren Abscheiderstufe aufweist, mit einer Anzahl von Ausströmschlitzen (18) und Ausströmöffnungen (20), in Registeranordnung zu den Ausströmschlitzen und seitlich von diesen sich erstreckend, um das Gemisch von der Steigleitung zu einer Umhüllung (14) zu leiten, welche die Ausströmoffnungen umgibt, wobei Wasser aus dem Gemisch sich an der Umhüllung sammelt und das verbleibende Gemisch fortgesetzt an der Umhüllung aufsteigt, mit einer Einrichtung zum Leiten des verbleibenden Gemisches zu der oberen Abscheiderstufe, die oberhalb der ersten Stufe angeordnet ist, wobei die obere Abscheiderstufe eine zweite Steigleitung (24) zum Aufnehmen des verbleibenden Gemisches und zum Lenken des Gemisches zu einem oberen Abschnitt aufweist,
dadurch gekennzeichnet,
daß der obere Abschnitt der zweiten Steigleitung eine Anzahl von Ausströmschlitzen (32) und Ausströmöffnungen (34) aufweist, in Registeranordnung zu den Ausströmschlitzen und seitlich von den Ausströmschlitzen (32) sich erstreckend, um das Gemisch von der zweiten Steigleitung gegen eine Umhüllung (44) zu lenken, welche die Ausströmöffnungen (34) umschließt, daß die Ausströmöffnungen (20, 34) eine Anzahl von Leitungen mit offenen Enden aufweisen, die gleichförmig geneigt relativ zu

den Radien verlaufen die durch die entsprechenden Ausströmschlitze (18, 32) verlaufen, von denen sie sich erstrecken, und daß in zumindest einer der Abscheiderstufen die Leitungen, die die Ausströmöffnungen (20, 34) enthalten, im Inneren durch horizontale Trennwände (56) unterteilt sind, um in jeder Leitung eine Anzahl von Dampf-Wassergemischpfaden (58) zu formen, die übereinander verlaufen und der entsprechende Steigleitungspfad unterteilt ist, um eine Anzahl von Vertikalpfaden (62) zu formen, deren Anzahl mit der Anzahl der Pfade (58) in den Leitungen korrespondiert, wobei jeder Pfad (62) der Steigleitung (12, 24) nur mit den Pfaden (58) der Leitungen gekoppelt sind, welche die gleiche relative Vertikalposition einnehmen,

2. Abscheider nach Anspruch 1,
dadurch gekennzeichnet,
daß die gleiche Umhüllung (14) sowohl die erste als auch die zweite Steigleitung der Abscheiderstufen umschließt.

3. Abscheider nach Anspruch 2,
dadurch gekennzeichnet,
daß eine Anzahl von Öffnungen (36) in der Umhüllung vorhanden ist, die ein radiales Ausströmen von Wasser zwischen den Abscheiderstufen zulassen.

4. Abscheider nach Anspruch 3,
dadurch gekennzeichnet,
daß zumindest ein Teil der Öffnungen (36) in der Umhüllung (14) oberhalb des Niveaus der Ausströmoffnungen (20) dar ersten Abscheiderstufe angeordnet sind.

5. Abscheider nach Anspruch 3 oder 4,
dadurch gekennzeichnet,
daß eine oder mehrere Abdeckungen die Öffnungen (36) zum Unterbrechen des radialen Ausströmens von Wasser umgeben, wobei das aufgefangene Wasser nach unten in der Weise abströmt, daß es von den Abdeckungen mit geringer oder keiner Radial- oder Wirbelströmung abfließt.

6. Abscheider nach irgendeinem vorstehenden Anspruch,
dadurch gekennzeichnet,
daß die Lenkeinrichtung einen koaxialen Ablaufring (28) aufweist, der von der Steigleitung der zweiten Abscheiderstufe (24) sich nach unten gegen die Ausströmöffnungen (20) erstreckt, die der Steigleitung der ersten Abscheiderstufe zugeordnet sind sowie eine Spritzwasserplatte (26), die die Ausströmöffnungen (34) der zweiten Abscheiderstufe von den Ausströmöffnungen (20) der ersten Abscheiderstufe isoliert.

7. Abscheider nach irgendeinem vorstehenden Anspruch,
dadurch gekennzeichnet,
daß die Ausströmöffnungen (20, 34) von zumindest einer der Abscheiderstufen eine Anzahl von spiralförmigen Leitungen umfassen.

8. Abscheider nach irgendeinem vorstehenden Anspruch,
dadurch gekennzeichnet,
daß die Ausströmöffnungen (20, 34) zumindest einer der Abscheiderstufen eine Anzahl von im wesentlichen linearen, tangential verlaufenden Leitungen umfassen.

9. Abscheider nach Anspruch 8,
dadurch gekennzeichnet,
daß die tangentialen Teile an ihren offenen Enden nicht gekrümmt sind.

10. Abscheider nach irgendeinem vorstehenden Anspruch,
dadurch gekennzeichnet,
daß zumindest die erste Steigleitung (12) ein zylindrisches Rohr enthält, in dessen Inneren schraubenförmig gewundene Umlenkbleche (52, 54) angebracht sind, die das Dampf-Wasser-Gemisch während seines Durhhganges durch die Steigleitung und bevor es die Ausströmöffnungen (20) erreicht, in Drehung versetzen.

11. Abscheider nach irgendeinem vorstehenden Anspruch,
dadurch gekennzeichnet,
daß eine Wirbel dämpfende Einrichtung für das Wasser an der Basis des Abscheiders vorhanden ist, so daß die Strömsgeschwindigkeit des ausströenden Wassers nur Komponenten in der Vertikalebene aufweist.

12. Abscheider nach Anspruch 11,
dadurch gekennzeichnet,
daß die Wirbel dämpfende Einrichtung einen Strömungsdiffusor am Bodenende der Umhüllung und/oder vertikale Radialplatten umfaßt.

13. Abscheider nach Anspruch 12,
dadurch gekennzeichnet,
daß die Wirbel dämpfende Einrichtung einen Strömungsdiffusor in Gestalt eines schalenförmigen, perforierten Ringteiles und perforierte Radialplatten umfaßt, die zusammen es ermöglichen, die kinetische Energie in dem aus

dem Abscheider austretenden Wasser zu entfernen, wobei diese Energie durch die Verwirbelung des Gemisches entsteht, wenn dieses die Steigleitungen und die Ausströmeinrichtungen passiert.

14. Abscheider nach irgendeinem vorstehenden Anspruch,
dadurch gekennzeichnet,
daß die Trennwände bzw. Unterteilungen in den entsprechenden Steigleitungen (12, 24) konzentrische Rohre (60) und die Unterteilungen in den entsprechenden Öffnungen (20, 34) horizontale Platten (56) umfassen.

Revendications

1. Séparateur vapeur eau (10) comportant des étages de séparation inférieur et supérieur, dans lequel l'étage inférieur comporte une première colonne montante (12) destinée a recevoir un mélange vapeur-eau et à diriger ledit mélange vers sa section supérieure qui comporte de multiples fentes d'évacuation (18), et des passages d'évacuation (20) qui coïncident avec les fentes et s'étendent latéralement depuis celles-ci en vue de diriger ledit mélange de la colonne montante vers une chemise (14) entourant les passages d'évacuation, pour qu'ainsi de l'eau l'eau provenant dudit mélange s'accumule sur la chemise, tandis que le mélange résiduel continue à monter depuis celle-ci, des moyens étant prévus pour diriger ledit mélange résiduel vers l'étage de séparation supérieur disposé au-dessus du premier étage, étage de séparation supérieur qui comporte une seconde colonne montante (24) destinée à recevoir ledit mélange résiduel et à diriger celui-ci vers sa section supérieure,
CARACTERISE EN CE QUE
la section supérieure de la seconde colonne montante comporte de multiples fentes d'évacuation (32), et des passages d'évacuation (34) qui coïncident avec les fentes, les passages s'étendant latéralement depuis les fentes (32) pour diriger ledit rélange de la seconde colonne montante vers une chemise (44) qui entoure les passages d'évacuation (34),
EN CE QUE
les passages d'évacuation (20, 34) comportent de multiples conduits à extrémité ouverte orientés suivant un angle uniforme par rapport à des rayons passant par les fentes (18, 32) respectives à partir desquelles ils s'étendent,
ET EN CE QUE
dans l'un au moins des étages de séparation, les conduits comportant les passages d'évacuation (20, 34) sont divisés intérieurement par des cloisons horizontales (56) pour définir dans chaque conduit plusieurs trajectoires de mélange vapeur-eau (58) disposées les unes au-dessus des autres, la trajectoire de la colonne montante correspondante étant divisée pour définir plusieurs trajectoires verticales (62) dont le nombre correspond au nombre des trajectoires (58) définies dans les conduits, et chaque trajectoire (62) de la colonne montante (12, 24) étant reliée uniquement aux trajectoires (58) des conduits qui occupent la même position relative en hauteur.

2. Séparateur selon la revendication 1, CHARACTERISE EN CE QUE la même chemise (14) s'étend autour des colonnes montantes des premier et second étages de séparation.

3. Séparateur selon la revendication 2, CARACTERISE EN CE QUE plusieurs orifices (36) sont définis dans ladite chemise pour permettre une évacuation d'eau radiale entre les étages de séparation.

4. Séparateur selon la revendication 3, CARACTERISE EN CE QU'une partie au fins des orifices (36) définis dans la chemise (14) est située au-dessus du niveau des passages d'évacuation (20) du premier étage de séparation.

5. Séparateur selon la revendication 3 ou la revendication 4, CARACTERISE EN CE QU'une ou plusieurs enveloppes entourent les orifices (36) en vue d'intercepter les évacuations d'eau radiales, pour qu'ainsi l'eau emprisonnée s'écoule verticalement vers le bas en tombant de l'enveloppe avec une vitesse radiale ou tourbillonnaire faible ou nulle.

6. Séparateur selon l'une quelconque des revendications précédentes, CARACTERISE EN CE QUE les moyens directeurs comportent un anneau d'égouttage coaxial (28) qui pend depuis la colonne montante (24) du second étage en direction desdits passages d'évacuation (20) associés à la colonne montante du premier étage, et une plaque d'éclaboussures (26) qui isole les passages d'évacuation (34) du second étage de séparation des passages d'évacuation (20) du premier étage de séparation.

7. Séparateur selon l'une quelconque des revendications précédentes, CARACTERISE EN CE QUE les passages d'évacuation (20, 34) de l'un au moins des étages de séparation comportent de multiples conduits en spirale.

8. Séparateur selon l'une quelconque des revendications 1 à 6, CARACTERISE EN CE QUE les passages d'évacuation (20, 34) de l'un au moins des étages de séparation comportent de multiples conduits tangentiels sensiblement linéaires.

9. Séparateur selon la revendication 8, CARACTERISE EN CE QUE les bras tangentiels sont incurvés au niveau de leurs extrémités ouvertes.

10. Séparateur selon l'une quelconque des revendications précédentes, CARACTERISE EN CE QU'au moins ladite première colonne montante (12) comporte un tube cylindrique équipé intérieurement de moyens déflecteurs hélicoïdaux (52, 54) destinés à faire tourner le mélange vapeur-eau lorsqu'il remonte le long de la colonne montante et avant qu'il ne pénètre dans les passages d'évacuation respectifs (20).

11. Séparateur selon l'une quelconque des revendications précédentes, CARACTERISE EN CE QU'il est prévu des moyens pour empêcher un vortex de l'eau au niveau de la base du séparateur, pour qu'ainsi la vitesse de l'eau évacuée ait des composantes uniquement dans le plan vertical.

12. Séparateur selon la revendication 11, CARACTERISE EN CE QUE les moyens antivortex comportent un diffuseur d'écoulement au niveau de l'extrémité inférieure de la chemise et/ou des plaques radiales verticales.

13. Séparateur selon la revendication 12, CARACTERISE EN CE QUE les moyens antivortex comportent un diffuseur d'écoulement qui se présente sous la forme d'un élément annulaire perforé en forme de cuvette, et des plaques radiales perforées, afin de faciliter l'élimination de l'énergie cinétique présente dans l'eau qui sort du séparateur, du fait du tourbillon imparti au mélange, lorsque ce dernier passe à travers les colonnes montantes et les moyens d'évacuation.

14. Séparateur selon l'une quelconque des revendications précédentes, CARACTERISE EN CE QUE les cloisons prévues dans la colonne montante (12, 24) correspondante comportent des tubes concentriques (60); et en ce que les cloisons prévues dans les passages d'évacuation (20, 34) respectifs comportent des plaques horizontales (56).

Fig.1.

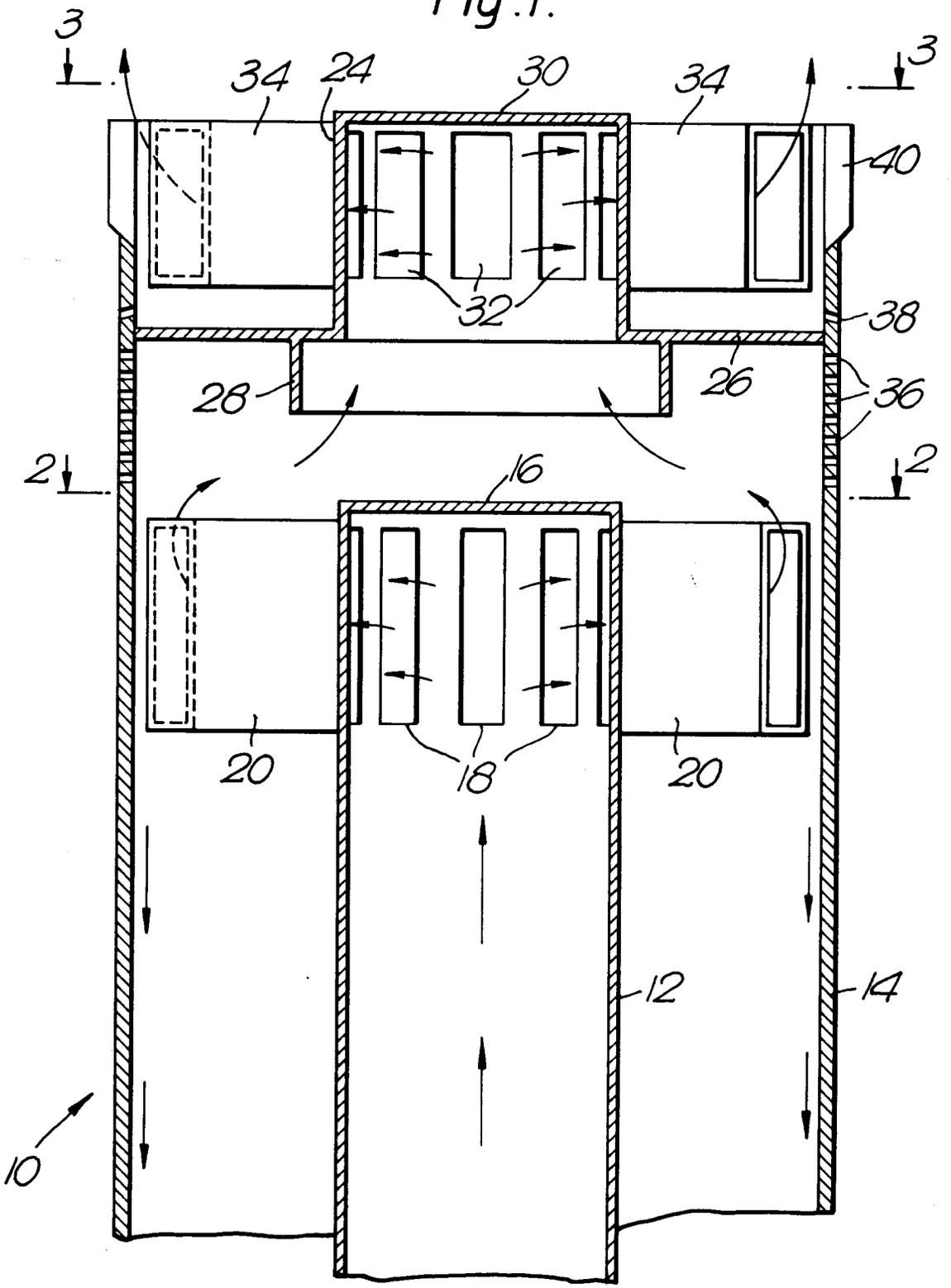


Fig.2.

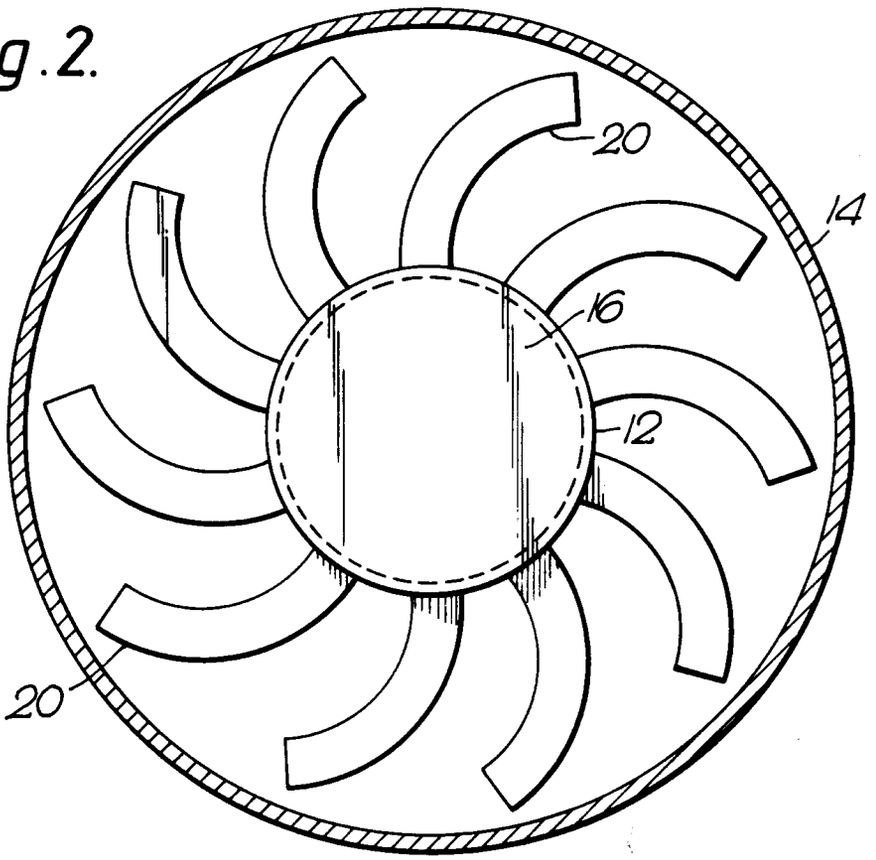


Fig.3.

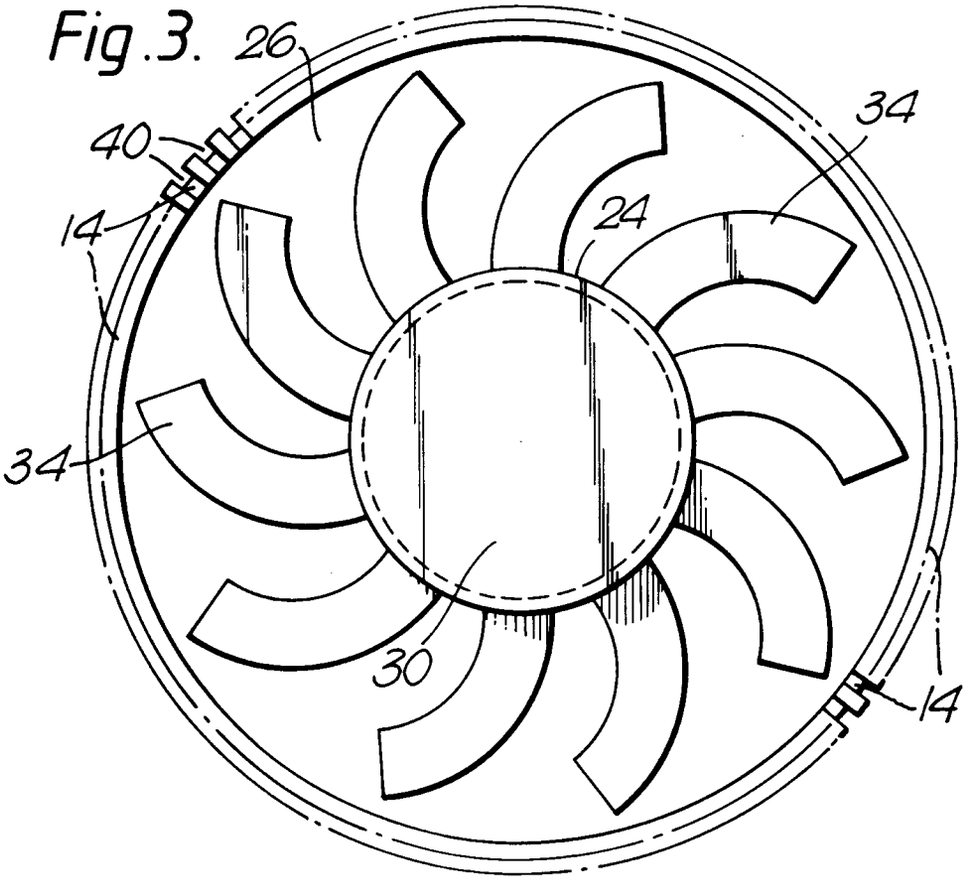
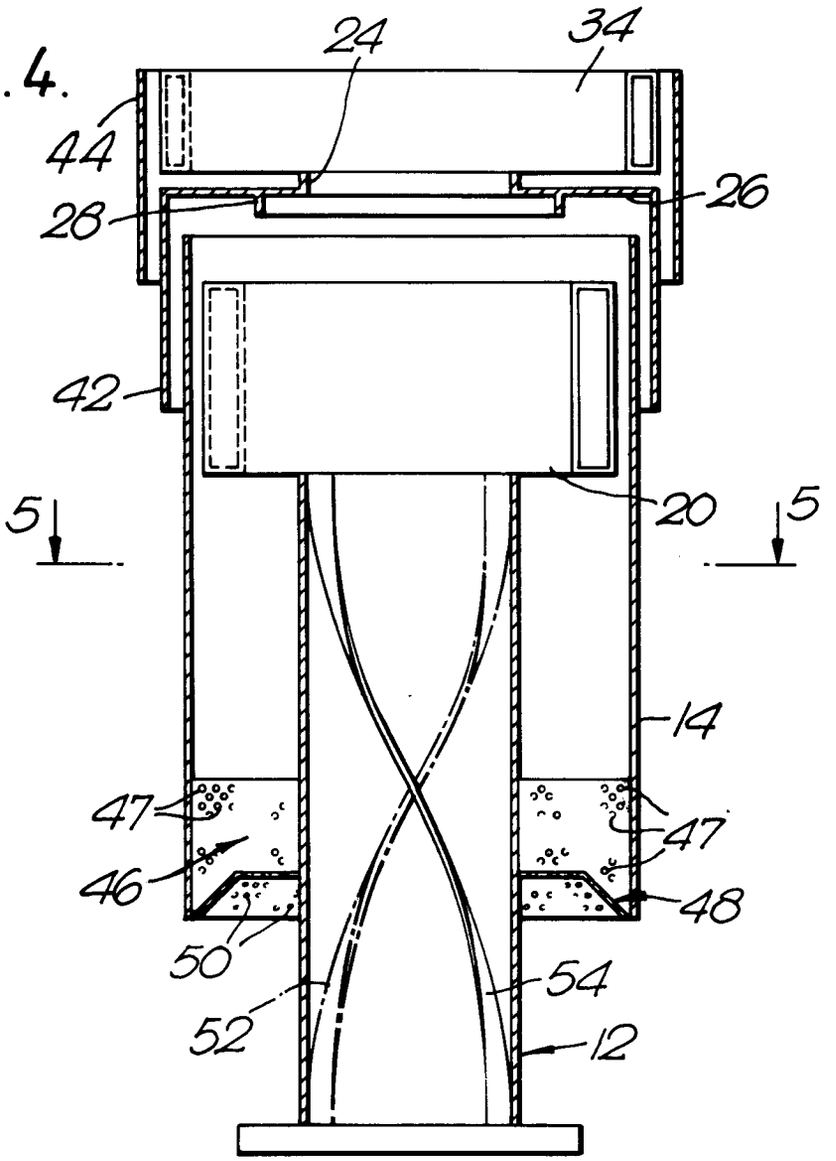


Fig.4.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12

Fig.5.

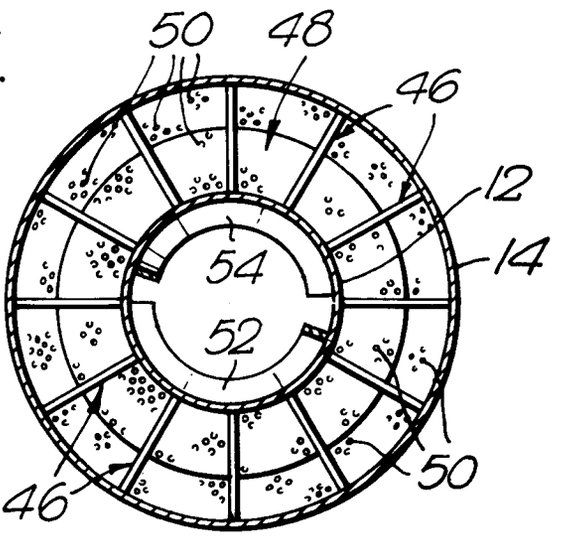
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Fig. 6.

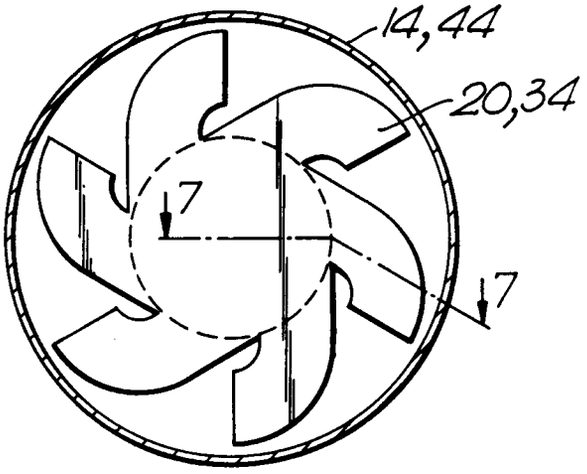

Fig. 8.

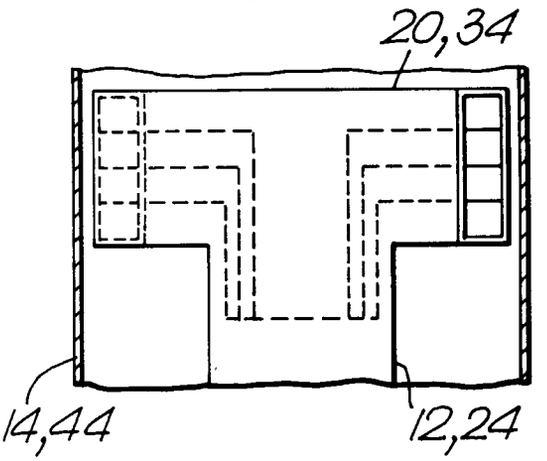

Fig. 7.