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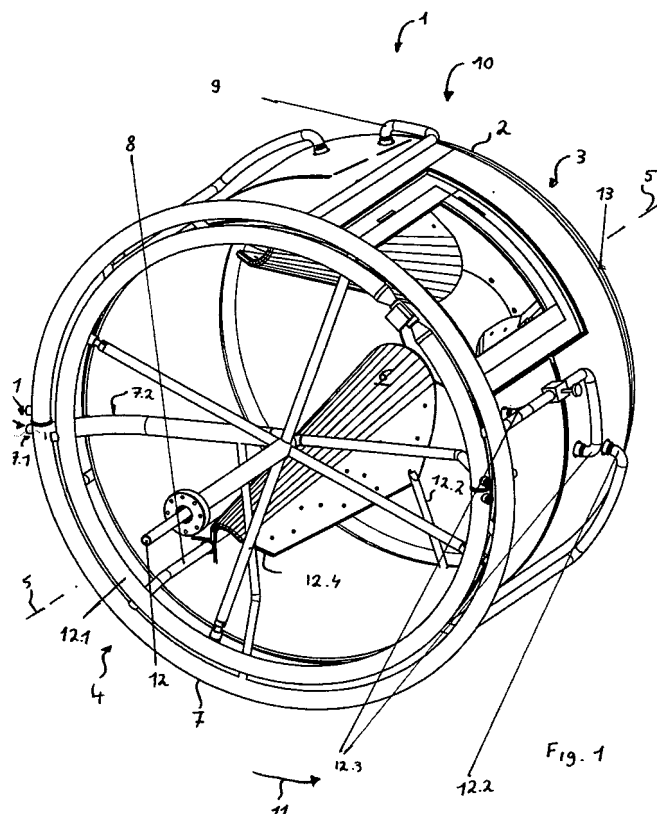
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(54) **Mixer with indirect steam heating and/or water heating or cooling**

(57) The present invention relates to a mixer (1) with a drum (10) that comprises a mantel (2), a bottom and a

top and which rotates around an axis of rotation (5). The present invention further relates to a method for heating the rotating drum of a mixer.



Description

[0001] The present invention relates to a mixer with a drum that comprises a mantel, a bottom and a top and which rotates around an axis of rotation. The present invention further relates to a method for heating the rotating drum of a mixer.

[0002] Such mixers are known from the state of the art and for example produced by the applicant of this patent application. These mixers are particularly utilized for dry mixing, for example of chemicals, food products or the like. In the past, these mixers have been indirectly heated, i.e. the heating medium does not get into contact with the product to be mixed, with water or oil as a heating medium. However, the maximum temperature up to which the mixer can be heated with these transfer media and/or the heat transfer is limited.

[0003] It was therefore the objective of the present invention to provide a mixer that can be heated to higher temperatures than mixers according to the state of the art and which is easy to build, to clean and/or to maintain.

[0004] This objective is attained with a mixer with a drum that comprises a mantel, which is closed at both ends and which rotates around an axis of rotation, whereas the drum is indirectly heated with steam and/or heated or cooled with water and/or any other fluid medium.

[0005] The present invention relates to a mixer, this mixer comprises a drum, which rotates around an axis of rotation, which is preferably arranged horizontally. The rotation of the drum can be continuous or discontinuous. The drum can rotate around the axis of rotation clockwise or counterclockwise. The drum of the mixer comprises a mantel, which is preferably shaped cylindrically and which is closed at both ends, for example with a column-plate. The drum is preferably made from steel, particularly from stainless-steel.

[0006] According to the present invention, the drum is heated indirectly with steam, i.e. the product to be mixed is, during the mixing process, never in contact with this heating-steam. During the heating of the drum, the steam condensates at least partially and this condensate is removed from the mixer without touching the product. The person skilled in the art understands, that steam can be added to the product inside the drum in case the recipe requires the addition of steam.

[0007] Preferably, the drum comprises at least one, preferably a multitude of internal mixing means. Such an internal mixing means is for example a plate, which is preferably bent. Each internal mixing means is preferably fixed to the drum and more preferably co-rotates together with the drum. Even more preferred, the inventive mixer does not comprise any mixing means which move relative to the drum.

[0008] Preferably at least one such internal mixing means and/or the mantel of the drum are heated with steam. Preferably, each internal mixing means comprises one steam inlet and one condensate outlet. The mantel comprises preferably one two or more hollow seg-

ments which can be subjected to steam, preferably individually. In case water is used as a heat transfer medium, preferably two or more individual segments are provided. Preferably, the internal mixing means are at least partially hollow. In this hollow volume, the steam is injected and heats the sidewall of the internal mixing means. The mantel comprises preferably two sidewalls, preferably concentric sidewalls, which are spaced apart. In this hollow volume steam and/or water is injected, for example to heat and/or cool the inner sidewall of the mantel. In case of water as a heat transfer medium, the hollow volume between the sidewalls is preferably divided in two or more individual segments. Each segment extends preferably essentially over the entire length of the mantel and more preferably along only a part of the circumference of the inner sidewall. Each segment preferably comprises a steam-inlet and a condensate outlet. The segments are operated in parallel. These segments can be operated in series, for example, in case water is inserted into the hollow volume between the sidewalls.

[0009] In a preferred embodiment of the present invention, condensate is removed from each internal mixing means and/or the mantel via a collecting volume, preferably a collection pipe, which is connected to the condensate discharge of one, preferably each, internal mixing means and/or the condensate discharge from the mantel. The collecting volume co-rotates with the drum. Preferably, the collecting volume, preferably the collecting pipe, has the same shape as the circumference of the mantel of the drum. More preferably, the collecting volume, preferably the collecting pipe, is at least partially ring-shaped. In an even more preferred embodiment of the present invention, the cross section of the collecting volume, preferably the collecting pipe, is closed at one position, at least partially. Preferably, one of the ends, more preferably both ends of the collecting volume, preferably the collecting pipe, are closed. Preferably, the collecting volume, preferably the collecting pipe, extends at least partially, more preferably entirely beyond the circumference of the drum, i.e. the distance of the collecting volume from the centerline is at least locally, preferably entirely, larger than the distance of the mantel of the drum from this centerline.

[0010] Preferably, internal mixing means comprise a condensate collection area in which the condensate is collected before it is discharged. More preferred, the condensate collection area is tilted towards the condensate discharge.

[0011] The person skilled in the art understands that, in case the mixer is heated or cooled with water and/or oil, in the entire disclosure the subject matter "steam" and "condensate" has to be substituted by the subject matter "water and/or oil and/or any other fluid medium". Particularly, the steam inlet is the water/oil-inlet, whereas the condensate outlet, the condensate collection and/or condensate discharge is the water/oil outlet, water/oil collection and/or the water/oil discharge.

[0012] Another subject matter of the present invention

is a method for heating the rotating drum of a mixer, with steam, whereas condensate is removed from the mixer discontinuously.

[0013] The disclosure made regarding the inventive mixer also applies to the inventive method and vice versa.

[0014] According to inventive method of the present invention, the condensate is removed from the mixer discontinuously. Preferably, the discharge takes only place in certain rotational positions of the drum, preferably limited to a rotational segment of $<180^\circ$, more preferably $<150^\circ$ and even more preferably $<120^\circ$ and even much more preferred $<90^\circ$.

[0015] According to another or a preferred embodiment of the present invention, the condensate is discharged from the mixer, from the internal mixing means and/or from the mantel at least temporarily, preferably entirely, by gravity, i.e. no pump is needed to discharge the condensate.

[0016] The disclosure made regarding the inventive mixer and the inventive method also applies to this inventive method and vice versa.

[0017] According to a preferred or another embodiment of the present invention, the mixing means and/or at least a segment of the mantel of the drum is heated with steam and the condensate is removed from the mixer and/or from the internal mixing means and/or from the mantel and/or only once per rotation of the drum.

[0018] The disclosure made regarding the inventive mixer and the inventive method also applies to this inventive method and vice versa.

[0019] The inventions are now explained according to fig. 1 - 7. These explanations do not limit the scope of protection. The explanations apply to all inventions likewise.

Fig. 1 shows the inventive mixer.

Fig. 2 shows construction details of the mixer according to fig. 2.

Fig. 3 - 7 show enlarged drawings shown in fig. 2.

[0020] Fig. 1 shows the inventive mixer 1. This mixer comprises a drum 10 with a mantel 2, which is in the present case cylindrical. The mantel 11 is closed at its first and second end 3, 4 by a bottom plate. For mixing purposes, the drum rotates around its axis of rotation 5. In the present case, the mantel 2 of the drum 10 comprises two side walls, which are arranged concentrically and which are spaced apart, so that there is a hollow volume between the two side walls of the drum. Inside, the inventive mixer comprises at least one mixing means 6, which improves the mixing of products within the drum. As can be particularly seen from fig. 3, this mixing means 6 is hollow, so that steam can be injected into the mixing means 6. In the present case, the hollow volume between the first and the second side wall of the mantel 2 is divided in two separate segments. Each segment extends es-

entially over the entire axial length of the drum 10 but extends radially only over a segment of a circle. Each of these segments comprises a steam supply 12. 3, which is, in the present case, connected to a steam distribution pipe 12.1, which has, in the present case, the shape of a ring. The internal mixing means 6 is also connected to a steam supply via the pipe 12.2 which is also connected to the distribution pipe 12.1. Between the steam inlet 12 and the distribution ring 12.1, a connecting pipe 12.4 is arranged. The steam supply to the segments of the mantel and the internal mixing means 6 is operated preferably in parallel. The steam can be fed to the mixer continuously or discontinuously. During the heating of the mixer the steam supplied condensates and this condensate has to be removed from the internal mixing means 6 as well as from the hollow segments of the mantel 2. For this purpose, each internal mixing means comprises a condensate discharge pipe 8 and each hollow segment of the mantel comprises a condensate discharge pipe 9. The pipes 8, 9 are connected to a condensate collection pipe 7, respectively, in which the condensate is collected prior to discharging from the mixer. In the present case, the condensate collection pipe 7 is designed as a ring, whose radius is larger than the external radius of drum 10. The cross section of this pipe 7 is closed at least partially, preferably entirely, at one position 16, preferably between the two ends 7.1 of the pipe 7. From this pipe 7 a discharge pipe extends from the collection pipe 7 here to the center of the drum, through which the condensate which has been collected in the collecting pipe 7 is discharged to the ambient.

[0021] The operation of the inventive mixer is as follows:

The mixing material is added and discharged to the drum 10 continuously or batchwise. During the mixing the drum 10 rotates here counter-clockwise as depicted by arrow 11. In order to heat drum 10, steam is supplied via the steam inlet 12. From there the steam flows via pipe 12.4 to the, here ring-shaped, steam distribution pipe 12.1. To this steam distribution pipe 12.1 a multitude of pipes 12.3, 12.2 are connected, which supply the steam to the internal mixing means 6 and/or the segments of the hollow mantel, respectively. This steam condensates in the internal mixing means 6 and/or in the mantel 2. This condensate is removed from the individual internal mixing means 6, when its condensate discharge pipe 8 is in a position approximately between 7 and 5 o'clock. The condensate from the mantel is discharged, when the condensate discharge pipe 9 of the mantel is in a rotational position between 7 and 5 o'clock. In these positions, the condensate flows from the internal mixing means 6 and from the hollow volume in the mantel into the condensate collection pipe 7. Since the cross section of this pipe 7 is closed at least partially at position 16, the collected fluid is pushed upwards during the rotation of the pipe and

once the discharge pipe has reached approximately the 2 o'clock-position, the collected fluid is discharged via this pipe 7.2 to the ambient. The discharge takes place until the discharge pipe 7.2 has approximately reached the 12 o'clock-position. During the subsequent rotation of the drum, the discharge is repeated. A person skilled in the art understands that during one entire rotation of drum 10, each internal mixing means 6 and each segment in the mantel 2 is emptied from condensate only once. No pump is needed for the discharge of the condensate. Once the condensate in the collection pipe 7 has been lifted over a certain height in the collection pipe 7, due to the rotation of the collection pipe 7, the discharge takes place by gravity.

[0022] Fig. 2 - 7 show construction details of the inventive mixer. As can be particularly seen from fig. 3, in the present case, the mixer comprises a multitude, here three internal mixing means 6, which are all hollow, so that steam can be injected into the internal of these mixing means 6, where it condensates and thereby heats the product to be mixed. The means 6 are fixed to the drum 10 and co-rotate with drum 10. There are no moving parts in the drum. As can be also seen from fig. 3, the inventive mixer comprises preferably support means 14 to support the steam inlet 12 and discharge outlet 7.2 and/or the rotational axis of the mixer.

[0023] Fig. 4 clearly depicts that the condensate collection pipe 7 is fixed to the drum 10 and co-rotates together with the drum 10 and that the diameter of the collection pipe 7 is larger than the outer diameter of the drum 10. This assures that when a pipe 8 or 9 is in its discharge position, e. g. between the 7 and 5 o'clock-position, the condensate flows downwards by gravity into the collection pipe 7. As can be particularly seen from fig. 5, the condensate discharge pipe 8 comprises a sloped portion 8.1, which is sloped downwards when this respective pipe 8 is in its discharge position. This also promotes the discharge from the internal mixing means 6 into the collection pipe 7. Fig. 5 also depicts that each internal mixing means 6 comprises a condensate collection area 6.1. In this collection area 6.1 the condensate in the internal mixing means 6 is collected during the rotation of drum 10. From this collection area 6.1 the condensate flows via condensate discharge pipe 8 into the condensate collection pipe 7. The collection area 6.1 is preferably sloped towards the collection pipe 7, to promote the outflow of the condensate.

[0024] Fig. 6 and 7 show, that steam inlet pipe 12 and condensate discharge 7.2 are at least partially arranged concentrically. Furthermore, it can be seen that drum 10 comprises an inspection opening 15. Particularly, from fig. 7 it can be seen that in the steam supply pipe 12.3 a valve 13 is provided, which is open during steam supply, so that both segments of the hollow mantel 2 are supplied with steam in parallel. In case water is supplied to the hollow mantel, this valve is closed, so that there is only

one supply to the mantel. The two segments are now operated in series. In a preferable embodiment, fluid guiding means, e. g. for water, are arranged between the two side walls to improve the heat transfer between the fluid and the inner side wall of the drum 10.

[0025] List of reference signs:

1	mixer
2	mantel
3	first end,
4	second end
5	axis of rotation
6	internal mixing means, scoop, shovel
6.1	condensate collection area
7	condensate collecting volume, condensate collection pipe
7.1	ends of the condensate collecting pipe
7.2	discharge of the condensate collecting pipe
8	condensate discharge of the mixing means 6
8.1	downward slope
9	condensate discharge of the mantel
10	drum
11	direction of rotation
12	steam inlet
12.1	steam distribution pipe
12.2	steam supply to internal mixing means 6
12.3	steam supply to the mantel 2 of the drum 10
12.4	supply from the steam inlet 12 to the distribution pipe 12.1
13	valve
14	support
15	inspection-, cleaning-opening
16	at least partial closing of the inner diameter of the pipe

Claims

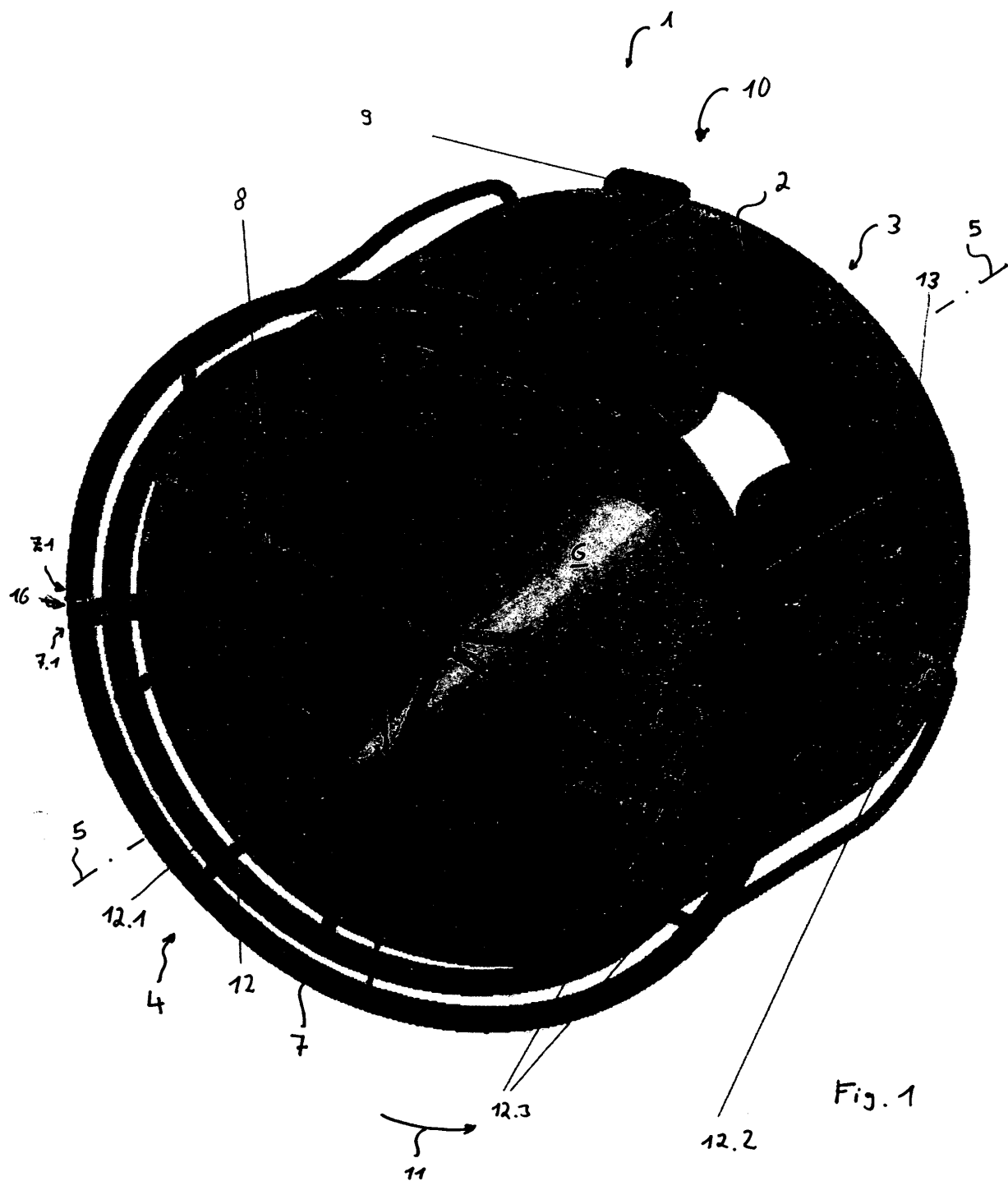
1. Mixer (1) with a drum (10) that comprises a mantel (2), which is closed at both ends (3, 4) and which rotates around an axis of rotation (5), **characterized in, that** the drum (10) is indirectly heated with steam and/or cooled with water and/or oil and/or any other fluid medium.
2. Mixer according to claim 1, **characterized in, that** the drum (10) comprises at least one, preferably a multitude of internal mixing means (6) and that at least one mixing means (6) and/or the mantel (2) of the drum (10) are heated with steam and/or cooled with water and/or oil and/or any other fluid medium.
3. Mixer according to claims 1 or 2, **characterized in, that** the mixing means (6) are at least partially hollow and/or that the mantel (2) comprises two spaced apart sidewalls.
4. Mixer according to one of the preceding claims,

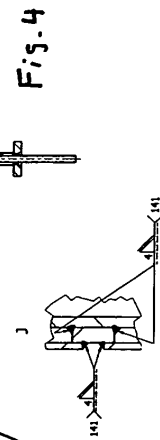
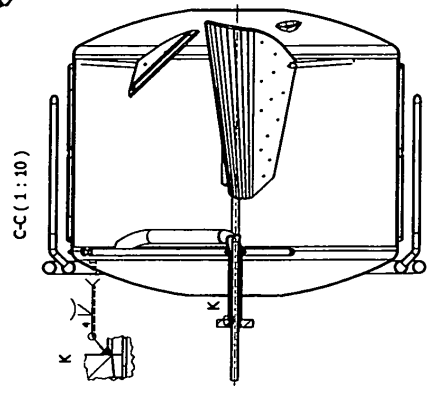
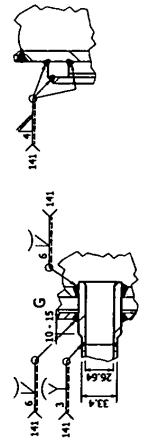
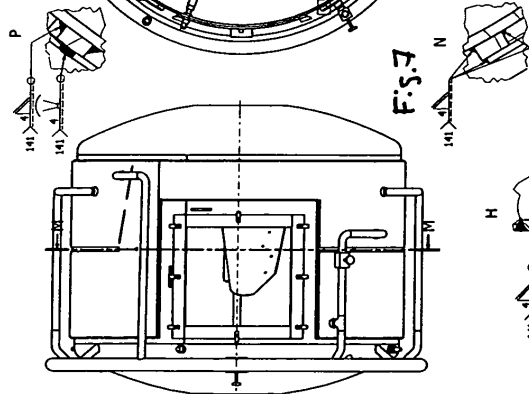
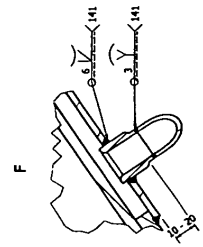
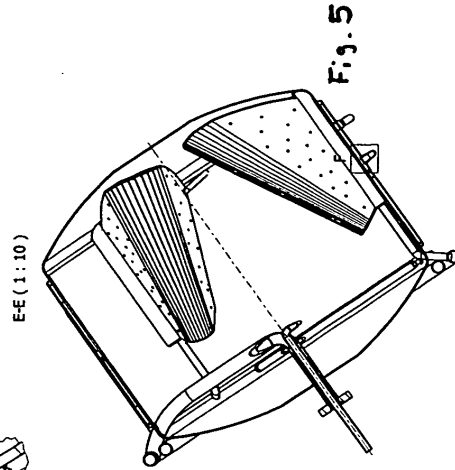
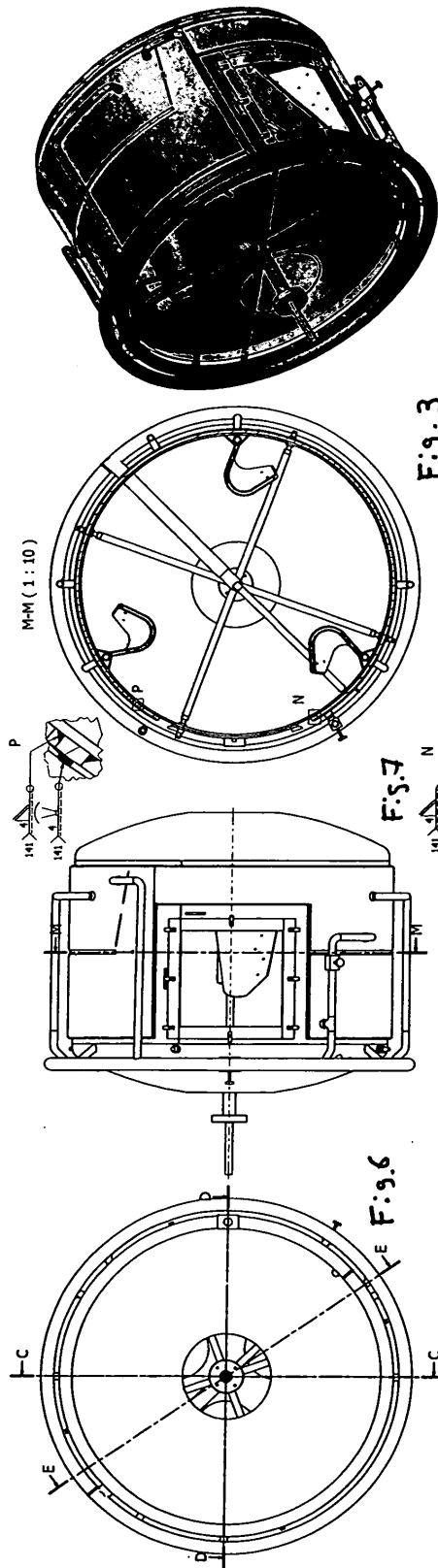
characterized in, that condensate is removed from each mixing means (6) and/or the mantel (2) via a collecting volume, preferably a collection pipe (7) which is connected to the condensate discharge (8) of each mixing means (6) and/or the condensate discharge (9) of the mantel (2). 5

5. Mixer according to claim 4, **characterized in, that** the collecting pipe (7) co-rotates with the drum (10). 10
6. Mixer according to one of claims 4 or 5, **characterized in, that** the collecting pipe (7) is at least partially ring shaped.
7. Mixer according to claim 6, **characterized in, that** the collecting pipe is closed at one location (16), preferably at one or both of its ends (7.1). 15
8. Mixer according to claims 4 - 7, **characterized in, that** the collecting pipe (7) extends at least partially beyond the circumference of the drum. 20
9. Mixer according to one of the claims 2 - 8, **characterized in, that** the internal mixing means (6) comprise a condensate collection area (6.1). 25
10. Mixer according to claim 9, **characterized in, that** the condensate collection area (6.1) is tilted towards the condensate discharge (8). 30
11. Method for heating the rotating drum (10) of a mixer (1), with steam, **characterized in, that** condensate is removed discontinuously.
12. Method according to claim 11 or the preamble of claim 11, **characterized in, that** the condensate is discharged from the mixer (1) and/or from the internal mixing means (6) and/or from the mantel (2) by gravity. 35
13. Method according to one of the preceding claims or the preamble of claim 11, **characterized in, that** mixing means (6) and/or at least a segment of the mantel (2) of the drum is heated with steam and that the condensate is removed discontinuously only once per rotation from the mixer, from each mixing means (6) and/or from each segment of the mantel. 40 45

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EUROPEAN SEARCH REPORT

Application Number
EP 11 00 8149

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	US 3 992 148 A (SHORE DAVID TEIGNMOUTH ET AL) 16 November 1976 (1976-11-16) * column 1, line 5 - line 7 * * column 1, line 42 - line 58 * * column 2, line 12 - line 28 * * figure 1 * -----	1,3-5,8 2,6,7,9,10	INV. B01F9/06 B01F15/06 F28B9/08 F28F5/02
X A	US 3 565 168 A (POWELL HAROLD R ET AL) 23 February 1971 (1971-02-23) * column 1, line 1 - line 5 * * column 1, line 27 - line 30 * * column 1, line 61 - line 68 * * figures * -----	1,3,4 2,5-10	
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-/--			
2 The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 2 October 2012	Examiner Real Cabrera, Rafael
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 11 00 8149

DOCUMENTS CONSIDERED TO BE RELEVANT			
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X	US 738 800 A (HECKING MAX [DE]) 15 September 1903 (1903-09-15) * page 1, line 81 - line 94 * * figures 1,4,5 *	11-13	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 2 October 2012	Examiner Real Cabrera, Rafael
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03/82 (P04C01)



Application Number

EP 11 00 8149

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☒ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

1-13

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



**LACK OF UNITY OF INVENTION
SHEET B**

Application Number

EP 11 00 8149

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-10

Mixer with a rotating drum comprising at least one internal mixing element which is heated with steam and/or cooled with a fluid medium, and other features.

1.1. claims: 1-5, 8-10

Mixer with a rotating drum comprising at least one internal mixing element which is heated with steam and/or cooled with a fluid medium.

1.2. claims: 6, 7

Mixer with a rotating drum comprising a condensate collecting pipe being at least partially ring shaped.

2. claims: 11(completely); 12, 13(partially)

Method for heating a rotating drum with steam wherein condensate is removed discontinuously.

3. claims: 12, 13(partially)

Method for heating a rotating drum with steam wherein condensate is discharged by gravity.

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 00 8149

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

02-10-2012

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