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(54) **DEVICE AND METHOD FOR PRODUCTION OF ASPHALT, INCLUDING ADDITION OF WATER**

(57) Apparatus for production of asphalt mass, wherein the apparatus comprises a mixing device (10), a solids source (14), two bitumen sources (11, 12), a bitumen balance (16) having agitator, in flow connection with the mixing device (10) via conduit (25), an amine source (13), and a water source (15) for foaming of bitumen. A buffer container (17) is arranged in conduit (25)

between the bitumen balance (16) and the mixing device (10) to receive apportioned bitumen. A mixing means with rotor (23) is arranged at the mixing device (10) in connection with a water source (15) and bitumen from the buffer container (17). The apparatus offers a high bitumen production rate.

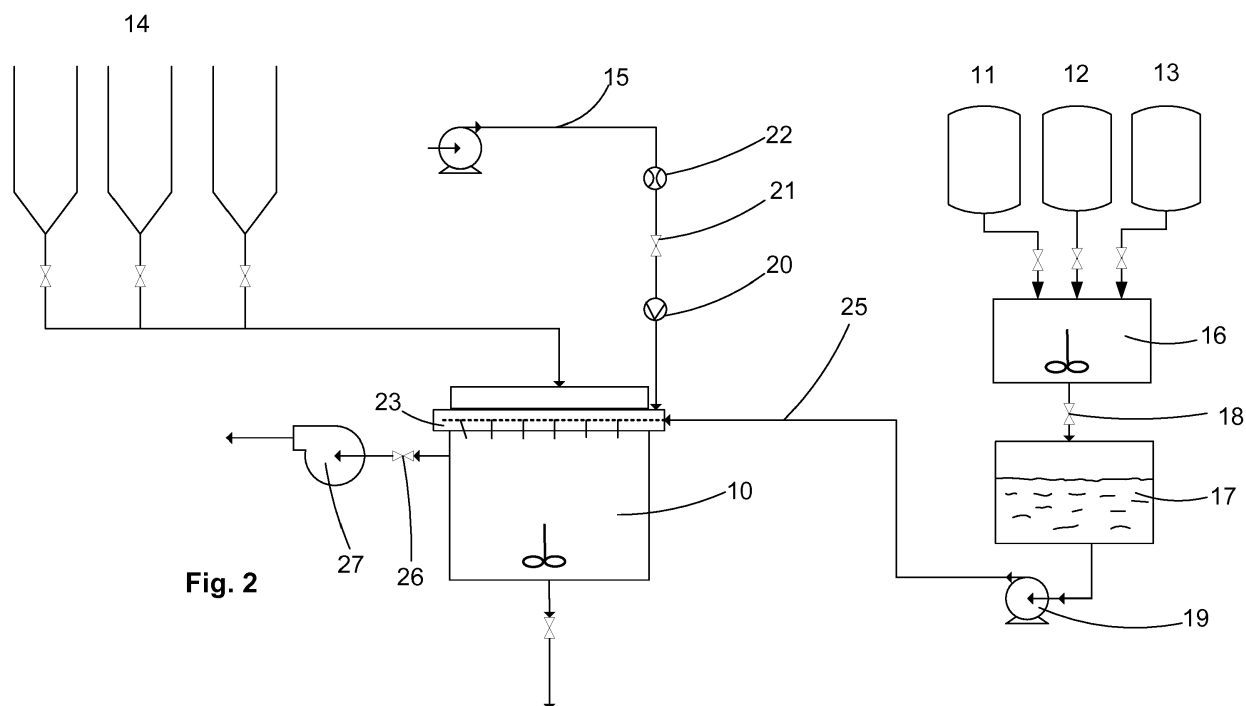


Fig. 2

Description

[0001] The invention concerns an apparatus and a process for production of asphalt, according to the preamble of claim 1 and 5, respectively.

Background

[0002] Asphalt is a mixture of a bitumen containing binder with mineral aggregate (stone), sand and filler. Asphalt typically contains 4-7 weight percent bitumen and is substantially used for road pavement. The composition vary according to the desired hardness, climatic conditions etc.

[0003] Today there are commercially available plants which are designed for production of asphalt mixed with amine and solids, and asphalt from a bitumen emulsion where liquid bitumen is foamed with water to form an emulsion with a predetermined amount of water. Amine is added to obtain better adhesion between bitumen and gravel material.

[0004] During production of asphalt with bitumen emulsion, solids in the form of gravel, sand and other additives are first weighted and supplied to a mixing container. Similarly, in a variant, low-viscous bitumen is weighted, for example V-1500 and amine, which both are mixed in another container (bitumen balance). After the solids have been supplied to the mixing container, the mixture is supplied with the low-viscous bitumen and amine from the bitumen balance to the mixing container. Then, more viscous bitumen is supplied, such as 70/100, from another supply than the bitumen balance. The viscous bitumen is supplied with water at high pressure and temperature to form an oil-in-water emulsion with bitumen dispersed in a water phase. The bitumen emulsion is then supplied to the mixing container where the low-viscous bitumen with amine, solids and bitumen emulsion is mixed at a temperature and for a period of time sufficient to produce a homogenous asphalt mass. Accordingly, a process like this requires two separate supply conduits for bitumen.

[0005] A disadvantage of the method above is that the different operations has to occur sequentially. This represents a disadvantage when one of the bitumen types is to be foamed with water to produce bitumen emulsion. First, the solids have to be weighted and supplied to the mixing container, and the low-viscous bitumen is weighted, mixed with amine and supplied to the mixing container. First then the viscous bitumen can be weighted, foamed with water vapor to produce the bitumen emulsion and supplied to the mixing container together with the rest of the components.

[0006] There is therefore a need for a simpler and faster process for production of asphalt. There is also a need for a simpler process for production of asphalt.

[0007] NO 311 140 B1 describes a method for production of a lukewarm mass of asphalt composition, where an aggregating material mixed with a soft bitumen binder,

is added to a foamed hard bitumen binder having a water content of 2-7 weight percent.

Object

[0008] The object of the invention is to provide a process and apparatus for production of asphalt mass in a simpler and faster manner than with prior art processes.

The invention

[0009] This is achieved by an apparatus according to the characterizing part of claim 1 and a process according to the characterizing part of claim 5. Further advantageous features appear from the respective dependent claims.

[0010] The apparatus for production of asphalt mass according to the invention comprises a mixing device, a solids source, at least two bitumen sources, a bitumen balance having agitator, in flow connection with the mixing device via conduit, optionally an amine source, and a water source to foam bitumen for production of a bitumen emulsion with bitumen dispersed by a certain amount of water.

[0011] In accordance with the invention, the two bitumen sources are in flow connection with the bitumen balance. A buffer container is arranged in the conduit downstream of the bitumen balance and upstream of the mixing device, to receive apportioned bitumen. A mixing means having a rotor and motor is arranged ahead of the mixing device, upstream of the same and in flow connection with the water source and with the conduit downstream of the buffer container. The mixing means is arranged to perform foaming of bitumen and water, when this is to be included in the production.

[0012] A pump is advantageously arranged in the conduit between the mixing means and the buffer container.

[0013] The conduit for supply of water is advantageously provided with a check valve to prevent bitumen from flowing into the water supply in processes where foaming of bitumen is not performed.

[0014] In a process according to the invention for production of asphalt, a mixing device is supplied with solids, bitumen and bitumen emulsion having bitumen dispersed with a determined amount of water, said process comprising

a) apportioning solids and supplying the solids to the mixing device (mixer),

b) apportioning bitumen from a first source, optionally added with amine from an amine source, and mixing said bitumen and amine to form a first bitumen composition,

c) apportioning bitumen from a second source,

d) optional foaming of one or more of the bitumen

sources in a mixing device during supply of water, and

e) supplying the first bitumen composition to the mixing device.

[0015] In accordance with the invention, both bitumen sources are supplied to the bitumen balance for apportioning, and optionally mixing with amine, whereupon the apportioned bitumen is supplied to the buffer container, and further apportioning of bitumen starts in the bitumen balance. Bitumen contained in the buffer container is then supplied to a mixing means arranged upstream of the mixing device, whereby optional foaming of one or more of the bitumen sources is performed in a mixing means during supply of water, prior to supply of the solids to the mixing device with the solids.

[0016] Allotted bitumen in the bitumen balance can simply be dropped down into the buffer container by activating a valve or similar. Bitumen contained in the bitumen container is pumped to the mixing means (which has an internal rotor with motor).

[0017] In other words, the process according to the invention exhibits both supply conduits for bitumen, and amine, into the bitumen balance with agitator, and a buffer container arranged downstream of the bitumen balance, via a pump upstream of a mixing container (mixer) for mixing solids and bitumen for production of finished asphalt. The mixing container is advantageously provided with an exhaust fan or similar, which is arranged to vent water vapor formed during the optional foaming in step d) above. This water vapor-containing exhaust air is not released to the environments, but is guided back to the system at, or prior to, apportioning of solids in step a) above. When solids are dropped into the mixing container, this exhaust fan is closed. This can be performed by a damper or similar at the inlet side of the fan.

[0018] In the following, the invention is described by means of drawings, where identical reference numerals denotes similar or identical components. In the drawings:

Fig. 1 illustrates a strongly simplified process flow diagram of a process for production of asphalt, with and without emulsified bitumen, in accordance with prior art

Fig. 2 illustrates a process flow diagram similar to Fig. 1, but in accordance with the invention.

[0019] In the drawings, details concerning flow control, temperature control and other technical details of the process omitted for simplicity, to simplify the interpretation of the invention. A person skilled in the art will with his/hers professional knowledge and the present description be able to evolve a fully operative process.

[0020] Referring to Fig. 1, a prior art process is illustrated, by a strongly simplified process flow diagram, a process for production of asphalt with possibility for using bitumen emulsion with bitumen dispersed by a certain

amount of water, also called foaming.

[0021] low-viscous bitumen in container 12 is mixed with amine from 13 in a bitumen balance 16 provided with agitator. The weighed-in and agitated substantially low-viscous bitumen composition is supplied to a mixing device 10 via conduit 25, together with solids, such as sand and gravel indicated at 14.

[0022] The solids at 14 is naturally also weighed-in prior to supply to the mixing device (the mixer) 10. Relatively low-viscous bitumen must also be added to the asphalt mass. In this process, viscous bitumen, such as 70/100, is supplied from container 11, apportioned by a flow meter 22 and controlled by valve 21 in conduit 24, and foamed by supply of water 15, and then supplied to the mixing device 10 for mixing with the remaining components for production of finished asphalt mass.

[0023] The viscous bitumen being foamed is this process not supplied any amine. As mentioned in the introductory part of the description, the production occurs sequentially.

[0024] First, solids indicated at 14, such as gravel, sand and other components, are apportioned and supplied to the mixing device 10. At the same time, the bitumen balance is supplied with low-viscous bitumen and amine for apportioning and mixing.

[0025] After the solids have been supplied to the mixing device 10, the bitumen mixture is supplied from the bitumen balance 16 to the mixing device 10. A valve downstream of the bitumen balance is indicated at 18. As soon as the bitumen balance 16 is empty, a new apportioning and mixing of low-viscous bitumen and amine is initiated, to the next production batch. In recipes where the asphalt is to be supplied with viscous bitumen, the process now starts by foaming the asphalt with water to produce bitumen emulsion (O/W).

[0026] In further details, bitumen is pumped from container 11 to a mixing unit 17 supplied with water 15 to foam the bitumen as stated above. Flow meters are omitted for simplicity. The desired amount of bitumen emulsion is further supplied to the mixing device 10, where it is mixed with the solids and the low-viscous bitumen composition from the bitumen balance 16, for production of finished asphalt mass.

[0027] As stated above, the last step prior to mixing with foaming of viscous bitumen is time-consuming. However, the present invention illustrated in Fig. 2 has provided a solution to this problem by a simplified process which also can be performed in a shorter period of time.

[0028] In accordance with the present invention, the separate supply of viscous bitumen via flow meter from the container 11 for foaming has been omitted. Instead, all bitumen variants are supplied to one and same bitumen balance 16 for apportioning and mixing with amine from the containers 11, 12 and 13.

[0029] In accordance with the invention, a buffer container 17 is arranged downstream of the bitumen balance 16. Moreover, a pump device or similar 19 is arranged downstream of the buffer container, said pump device

being further connected with the mixing unit 23, prior to arrival in the mixing device 10. The process occurs as follows: Similar to the prior art, solids is apportioned at 14 and is supplied to the mixing device 10. Simultaneously, or even before apportioning of solids, an apportioning and mixing of low-viscous bitumen from container 12 and amine from container 13 is performed in the bitumen balance 16, whereupon the finished bitumen composition is supplied to the buffer container 17, for example by gravitational flow.

[0030] As soon as the bitumen balance is empty, a new sequence of bitumen weighing is initiated. This is described in further detail below. As soon as the solids have been supplied to the mixing device 10, bitumen is guided from the buffer container 17 to the mixing unit 23, prior to the mixing device 10, for example by a pump 19. As soon as the buffer container 17 is empty, it is prepared to receive bitumen from the bitumen balance 16. In recipes where bitumen emulsion is to be used, the bitumen balance 16 contains viscous bitumen. This viscous bitumen, which is to be foamed, is guided down into the empty buffer container 17 and further to the mixing unit 23, where water is added, prior to the mixing device 10. A check valve 20 is provided in the conduit 15 for supply of water. This will prevent bitumen composition from entering the system for supply of water during supply of bitumen composition which is not to be foamed with water.

[0031] A mixing means 23 with motor and rotor is arranged upstream prior to the mixing device 10 to assist production of bitumen emulsion where viscous bitumen is supplied to the mixing means 23 together with water in conduit 15. A person skilled in the art will also appreciate that also the viscous bitumen can be mixed with amine, contrary to the process described in connection with Fig. 1. As stated above in the general section of the description, an exhaust fan 27 is advantageously arranged, able to withdraw vapor-containing air from the mixing device 10 during the optional foaming of the bitumen. The exhaust fan 27 recycles air drawn from the mixing device 10, back to conduits for supply of solids (not illustrated). A damper 26 or similar is mounted at the suction side of the fan, and closes as soon as the foaming has finished, to prevent solids from being withdrawn from the mixing device 10.

[0032] The process in accordance with the present invention is described by production of asphalt mass with low-viscous bitumen mixed with amine and viscous bitumen foamed with water. A person skilled in the art will naturally realize that the process advantageously can be operated in numerous operation modes.

[0033] In a first embodiment, asphalt can be produced without any bitumen foaming. In a second embodiment, asphalt can be produced with foaming of the low-viscous bitumen (V-1500).

[0034] In a third embodiment, asphalt can be produced with foaming of the viscous bitumen (70/100), whereas in a fourth embodiment, asphalt can be produced by

foaming of both bitumen types. And as indicated above, in all embodiments amine can be added to both of the bitumen types.

[0035] Accordingly, this process is novel and provides operational advantages which is unobtainable by the prior art.

Claims

1. Apparatus for production of asphalt mass, said apparatus comprising a mixing device (10), a solids source (14), at least two bitumen sources (11, 12), a bitumen balance (16) having mixing means and mixing agitator in flow connection with the mixing device (10) via conduit (25), optionally an amine source (13), and a water source (15) for foaming of bitumen to produce a bitumen emulsion having bitumen dispersed by a predetermined amount of water, and a mixing means (23) to perform optional foaming of bitumen supplied in conduit (25) with water supplied in conduit (15), **characterized in that** said at least two bitumen sources (11, 12) are in flow connection with the bitumen balance (16), wherein a buffer container (17) is arranged in the conduit (25) downstream of the bitumen balance (16) to pump (19), to receive apportioned bitumen.
2. The apparatus of claim 1, **characterized in that** a pump (19) is arranged in the conduit (25) between the mixing means with mixing rotor (23) and the buffer container (17).
3. The apparatus of claim 1, **characterized in that** the conduit (15) for supply of water is provided with a check valve (20) to prevent bitumen from flowing into the water supply in processes where bitumen is not to be foamed.
4. The apparatus of any one of claim 1 to 3, **characterized in that** the apparatus comprises an exhaust fan (27) arranged to withdraw air from the mixing device (10) during optional foaming of bitumen, wherein a damper means (26) is arranged at the inlet side of the exhaust fan (17) to close, and open venting from the mixing device (10), respectively.
5. Process for production of asphalt, wherein a mixing device (10) is supplied with solids (14), bitumen and bitumen emulsion with bitumen dispersed with a predetermined amount of water, said process comprising:
 - a. apportioning of solids (14) and supplying solids to the mixing device (10),
 - b. apportioning of bitumen from a first source (12), optionally with amine added from an amine source (13), and mixing of said bitumen and

amine to form a first bitumen composition,
c. apportioning of bitumen from a second source (11),
d. optional foaming of one or more of the bitumen sources (11, 12) in a mixing means (23) during supply of water (15),
e. supplying the first bitumen composition to the mixing device,
characterized in that both bitumen sources (11, 12) are supplied to a bitumen balance (16) for apportioning and optionally mixing with amine, whereupon the apportioned bitumen is supplied to a buffer container (17), and initiating apportioning of further bitumen in the bitumen balance (16).

6. The process of claim 5, **characterized in that** apportioned bitumen in the bitumen balance (16) is dropped down into the buffer container (17).

7. The process of claim 5, **characterized in that** bitumen accommodated in the buffer container (17) is pumped (19) to the mixing means (23).

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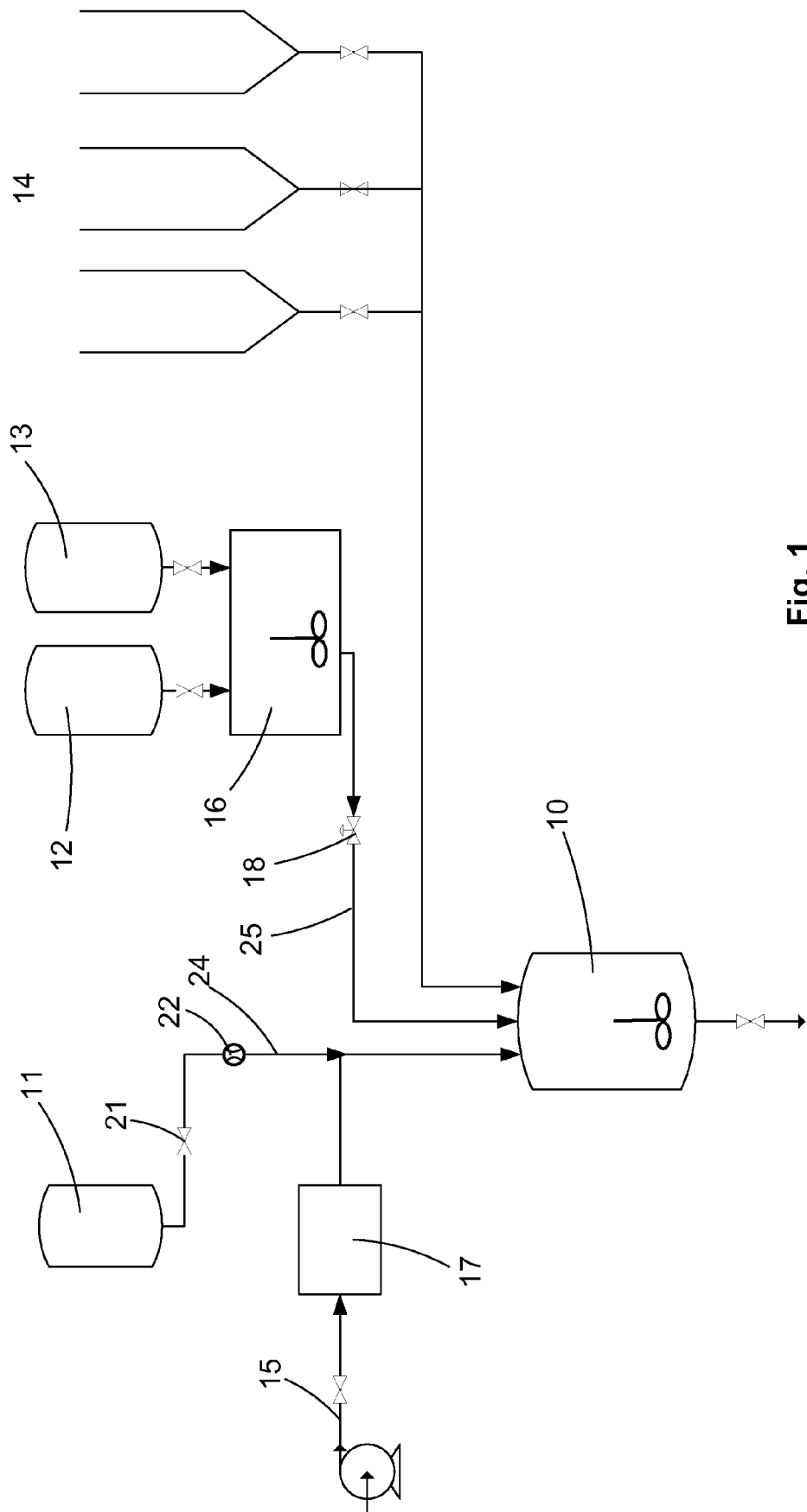


Fig. 1

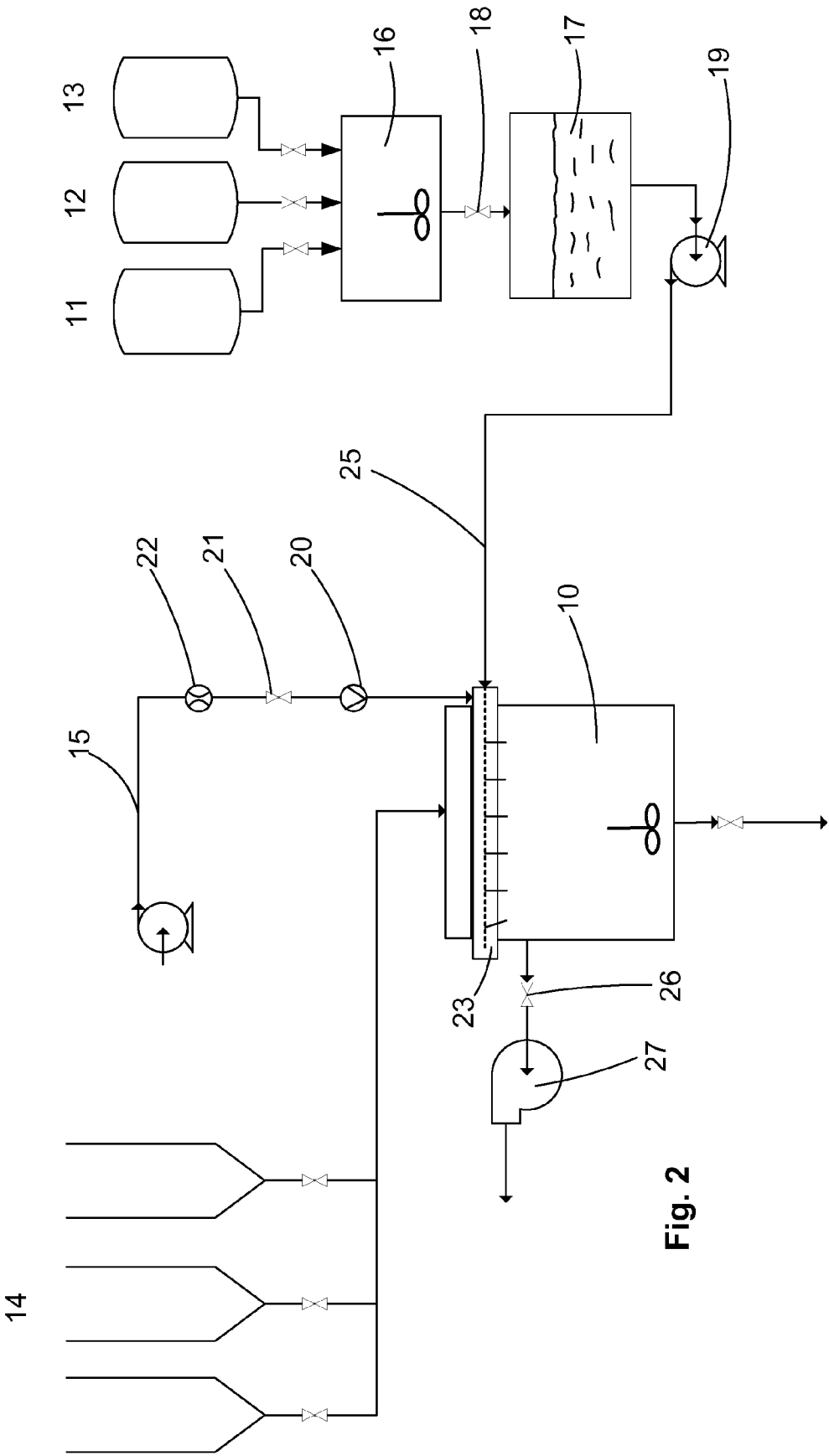


Fig. 2



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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 25 August 2015	Examiner Beucher, Stefan
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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