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(72) Inventors:
• **HILDEN, Pekka**
JYVÄSKYLÄ (FI)
• **PIIPPOLA, Leif**
TAMPERE (FI)
• **SAIKKONEN, Tuomo**
JYVÄSKYLÄ (FI)

(71) Applicant: **Valmet Technologies Oy**
02150 Espoo (FI)

(74) Representative: **Kespat Oy**
Vasarakatu 1
40320 Jyväskylä (FI)

(54) **ARRANGEMENT IN STOCK PREPARATION**

(57) The invention relates to an arrangement in stock preparation. In the arrangement, a machine tank (12) containing stock is linked to a container (40). In addition, the container (40) is linked to a forming unit (25). Further,

the container (40) and the forming unit (25) are parts of a forming section (26) of a fiber molding machine. Between the stock preparation and the forming section (26) there is a water cutoff (27).

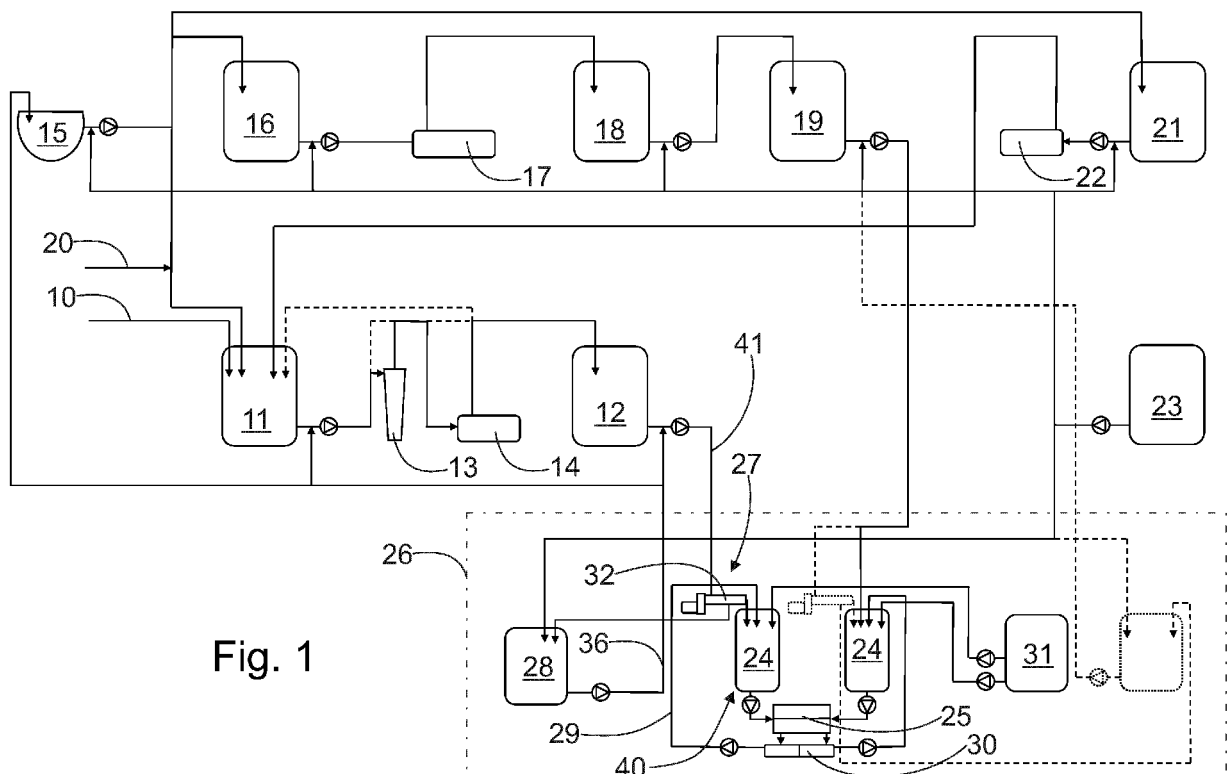


Fig. 1

Description

[0001] The present invention relates to an arrangement in stock preparation, wherein a machine tank containing stock is linked to a container, and the container is linked to a forming unit, and the container and the forming unit are parts of a forming section of a fiber molding machine.

[0002] In the fiber forming, or in other words in the forming of a molded fiber product the stock is prepared basically like in the fiber web forming. However, molds are used instead of wires and the products are separate three-dimensional items instead of continuous web. For example, pulp bales are pulpered with water, and then the aqueous stock is cleaned and refined, if necessary. The stock is stored in a machine tank. From the machine tank stock in consistency about 4% is dosed to a container and the final consistency of stock is adjusted in the container. In the container stock is mostly as pulp slurry into which for one or more suction molds are immersed. From the molds the water is returned to the stock preparation.

[0003] In the known technology, the amount of removed water is high. This requires big tanks and simultaneously the consumption of fresh water is high. In case of foaming of the slurry, the amount of the circulating water remains high but also adds foaming in the mass department which prevent the use of the circulating water. This makes measuring and controlling of the flow difficult. On the other hand, the need for dilution of the slurry is small. So, most of the circulating water will go to waste. Simultaneously, foaming agent is consumed a lot.

[0004] The object of the invention is to provide a new arrangement in stock preparation, which saves fresh water, foaming agent and energy, and which is easy to control. The characteristic features of the arrangement according to the invention are stated in the accompanying Claims. The arrangement includes a special stage which creates significant advantages to the stock preparation and forming section, especially in foam forming. The stage is easy to include to the stock preparation and the components used are simple and robust. Also the stock can be controlled precisely, and the flow rates of the water are smaller than before.

[0005] The invention is described below in detail by referring to the enclosed drawings, which illustrate some of the embodiments of the invention, in which

Figure 1 shows a chart of the arrangement according to the invention,
 Figure 2 shows a partial enlargement of Figure 1,
 Figure 3 shows a modification of the arrangement according to the invention.

[0006] Figures 1 shows one embodiment of the arrangement according to the invention. Here there are three options how pulp is supplied to the stock prepara-

tion. First, if there is a pulp mill nearby, pulp is supplied via a mass pipe 10 to a stock tank 11. Then pulp is pumped to a machine tank 12 containing stock ready to use. If necessary, pulp is still cleaned with a cleaner 13 and refined with a refiner 14 before the machine tank 12. Second, also pulp bales may be used. In the arrangement, there is a pulper 15 for the pulp bales. Pulpered pulp may be fed to same stock tank 11 as the mass pipe 10, but here the pulper 15 has a collateral stock tank 16 where the pulp is pumped to a refiner 17 and thereby to a dosing tank 18. Finally pulp is pumped to a collateral machine tank 19. Also broke may be used. A broke line 20 feeds broke to either or both stock tanks 11, 16 or to a broke tank 21. Here there is a third refiner 22 for refining broke before the first stock tank 11.

[0007] The pulp from the pulp mill is already aqueous the consistency being usually 0,5 - 4%. If necessary, water is added to the pulp from a purified water tank 23. The pulper needs a lot of water, but here the arrangement has a surprising solution to extract water from a later stage and recirculate it back to the earlier stage, for example to the pulper for saving fresh water. In the arrangement in stock preparation, the machine tank 12 containing stock is linked to a foam generator 24. The foam generator 24 is further linked to a forming unit 25. Here the forming unit 25 includes a pair of molds. Together the foam generator 24 and the forming unit 25 are parts of a forming section 26 which is positioned inside a rectangle with dashed line in Figure 1. This forming section is a part of a fiber molding machine for forming three-dimensional products. Advantageously, the forming section utilizes a combination of foam forming and press forming. The stock is foamed in the foam generator and fed as foam into the forming unit, more precisely into the foam forming unit. In the foam forming unit foam is press formed between the molds.

[0008] According to the invention, between the stock preparation and the forming section 26 there is a water cutoff 27. This special stage works in two ways. First, the amount of water is reduced before the foam generator. In other words, there is a water separation between the stock preparation and forming unit. In this way, the consistency is optimized for the foam generation. Simultaneously, the drainage capacity of the forming unit is adequate without any excess flow. In other words, the foam generation can be adjusted in view of the forming unit. The reduced water is led to a filtrate water tank 28 nearby the water cutoff 27. From the filtrate water tank water can be returned to the stock preparation. In this way, the water amounts, and flows are precisely controllable, and both the stock preparation and the forming unit can operate optimally. On both side of the water cutoff the water flows are appropriate which reduces the use of fresh water.

[0009] The other way of the water cutoff is how the pressed water from the forming unit is handled. According to the invention, from the forming unit 25 there is a closed water circulation line 29 back to the foam generator 24. Excess water, if any, maybe drained to a sewer

or salvage. In practice, when water is reduced before the forming unit and it corresponds to the drainage capacity of the forming unit, the flow of the circulating water is quite constant and small. In other words, the thickener is adjusted so that the consistency after the thickener is the same as the consistency after the forming unit. Simultaneously, foaming agent returns right back to the foam generator without mixing with filtrate water. This reduces the usage of foaming agent and filtrate water is foamless thereby easy to measure and control. Any additional foaming agent needed for stable foaming will be led straight into the foam generator or in the pipe before the foaming tank. And more, these two separate water circulation can be in different temperatures. This saves energy a lot. The temperature control of the foam generator is needed to enable the control of the foaming process. Pressed water is collected with a vacuum tank 30 placed under the forming unit 25. The pressure during forming when the mold closed pushes water out which is aided with gravity and vacuum. This shortens the production cycle and boosts the drainage. From the vacuum tank 30 pressed water is pumped back to the foam generator 24.

[0010] In the shown embodiment, the forming unit includes two parallel foam generators. In this way, two different stocks may be used to form multilayered products with different layer content. For example, the pulps may differ, or they have different mechanical preparations like refining. The second foam generator may be equipped also with a thickener and a filtrate water tank which are shown in dashed line in Figures 1 and 2. In other words, there is at least one further foam generator, and optionally an extra thickener with a filtrate water tank. In Figure 3 there is only one foam generator 24. In Figure 2 is shown the forming section 26 which also includes a chemical tank 31 including foaming agent and other additives if needed.

[0011] In the shown embodiment, the water cutoff 27 includes a thickener 32 arranged before the foam generator 24. The thickener removes water from the stock. For example, in the machine tank 12 the consistency is 1% and after the thickener it will be 10%, which is advantageous for forming unit, as mentioned earlier. More generally, after the thickener 32 the stock consistency is 20 - 40 %, preferably 25 - 35%. Here, the thickener 32 includes an inlet 33 connected to a feed pipe 41 from the machine tank 12, and an outlet 34 extending to the foam generator 24. The inlet may be equipped with a separate feed funnel. The stock can be easily pumped to the thickener. Then, the thickener 32 further includes a filtrate outlet 35 connected to the filtrate water tank 28. In the filtrate water tank water is collected and returned to the stock preparation. One advantageous thickener is a screw press separator, which is robust, and the consistency can be controlled in a wide range basically by controlling the rotation speed of the screw. Another way to control the consistency is the back pressure which is adjusted by counterweights. Then the basic structure of the

separator may remain even if different consistencies are used.

[0012] Advantageously, the filtrate water tank 28 is arranged close to the forming section 26. Also the filtrate water tank 28 is positioned lower than the thickener 32. In this way, filtrate water flows without pumping. At the same time, the function of the thickener remains undisturbed. The filtrate water is returned to the stock preparation. Here the filtrate water tank 28 is linked to the feed pipe 41. Then returned filtrate water retrieves stock from the machine tank 12 and is used to control the consistency of the stock. On the other hand, the filtrate water tank 28 has a return pipe 36 linked back to the pulping of bales or dilution of any pulp feed. In Figure 1, filtrate water is dosed after the stock tank and into the pulper 15.

[0013] The structure of the foam generator is shown in more detail in Figure 3. According to the invention, the foam generator 24 has a partially open top. In other words, the foam generator has at least partially covered top with opening for stock. Also, the thickener 32 is arranged above the foam generator 24. In this way stock is dosed by gravity into the foam generation. The thickener is higher than the foam generator but not necessarily directly above. Stock may be guided with an inclined feed chute with angle adjustment from the thickener to the foam generator. Also, a funnel after the thickener is possible. Then splashing of foam will be prevented which reduces contamination. In addition, the foam generator is equipped with ventilation to prevent irritation problems caused by foaming agent. Advantageously, the foam generator 24 is a vertical cylinder 37, and the outlet 34 is arranged in the center of the cylinder 37. Then the stock is stirred forming a cyclone and the stock is dropped right into the eye of the cyclone. This boosts the foam generation. However, the feed should be as far as possible from the inlet of the pump to maximize the time for mixing. Stock flow from the thickener should be as stable as possible. Stock from the thickener can be prediluted with incoming foam water or it can be crushed by a breaker roll or similar to prevent problems created by stock pile-up.

[0014] With the thickener, the stock can be easily adjusted as desired. In the foam generator 24 the stock consistency is 0,5 - 12, preferably 1 - 8% while the consistency of the stock entering to the foam generator is 20 - 40 %, preferably 25 - 35%, as earlier mentioned. By a determined dosing, the consistency on the stock in the foam generation may be estimated. However, when knowing the features of the foam generator and the rotating speed of the rotor inside the cylinder, the density of foam can be determined from the height of the cyclone. For this, the foam generator 24 has a surface height gauge 38 (Figure 3). This simple measurement can be used as a control value for the forming process and the stock preparation. Then, the density of the foam in the foam generator will be measured based on pressure differences, i.e. the height and hydrostatic pressure from the pump inlet line with a correction by calculation. This

place is advantageous since the pressure is low and stable. Also, inline measurement techniques based on shear force can be used for foaming system consistency control. The foam generator can be equipped also with a scales to be able to increase the accuracy of the consistency control.

[0015] In practice, the foam has an optimal temperature range where the properties of the foam are propitious. To keep the temperature stable, the cylinder has an outer water cooling arrangement 39 like an outer water jacket or spiral cooling water pipe attached to the outer wall of the cylinder.

[0016] According to the invention, the stock coming from the stock preparation at a consistency of 4%, for example, is passed through thickener. The filtrate water leaving the thickener is returned to the stock preparation, where it is utilized for pulping and for consistency adjustments between the dosing stages. The feed flow, filtrate water flow and feed consistency are measured to determine the exact mass flow of the accept.

[0017] By placing the thickener higher than the foam generator, the thickened stock can be dosed directly into the forming section, right into the foam generator actually. The placement of the thickener avoids extra measuring and transfer steps. The dry matter after the forming process is about 30%. With the thickener, it is possible to achieve the same dry matter level, whereby the water circulation can be cut off between the stock preparation and the forming unit.

[0018] By thickening, fresh water is significantly saved. In practice, about 20 m³ water per ton is saved when compared traditional 4% feed consistency to 30% feed consistency with the thickening according to the invention. In addition, when the entry of foamy water into the circulating water of the stock preparation is prevented, conventional measuring devices can still be used for the consistency and surface measurements of the stock preparation. Foaming circulating water would cause difficulties in the operation of traditional measuring devices and would incur additional costs as the necessary measuring arrangements become more complicated.

[0019] The compact size of the thickener allows placing it above the foam generator. This saves the need for separate feed pumps and conveyors. Consumption of foaming agent drops significantly when the water circuit is closed between the stock preparation and the forming unit. The reduction in chemical consumption also significantly reduces the operating costs of the process. By forming the water circulation between the forming unit and the foam generator, the treatment of foamy waters can be limited to the smallest possible area. Stabilization of the amount of foaming agent is easier when the treatment of foamy waters is limited to a small area. This makes it easier to control the foaming process. Also, it is possible to run the foam generator and the stock preparation at different process temperatures. The use of a thickener reduces material flows and allows the use of different process temperatures without significant addi-

tional energy consumption. The thickener may be called as concentrator or dehydrator.

5 Claims

1. Arrangement in stock preparation, wherein a machine tank (12) containing stock is linked to a container (40), and the container (40) is linked to a forming unit (25), and the container (40) and the forming unit (25) are parts of a forming section (26) of a fiber molding machine, **characterized in that** between the stock preparation and the forming section (26) there is a water cutoff (27).
2. Arrangement according to claim 1, **characterized in that** the container (40) is a foam generator (24).
3. Arrangement according to claim 2, **characterized in that** the water cutoff (27) includes a thickener (32) arranged before the foam generator (24).
4. Arrangement according to claim 2 or 3, **characterized in that** the thickener (32) includes an inlet (33) connected to a feed pipe (41) from the machine tank (12), and an outlet (34) extending to the foam generator (24).
5. Arrangement according to claim 3 or 4, **characterized in that** the thickener (32) further includes a filtrate outlet (35) connected to a filtrate water tank (28).
6. Arrangement according to any of claims 3 - 5, **characterized in that** after the thickener (32) the stock consistency is 20 - 40 %, preferably 25 - 35%.
7. Arrangement according to claim 4, **characterized in that** a filtrate water tank (28) is arranged close to the forming section (26) and is linked to the feed pipe (41).
8. Arrangement according to claim 7, **characterized in that** the filtrate water tank (28) has a return pipe (36) linked back to the stock preparation.
9. Arrangement according to any of claims 2 - 8, **characterized in that** the foam generator (24) has a partially open top and the thickener (32) is arranged above the foam generator (24).
10. Arrangement according to claim 4, **characterized in that** the foam generator (24) is a vertical cylinder (37) and the outlet (34) is arranged in the center of the cylinder (37) .
11. Arrangement according to any of claims 2 - 10, **characterized in that** in the foam generator (24) the stock

consistency is 0,5 - 12, preferably 1 - 8%.

12. Arrangement according to any of claims 2 - 11, **characterized in that** the foam generator (24) has a surface height gauge (38). 5
13. Arrangement according to any of claims 2 - 12, **characterized in that** from the forming unit (25) there is a closed water circulation line (29) back to the foam generator (24). 10
14. Arrangement according to any of claims 10 - 13, **characterized in that** the cylinder has an outer water cooling arrangement (39). 15
15. Arrangement according to any of claims 2 - 14, **characterized in that** there is at least one further foam generator with own filtrate water tank and thickener. 20

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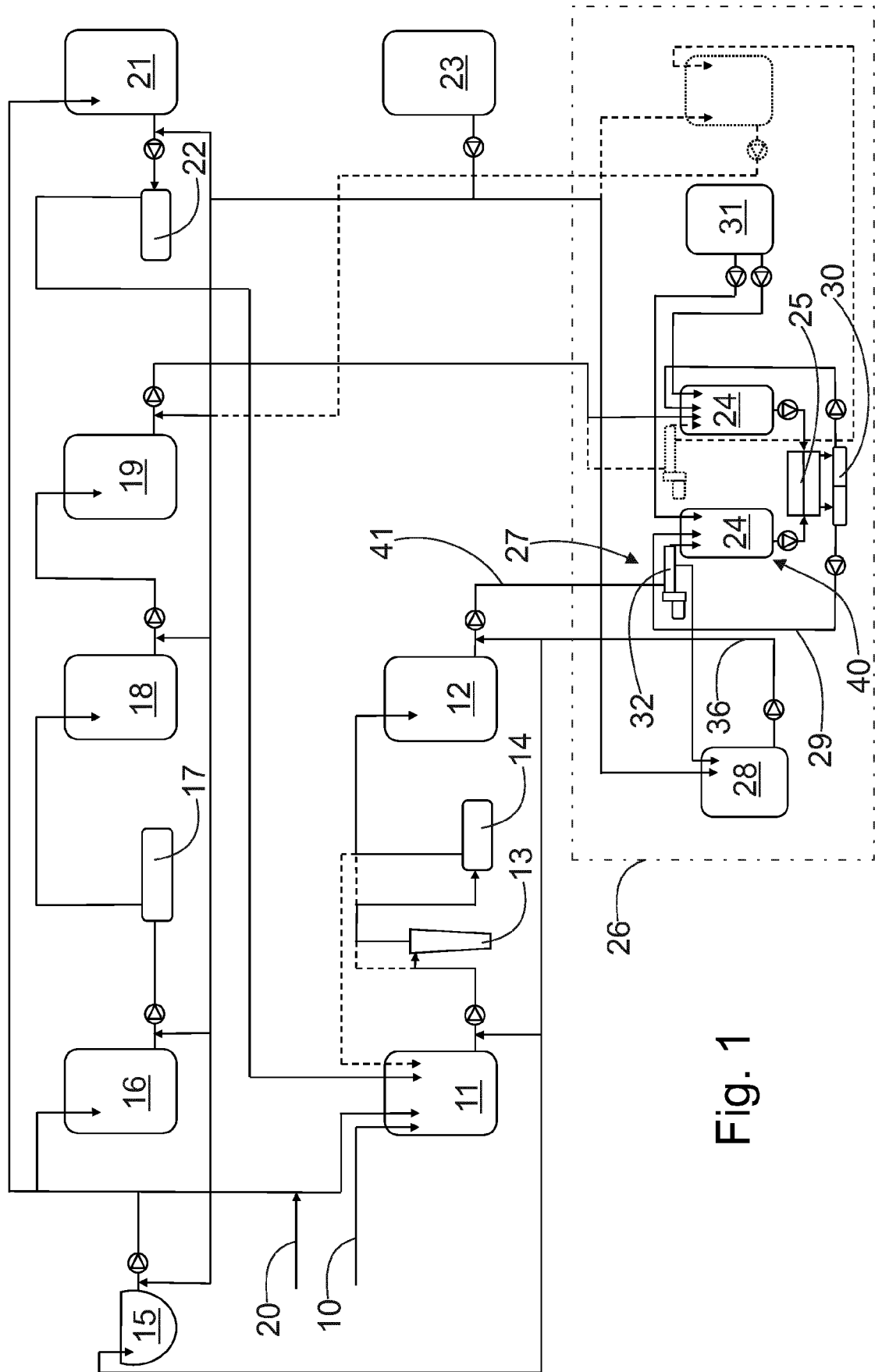


Fig. 1

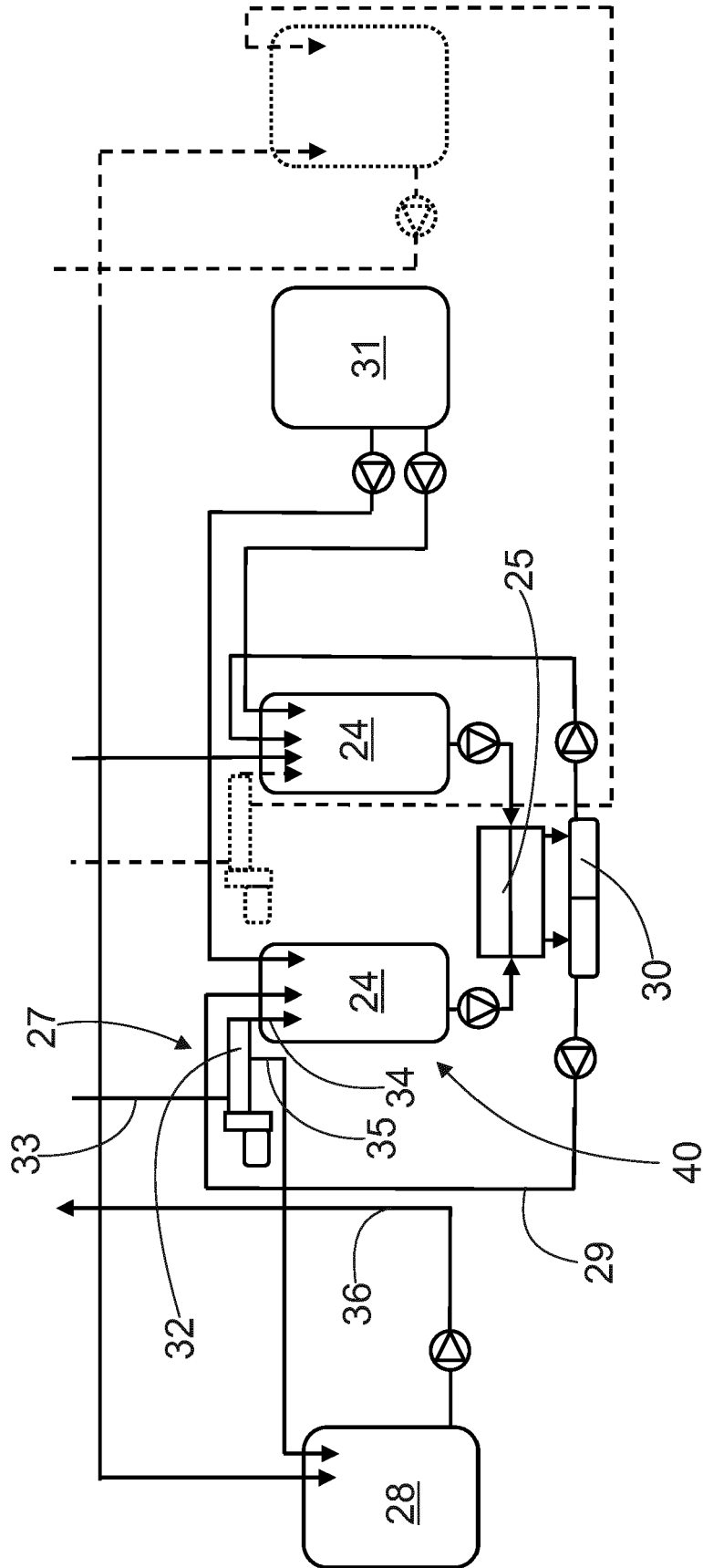
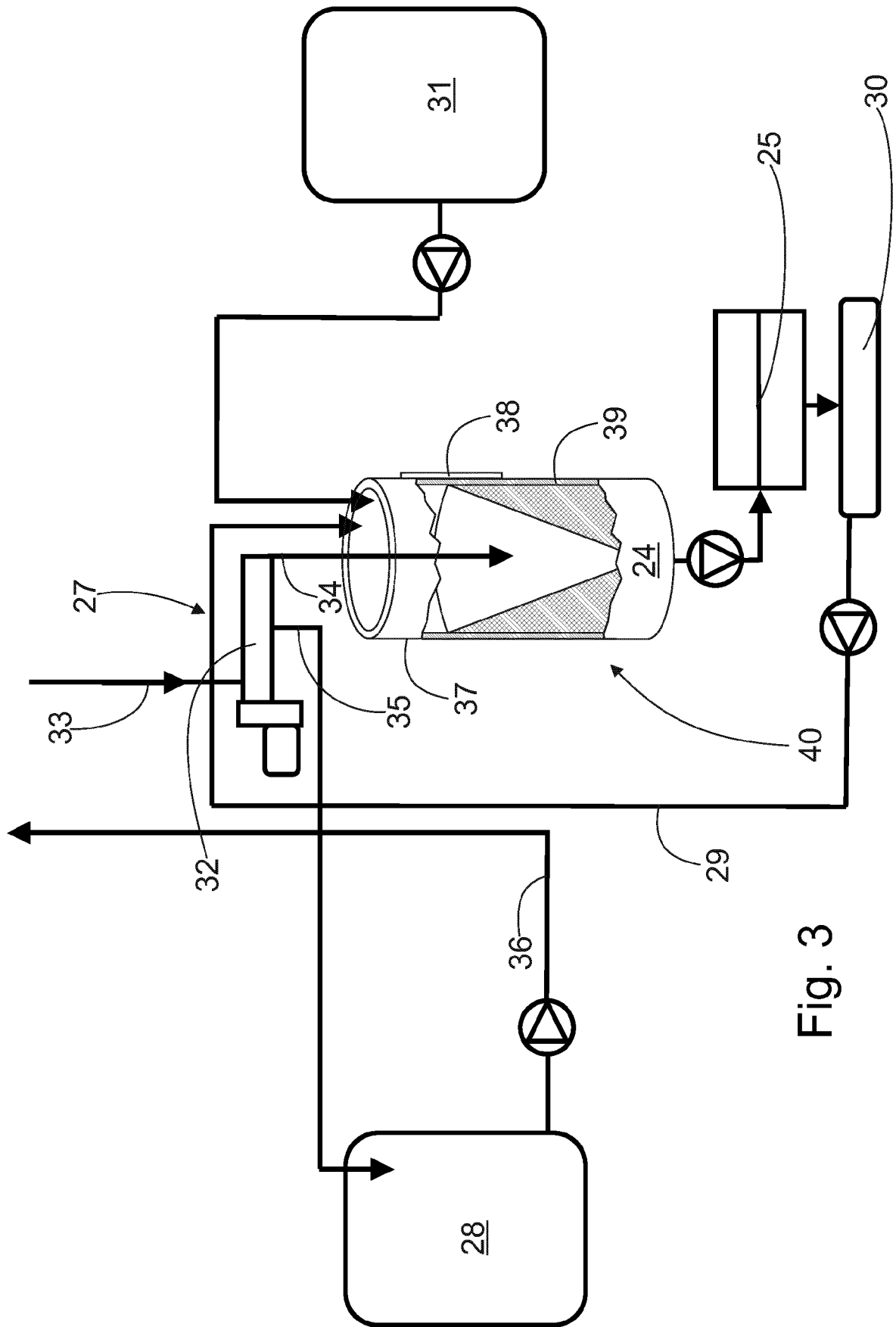


Fig. 2





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Place of search Munich		Date of completion of the search 1 December 2021	Examiner Pregetter, Mario
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