(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
23 September 2004 (23.09.2004)

PCT

(10) International Publication Number
WO 2004/081467 A2

(51) International Patent Classification[7]: F25C 1/00

(21) International Application Number:
PCT/GB2004/000986

(22) International Filing Date: 11 March 2004 (11.03.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
0305565.4 11 March 2003 (11.03.2003) GB

(71) Applicant and
(72) Inventor: **RUGERIS, Jess, Edward** [GB/GB]; 15 Cherimoya Gardens, West Molesey, Surrey KT8 1SA (GB).

(74) Agent: **GILL, David, Alan**; W.P. Thompson & Co., 55 Dryry Lane, London WC2B 5SQ (GB).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

**Published:**
— *without international search report and to be republished upon receipt of that report*

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

WO 2004/081467 A2

(54) Title: ICE-MAKING APPARATUS AND RELATED METHOD

(57) Abstract: Ice-making apparatus comprising water deliver means, a colouring station arranged to impart colour to water received from the water delivery means and a freezing station for forming readily separable blocks of ice from the coloured water formed at the colouring station and for selectively discharging the readily separable blocks of ice into a storage means so as to present ice of a required colour, or combination of colours, the freezing station can advantageously employ open ended shaping elements, and associated freezing elements, allowing for the freezing of water therein so as to form a block of ice of an appropriate shape defined by the shaping element, and to subsequent allow for the removal of the shaped ice block from the lower open end thereof.

# ICE-MAKING APPARATUS AND RELATED METHOD

The present invention relates to apparatus and method for making ice and, in particular, to such apparatus for forming coloured ice.

Ice currently finds wide application in the beverage industry primarily for cooling beverages, for example at the time of serving to a customer.

However, the use of ice is generally limited merely to such cooling purposes and it currently has no value with regard to enhancing the aesthetic qualities of the beverage, or, for example, providing verification of the quality/purity of the beverage.

Commercialised ice making machines are currently known for producing large quantities of ice cubes that can be packaged and sold to customers as required but the ice generated by such machines likewise suffers the same limitations as noted above.

The present invention seeks to provide for ice-making apparatus having advantages over known such apparatus.

According to one aspect of the present invention, there is provided an ice-making apparatus comprising water-delivery means, a colouring station arranged to impart colour to water received from the water delivery means and a freezing station for forming readily separable blocks of ice from the coloured water formed at the colouring station and for selectively discharging the readily separable blocks of ice into a storage means so as to present ice of any required colour, or combination of colours.

The apparatus is advantageously modular in nature and can be controlled so as to provide for an appropriate quantity of ice of one colour, a mixture of colours, or separate colours.

The aforesaid control is advantageously achieved by way of a microprocessor control unit.

Of course it will also be appreciated that all operations can be controlled as required on a manual basis.

Preferably, the colouring station comprises means for heating a charge of water received from the said water delivery means and means for introducing a natural substance from an additive storage means and which is arranged to be infused within the water so as to impart the required colouring.

Further, the apparatus can include a cooling station for cooling the said infusion and, preferably, also filtering means for filtering the said infusion so as to deliver a cool filtered infusion to the said freezing station.

In particular, the said charge of water is heated to boiling point and then allowed to cool to a temperature in the region of 90 degrees.

Preferably, the natural substance is introduced into the water for a period in the region of at least five minutes.

The apparatus can advantageously include a purification unit for purifying the water delivered thereto.

In particular, the apparatus can include a plurality of additive chambers each of which can deliver its contents under microprocessor control to one or more of a plurality of heating chambers which, in turn, can deliver an infusion to one or more of an array of freezing chambers likewise under microprocessor control.

If required, the apparatus can be arranged to produce ice of a plurality of colours simultaneously.

Also, the freezing chambers may be arranged to form relatively separable ice blocks of different shapes, which shapes can exhibit characteristics related to the particular colours selected.

According to another aspect of the present invention, there is provided a method of forming blocks of ice of predetermined shaped by means of open ended shaping elements, the method comprising introducing water to form the said ice blocks into the said shaping elements each of which is arranged to surround a freezing element, freezing the water surrounded by the shaping element by means of the freezing element located within the shaping element and subsequently heating the shaping element and freezing element relative to the ice so as to allow for the ice block shaped by the shaping element to be

moved therefrom by way of the lower open end of the shaping element.

It should be appreciated that the method can also be employed with shaping elements having an opening otherwise than at the bottom thereof.

Preferably, the shaping elements are arranged to be located within a chamber within which water is introduced so as to, at least partially, submerge the shaping elements.

In such a manner, the level of water within the chamber can be employed to determine the vertical dimension of the shaped ice blocks.

Advantageously, the freezing elements are arranged to be moveable reciprocally relative to the shaping elements so as to introduce the freezing elements thereto, and remove them therefrom.

Alternatively, the freezing elements are permanently mounted so as to be surrounded by the shaping elements.

Preferably, the heating of the shaping and freezing elements relative to the ice is conducted so as to allow the shaped ice block to fall through the lower open end of the shaping element.

The method can advantageously further employ the step of draining excess water from the chamber subsequent to formation of the shaped ice blocks within the shaping elements so that the above-mentioned relative heating stages can allow for the shaped ice blocks to drop to the lower regions of the chambers from which they can be recovered and delivered to storage hoppers as required.

With regard to a further aspect of the present invention, there is provided ice forming apparatus comprising open ended shaping elements arranged for receiving water to be frozen, a freezing element arranged to be received within the shaping element so as to freeze water within the shaping element, and means for heating the shaping element and freezing element relative to the ice so as to allow the shaped ice block to be removed from a lower open end of the shaping element.

Again, the ice forming apparatus can alternatively employ shaping elements having an opening otherwise than at the bottom therof.

A plurality of open-ended shaping elements, and the respective plurality of freezing elements can advantageously be provided.

The shaping elements are advantageously formed of an appropriate polymer to allow for the definition of the shape of the ice block being formed therein while serving to limit freezing of the water located outside of the shaping element.

The said plurality of shaping elements are advantageously joined so as to form a lattice of such elements.

The freezing elements are be arranged to be reciprocally mounted so as to be located within, and removed from within, the shaping elements as required.

Advantageously, the apparatus includes a shallow chamber within which water can be introduced so as to least partially submerge the shaping elements prior to freezing of the water therein.

Such chamber advantageously includes drainage means for draining excess water therefrom subsequent to the formation of the shaped frozen blocks. Yet further, the chamber can be adapted so as to allow for the ready removal of shaped blocks that have been released from the shaping elements by way of the lower open end.

Of course, it should be appreciated that the shape amendments can be provided so as define a variety of different shaped ice blocks.

The method of forming the shaped ice blocks and the apparatus employed therefore can be employed within the ice making apparatus as defined hereinbefore.

The invention is described further hereinafter, by way of example only, with reference to the accompanying drawings in which:

Fig. 1 is a schematic illustration of apparatus embodying the present invention;

Fig. 2 illustrates one form of freezing chamber for use in the apparatus of Fig. 1 and

Fig. 3 is a perspective view of part of the apparatus of Fig. 2.

The modular nature of the apparatus can also allow for the

provision of separate colour feeds to each freezing chamber module serving to produce the ice blocks/cubes. The feeds can also be directed to one or more chambers to produce multiple colour ice blocks/cubes.

In the figure, there is illustrated a schematic block diagram of ice making apparatus 10 which is arranged to deliver coloured ice of one, a variety, or a combination of colours as required.

The apparatus 10 includes a water inlet 12 which feeds into a water purification unit 14 such that the ice of the apparatus is formed from purified water.

The water, once purified, is delivered in the illustrated embodiment to an array of heating chambers 16A-16E in which the water is arranged to be heated to boiling point and then cooled to in the region of 90 degrees.

Adjacent to the array of heating chambers 16A-16E is an array of additive chambers 18A-18E each of which contains a natural substance, such as a herbal, fruit and/or vegetable substance.

The array of heating chambers 18A-18E is arranged to be reciprocally movable in the direction of arrows A such that the content of any one of the chambers see additive chambers 18A-18E can be delivered to any one or more of the array of heating chambers 16A-16E.

Once added to the water within one of the heating chambers 16A-16E, the additive serves to create an infusion upon the heating of the water in accordance with a method which is outlined further below.

Once the infusion has cooled to the required temperature, it can be dispended into an array of freezing chambers 20A-20E which is likewise reciprocally mounted in the direction of arrows B so that the infusion of any one or more of the chambers 16A-16E can be delivered to any one or more of the freezing chambers 20A-20E.

Each of the freezing chambers can be arranged so as to form blocks of ice having different distinctive shapes, and which shapes may be arranged to relate to the particular substance being added to

the water from the additive chambers 18A-18E.

Once frozen within the array of freezing chambers, the ice is then delivered by way of a delivery funnel 22 into one or more storage hoppers 24A-24D.

Again, the delivery funnel 22 is arranged to be reciprocally mounted in the direction of arrow C such that the ice formed in any one or more of the array of freezing chambers 20A-20E can be delivered to any one or more of the storage hoppers 24A-24D.

Thus, as will be appreciated, in view of the reciprocal mounting of the array of additive chambers, the array of freezing chambers, and the deliver funnel 22, each of the storage hoppers 24A-24D can be provided with ice of all one colour, ice of different colours, or ice of a combination of any required plurality of colours. Also, the reciprocal mounting of the additive chambers 18A-18E allows for a plurality of additives to be introduced to any one of the array of heating chambers 16A-16E so as to further vary the colour of the ice box eventually formed.

The storage hoppers are advantageously transparent so that the aesthetic qualities can be readily appreciated.

Of course, the relative positioning of the array of additive chambers 18A-18E, the array of freezing chambers 20A-20E and the delivery funnel 22 can advantageously be effected under microprocessor control.

Turning now to Fig. 2, there is illustrated one example of a freezing chamber 20 suitable for use within the apparatus illustrated in Fig. 1.

The freezing chamber 20 includes a shallow water holding chamber or tank 26 in which is located three shaping elements 28A, 28B, 28C which are arranged to form three shaped ice blocks as to be described further. The shaping elements are open ended in that they are open at the top and bottom.

The shaping elements 28A, 28B and 28C are connected by way of connection members 30 so as to form a lattice structure of shaping elements, which is illustrated further in the perspective view offered by Fig. 3. Turning to Fig. 2, there is illustrated a

respective plurality of three freezing elements 32A, 32B and 32C arranged for insertion within the shaping elements 28A, 28B, 28C. The freezing elements 32A, 32B, 32C are arranged to depend from a laterally extending support arm 34 which itself is reciprocally mounted for movement in the direction of arrows D.

In the position illustrated in Fig. 2, the lateral support arm 34 is illustrated in a raised position in which the freezing elements 32A, 32B, 32C have been retracted from within the shaping elements 28A, 28B, 28C respectively.

In order to form the required ice blocks, water is introduced into the tank 26 to a level illustrated at 36 so that each of the shaping elements 28A, 28B, 28C is just fully submerged.

The lateral support arm 34 is then lowered so as to introduce each of the freezing elements 32A, 32B, 32C to within the shaping elements 28A, 28B, 28C, and the freezing elements are then activated so as to lower the temperature of the water within each of the shaping elements, so as to eventually freeze the water therein which then forms an ice block having a lateral periphery designed by the shape of the shaping elements 28.

A timing arrangement (not shown) is arranged to allow for an appropriate period of freezing of the water surrounded by the walls of the shaping elements 28A, 28B, 28C such that when it is determined that the water within the shaping element 28A, 28B, 28C has frozen, the freezing operation is halted.

At this stage, excess water remaining within the water tank 26 can be drained by way of drainage means (not shown) and the apparatus then arranged for removal of the ice blocks from each of the shaping elements.

In the illustrated example such removal is achieved by means of the relative warming/heating of the shaping elements 28A, 28B, 28C and freezing elements 32A, 32B, 32C so as to allow for the shaped ice blocks to fall through the lower opening of the shaping element 28A, 28B, 28C.

The shaped ice blocks then effectively falling from the shaping elements 28A, 28B, 28C and can be allowed to collect on the

lower surface of the tank 26 and to be recovered therefrom as required for delivery to the storage hoppers 24A-24D as illustrated in Fig. 1.

The receptacle motion offered by means of the support arm 34 to the freezing elements 32A, 32B, 32C can be arranged to be employed as part of the operation cycle of the apparatus or, alternatively, can merely be employed so as to allow for maintenance operations to be conducted. Thus, with regard to this latter aspect, during repeated operation cycles, the freezing elements 32A, 32B, 32C can be arranged to be permanently located within the shaping elements 28A, 28B, 28C and water introduced into the shaping elements merely through the delivery of water into the water tank so as to effectively submerge the shaping elements as required. Of course, the freezing elements can be mounted in a stationary manner relative to the shaping elements.

The shaping elements are advantageously formed from an appropriate polymer and can be connected so as to provide a lattice of any appropriate number of shaping elements which can be of the same, or quite different but generally a aesthetically interesting, shapes.

It should of course be appreciated that this aspect of the invention is not restricted to the details of the above-mentioned description since any appropriate plurality of shaping elements and the respective number of freezing elements can be provided.

For example, one arrangement of the apparatus could be provided with twenty separate freezing elements and the apparatus could then further comprise a lattice of twenty shaping elements all of the same shape, or of different shapes, or two separate lattices, each containing ten shaping elements of the same, or different shapes/dimensions.

Advantageously, through providing shaping elements which are open at the lower end, this allows for the shaped ice blocks to effectively drop therefrom for onward delivery into an appropriate form of storage means. This greatly enhances productivity.

One method of forming the ice blocks within apparatus

embodying the invention is known from co-pending International application PCT/GB2002/00402 and includes the steps of introducing a herbal, and/or vegetable and/or fruit substance into a liquid, which is at an elevated temperature, for a period of, for example, five minutes, allowing the product of the infusion to cool, and then freezing the cooled infused liquid into easily separable ice blocks.

Preferably, the liquid comprises water which is heated to attain boiling point prior to the addition of the said substance. Once cooled, preferably to room temperature, the infusion is then filtered prior to use in the formation of the ice blocks.

As in that earlier application, the ice blocks, so formed, may be used to make an instant drink by adding them to hot water, or they may be used to cool a drink which has been prepared separately.

The ice blocks can advantageously be employed to impart colouring to the liquid to which they are added as and when required.

Alternatively, or in addition, the ice blocks can be employed to impart fragrance to a beverage.

In one particular illustrative method, a mixture of herbal substances is delivered from an additive chamber 18A and added to pure water in the heating chamber 16A and is boiled and cooled to a temperature of 90°C, the infusion so produced being strained from the chamber 16A and fed into ice-cube moulds within the freezing chamber 20A, where it is frozen until being dispensed into the storage hopper via the funnel 22.

Advantageously, the ratio of the infused product to liquid for forming the ice blocks is 100ml to 2.2 litres, although this ratio is flexible dependent on the colour required or substance used.

Preferably, the step of filtration is conducted by means of a cotton filter, and preferably a 100% cotton filter.

It will be understood that varieties of the substances may be mixed in proportions which produce infusions of preferred colours and/or fragrances and, if required, flavours and also health benefits.

The temperature of the liquid in which the substances are

infused may be adjusted to suit the substance in order to bring out colours and, if necessary, the oils and flavours to the best advantage.

In making the infusions it has been found beneficial to stir the contents of the container gently at intervals during the process of making the infusions. Accordingly, the apparatus can include agitation means associated with the heating chambers 16A-16E.

It will be understood that, although particular arrangements, illustrative of the invention, have been described by way of example, variations and modifications thereof may be conceived as well as other arrangements.

Advantageously, the ice blocks, with their infused filtered content, provide means for colouring a drink in a particularly creative and aesthetic manner. A variety of ice blocks can be readily selected by a consumer for addition to a liquid in any order and/or combination required so as to arrive at an attractive drink or for any other ice-requirement, such as food-display with crushed or flaked ice. Importantly, the ice blocks of the present invention do not add any taste to the beverage whatsoever, although if required some degree of taste can also be imparted.

However, the method of the invention may be employed using other materials.

The range and intensity of the colours can be controlled through manipulation of the filtration process and infusion time employed.

Also, the colouring employed for the ice can be produced remote from the apparatus such that an array of additive chambers and an array of heating chambers are effectively replaced by a colour injection unit arranged to introduce concentrated coloured liquid formed for example in accordance with the method described above directly into the purified water to be frozen into the required ice blocks.

**CLAIMS**

1. Ice-making apparatus comprising water deliver means, a colouring station arranged to impart colour to water received from the water delivery means and a freezing station for forming readily separable blocks of ice from the coloured water formed at the colouring station and for selectively discharging the readily separable blocks of ice into a storage means so as to present ice of a required colour, or combination of colours.

2. Apparatus as claimed in Claim 1, wherein the colouring station comprises means for heating a charge water received from the said water deliver means and means for introducing a natural substance from an additive storage means and which is arranged to be infused within the water so as to impart the required colouring.

3. Apparatus as claimed in Claim 2, and including a cooling station for cooling the said infusion.

4. Apparatus as claimed in Claims 2 or 3, and including filtering means for filtering the said infusion so as to deliver a cool filtered infusion to the said freezing station.

5. Apparatus as claimed in Claims 2, 3 or 4, wherein the means for heating is arranged to heat to boiling point the charge of water and then to allow it to cool to a temperature in the region of 90 degrees.

6. Apparatus as claimed in any one or more of Claims 1 to 5 and including a purification unit for purifying the water delivered thereto.

7. Apparatus as claimed in Claim 2, and including a plurality of additive chambers each of which can deliver its contents under microprocessor control to one or more of a plurality of heating

chambers which, in turn, can deliver an infusion to one or more of an array of freezing chambers likewise under microprocessor control.

8. Apparatus as claimed in any one or more of Claims 1 to 7 wherein freezing chambers are arranged to form relatively separable ice blocks of different shapes, which shapes can exhibit characteristics relating to the particular colours selected.

9. Apparatus as claimed in Claim 2 and arranged such that a herbal, and/or fruit and/or vegetable substance is introduced to the liquid for a period in the region of five minutes.

10. Apparatus as claimed in Claim 1, wherein the said colouring station comprises an array of dispensing units each arranged to contain a colouring infusion.

11. Apparatus as claimed in Claim 10, wherein the colouring infusion is a concentrate.

12. A method of forming blocks of ice of predetermined shaped by means of open ended shaping elements, the method comprising introducing water to form the said ice blocks into the said shaping elements each of which is arranged to surround a freezing element, freezing the water surrounded by the shaping element by means of the freezing element located within the shaping element and subsequently heating the shaping element and freezing element relative to the ice so as to allow for the ice block shaped by the shaping element to be moved therefrom by way of the lower open end of the shaping element.

13. A method as claimed in Claim 12, and including the step of locating the shaping elements within a chamber so as to allow for the at least part submerging of the shaping elements in water introduced into the chamber.

14. A method as claimed in Claim 12 or 13, and including the step

of moving the freezing elements into, or away from, the shaping elements.

15. A method as claimed in Claim 12, 13 or 14, wherein the step of heating the shaping element and freezing element relative to the ice allows for the shaped ice block to fall from the lower open end of the shaping element.

16. A method as claimed in Claim 12, 13, 14 or 15, and including the step of draining water remaining within the chamber subsequent to the freezing of the ice blocks so as to allow for at least temporary collection of the ice blocks within the chamber.

17. Ice forming apparatus comprising open ended shaping elements arranged for receiving water to be frozen, a freezing element arranged to be received within the shaping element so as to freeze water within the shaping element, and means for heating the shaping element and freezing element relative to the ice so as to allow the shaped ice block to be removed from a lower open end of the shaping element.

18. Apparatus as claimed in Claim 17 when the shaping elements are arranged to be located within a chamber within which water can be introduced so as to at least partially submerge the shaping elements.

19. Apparatus as claimed in Claim 18, and including means for draining water from the chamber subsequent to the formation of the frozen blocks so as to allow for the at least temporary collection of the frozen blocks within the chamber.

20. Apparatus as claimed in Claim 17, 18 or 19, wherein the freezing elements are arranged to be reciprocally movable relative to the shaping elements.

21. Apparatus as claimed in Claim 17, 18, 19 or 20, wherein the shaping and freezing elements are arranged to be heated to an extend to allow the shaped ice block to fall through the lower open end of the shaping element.

22. Apparatus as claimed in Claim 17, 18, 19, 20 or 21, wherein the open ends of the shaping elements are of similar shape and dimensions.

23. Apparatus as claimed in any one or more of Claims 17-22, wherein the shaping elements are removably mounted within the apparatus.

24. Apparatus as claimed in any one or more of Claims 17-23, wherein the shaping elements are formed from a polymer material.

25. Apparatus as claimed in any one or more of Claims 17-24 and including a plurality of laterally spaced shaping elements.

26. Apparatus as claimed in Claim 25, wherein the laterally spaced shaping elements comprise a lattice of shaping elements.

27. Ice making apparatus as claimed in any one or more of claims 1-11, and including ice forming apparatus within the freezing station thereof and as defined in any one or more of Claims 17-26.

28. Ice making apparatus substantially as hereinbefore described with reference to, and as illustrated in Fig. 1 and Figs. 2 and 3 of the accompanying drawings.

29. A method of forming blocks of ice of a predetermined shaped substantially as hereinbefore described with reference to Figs. 2 and 3 of the accompanying drawings.

30. Ice making apparatus comprising an open ended shaping element

substantially as hereinbefore described with reference to, and as illustrated in, Figs. 2 and 3 of the accompanying drawings.

Fig.1.

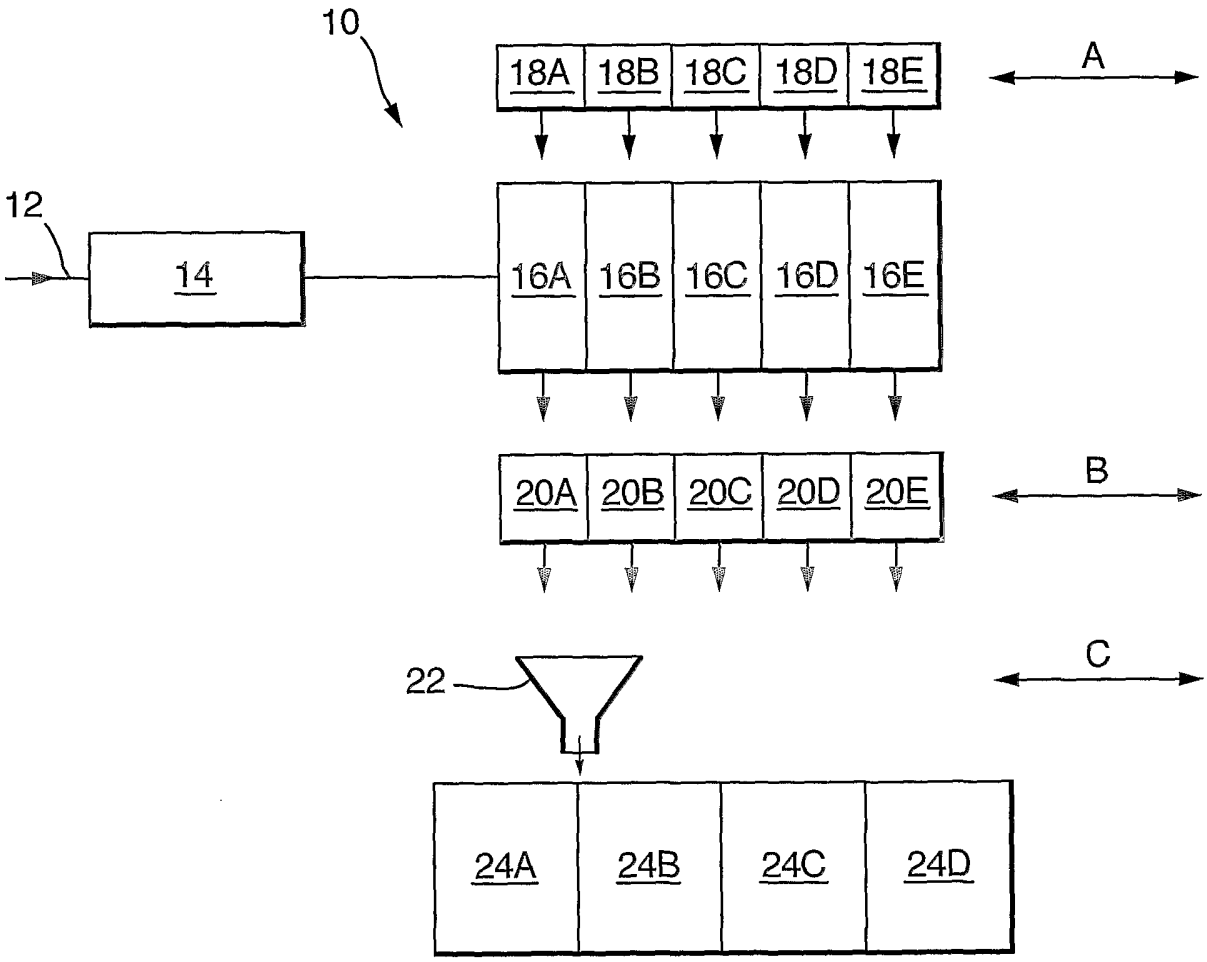
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Fig.2.

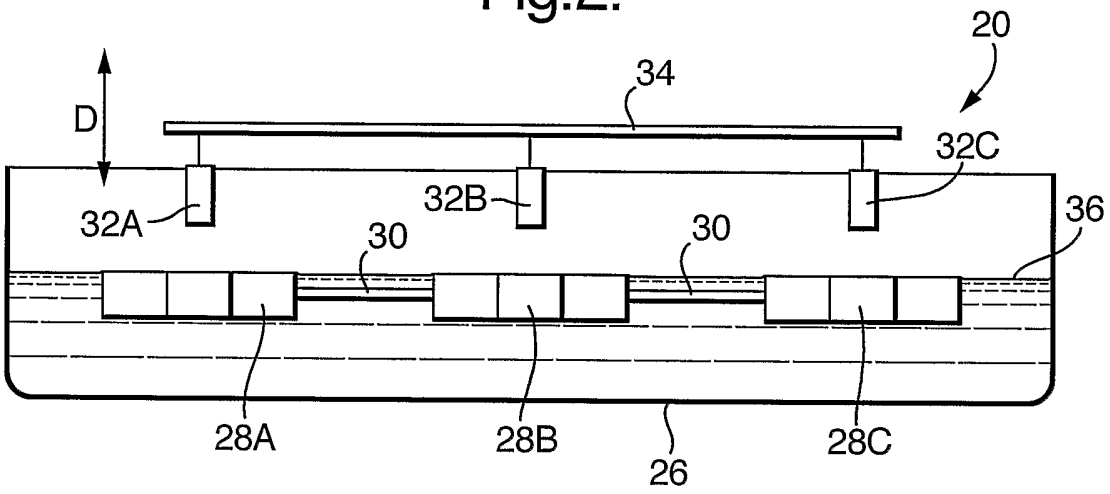


Fig.3.