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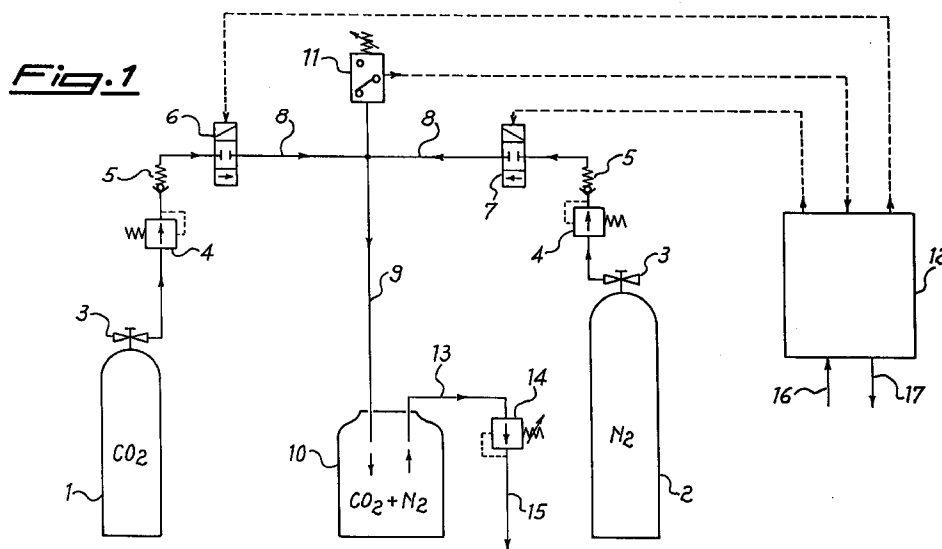
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(54) Plant and method for dispensing beverages

(57) A plant for dispensing beverages and a method for feeding a mixture of gas under pressure to the containers of the beverages for the purpose of enabling their dispensing, are described. The plant is provided with means for feeding a mixture of gases, comprising

at least two separate sources of different gas and means for producing one or more mixtures with pre-determined compositions of the said gases.



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Description

The present invention relates to a plant and a method for dispensing beverages and, in particular, for dispensing beverages by means of gases and/or gas mixtures under pressure.

Carbon dioxide contained in cylinders under pressure is generally used in the more common type of dispenser plants, to both maintain the CO₂ content of the drink and dispense the gassed drink.

However, especially in the case of plants for dispensing types of drink that have low gas-content, e.g. ice-tea or some types of beer, carbon dioxide is found to be little suited to such purposes, since the same carbon dioxide confers an undesirable excess of gassing to the drink. For this reason, more recent techniques have tended to use gas mixtures comprising a predetermined percentage of nitrogen in addition to carbon dioxide; these mixtures have also been called "carbonitrogen" for short. Such mixtures, containing around from 20% to 40% of N₂ by volume, are distributed in cylinders ready to be connected to the dispensing plant.

This arrangement presents various drawbacks, however. Above all, it must be remembered that nitrogen, unlike the situation of carbon dioxide, is not easily liquefied on an industrial scale for such uses. Therefore, the cylinders of carbonitrogen have a very limited useful storage life - generally from between 1/5 and 1/10 of the duration of the traditional cylinders of CO₂.

Furthermore, because of the different characteristics of the two compounds, the CO₂/N₂ mixture is not azeotropic and therefore the composition of the same mixture varies over time as a function of various factors, e.g. the volume contained in the cylinder and the temperature. The same mixtures are also subject to stratification, which also prevents the gas mixture from having a constant composition.

This being stated, an object of the present invention is to produce a plant that allows beverages with low carbon dioxide content to be both stored and dispensed.

Another object of the present invention is to produce a plant that allows different types of beverages to be stored and dispensed without altering their carbon dioxide content.

Yet another object of the present invention is to produce a plant to dispense beverages, which is able to generate one or more gas mixtures with clearly defined compositions which are stable over time.

A further object of the present invention is to provide a method for feeding a gas or a mixture of gases under pressure to a plant for dispensing beverages that allows the optimum use of the gases and/or the mixtures for dispensing the beverages.

These objects are achieved by the present invention, which relates to a plant for dispensing beverages, of the type comprising means for feeding a gas or a mixture of gases under pressure into the container of the beverages and thus enabling its dispensing, character-

ised by the means of feeding comprising at least two separate sources of different gases and means for producing one or more mixtures with predetermined composition.

In this way, the use of pre-mixed gas mixtures (which are not very economical either in terms of their storage duration or in terms of the varying characteristics of the same mixtures in use) can be avoided.

In particular, with regard to the separate sources of different gases, provision is made for the use of two separate cylinders, one containing nitrogen and the other containing carbon dioxide, which are easily obtained commercially.

The plant is therefore provided with at least one unit for mixing the gases and at least one tank for the accumulation of each mixture with a pre-determined composition.

In particular, the mixing unit comprises a device for controlling the opening and closing times of a plurality of electrovalves along the conduits that connect the gas cylinders with the tanks for each mixture of pre-determined composition. Furthermore, means for setting the composition of each of the mixtures are advantageously provided.

The invention further relates to a method of feeding a mixture of gas under pressure to a plant for dispensing beverages, characterised by providing for the generation of mixtures of different gases with one or more pre-determined compositions, starting from gases fed from at least two separate sources.

The method according to the invention provides for the control of the compositions of each mixture by means of regulating the outlet pressure from each of the cylinders; in particular, enabling the feeding of each gas by means of the controlled opening of first electrovalves for periods of time that are proportional to the desired content of each gas in the mixture.

Further advantages and characteristics of the invention will be more evident from the following description which is by way of example and not of limitation, and from reference to the attached drawings, in which:

Figure 1 is a scheme of a plant according to a possible embodiment of the invention;

Figure 2 is a scheme of a plant according to another possible embodiment of the invention;

Figure 3 is a scheme for a control unit for the plant according to the invention; and

Figure 4 is a diagram that illustrates the operation of a plant according to the invention.

The plant illustrated schematically in Figure 1 comprises two separate sources of different gas consisting of a cylinder 1 containing carbon dioxide and a cylinder 2 containing nitrogen. Carbon dioxide in the liquid state is contained in cylinders easily obtained commercially, just as nitrogen is easily obtained in cylinders in the gas-

eous state.

Taking the flow of each gas along the conduits as reference, there is a primary pressure reducing valve 4 downstream of the outlet valve 3 of each cylinder to maintain a maximum predetermined value of the pressure of the respective gases in the conduits downstream of the same reducing valves. Each pressure reducing valve 4 is then connected through a nonreturn valve 5 to its respective electrovalve 6 or 7 of the single-way normally closed type.

The outlets from the electrovalves 6 and 7 are two capillary conduits 8 flowing into a common conduit 9 that feeds a buffer tank 10 with the gas mixture. The capillary conduits 8 serve to attenuate the pressure peaks caused by the opening of the electrovalves 6 and 7 during the operation of the plant.

The pressure of the mixture of gas downstream of the electrovalves 6 and 7 is measured by a pressure switch 11 of the adjustable type, which can supply a signal, e.g. making and/or breaking an electric circuit, to the control device 12. Other pressure switches or similar pressure transducers (not shown for clarity) are provided in the circuit between the outlet valve 3 and the pressure reducing valves 4 to detect lack of gas pressure in each cylinder and furnish this information in the form of an electric signal to the control device 12.

There is a secondary pressure reducing valve 14, of the adjustable type, on the outlet conduit 13 from the buffer tank 10, to allow the mixture of gas to be fed with sufficient pressure through the conduit 15 to the drums containing the beverage to be dispensed.

As an example of typical gas pressure values during normal operation of the plant, the pressure downstream of the primary reducing valves 4 is maintained at around 6 bar, while the pressure of the mixture dispensed downstream of the secondary reducing valve, adjustable between 0 and 4 bar, is maintained at around 3 bar. The pressure switch 11 changes over into the closed state (ON state) when the pressure detected in the buffer tank 10 exceeds the dispensing pressure by only 1 bar, i.e. if it falls to around 4 bar, while it changes over into the open state (OFF state) when the pressure in the tank exceeds the dispensing pressure by around 2 bar, i.e. when it reaches about 5 bar.

The control unit 12 controls the operation of the electrovalves 6 and 7 on the basis of the signals representing the pressure values detected in the conduits of the plant, e.g. the signals that arrive from the pressure switch 11 and from other similar devices (not shown).

Further input and output signals of the circuit 12 are represented by the arrows 16 and 17. The arrow 16 generally indicates signals from a means that allows the composition of the mixture of gas to be set, e.g. a keyboard, while the arrow 17 indicates signals generally destined for the display of the set values, together with the signals to control the plant in standby condition, e.g. control signals addressed to devices for unloading any back-pressure or similar.

To achieve the two-gas mixture according to the desired volumetric percentages, the opening and closing of electrovalves 6 and 7 is commanded cyclically by the control device 12 until the pressure switch 11 detects sufficient pressure of the mixture in the buffer tank 10.

In particular, in each cycle the electrovalve 6 which controls the flow of carbon dioxide is opened for an interval of time proportional to the volumetric percentage of CO₂ that the mixture is required to contain, while the electrovalve 7 stays closed for this period. In the same cycle, when the electrovalve 6 is closed again, the electrovalve 7 is opened in turn for an interval of time proportional to the volumetric percentage of N₂ that the mixture is required to contain.

For instance, assuming that a mixture containing 60% of CO₂ by volume is required and that each cycle lasts one second, the electrovalve 6 will stay open for 0.6 seconds while the electrovalve 7 stays closed, then the electrovalve 7 will be opened for the following 0.4 seconds while the electrovalve 6 stays closed.

In this way, each cycle generates a fraction of mixture already having the desired volumetric composition. Repeating the cycles to reach the pressure value at which the pressure switch 11 changes over, will result in the buffer tank 10 containing a mixture of gas with extremely precise volumetric composition.

Figure 2 shows another embodiment of the plant according to the invention, i.e. a plant which allows the formation of at least two mixtures of gas with different compositions. The elements that are common to both Figs. 1 and 2 plants are shown with the same numerical references. In particular, there are respective outlet valves 3 downstream of the cylinders 1 and 2, the respective primary pressure reducing valves 4, nonreturn valves 5, electrovalves 6 and 7, as well as the capillary conduits 8 already described.

In this case, the capillary conduits 8 are connected at one end to a single conduit 90, whose other end is in turn connected to two separate conduits that direct the flow of gas to second electrovalves 100 and 200. These latter are operated in mutual exclusion by the control device 112 and allow the flow of gas to be directed towards one or other of the buffer tanks 110 or 210. The mixture contained in the tank 110 is indicated by the letter A, while the mixture contained in the tank 210, being different in composition from the mixture A, is indicated by the letter B.

In the plant shown schematically in Figure 2 there are two separate pressure switches 111 and 211 associated respectively with the buffer tanks 110 and 210. On the outlet conduits of the latter (also not shown for simplicity) there is also provision for respective secondary pressure reducing valves similar to the pressure reducing valves 14 in the plant shown schematically in Figure 1.

The electric signals generated by the pressure switches 111 and 211, and signals derived from other

similar transducers already mentioned (but not shown) for the plant of Figure 1 and signals indicated also in this case by the arrow 16, arrive at the control device 112. The outgoing signals of the control device 112, as well as the signals to control the first electrovalves 6 and 7, the signals in this case indicated by the arrow 17, include the signals which control the second electrovalves 100 and 200.

Figure 3 shows the scheme of a control device 112 for the plant represented in Figure 2. The control device consists of a main section 50 comprising the power supply unit, which is connected to the mains voltage, the microprocessor control unit which manages the device, together with an input/output interface to receive and display the data set by the user, e.g. the volumetric composition of the mixture, by means of suitable means indicated by the reference number 51. Section 50 also manages the i/o signals with the arrows 16 and 17 already mentioned and a remote acoustic warning 52 to signal possible anomalies of the plant and/or that one or both of the gas cylinders are empty.

Section 53 of the control unit 112 controls the electrovalves 100 and 200 on the basis of the signals received from the pressure switches 111 and 112, in such a way as to direct the flow of only one of the mixtures generated toward the appropriate buffer tank. Section 54 controls the cyclical opening of electrovalves 6 and 7 that allows production of the mixture of gas with the exact composition. All the electrovalves 6, 7, 100 and 200 have a terminal of the electric windings connected to a common pole 55 of the mains.

A strip of electrical connectors 56 allow further cards 53' and 54' to be connected in series to the control device 112, in the case in which it is necessary to provide for more than two mixtures with different compositions. In this way, it is possible to generate more than two mixtures with different compositions and to direct each mixture to the appropriate buffer tank.

Figure 4 shows the method for producing two mixtures A and B having different compositions, with particular reference to the states of opening and closing of the electrovalves 6, 7, 100 and 200 of the plant of Figure 3. The graphs corresponding to the activation states of the electrovalves 6, 7, 100, 200 are indicated respectively by the references EV-CO₂, EV-N₂, EV2, EV1.

The composition of the mixture A is produced in the interval of time between t_1 and t_2 . It is naturally assumed in this case that the pressure switch 111 tripped in the instant t_1 or in an instant immediately before. The control unit 112 then commands the opening of the electrovalve 100 at the instant t_1 , corresponding to the change of state from OFF to ON in the graph EV1, while the electrovalve 200 (graph EV2) is kept closed by the control circuit 112 to avoid mixture A flowing into buffer tank 210.

The first mixing cycle (whose duration is fixed at T) begins simultaneously with the opening of the electrovalve 100, by the activation of the electrovalve 7 (graph

EV-N₂) for an interval of time T'_A which is proportional, with respect to the period T, to the volumetric percentage of nitrogen in the mixture A, while the electrovalve 6 is kept closed (graph EV-CO₂) by the control device 112. At the end of the interval of time T'_A , the electrovalve 7 is closed again and the electrovalve 6 is opened simultaneously. This is kept open for an interval of T''_A which is proportional, with respect to the period T, to the percentage of carbon dioxide in the mixture A, while the electrovalve 7 remains closed. The cycles of duration T are repeated up to the instant t_2 , in which the pressure switch 111 undergoes a new change of state, indicating that the system has reached the operating pressure of the mixture A in the buffer tank 110.

The same method is applied for the formation of the mixture B in the interval between the instants t_3 and t_4 . In this interval of time, the control device 112 keeps the electrovalve 200 open, while the electrovalve 100 is kept closed. To achieve the different composition of the B mixture on the other hand, the interval of time of opening T'_B of the electrovalve 7 (graph EV-N₂) and the interval of time T''_B opening of the electrovalve 6 (graph EV-CO₂) are varied within the time of duration T of each cycle.

As has been previously described, the same method may be applied either to a plant like the one illustrated in Figure 1 for the production of one single type of mixture, or to plants that require several types of mixtures with different volumetric compositions. Although a particular application for mixing only two separate gases in the technical sector of the distribution of beverages has been described, the same method is however easily applicable to mixing of two or more gases in other technical sectors where a high degree of precision is required in the composition of the mixture.

Claims

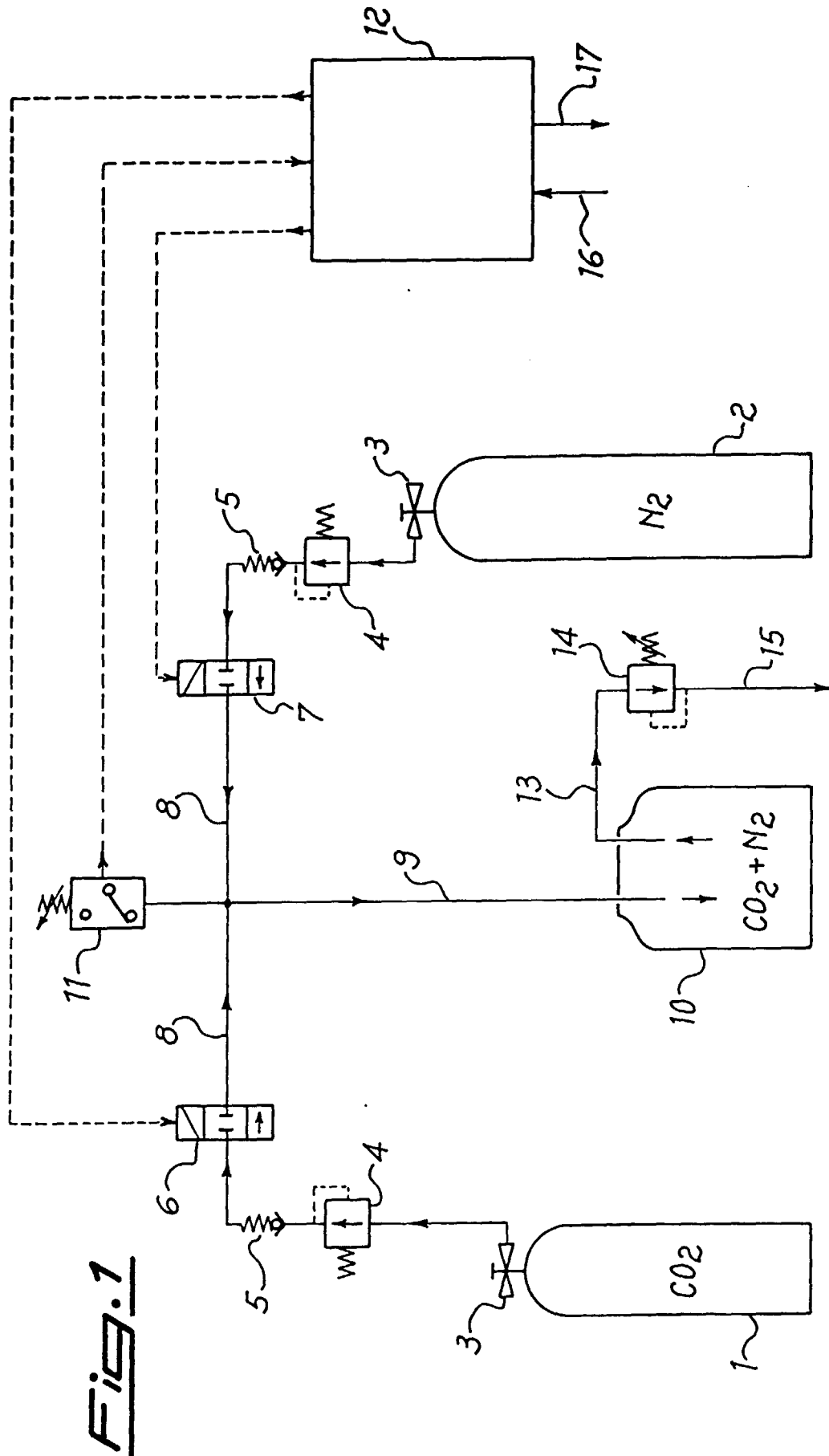
1. Plant for dispensing beverages, of the type comprising means for feeding a gas or a mixture of gases under pressure into the containers of said beverages and enabling their dispensing, characterised by said means comprising at least two separate sources of different gases and means for producing one or more mixtures with predetermined compositions of said gases.
2. A plant according to Claim 1, characterised by said separate sources of different gases comprising at least one cylinder containing nitrogen and at least one cylinder containing carbon dioxide.
3. A plant according to Claim 1 or 2, characterised by comprising at least one unit for mixing said gases and at least one tank for the accumulation of each mixture with pre-determined composition.
4. A plant according to Claim 3, characterised by said

mixing unit comprising at least one primary pressure reducing valve on the outlet conduit of the gas from each cylinder and at least a first electrovalve arranged downstream of said primary pressure reducing valve and upstream of a buffer tank, or upstream of a common conduit that feeds said buffer tank.

5. A plant according to Claim 4, characterised by comprising a capillary-type conduit which connects the outlet of each of said first electrovalves with said common conduit that feeds said buffer tank. 10
6. A plant according to Claim 4 or 5, characterised by comprising two or more buffer tanks and two or more corresponding conduits connecting them to said common conduit, together with second electrovalves located along said two or more connection conduits. 15
7. A plant according to any of the preceding Claims, characterised by comprising means for detecting the pressure in each of said buffer tanks. 20
8. A plant according to any of the preceding Claims, characterised by comprising a control device to command the times of opening and of closing of said first electrovalves and/or of said second electrovalves. 25
9. A plant according to any of the preceding Claims, characterised by comprising means for setting and means for displaying the composition of each of said mixtures. 30
10. Method for feeding a mixture of gas under pressure to a plant for dispensing beverages, characterised by providing for the generation of mixtures of gases with one or more different pre-determined compositions, said gases being fed from at least two separate sources. 35
11. A method according to Claim 10, characterised by said gases comprising nitrogen and carbon dioxide contained in separate cylinders. 40
12. A method according to Claim 10 or 11, characterised by comprising the storage of each of said mixtures in separate buffer tanks. 45
13. A method according to any of Claims 10 to 12, characterised by providing for the control of the compositions of each mixture by means of regulating the pressure at the outlet of each of said cylinders, this being made by activating the feeding of each gas by means of the controlled opening of the first electrovalves for a period of time that is a function of the desired proportional quantity of each gas in the 50

mixture.

14. A method according to any of Claims 10 to 13, characterised by said first electrovalves being controlled cyclically in opening and closing in a mutually exclusive way.
15. A method according to any of Claims 10 to 14, characterised by providing for the controlled interception and/or feeding by means of second electrovalves of each of said mixtures upstream of each of said buffer tanks, each one of said mixtures of gas being fed to one corresponding tank of said buffer tanks while the feeding of other mixtures to the remaining buffer tanks is excluded. 55



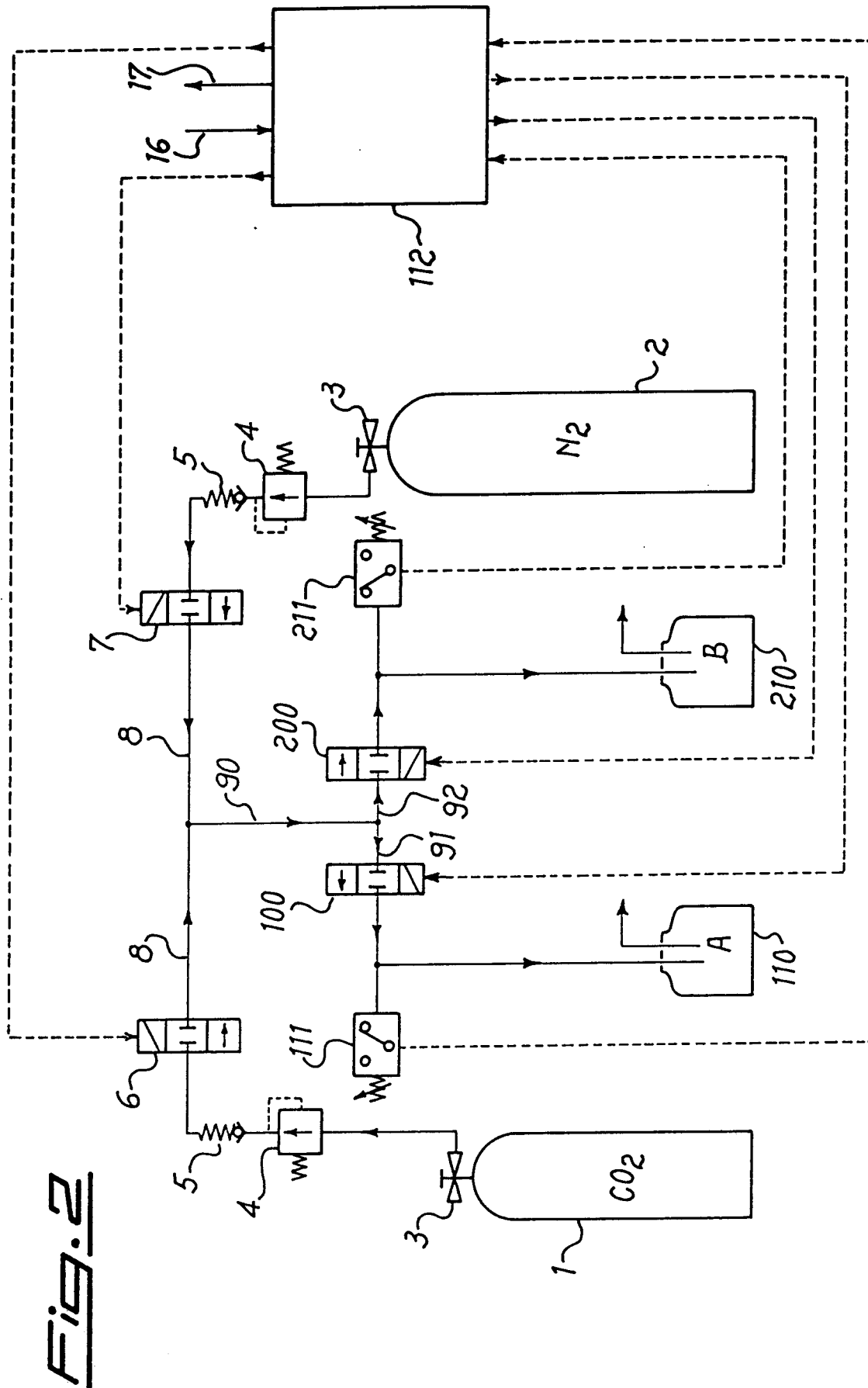
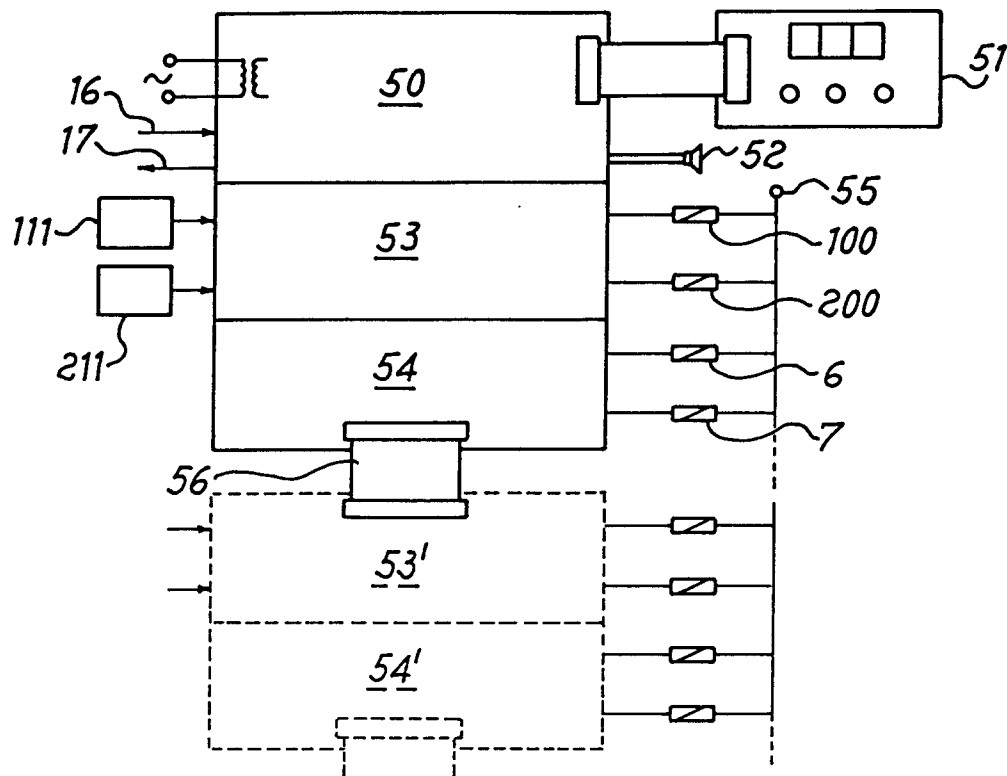
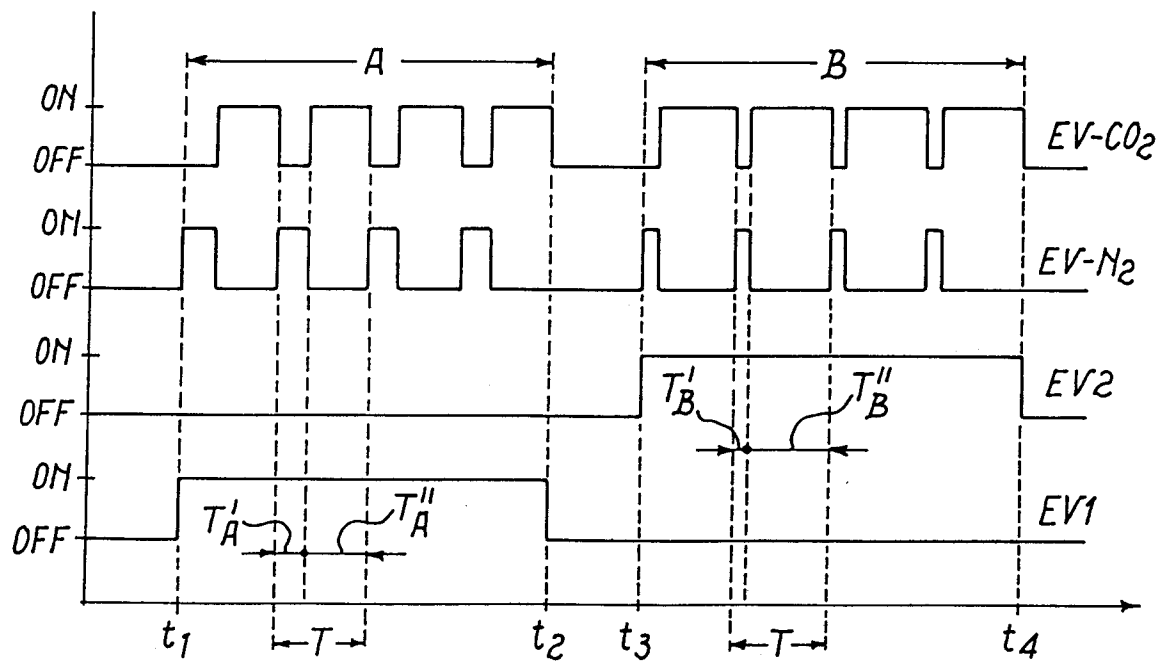


Fig. 3Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 97 12 0931

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE 296 08 397 U (BIERHANDELS GES A OSTERKAMP H0) 29 August 1996 * page 2, line 4 - line 8; claim 1; figure 1 *	1-3,9-11	B67D1/00 B67D1/12 B67D1/04
X	WO 90 13511 A (MCDANTIM INC) 15 November 1990 * page 2, line 13 - line 19; claim 1; figure 1 *	1-3,9-11	
X	EP 0 278 119 A (NORGREN MARTONAIR LTD) 17 August 1988 * column 6, line 38 - line 48; claim 1; figure 1 *	1-3,9-11	
A	US 3 876 107 A (MEINDL JOHANNES KARL ET AL) 8 April 1975		
A	US 4 364 493 A (RAYNES STEPHEN H ET AL) 21 December 1982		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			B67D F17C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 24 April 1998	Examiner Müller, C
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