(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number : **0 661 493 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **94309885.5**

(22) Date of filing : **22.12.94**

(51) Int. Cl.[6] : **F17C 5/00,** F17C 13/02

(30) Priority : **28.12.93 JP 338178/93**

(43) Date of publication of application :
05.07.95 Bulletin 95/27

(84) Designated Contracting States :
DE FR GB IT

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(54) Gas charging equipment.

(57) In an LP gas charging equipment having an electrobalance (3) disposed in a carrying-in line (1) to a turntable (A) to weigh containers, a control panel (B) to which the electrobalance is connected and which has a central processing unit, gas charging valves adapted to open while the containers are moved by the turntable to supply gas from a gas distributor (5) to the containers, and flowmeters (9) for measuring the flow rate of gas at the time of gas charging, the amount of gas to be charged being calculated by the central processing unit (B) on the basis of the measured value provided from the electrobalance to control the gas charging work, an air distributor (6) and an electric distributor (7) are disposed centrally on the turntable, solenoid valves (15) and controllers (33) are arranged around those distributors, the controllers having address memories corresponding to container rest portions on the turntable, and the solenoid valves and flowmeters are connected to the solenoid valves in corresponding relation to the said memory addresses.

FIG. 1

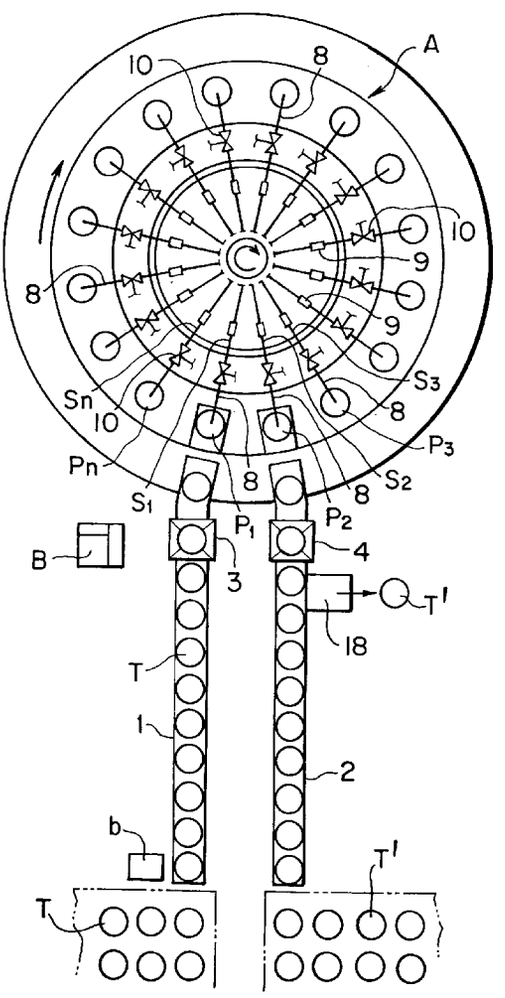

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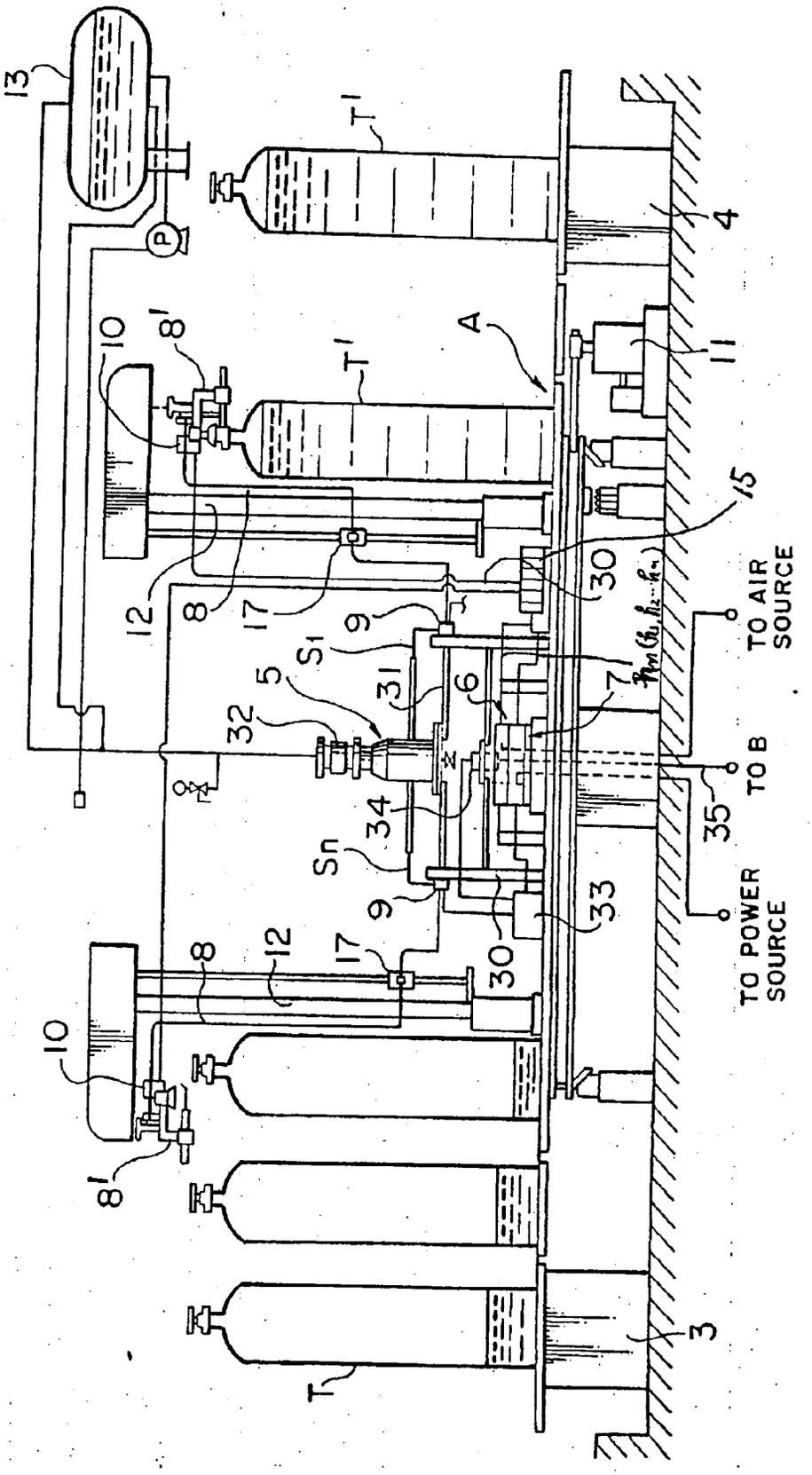
FIG. 2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TO B
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Sn
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TO POWER SOURCE
T
3

Background of the Invention

The present invention relates to a fluid charging equipment for charging LP gas or the like and more particularly to an improvement of equipment for charging a predetermined amount of fluid, eg LP gas, automatically into each of gas containers conveyed onto a turntable. In fact it may be liquid which is charged into LP gas cylinders or containers, but they are still referred to as gas cylinders because any such liquid is unstable at ambient temperatures and the liquid flashes to gas when the container is opened to dispense the gas.

The applicant in the present case has previously proposed an automatic LP gas charging equipment (Japanese Utility Model Laid Open No 62-34296) wherein each container is put on an electrobalance disposed on a carrying-in line to a turntable and is weighed, then the amount of gas to be charged into the container is calculated on the basis of the measured value and such amount of gas is charged into the container through a gas distributor and a gas charging valve while the container is moved by the turntable, further, there are used the gas distributor, an air distributor, solenoid valves, controllers and an optical fiber rotary joint.

According to an embodiment of the above conventional equipment, the solenoid valves and the controllers are arranged fixedly under the turntable, so at the time of installing the equipment in a gas charging factory, much time and labor are required for the mounting and wiring of the solenoid valves and controllers. Thus, not only the working efficiency is low but also inconvenience is encountered in maintenance and inspection. Besides, because of low response characteristic for the flowmeters and controllers, the gas charging valve is inferior in the instantaneousness of its closing motion and for this reason it has heretofore been impossible to obtain a high gas charging volume accuracy.

The present invention has been accomplished in view of such circumstances and it is the object of the invention at least in its preferred form to provide a gas charging equipment capable of being installed in a factory at an improved working efficiency, permitting easy maintenance and inspection and attaining improvement in both gas charging volume accuracy and gas charging accuracy.

Summary of the Invention

According to the invention there is provided a charging equipment for charging fluid with containers comprising a turntable having a plurality of peripherally arranged locations each for receiving a container to be charged with said fluid as the turntable rotates, characterised in that said turntable also carries a corresponding plurality of fluid supply lines and a central distributor by which said supply lines are supplied with said fluid from a common source and further characterised by individual programmable central means on the turntable for said supply lines and connected for controlling the supply of said fluid to the individual containers to fill same to the required degree, based upon the supply of weight data of each container when it is placed upon a said location on the turntable for filling, to the control means.

The preferred form of gas charging equipment of the present invention is characterised by a number of features singly or in any combination including an air distributor and an electric distributor disposed centrally on a turntable, solenoid valves and controllers arranged around those distributors, a predetermined number of container rest portions arranged at equal intervals on the outer peripheral portion of the turntable, a gas distributor disposed centrally above the turntable so as to rotate integrally with the turntable; a gas supply pipe connected from above the turntable to the gas distributor, gas distributing pipes connected manifoldly to the gas distributor, flowmeters and gas charging valves disposed in those gas charging hoses; air hoses connected manifoldly to the air distributor and also connected to the gas charging valves through the solenoid valves to open and close the gas charging valves; the controllers each being provided with a central processing unit and have address memories corresponding to the container rest portions, and the solenoid valves and the flowmeters being connected to the controllers in corresponding relation to the addresses of the memories; an optical fiber joint disposed above and on the axes of both air distributor and electric distributor, optical communication between the controllers and a control panel being performed by utilizing central cavities of both distributors. In a particularly preferred arrangement, an air distributor and an electric distributor are disposed centrally on a turntable and the solenoid valves and controllers are arranged around those distributors.

According to the preferred form of the present invention, since solenoid valves and controllers are disposed on the turntable, not only the efficiency of the installing work is improved but also maintenance and inspection are easy. Besides, all of solenoid valves, flowmeters and controllers are on the turntable, the controllers are each provided with a central processing unit and have address memories in corresponding relation to the container rest portions, the amount of gas charged is inputted and stored for each memory address, and the solenoid valves are actuated in accordance with the operation of the flowmeters, so that the response characteristic to a signal command is improved and there is attained an instantaneous closing motion of each gas charging valve.

Brief Description of the Drawings

Fig.1 is a plan view showing an outline of the equipment according to the present invention;
Fig. 2 is a developed sectional view of the equipment shown in Fig. 1;
and Fig. 3 is a block diagram.

Detailed Description of the Preferred Embodiment

Fig. 1 is a schematic plan view of an LP gas charging equipment according to an embodiment of the present invention and Fig. 2 is a developed sectional side view thereof. In these figures, the reference mark A denotes a turntable, the numeral 1 denotes a carrying-in or feed line, numeral 2 denotes a carrying-out or discharge line, numerals 3 and 4 each denote an electrobalance, numeral 5 denotes a gas distributor, 6 denotes an air distributor, 7 denotes an electric distributor, T denotes a container not charged with gas yet, T' denotes a container already charged with gas, and B denotes a control panel which has a central processing unit (CPU) and is connected to an input operating portion b, electrobalances 3, 4 and further to controllers 33 which will be described later.

The turntable A is installed on a floor surface so as to be rotatable horizontally and it is rotated continuously at low speed by means of a drive unit 11.

On the turntable A are positioned and arranged container rest or holder portions P_1, P_2 ... P_n at equal intervals and on the same circumference, and near those container rest portions are erected support rods 12 which hold gas charging hoses 8, respectively.

Also, centrally on the turntable A are disposed an air distributor 6 and an electric distributor 7 in a plural-stage fashion, and around those distributors are arranged solenoid valves 15 and controllers 33 and erected the same number of support rods 30, 30, ... as the number of the container rest portions P_1, P_2 ... P_n. Further, a table 31 is mounted bridgewise over the support rods 30, 30, ... and a gas distributor 5 is supported on the table 31 so as to be rotatable integrally with the turntable A.

The controllers 33 are each provided with a central processing unit (CPU) and have address memories in corresponding relation to the container rest portions P_1, P_2, ... P_n.

The gas distributor 5 has a unitary body structure and LP gas is fed thereto from a tank 13 and from above the turntable A through a high-pressure swivel 32. To the peripheral surface of the gas distributor 5 are manifoldly connected the same number of gas distributing pipes S_1, S_2 ... S_n as the number of the container rest portions P_1, P_2 ... P_n.

The gas distributing pipes S_1, S_2, ... S_n are simultaneously supplied with gas and are laid along the support rods 30, 30, ... and are connected to flowmeters 9 fixed to the support rods 30, 30, ... The distal ends of the gas distributing pipes are connected respectively through connectors 17 to the corresponding gas charging hoses 8 held by the support rods 12.

According to the above arrangement of the support rods 30, 30, not only the gas distributor 5 can be supported by utilizing the space formed above the air distributor 6 but also the manifoldly branched gas distributing pipes S_1, S_2, ... S_n can be laid in an orderly way along the support rods 30, 30, ... Thus, the pipes on the turntable A which are apt to be complicated can be arranged neatly, whereby the piping and checking works can be done easily.

The front end of each gas charging hose 8 is provided with a gas charger 8' for mounting and removal with respect to an upper-end opening of a container T. The gas charger 8' is provided with a gas charging valve 10 adapted to be opened and closed by air from the air distributor 6.

The air distributor 6 is constituted by an air rotary joint which comprises an inner fixed body and an outer rotatable body, and air hoses h_1, h_2, ... h_n for the distribution of air are arranged along the said rotatable body. The air hoses h_1, h_2 ... h_n are connected to the corresponding gas charging valves 10 through the solenoid valves 15 arranged on the turntable A. Upon turning ON of a solenoid valve 15, the corresponding gas charging valve 10 is opened, while upon turning OFF of the valve 15, the valve 10 is closed.

The electric distributor 7 is a hollow, electric rotary joint. Wires branched on the outer periphery of the distributor 7 are connected to the controllers 33, and the solenoid valves 15 are connected to an controlled by the controllers 33. The solenoid valves 15, ... may be arranged individually in a dispersed form, or may be concentrated on one place.

The flowmeters 9, which are turbo-flowmeters, measure the flow rate of gas by counting the number of pulses which are formed upon flowing of gas through each flowmeter. They are connected to the controllers 33 so that the pulse signals obtained are transmitted to the controllers.

More particularly, the pulse signal obtained in each flowmeter 9 is transmitted to the corresponding controller 33, in which the number of pulses is counted. When a predetermined number of pulses corresponding to the flow rate of gas charged has been counted, a signal for actuating the associated solenoid valve 15 is provided from the controller 33 to close the associated gas charging valve 10 and at this time the relevant container will be correctly filled.

The control panel B is provided with a central processing unit (CPU) and is connected to electrobalances 3, 4 and also to an input operating portion. In the CPU, the amount of gas to be charged is calculated on the basis of data such as measured data provided from those components, then the thus-calculated gas charging volume is transmitted to the

controller 33 concerned, and when the container T concerned is put on any one of the container rest portions P_1, P_2 ... P_n, such gas charging volume is stored in the address memory corresponding to the container rest portion with the container T put thereon.

The communication between each controller 33 and the control panel B is performed by optical communication through an optical fiber rotary joint 34.

The optical fiber rotary joint 34 is disposed on the air distributor 6, more specifically on the axis of the air distributor 6 and electric distributor 7, and optical fiber 35 is extended through central cavities of both distributors 6 and 7.

The control panel B is connected to a host computer H disposed within an office or a control center, and required data on the containers T such as customers' names and specified amounts of gas to be charged are inputted to and outputted from the hose computer H.

In the drawings, the numeral 18 denotes a discharge line for the discharge of defective containers.

The gas charging operation in the above equipment will now be described. After the operator has inputted required data on containers T to be carried in, through the input operating portion b, the containers T of a predetermined lot are successively carried onto the carrying-in line 1 and moved on the same line, then when a container T has reached the electrobalance 3, it is weighed on that electrobalance and the amount of gas to be charged is calculated by the control panel B on the basis of the data obtained, the result of which is transmitted to the corresponding controller 33 and is stored ready to be transferred when the container is moved onto the turntable A. That container T is then moved onto the turntable A and the amount of gas to be charged is allocated thereto. In this way, containers A are successively put on the container rest portions P_1, P_2, ... P_n which successively come to assume the inlet port, whereupon the charging volume data accumulated in the controllers 33 are stored in the memory addresses of the controllers 33 corresponding correctly to the containers on rest portions P_1, P_2 ... P_n.

Every time the operator sets the charger 8' to each container T, the predetermined amount of gas is charged into the container in accordance with ON-OFF operating of the associated solenoid valve 15 which is controlled by the corresponding controller 33, and through the corresponding flowmeter 9, during movement of the container T which rotates together with the turntable A. Setting of the charger 8' to each container may be automatic.

The flow rate of gas to be charged, here indicated by Q, is calculated as follows in the control panel B:

$$Q = (W - [W_1 - w])/r \times K$$

where W is a specified weight of gas, W_1 is the weight of container including gas residue, w is container tare data, r is the specific gravity of gas, and K is a temperature coefficient, W, w and r being inputted beforehand through the input operating portion, W_1 being provided from the electrobalance 3 and K provided from a temperature compensation circuit.

Therefore, when each container T has arrived at the outlet, the charger 8' is disengaged from the container, indicated at T', automatically and the container T' is put on the electrobalance 4 to check the gas-charged weight of the container and calculate overweight or short weight of gas in the control panel B: {$W_4 = W - [W_1' - w]$; W_1' being weight data obtained by the electrobalance 4}. Then, if the measured weight of the gas in the container T' is within the allowable range, the container is fed onto the carrying-out line 2, while if the measure weight of gas in the container T' is overweight or short weight with respect to the allowable range, the container is fed to the discharge line 18.

The above operations are performed continuously to effect the gas charging work.

In connection with the above operations, when a container T is put on any of the container rest portions P_1, P_2, ... P_n provided on the turntable A, the gas charging volume data accumulated in the corresponding controller 33 are stored in the memory address corresponding to that container rest portion, so it is not always required to put containers in the regular order onto the container rest portions P_1, P_2, ... P_n, but such regular order may be skipped, for example due to delay in the weighing or carrying-in operation. Thus, there is no fear of mistake caused by container positioning in the gas charging work.

In the present invention, moreover, a suitable explosion-proof measure is applied to the electric wiring portion from the standpoint of safety.

According to the present invention, since solenoid valves and controllers are arranged on the turntable, not only the installation work efficiency is improved but also maintenance and inspection are easy. Besides, since the gas charging volume obtained by calculation in the control panel is stored in the address memory of each controller on the turntable and the gas charging valves are opened and closed through communication with the solenoid valves and flowmeters on the turntable, the response characteristic to a signal command is improved and there is attained instantaneousness of the gas charging valve closing motion, whereby the gas charging volume accuracy is improved.

Further, since address memories corresponding to the container rest portions are provided in the controllers, there will occur no problem even if a container T is put on any of the container rest portions while skipping the regular order of arrangement of the container rest portions due to delay in the weighing or carry-in operation. Thus, it is not likely at all that there will occur a mistake in the gas charging work caused by container positioning, so that the gas charging accu-

racy can be enhanced.

Claims

1. A charging equipment for charging fluid into containers comprising a turntable (A) having a plurality of peripherally arranged sections (P_1, P_2, P_n) each for receiving a container (T) to be charged with said fluid as the turntable (A) rotates, characterised in that said turntable also carries a corresponding plurality of fluid supply lines (8, 21) and a central distributor (5) by which said supply lines are supplied with said fluid from a common source (13) and further characterised by individual programmable control means (15, 33) on the turntable for said supply lines and connected for controlling the supply of said fluid to the individual containers (T), to fill same to the required degree, based upon the supply of weight data of each container when it is placed upon a said location in the turntable for filling, to the control means.

2. A charging equipment according to Claim 1, characterised by an electrobalance (3) supplying said weight data.

3. A charging equipment according to Claim 2, characterised by a feed line (1) for feeding the containers (T) to be filled, one to the turntable (A) and said electrobalance (3) is connected in said feed line (1).

4. A charging equipment according to Claim 2, 3 or 4, characterised by a control panel (B) to which said electrobalance (3) is connected, said control panel (B) comprising a CPU and being connected to supply said weight data to the control means (15, 33).

5. A charging equipment according to claim 4, characterised in that said CPU is connected to said control means (15, 33) by an optical connection.

6. A charging equipment according to any preceding claim, characterised in that said control means (15, 33) each comprises a gas charging valve (10) and a flowmeter (17).

7. A charging equipment according to Claim 6, characterised in that each gas charging valve (10) is under the control of a compressed air supply (6) in turn controlled by the control means (15, 33) and the flowmeter (17) is operated sufficiently to supply the required amount of gas based upon the weight data when the valve is open.

8. A charging equipment according to any preceding claim characterised in that the turntable (A) carries centrally an air distributor (6) connected to air supply lines (h_1, h_2, h_n) and an electric distributor (7) connected to the programmable control means (15, 33) to supply compressed air to the gas charging lines (8, 21) to control the flow of gas to the cylinders (T) and to provide electrical supplies to the control means (15, 33).

9. A charging equipment according to claim 8, characterised by solenoid valves (15) in said air supply lines (h_1, h_2 ...h_n).

10. A charging equipment according to Claim 9 characterised in that an optical fibre rotary joint is disposed above the air distributor and electric distributor and there is optical communication, between the control means (15,33) and means supplying said weight data, by optical fibre means (35) passing through cavities in said distributors (6,7).

11. A charging equipment according to any preceding claim characterised in that a fluid supply pipe is connected from above the turntable (A) to the gas distributor (5).

12. A charging equipment according to any preceding claim, characterised in that the said fluid is LP gas.

13. A gas charging equipment for LP gas, having an electrobalance disposed on a carrying-in line to a turntable to weigh containers and a control panel to which said electrobalance is connected and which has a central processing unit; gas charging valves which are opened while said containers are moved by said turntable to supply the gas to the containers from a gas distributor; and flowmeters for measuring the flow rate of gas at the time of gas charging, the amount of the gas to be charged into each said container being calculated by the central processing unit on the basis of the value measured by said electrobalance to control the gas charging operation, characterised in that:

an air distributor and an electric distributor are disposed centrally on said turntable, solenoid valves and controllers are arranged around said distributors, a predetermined number of container rest portions are arranged at equal intervals on the outer peripheral portion of the turntable, and the gas distributor is disposed centrally above the turntable so as to rotate integrally with the turntable;

a gas supply pipe is connected from above the turntable to the gas distributor, gas distributing pipes are connected manifoldly to the gas dis-

tributor, and flowmeters and gas charging valves are disposed in those gas charging hoses;

air hoses are connected manifoldly to said air distributor and also connected to the gas charging valves through said solenoid valves to open and close the gas charging valves;

said controllers are each provided with a central processing unit and have address memories corresponding to said container rest portions, and said solenoid valves and said flowmeters are connected to the controllers in corresponding relation to the addresses of said memories; and

an optical fiber rotary joint is disposed above and on the axis of both said air distributor and electric distributor, and optical communication between said controllers and said control panel is performed by utilising central cavities of both said distributors.

FIG. 1

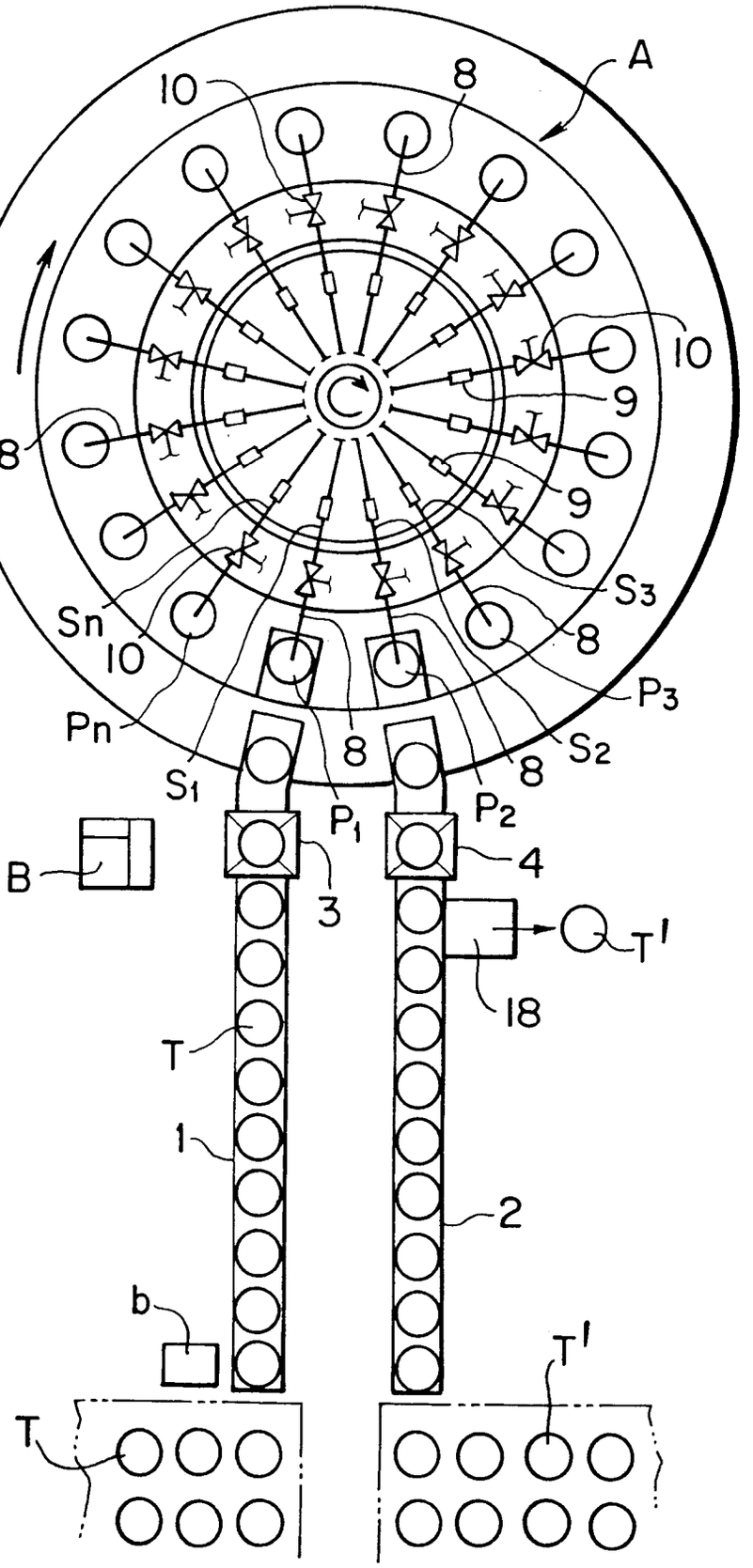

FIG. 2

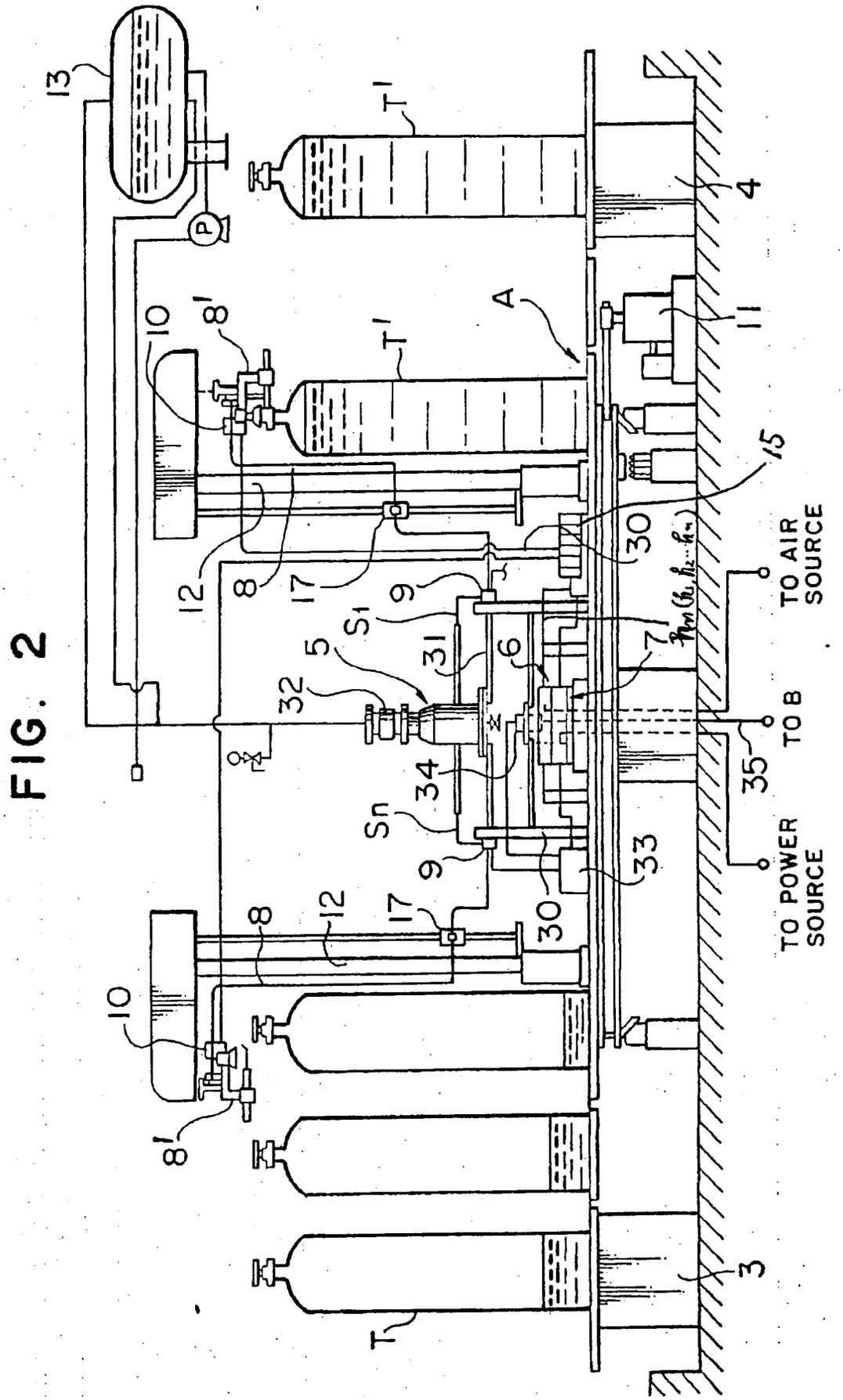
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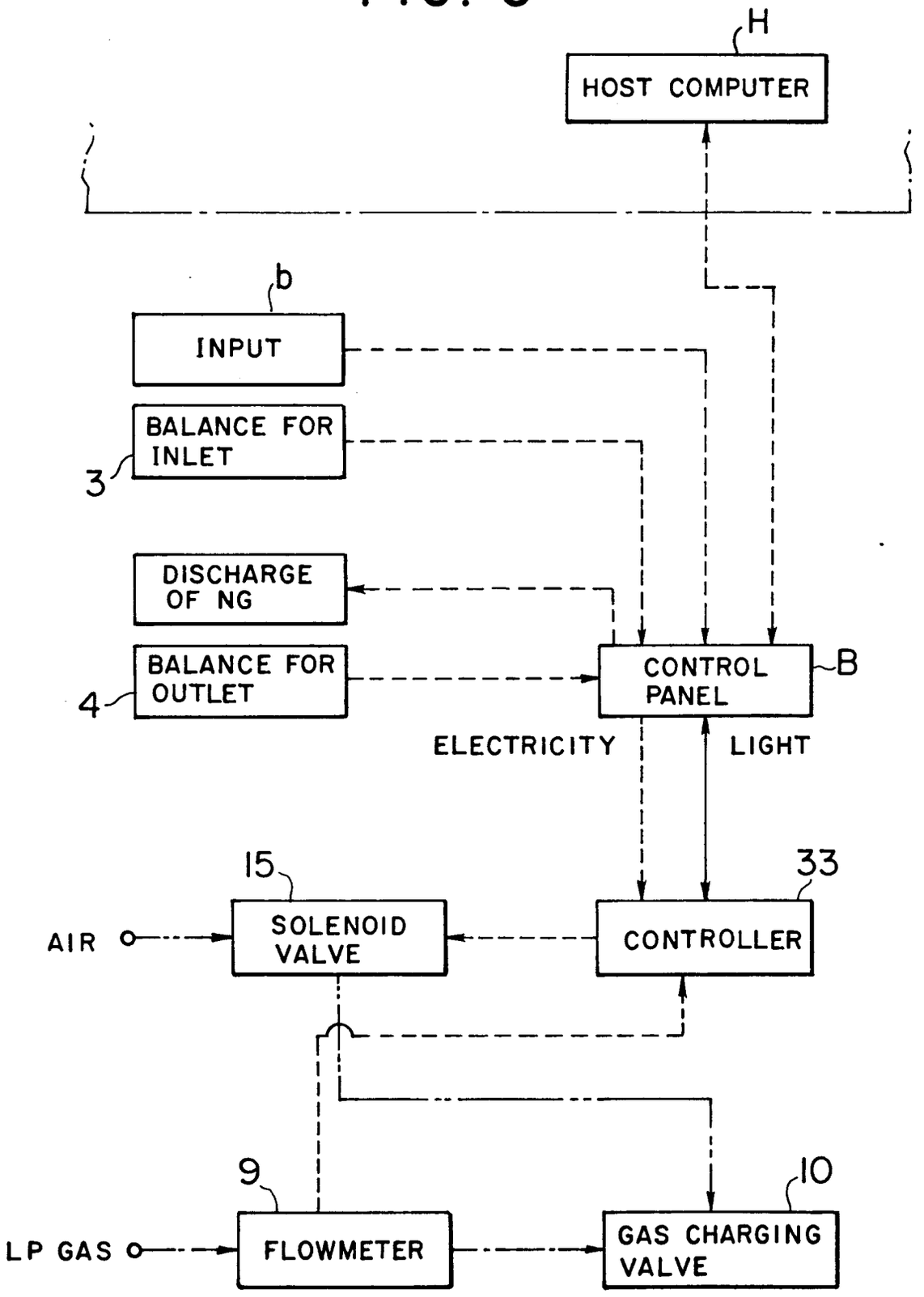
FIG. 3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AIR
SOLENOID VALVE
CONTROLLER
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10
LP GAS
FLOWMETER
GAS CHARGING VALVE

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 9885

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	PATENT ABSTRACTS OF JAPAN vol. 015, no. 168 (M-1107) 26 April 1991 & JP-A-03 033 598 (MEIKO SANGYO K.K.) 13 February 1991 * figures 1-3 of JPA 03 033 598 * * abstract *	1,11,12	F17C5/00 F17C13/02
X	PATENT ABSTRACTS OF JAPAN vol. 8, no. 203 (M-326) (1640) 18 September 1984 & JP-A-59 093 598 (MEIKOU SANGYO K.K.) 30 May 1984 * figure * * abstract *	1-4,12, 13	
X	EP-A-0 534 876 (PROVENCALE D'AUTOMATION ET DE MECANIQUE) * abstract * * column 5, line 3 - column 10, line 37 * * figures 1,2 *	1-4,12	
A		13	TECHNICAL FIELDS SEARCHED (Int.Cl.6) F17C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 April 1995	Siem, T

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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D : document cited in the application
L : document cited for other reasons

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