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

(11) Publication number: **0 313 384 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **88309918.6**

(22) Date of filing: **21.10.88**

(51) Int. Cl.4: **B 67 D 1/00**
B 67 D 1/12

(30) Priority: **23.10.87 US 112906**

(43) Date of publication of application:
26.04.89 Bulletin 89/17

(84) Designated Contracting States:
AT BE CH DE ES FR GB GR IT LI LU NL SE

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(54) Beverage dispensing valve.

(57) A postmix beverage dispenser valve including a fluidic oscillator flowmeter (28) in conjunction with a master controller (38) and a flow control valve (26) such as a proportional solenoid (44). The frequency of the syrup oscillations in the fluidic oscillator is linearly related to the syrup velocity and thus to the volume flow rate. Various sensors can be used to detect the fluid oscillations. A pressure compensation device (60) can be used to isolate the solenoid armature from varying syrup pressures.

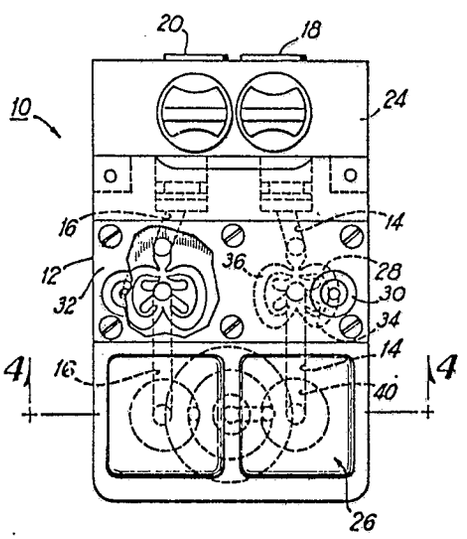

FIG 3

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Description

BEVERAGE DISPENSING VALVE

The present invention relates to postmix beverage dispenser valves such as for soft drinks and juices, and in particular to the use of a fluidic oscillator as a volumetric flowmeter in such a valve.

Traditional postmix beverage dispensing valves include separate water (carbonated or still) and syrup (or concentrate) conduits and separate flow regulators located therein upstream of electrically or mechanically actuated on/off control valves. Each flow regulator utilizes a spring-loaded cylindrical piston as a combination of force and valving element; the piston is able to reciprocate freely within the cylinder and respond to the pressure difference at the two ends of the cylinder, as shown, for example, in U.S. Patent 4,230,147; 3,422,842; and 2,984,261. The function of the piston and cylinder assembly is to maintain a constant pressure differential across the metering orifice machined directly in the face of the cylindrical piston, and to thus provide a constant flow regardless of the fluid pressure changes at the dispensing valve inlets. The flow regulator components operate at low force levels and operation at low force levels has a drawback of fostering hysteresis because of contaminants interposed between moving parts, and close fit between the parts themselves. Furthermore, it has been experienced that free pistons sometimes tend to stick in the regulator cylinder without regard to fit and finishing of the piston and the cylinder.

More recently, improvements in such valves to control the ratio of water to syrup have included the use of flow meters and control elements, as shown, for example, in U.S. Patent 4,487,333. The known flow meters are relatively expensive and include moving parts.

Viewed from one aspect the present invention provides a postmix beverage dispenser valve comprising:

(a) a body having a syrup conduit and a water conduit therethrough for carrying syrup and water, respectively, from respective inlet ports to a mixing nozzle;

(b) a fluidic oscillator flowmeter in at least one of said conduits for measuring the flow therethrough and including a sensor for generating electical signals corresponding to the said flow;

(c) a controller connected to said sensor for receiving signals therefrom and for generating control signals; and

(d) flow control means in said at least one conduit downstream from said flowmeter and connected to said controller for receiving said control signals and for controlling the flow through said flow control means.

Viewed from another aspect the invention provides a method of measuring the volumetric flow rate of syrup or water in a postmix beverage dispenser, comprising:

(a) feeding syrup flowing from an inlet port to a mixing nozzle, through a fluidic oscillator flowmeter;

(b) generating an electrical signal corresponding to the flow through said flowmeter; and

(c) controlling the syrup flow downstream from said fluidic oscillator in response to the flow through said flowmeter.

Some embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, in which:-

Fig. 1 is a block diagram illustrating the operation of a postmix beverage dispenser valve of the present invention;

Fig. 2 is a block diagram showing a closed loop feedback control of the present invention;

Fig. 3 is a top plan view of a postmix beverage dispenser valve according to the present invention;

Fig. 4 is a partly cross-sectional front elevational view of the valve of Fig. 3 taken along line 4-4 of Fig. 3; and;

Figs. 5 is a partly cross-sectional front elevational view similar to that shown in Fig. 4 but of an alternative embodiment.

With reference now to the drawings, Figs. 3 and 4 show a postmix beverage dispenser valve 10 according to the present invention.

The valve 10 includes a body 12 having a syrup conduit 14 and a separate water conduit 16 extending therethrough from syrup and water inlet ports 18 and 20, respectively, to a mixing nozzle 22. Each conduit includes a fluidic oscillator flowmeter therein upstream from a flow controller. Because these features are identical in the two conduits, a description of only one will be sufficient.

Pressurized syrup is delivered to the syrup inlet port 18 located in a detachable dispensing valve mounting block 24, flows through the syrup conduit 14, through the syrup fluidic oscillator 28, and then enters a syrup control valve 26. Fluid oscillations are sensed by a sensor 30 located in a sensor plate 32, which is attached to the valve body 12 by screws. The sensor 30 is able to detect the changes in one of the feedback branches 34 and 36 in the fluidic oscillator 28. The frequency of the syrup oscillations is linearly related to the syrup velocity and hence to the volume flow rate. Because of the fact that the syrup velocity and pressure in the flowmeter 28 feedback branches 34 and 36 cycle between their minimum and maximum values, a variety of different types of sensors can be used to determine oscillation frequency. Pressure, thermistor, resistance temperature sensors, or other suitable means of detecting fluid oscillations can be employed, provided that the sensor output is an electrical quantity which can be accepted by a master controller 38 mounted directly above the dispensing valve body 12. The preferred sensor 30 is a resistance temperature detector (RTD), such as temperature sensitive grids (ETG-50) by Micro-Measurements, Inc.

With reference now also to Figs. 1 and 2, the electrical signal from the sensor 30 representing actual syrup flow rate through the dispensing valve 10 is compared by the master controller 38 with a flow reference value, as illustrated in Fig. 2. If the actual flow value is not equal to the reference set point value, the error signal is processed by the controller 38 and the resulting manipulating signal acts on the syrup control valve 26 to correct the actual flow rate. If the desired flow rate reference value is kept constant, the controller action will provide constant syrup flow rate equal to the set point.

After leaving the fluidic oscillator 28, the syrup follows a channel 40 portion of the conduit 14 (see Figs. 3 and 4) and enters a control chamber 42. Fig. 4 shows a proportional solenoid 44 with a spring loaded armature 46 working as the control valve element. The proportional solenoid 44 is a readily available commercial product. The master controller 38, which will preferably include a microprocessor, generates the manipulating signal in a form wherein the voltage periodically energizes the solenoid 44 for a set interval of time. The position of the solenoid armature 46 in relation to the orifice 48 in the valve seat 49 can be varied by changing the width of the pulses sent to the solenoid coil in response to the error signal. If the solenoid coil is not energized, the solenoid armature 46 is seated in the orifice 48 by a spring 50 located on the top of the armature 46.

The proportional solenoid armature 46 as shown in Fig. 4 is subjected to varying pressure drop between the channel 40 and a channel 51 downstream from the orifice 48. The pressure of the flowing syrup in the channel 51 and in the mixing nozzle 22 is low and close to atmospheric pressure. The pressure in channel 40 is highly dependent on the syrup pressure applied to the dispensing valve 10 and to the pressure loss in the fluidic oscillator 28. Therefore, the controller 38, whose task is to minimize the error signal, must compensate for the varying force created by the pressure drop and the plunger spring 50.

Fig. 5 shows a valve 58, which is an alternative embodiment for isolating the armature 46 from the varying syrup pressure, by means of a pressure compensation device 60. Fig. 5 shows a diaphragm and control plunger assembly 62, a control spring 64, and an outlet orifice 66, all of which comprise the pressure compensating device 60 which maintains a small and constant pressure drop at the orifice 48, thus relieving the solenoid armature 46 from changing pressures. The pressure drop at the orifice 48 can be determined by the spring 64 and the working area of the diaphragm itself.

The water side of the dispensing valves 10 and 58 operate the same as the syrup side described above, and therefore a detailed description thereof is not necessary.

In addition, as shown in Fig. 1, the master controller can, if desired, provide information on the number of drinks per day, quantity of syrup sold per day, and total syrup sales.

It will thus be seen that the present invention, at least in its preferred forms, provides a system having greater accuracy, lower cost, and higher reliability, because of the use of the fluidic oscillator which has no moving parts; and furthermore which overcomes some of the problems in postmix beverage dispensing valves using either the aforementioned flow regulators or the known flow meters; and furthermore provides a postmix beverage dispensing valve incorporating a fluidic oscillator as a volumetric flowmeter working in conjunction with a flow control element to measure and modulate the flow of carbonated water and syrup through the valve.

It is to be clearly understood that there are no particular features of the foregoing specification, or of any claims appended hereto, which are at present regarded as being essential to the performance of the present invention, and that any one or more of such features or combinations thereof may therefore be included in, added to, omitted from or deleted from any of such claims if and when amended during the prosecution of this application or in the filing or prosecution of any divisional application based thereon. Furthermore the manner in which any of such features of the specification or claims are described or defined may be amended, broadened or otherwise modified in any manner which falls within the knowledge of a person skilled in the relevant art, for example so as to encompass, either implicitly or explicitly, equivalents or generalisations thereof.

Claims

1. A postmix beverage dispenser valve comprising:

(a) a body having a syrup conduit and a water conduit therethrough for carrying syrup and water, respectively, from respective inlet ports to a mixing nozzle;

(b) a fluidic oscillator flowmeter in at least one of said conduits for measuring the flow therethrough and including a sensor for generating electical signals corresponding to the said flow;

(c) a controller connected to said sensor for receiving signals therefrom and for generating control signals; and

(d) flow control means in said at least one conduit downstream from said flowmeter and connected to said controller for receiving said control signals and for controlling the flow through said flow control means.

2. A valve as claimed in claim 1 wherein a separate one of said flowmeter and said flow control element are located in each of said conduits.

3. A valve as claimed in claim 1 or 2 wherein said controller includes a microprocessor.

4. A valve as claimed in any of claims 1 to 3 wherein said flow control means is a proportional solenoid.

5. A valve as claimed in claim 4 wherein said

solenoid includes pressure compensation means for isolating its armature from varying syrup inlet pressures.

6. A method of measuring the volumetric flow rate of syrup or water in a postmix beverage dispenser, comprising:

(a) feeding syrup flowing from an inlet port to a mixing nozzle, through a fluidic oscillator flowmeter;

(b) generating an electrical signal corresponding to the flow through said flowmeter; and

(c) controlling the syrup flow downstream from said fluidic oscillator in response to the flow through said flowmeter.

7. A method as claimed in claim 6 wherein said generating step comprises sensing the frequency of the syrup oscillations in said fluidic oscillator and feeding electrical signals representing such frequency to a master controller.

8. A method as claimed in claim 7 including feeding said syrup through a flow control means downstream from said fluidic oscillator flowmeter, and feeding flow control signals from said master controller to said flow control means to control the flow of syrup therethrough in response to the measured syrup flow.

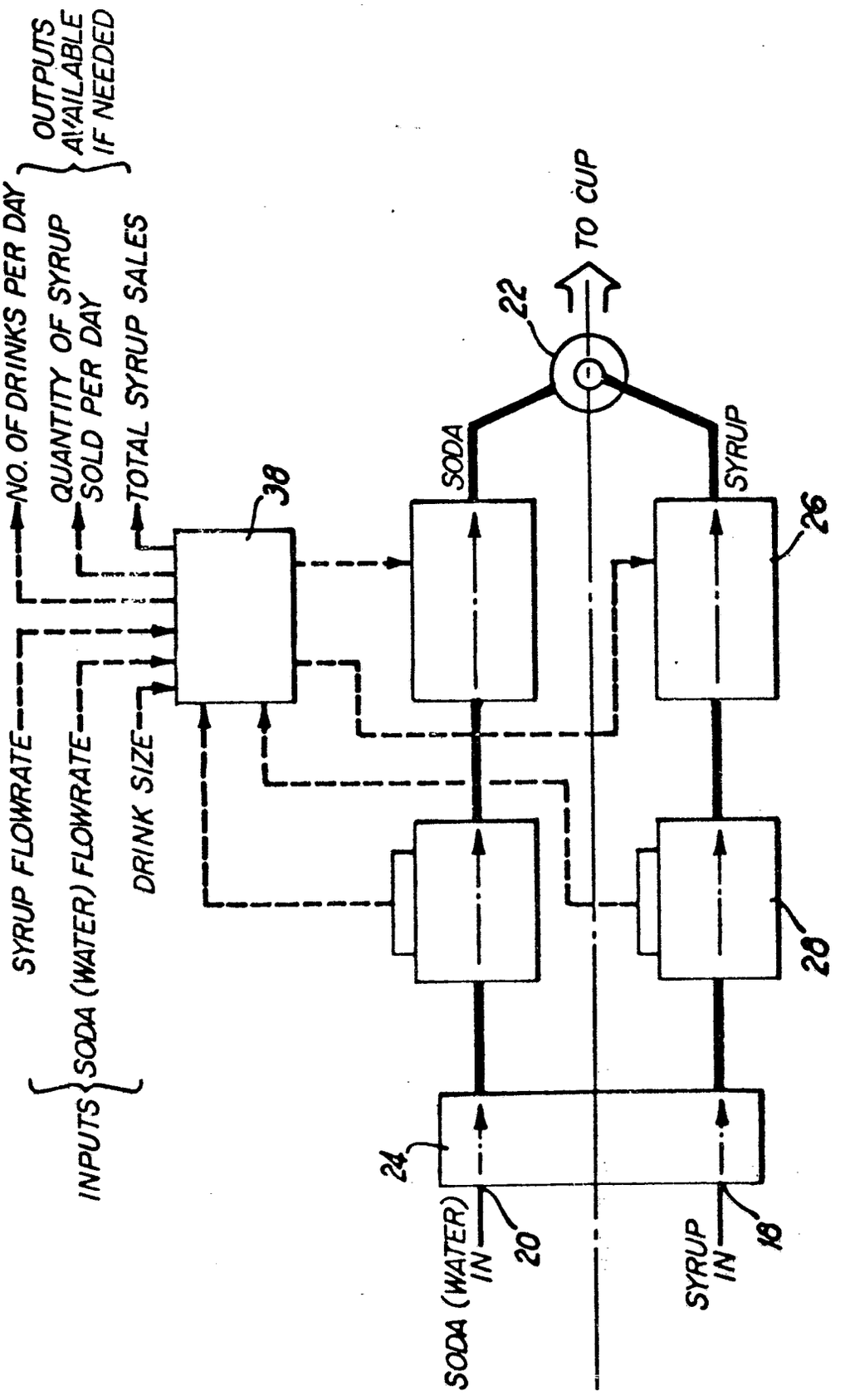
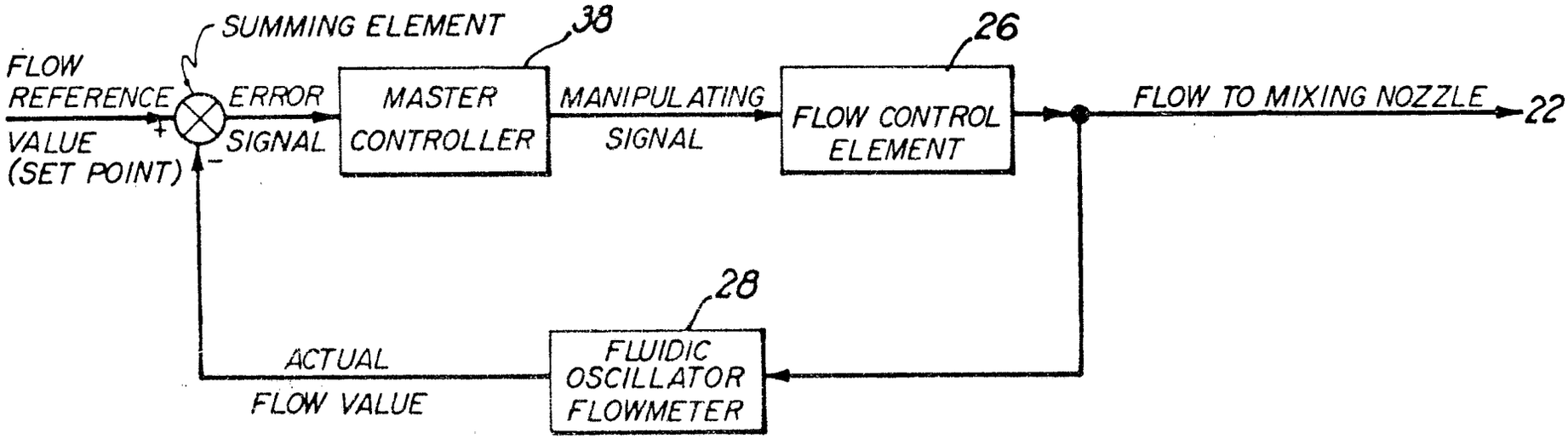

INPUTS
SODA (WATER) FLOWRATE
SYRUP FLOWRATE
DRINK SIZE
OUTPUTS AVAILABLE IF NEEDED
NO. OF DRINKS PER DAY
QUANTITY OF SYRUP SOLD PER DAY
TOTAL SYRUP SALES
30
SODA
SYRUP
22
TO CUP
26
20
24
SODA (WATER) IN
20
SYRUP IN
18

FIG 1

BLOCK DIAGRAM OF FEEDBACK CONTROL SYSTEM FOR BOTH SODA (WATER) AND SYRUP CIRCUITS



ERROR SIGNAL = FLOW REFERENCE VALUE MINUS ACTUAL FLOW VALUE

FIG 2

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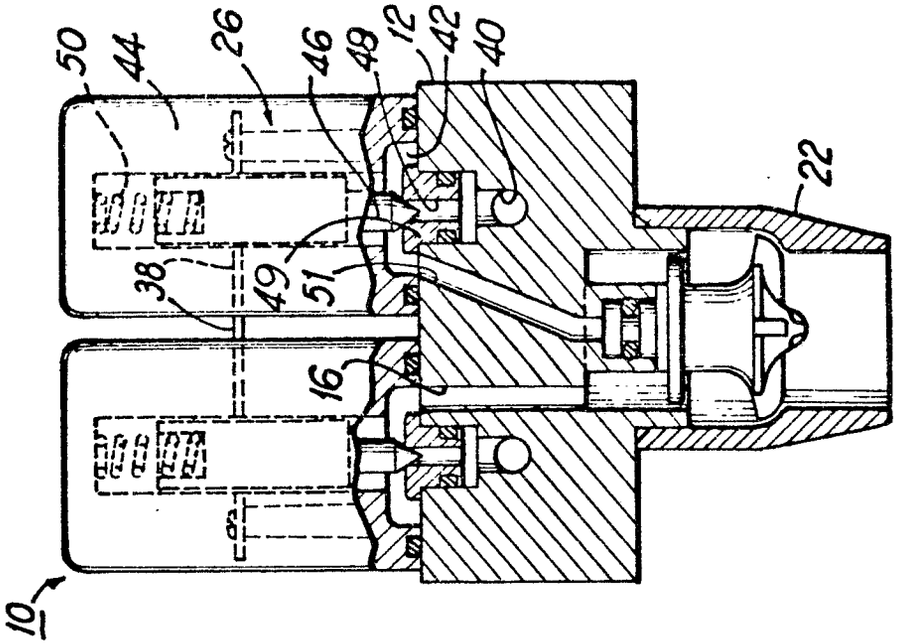
50
44
26
46
49
12
42
40
22
38
49
51
16
10

FIG 4

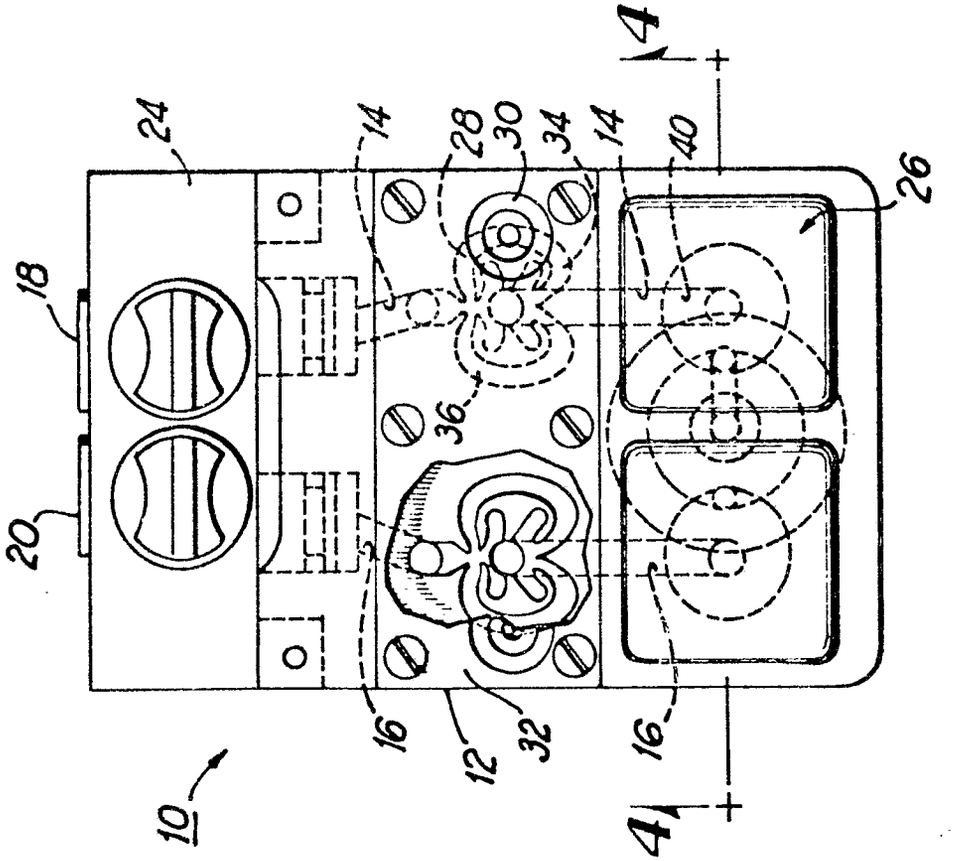
4
24
14
28
30
34
14
40
26
18
20
36
16
12
32
16
10
4

FIG 3

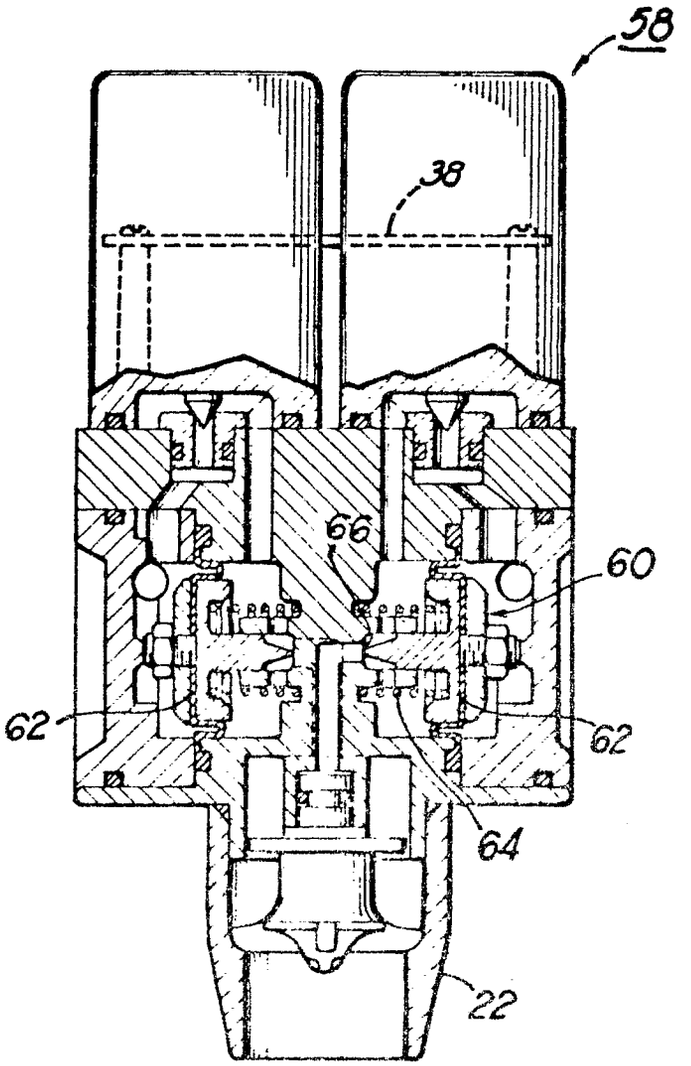

FIG 5

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EUROPEAN SEARCH REPORT

Application Number

EP 88 30 9918

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.4)
D,X	WO-A-8 302 935 (SIGNET SCIENTIFIC CO.) * Figure 2; page 7, line 5 - page 9, line 14 * & US-A-4 487 333	1-3	B 67 D 1/00 B 67 D 1/12
Y		4-8	
Y	US-A-4 585 206 (ITOH) * Claim 1; figures 1,2 *	4,5	
Y	US-A-3 889 534 (GRANT) * Figure 1; claims 1,2 *	6-8	
A	EP-A-0 229 632 (MKS INSTRUMENTS)		
A	DE-A-3 040 521 (R. BOSCH GmbH)		

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 67 D
G 05 D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	19-01-1989	DEUTSCH J.P.M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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