

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
3 March 2005 (03.03.2005)

PCT

(10) International Publication Number
WO 2005/018306 A1

(51) International Patent Classification⁷: **A01G 25/16**,
F16K 11/065

(21) International Application Number:
PCT/AU2004/001133

(22) International Filing Date: 25 August 2004 (25.08.2004)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
2003236429 25 August 2003 (25.08.2003) AU

(71) Applicant and

(72) Inventor: **BARRON, Michael, Charles** [AU/AU]; 93
Riverview Ave., Sth Guildford, W.A. 6055 (AU).

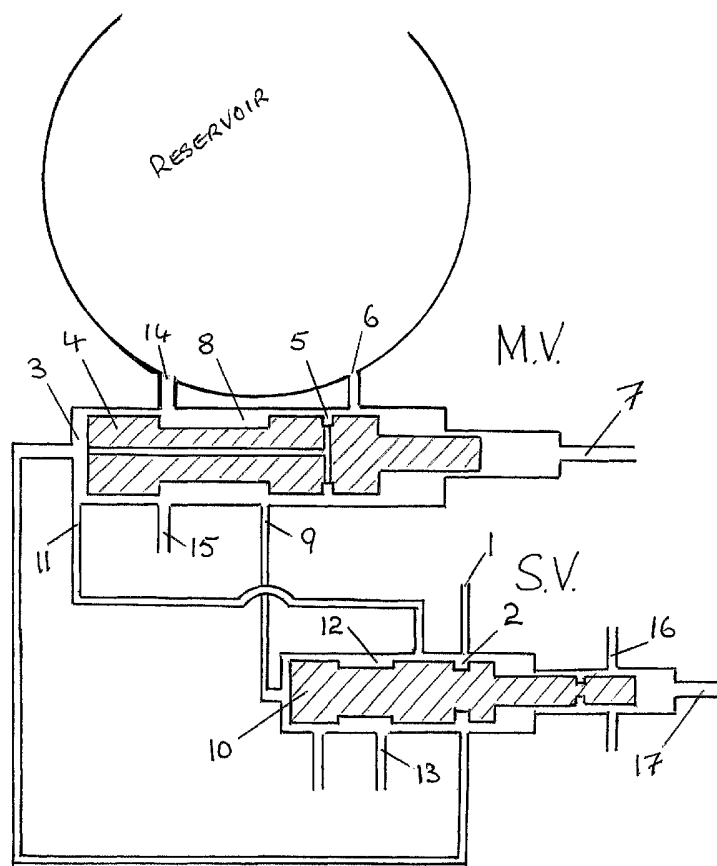
(74) Agent: **BARRON, Michael, Charles**; 93 Riverview Ave,
Sth Guildford, W.A. 6055 (AU).

(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, NA, 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).

[Continued on next page]

(54) Title: MEASURED DELIVERY SEQUENTIAL WATER IRRIGATOR



(57) Abstract: An irrigation water and measuring delivery system comprising a series of units each comprising two slide action spindle valves that may be in common body shell with inter-connecting ducts to form a metering valve (4) and a switch control valve (10) station serving an inverted dome reservoir. Supply water pressure supplies the energy for valve operation. The valves sense the internal fluid pressure and operate through a cycle of accepting a water charge in the reservoir, and a dump release of this charge and a signal initiating sequential operation of the next delivery unit. The size and the water charge of the individual reservoirs are selectable.



Declaration under Rule 4.17:

— *of inventorship (Rule 4.17(iv)) for US only*

Published:

— *with international search 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.

MEASURED DELIVERY SEQUENTIAL WATER IRRIGATOR

5 This invention relates to improvements in devices to measure and deliver irrigation water through multiple delivery locations in a sequential manner.

10 There has been a problem of delivery of a reliable quantity of irrigating water through small bore tube for growing plants. Some systems employ a restricted orifice at the discharge point to attempt to control the volume. This system can be unreliable due to supply fluid pressure variations and a degree of blockage. Electric power is sometimes used for electronic management this power is not always readily available in remote locations and is vulnerable to
15 disruption by weather and physical damage and supply and connection is relatively expensive. It has also been difficult to programme different water application rates or volume to suit a range of plant size, type and soil conditions on a common irrigation system. There is no measurement of actual quantity delivered in
20 fact an individual station may be blocked and deliver no water while the other part of the system continues to run.

These problems are overcome by the present invention which provides a selected quantity of water each station in a sequential
25 and measured manner. This quantity can be varied for each individual station so that every station in a line system can deliver the same quantity or the basic unit adjusted to give a unique selected quantity.

30 The device consists of a metering valve that directs a specific and finite volume into an inverted reservoir dome this will happen until a pressure level approximately equal to supply fluid pressure is

reached and this will occur regardless of the size of the selected reservoir this is not a time related control and when the operating
35 pressure is reached the valve will self activate and dump the water accumulated in the reservoir to the nominated position and at the same time signal – activate the following valve station in a sequential order to commence its fill cycle it is expected valve meters will often be employed in a multiple unit string and the
40 reservoir size for each unit can be selected on an individual basis.

The meter valve in this system is self activated and utilises the water supply pressure energy and can deliver a positive reliable and selectively varied quantity at a nominated station and as the
45 quantity of water per cycle is finite and clearly indicated the correct total quantity to be delivered at a location can be selected and managed.

The device is usually employed in a multiple unit string and each
50 station consists of two spindle valve stations one of which is the primary metering valve (MV) attached to an inverted dome reservoir. Reservoir size selected for the quantity of liquid required and the other is a switch control valve (SV) for fluid supply to the primary valve and detects and relay signals at stages of operation
55 and to signal start the cycle in the following station ensuring sequential operation.

The invention employs few moving parts in this form two sliding piston valve spindle stations that may be in a common housing
60 shell and employing the available water supply pressure energy a feature that allows this to work effectively is the inverted dome reservoir which supplies a pressure fluid flow energy source after the supply water flow is cut off. It can do this because inverted reservoir accepts a quantity of fluid with an entrapped pocket of air

65 above the liquid that is compressed by the supply water pressure
and expands to keep the reservoir liquid under pressure that is
initially close to mains water supply pressure when initial small
quantity of water from the reservoir is employed to operate the
valve spindle. This feature eliminates the normal restraint and
70 frustration experienced when attempting to utilise water supply
pressure energy to operate and close a valve which can result in
rapid pressure reduction related to small valve flow rate restrictions
as the valve nears closure. An additional valve spindle operating
feature is selection of different diameter ends to provide a floating
75 hydraulic pressure application to utilise fluid pressure energy to
correctly position the valve spindle for start then flow cycle and
finish of valve operation.

The system may consist of a number of units with each outlet
80 positioned as and where required and inter-connected with suitable
water hose or conduit to carry the water supply and sequential
signals. The device may be made of any suitable material such as
metal or moulded plastic.

85 To assist with understanding the invention reference will now be
made to the attached drawings which show one example of the
invention.

In the Drawings;

90 Figure 1. shows one example of an operating unit which consists of
a main valve (MV) and a signal valve (SV) both at the start of a
cycle position water supply 1 then flows across spindle valve port 2
enters MV cylinder at 3 and pushes spindle valve 4 until port 5 is in
line with opening 6 which is the entry to the inverted reservoirs
95 with bottom section only illustrated and remains in this position
until a significant design pressure has been generated by the flow

of water into the sealed inverted reservoir and the trapped air pocket is compressed further movement of the spindle valve occurs when sufficient force is generated by water pressure on the end of the spindle valve 4 in zone 3 with control balance force present on the opposite end of the spindle at 7. The area of spindle at this end is smaller to ensure a movement from left to right as fluid pressure rises when the reservoir operating pressure has been reached the spindle will move further to the right and opening 6 will connect to the reduced diameter section of the spindle 8 and allows fluid flow to escape the reservoir flowing out port 9 this pressure flow exerts a force on the end of SV spindle 10 causing the spindle to slide more cutting off the supply pressure source by closing port 2 and at the same time releasing the water column at the front end of the MV spindle at location 3 at port 11 water flows via the reduced diameter section 12 and exits at 13. Removal of the fluid supply and pressure at zone 3 allows the fluid pressure at 7 to return the MV spindle to the left hand start position and in so doing aligns and opens port 14 so that the main charge of water in the reservoir can flow across the reduced diameter section 8 of the spindle and exit at 15 which is directed to the desired water dump point for irrigation use an ongoing effect of the initial flow of water from duct 13 is directed to the SV at the following station duct 17 and this is the signal for the following station to commence operation in a sequential manner. The signal flow and SV spindle movement has the effect of opening water supply to following SV which flows through port 16 of the SV that has just finished its water cycle. This action ensures sequential operation for as many units as are assembled and connected in series for the operating line.

The claims defining the invention are as follows:

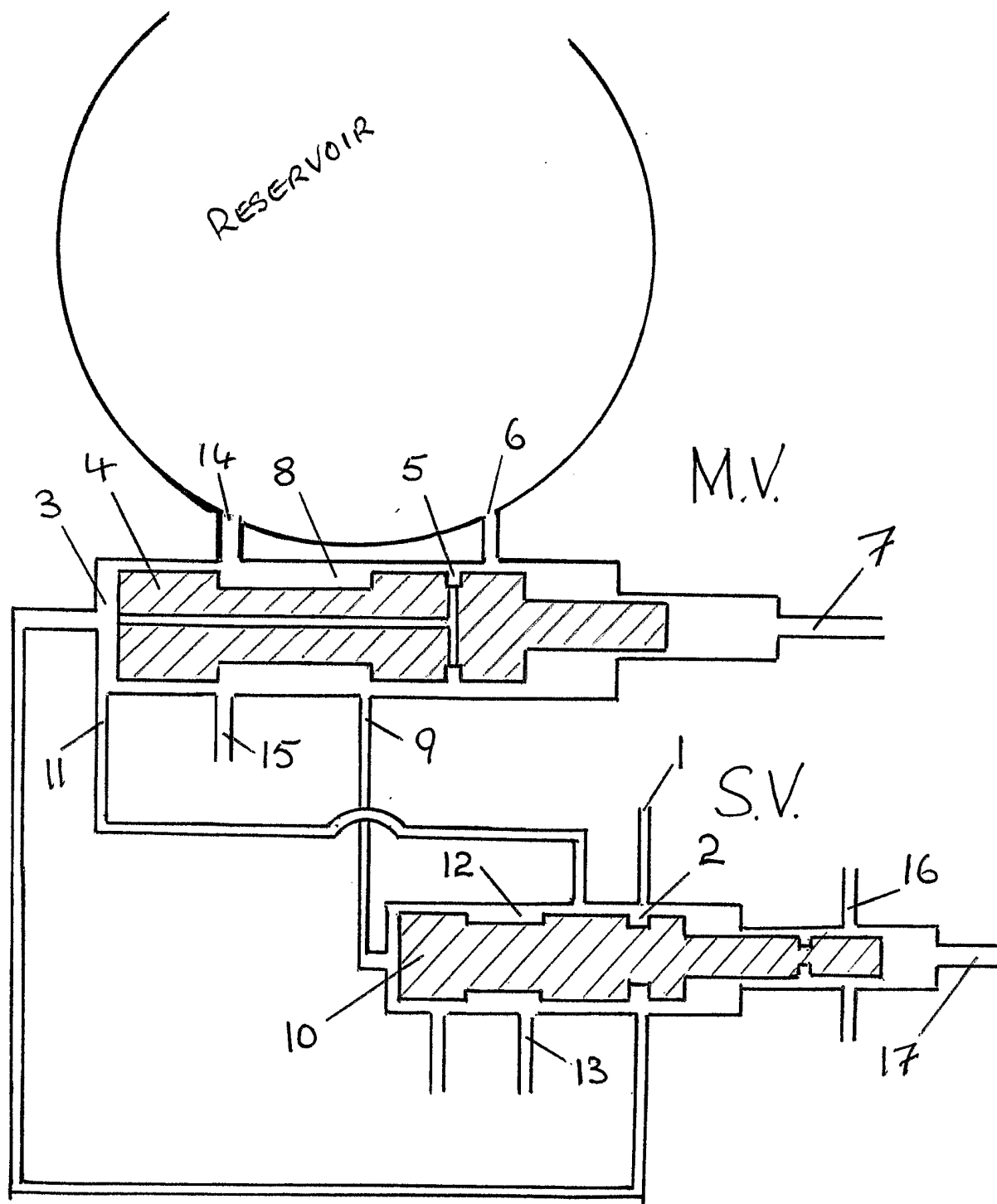
1. A liquid measuring and distribution unit comprising two slide action valve spindle stations and an inverted reservoir dome that operates off supply water pressure energy and performs in sequential operation when connected in series.
2. A liquid measuring unit of claim 1 that employs an inverted pressure dome reservoir to collect a measure of liquid for release for irrigation or fluid management.
3. A liquid measuring unit of claim 1 that generates a pressure cycle in the reservoir dome and this pressure variation is utilised to control valve slide position and operation with spindle position and moving in reaction to pressure.
4. A liquid measuring unit of claim 1 that employs the stored fluid pressure energy of the compressed air pocket in the inverted dome to cause and complete valve action to open and close ports.
5. A liquid measuring unit of claim 1 where differential axial forces are applied to the valve slide spindle due to different end diameters and areas and directs valve operation and timing.
6. A liquid measuring unit of claim 1 where axial differential forces are applied to the valve slide spindle due to different end diameters and then ensures valve slide action and direction of movement.
7. A liquid measuring unit of claim 1 where slide valve spindle position of a unit that has completed a cycle opens

the valve port to supply water to the following unit and ensure sequential operation.

8. A liquid measuring unit of claim 1 where screw or quick connect reservoir such as standard beverage containers of a range of sizes can be used as the inverted dome reservoir.
9. A liquid measuring unit of claim 1 where individual selection of inverted dome reservoir determines the amount of water collected at each individual site independent of reservoir size of other units in line.
10. A liquid measuring unit of claim 1 where the quantity of water or fluid collected and distributed at each individual site is unaffected over a wide range of normal water supply pressure.
11. A liquid measuring unit of claim 1 where the selected quantity of water is supplied in a useful batch quantity or slug for application at the site in a repetitive wet application and soak drain between application.
12. A liquid measuring unit of claim 1 where the selected quantity of water is supplied at the site in a solid low pressure liquid state to avoid wind and evaporation loss factors associated with continuous spray mist and drip applications.
13. A liquid measuring unit of claim 1 where the selected quantity of water is released in a batch manner through larger outlet openings than mist or drip feed arrangements which tend to be small openings to restrict flow and as such are vulnerable to blockage by small solid particles.

14. Liquid measuring unit substantially as herein described with reference to the accompanying drawing.

Fig 1



INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU2004/001133

A. CLASSIFICATION OF SUBJECT MATTER Int. Cl. ⁷ : A01G 25/16, F16K 11/065 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched AU: A01G 25/00, 25/02, 25/06, 25/16, F16K 11/065 (1975-PRESENT) Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) WPAT: A01G 25/IC or F16K 11/065 and (station+ or location+ or reservoir+) and (water+ or irrigat+) and (meter+ or suppli+ or sequence or order)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 3440867 A (H. GUNDERMANN GMBH & CO) 7 May 1986 See whole document (& Derwent Abstract No. 86-126048/20, Class P13)	1
A	EP 0309059 B1 (INNOCOM (I.T.) B.V.) 9 December 1992 See whole document	1
A	WO 1991/02455 A1 (SMITH) 7 March 1991 See whole document	1
A	Derwent Abstract Accession No. 85-030126/05, Class P13, SU 1098533 A (MELIORATION SYSTEMS) 23 June 1984	1
☐ Further documents are listed in the continuation of Box C ☒ See patent family annex		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
Date of the actual completion of the international search 13 October 2004		Date of mailing of the international search report 26 OCT 2004
Name and mailing address of the ISA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustalia.gov.au Facsimile No. (02) 6285 3929		Authorized officer BARRY STEPHENS Telephone No : (02) 6283 2106

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2004/001133

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member	
DE	3440867	NONE	
EP	0309059	AT	83121
		US	4934096
		DE	3876563
		NL	8702286, 187096

Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX