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IMPROVEMENTS IN OR RELATING TO LIQUID PERMEABILITY TESTING DEVICES

Field of the Invention

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The present invention relates to a device for testing the liquid permeability of the external façade of a building or like structure.

10 Background of the Invention

Devices for testing the water permeability of a building facade are known in the art. Devices of common use include apparatus where scaffolds and/or gondolas are used
15 to suspend or locate the test equipment during liquid permeability testing of joints, windows and similar features.

It is to be understood that, if any prior art publication
20 is referred to herein, such reference does not constitute an admission that the publication forms a part of the common general knowledge in the art, in Australia or any other country.

25 Summary of the Invention

Accordingly, in a first aspect there is provided a system for testing the liquid permeability of a façade of a building or like structure, said system comprising:

30 a reservoir for holding a supply of liquid having an outlet;

a modular liquid distribution means in fluid communication with said reservoir, said modular liquid distribution means comprising one or more interconnectable
35 water distribution modules, and at least one clamping device for securing said modular liquid distribution system to said façade.



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Each interconnectable module may comprise a conduit which is configured to be interconnectable with a like conduit so as to be in fluid communication. Furthermore, at least
5 one of said interconnectable modules may comprise at least one spray nozzle where said at least one spray nozzle may be manually or automatically adjusted to vary or regulate a spray pattern thereof.

10 In a further embodiment the modular liquid delivery system comprises a flow velocity, or flow volume, or flow pressure sensing system to measure one or more flow characteristics of liquid distributed by said modular liquid distribution system. The flow sensing system may
15 comprise at least one sensor in each of said interconnectable modules. Furthermore, the flow sensing system is used to regulate the spray pattern of liquid through said spray nozzles.

20 In a further embodiment, there is provided a central processing unit ("CPU") for controlling the distribution of liquid through and from the modular liquid distribution system. The flow sensing system may be coupled to the CPU to provide flow characteristics to the CPU.

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In a further embodiment there is provided a pump for pumping liquid in fluid communication between said outlet of said reservoir and at least one inlet of said modular liquid distribution system. The pump may be controlled by
30 the CPU for the supply of liquid to the modular liquid distribution system.

In a further embodiment the CPU is programmed to control the pump and the or each nozzle so as to regulate the flow
35 of liquid in accordance with at least one specific flow regime.

In a further embodiment the clamping device comprises a clamping portion. The clamping device may further comprise a body portion adjacent and proximal the clamping portion.

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The clamping device further comprises a fixed portion extending substantially parallel the clamping portion and located at a distal end of the body portion. The clamping portion is securably movable along a longitudinal axis of said body portion and may be fastened to the body portion using at least one mechanical fastener.

The clamping device may further comprise one or more screw threaded members for tightening the clamping device to the parapet, ledge, window or similar of a building or like structure.

The body portion may further comprise at least one holder configured to receive an interconnectable module of the modular liquid distribution system. The holding portion may further comprise a first holder positioned proximal the body portion and configured to receive an interconnectable module or distribution conduit, over which a retaining portion is positioned to secure said interconnectable module or distribution conduit, said retaining portion is engageable with the first holder by a fastener means.

In a second aspect, there is provided a method for testing the permeability of a façade of a building or like structure, said method comprising the steps of:

- (i) providing a reservoir of liquid;
- (ii) attaching at least one clamping means to at least one parapet façade or portion thereof;
- (iii) securing a modular liquid distribution system to said clamping means at a position where

liquid sprayed from said modular liquid distribution system impinges the facade;

- (iv) establishing a fluid communication path between said reservoir and said modular liquid distribution system;

wherein liquid from the reservoir is supplied to the modular liquid distribution system to impinge on the façade.

Furthermore, the method may further comprise the step of providing a pump in fluid communication with an outlet of said reservoir and at least one inlet of said modular liquid distribution to regulate the flow of liquid for dispersal.

In the claims of this application and in the description of the invention, except where the context requires otherwise due to express language or necessary implication, the words "comprise" or variations such as "comprises" or "comprising" are used in an inclusive sense, i.e. to specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

Brief Description of the Drawings

Embodiments of the present invention will now be described by way of example only with reference to the accompanying drawings in which:

Figure 1 shows a schematic elevation view of one embodiment of the system of the present invention.

Figure 2 shows a schematic view of a reservoir assembly incorporated in the embodiment shown in Figure 1.

Figure 3 shows a schematic view of a manifold assembly incorporated in the embodiment shown in Figure 1.

Figure 4 shows a modular liquid distribution system incorporated in the embodiment shown in Figure 1.

Figure 5A shows a schematic view of a further embodiment of a modular liquid distribution system in accordance with the present invention.

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Figure 5B is a schematic view of a further embodiment of the modular liquid distribution system shown in Figure 5A.

Figure 6 shows a schematic representation of a mounting assembly incorporated in the embodiment shown in Figure 1.

Figure 7 shows a schematic view of yet a further embodiment of a mounting assembly in fluid communication with a liquid modular distribution system in accordance with one embodiment of the present invention.

Figure 8 shows a schematic view of one embodiment of a clamping device in accordance with one embodiment of the present invention.

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Detailed Description of the Preferred Embodiments

Figures 1 through to Figure 8 illustrate an embodiment of a system 1 for testing the liquid permeability of an external façade 40 of a building or like structure. The system 1 comprises a reservoir 2 for holding a supply of liquid 26 and is generally located atop a portion of the façade 40 that is to be tested. The reservoir 4 comprises an outlet 14 in fluid communication with a modular liquid distribution system 6 comprising one or more interconnectable water distribution modules ("interconnectable modules") 16 for delivering or

dispersing liquid 26 onto external façade 40. The modular liquid distribution system 6, or a portion thereof, may be held or located in position using a clamping device 42 where at least one interconnectable module 16 is secured
5 to a building parapet or ledge ("parapet") 36 or other like suitable portion of a building façade 40.

The reservoir 2 generally comprises a tank 4 for holding the liquid 26 and has an inlet 12 to which an inlet
10 conduit 10 is attachable to enable refilling of the tank 4. The tank 4 also has an outlet 14 to which an outlet conduit 15 may be attached to feed the liquid 26 to the modular liquid distribution system 6.

15 The reservoir 2 also comprises a transport assembly 18 in which the tank 4 is supported. The transport assembly 18 provides easy portability of the tank 4 enabling it to be readily moved to any on-site location (such as a roof top 38) where liquid permeability testing is to be conducted.
20 The transport assembly 18 comprises a base 20 upon which the tank 4 may be positioned in a secure manner and a plurality of wheels 22 coupled to the base 20. The wheels 22 may incorporate a braking mechanism in order to prevent unwanted movement of the transport assembly 18 once
25 positioned appropriately.

The incorporation of the reservoir 2 within the system 1 allows a desired liquid flow rate to be achieved to supply the modular liquid distribution means 6 which may not be
30 possible if the system 6 were fed directly from a mains water supply. The reservoir 2 may further comprise a liquid controller to maintain the liquid level in the tank 4 between predetermined minimum and maximum levels. This may involve a level sensor 72 that sense when the
35 liquid level 28 has fallen below a pre-specified minimum level and operates a valve to refill the tank 4 to the predetermined maximum level. It will be appreciated that

various liquid levels may be calibrated in accordance with the desired flow rate(s) and the corresponding testing regimes.

5 Figure 1 shows several interconnectable modules 16 providing fluid communication between the outlet 14 of the tank 4 and the modular liquid distribution system 6. The required spray pattern of liquid into the external façade 40 determines the configuration of the interconnectable
10 module(s) 16. Due to the interconnectivity of modules 16, a plurality of same may be arranged or assembled in an appropriate manner to provide a different characteristic flow of liquid 26 in order to simulate varying rain conditions.

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The interconnectable modules 16 may comprise any and/or different, lengths of conduit. The interconnectable modules 16 are conveniently configured with at least one end capable of engaging a like end of another
20 interconnectable module 16. A further embodiment of interconnectable modules 16 may comprise separate connectors 46 to join the ends of said modules 16 together. The interconnectable modules 16 may be constructed from any material having sufficient strength
25 and corrosion resistance for carrying a supply of liquid. Such materials may comprise PVC and stainless steel. It may be appreciated that modules 16 that are load-bearing may comprise, for example, stainless steel and be interchangeable with like modules 16 made from PVC
30 materials or similar.

The interchangeable modules 16 may be of any length or be manufactured according to a variety of pre-specified lengths. The pre-specified lengths of the
35 interconnectable modules 16 may be influenced by the practicality of transportation and convenience of assembly of said modules 16 on-site. Furthermore, the diameter of

the interconnectable modules 16 may be fixed or be of a variety of pre-specified signs. The length and diameter of the interconnectable modules 16 to be used during testing will thus be dependent upon the nature of the testing regime required to be conducted.

In order to position the modular liquid distribution system 6 beyond the façade 40 of a building, at least one module 16 may be secured to a parapet 36 by a clamping device 42. Figure 8 shows one embodiment of a clamping device 42 used to secure the manifold assembly 34 to a parapet 36 or similar portion of a building façade 40 ("parapet"). The clamping device 42 comprises a body portion 64 and a fixed end 66 aligned orthogonal to a distal end of the body portion 64. A clamping portion 68 is fastened or attached to the underside of the body portion 64 at a distance from the fixed end 66 so as to engage said parapet 36. A mechanical fastener 70a, such as a bolt, may be used to fasten clamping portion 68 to the body portion 64. Similarly, mechanical fasteners, i.e., bolts 70b, 70c and 70d are used to secure the clamping device 42, by way of the clamping portion 68, to parapet 36. The bolts 70a, 70b and 70c are threadingly engaged with complementary apertures configured within the clamping 68 and body 64 portions to establish the appropriate fastening in order to secure the clamping device 42 to the parapet 36. It may be appreciated that any number of bolts or similar fasteners may be used to locate clamping portion 68 and/or fixed end 66 to the parapet 36.

The clamping device 42 further comprises at least one holder 44 located on an upper surface of the body portion 64. Holder(s) 44 are shaped or configured to receive an interconnectable module 16 of the modular liquid distribution system 6. The interconnectable module 16 is secured within holder(s) 44 by a complementary retainer(s)

80 configured to retain the module 16 within the holder(s) 44 in the direction indicated in Figure 8. It may be appreciated that the retainer(s) 80 may be mechanically fastened to each of the holders 44 to retain the interconnectable module 16 appropriately. Further, it will be appreciated to one skilled in the art that various methods/means may be used to retain interconnectable module(s) 16 or similar conduit(s) to clamping device 42.

10 In the embodiment in Figure 1 liquid is gravity fed from the reservoir 2 to the interconnectable modules 16. However, in an alternative embodiment as depicted in Figure 2 a pump 30 is included in the system 1 in fluid communication between the tank 4 and modules 16. The pump 15 30 is located upon the base 20 of the reservoir transport assembly 18.

More particularly, the pump 30 is connected to the modular liquid distribution system 6 via a transfer conduit 32. 20 The transfer conduit 32 may be rigid or flexible, depending upon the location of the pump 30 relative to the modular liquid distribution system 6.

The flow of liquid 26 provided by pump 30 may be regulated by a central processing unit (CPU) that may be programmed 25 to vary and/or regulate the rate of flow of liquid 26 through the system 1. The CPU may be programmed to control the pump 30 to pump liquid 26 from tank 4 to the modular liquid distribution system 6 at any desired flow 30 rate in order to achieve a desired dispersal of liquid 26 from the modular liquid distribution system 6. A control panel 8, for operating the CPU, may be located on or about the reservoir assembly 2 for access and use by an operator. It may be appreciated that control panel 8 may 35 provide complete access to the programmability and operational functions of the testing system 1 described herein. The control panel 8 may provide for initiation of

automatic sequences of desired testing regimes or, alternatively, may facilitate the operation of manual actuation or regulation of the pump 30 to regulate the flow of liquid 26 to the modular liquid distribution system 6. Furthermore, the control panel 8 may comprise a personal computer or a laptop computer that may be in wireless communication with the pump 30.

The pump 30 may comprise a liquid flow rate meter to measure, and subsequently indicate, the rate of flow of liquid 26 to the modular liquid distribution means 6. The flow rate meter may be configured to measure the liquid flow rate and report this data to the CPU for further processing or indication at the control panel 8 for review by an operator. The flow rate meter may alternatively be in wireless communication with said CPU (or laptop).

Additional liquid flow rate sensors may be positioned within any conduit section through which liquid 26 flows through the system 1, such as, for example, transfer conduit 15 (to measure output flow rate from the tank 4) or any interconnectable module 16. It will be realised that the flow rate sensors may be configured to transfer acquired flow rate measurements to the CPU for evaluation so as to regulate the performance of pump 30. The flow rate sensors may comprise any device known in the art for measuring the flow rate of a liquid within a conduit or channel section.

Figure 3 shows a further embodiment of the present invention where the supply of liquid 26 from tank 4, regulated by pump 30, to the modular liquid distribution system 6 may be facilitated using a manifold assembly 34. The manifold assembly 34 provides fluid communication between the pump 30 (of the transfer conduit 15) and the modular liquid distribution system 6 and comprises of at least one interconnectable module 16 that is securable to

a parapet 36 using the clamping device 42. The dimension and/or extension of each interconnectable module 16 is selected depending upon the desired distance out from the façade 40 that is required in order to achieve the appropriate spray pattern for the required testing regime. The embodiment shown in Figure 3 shows two interconnectable modules 16 connected by an elbow connector 74 to establish a right angle bend to supply liquid 26 downward to a connecting portion 46 to which the modular liquid distribution system 6 is to be connected. Furthermore, a brace 24 or similar may be required some circumstances to maintain the right angle bend and ensure the modular liquid distribution system 6 does not stray outward of the façade 40. Such a brace may comprise a rigid strut or a length of steel wire.

In a further embodiment, the modular liquid distribution system 6 may include the manifold assembly and be attached to the parapet 36 using

The connector 46, residing at the reservoir end of the manifold assembly 34, is configured so as to receive a supply of liquid 26 from the pump 30 (or the outlet transfer conduit 15 if no pump is to be used) to deliver liquid 26 to the modular liquid distribution system 6 for dispersal as required.

One embodiment of a modular liquid distribution system 6 is shown in Figure 4. Figure 4 shows one interconnectable module 16 aligned vertically and connected to an elbow section 52 using a connector 46. The connectivity of elbow section 52 to the interconnectable module 16 is such that both components are in fluid communication to supply liquid 26 to at least one nozzle 54 located at a distal end of the elbow section 52. Liquid 26 supplied to the modular liquid distribution system 6 from the manifold assembly 34 is thus dispersed onto façade 40 using spray

nozzle(s) 54. The embodiment of the modular liquid distribution system 6 shown in Figure 4 may be configured to produce a desirable characteristic dispersal pattern to test the permeability of, for example, windows or vertical joints.

The spray nozzle(s) 54 may comprise any known device in the art capable of spraying liquid. The spray nozzle(s) 54 may be configured to vary the spray rate and patterns either by manual actuation or by automatic self-adjustment. Alternatively, the spray nozzles 54 may be in communication (either directly or wirelessly) with the CPU so as to be integrated within the control system for complete regulation of liquid flow and dispersal to façade 40.

A further embodiment of a modular liquid distribution system 6 is shown in Figure 5A. In the embodiment shown, the elbow section 52 is replaced by a plurality of horizontally aligned interconnectable modules 16 joined by an intermediate manifold connector piece 58. The manifold portion 58 connects to an interconnectable module 16 aligned vertically to interconnect with the distal or downward end of the manifold assembly 34. The horizontally aligned interconnectable modules 16 are configured with at least one spray nozzle 54 to spray liquid 26. The spray nozzles 54 may be regularly spaced along said interconnectable modules 16 or at irregular intervals, depending upon the façade 40 or the specific nature and orientation of the joint being tested. The interconnectable modules 16 may be assembled using integral connecting units or by separate connector 46. The connection between the horizontally aligned interconnectable modules 16 and manifold 58 are such that all said modules are in fluid communication to receive a supply of liquid 26 from the manifold assembly 34 for dispersal from spray nozzles 54. The embodiment of the

modular liquid distribution system 6 shown in Figure 5A may be configured to produce a desirable characteristic flow dispersal pattern to test the permeability of, for example, horizontal joints and gable-end walls.

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Figure 5B shows a further embodiment of the modular liquid distribution system shown in Figure 5A whereby the horizontally aligned interconnectable modules 16 are connected using connecting portion(s) 60 that further
10 comprise spray nozzles 54. It may be appreciated that the embodiments shown in Figure 5A and Figure 5B may be configured to include any number of interconnecting modules 16 so as to disperse liquid 26 upon a façade 40 of varying dimensions. Furthermore, it may be realised that
15 manifold 58 may be configured in different shapes and angles to account for corner portions of building facades to test the extremities of corner regions. The manifold 58 may be, for example, configured whereby the centers of the two opposite openings are arranged in the same plane,
20 but at 90° angles to each other, to spray liquid about the corner of a building.

For each embodiment of the modular liquid distribution system 6 shown in Figures 5A and 5B, flow sensors may be
25 positioned or located within any of the interconnectable module(s) 16 to measure liquid flow rate. The data obtained from the sensors may be communicated to the CPU, either directly or wirelessly, for further evaluation and regulation of the pump 30, the liquid source filling
30 reservoir 4 and the operation of the spray nozzle(s) 54, either collectively or individually as required.

Figure 6 shows a further embodiment of the system 1 in which the manifold assembly 34 is connected to the modular
35 liquid distribution system 6 shown in Figure 4.

Similarly, Figure 7 shows a further embodiment of the system 1 in which the manifold assembly 34 is connected to either of the embodiments of the modular liquid distribution system 6 shown in Figures 5A or 5B.

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In a second aspect, there is provided a method for testing the permeability of the façade of a building or like structure, wherein a reservoir 2 is provided above an area to be tested. A modular liquid distribution system as
10 described herein is secured to a parapet, ledge or façade or portion thereof using a clamping device. Once secured, the modular liquid distribution system 6 is connected to the pump 30 or outlet conduit 15 of tank 4 to supply liquid 26 to be dispersed in accordance with a desired
15 testing regime.

All such modifications and variations together with others that would be obvious to a person of ordinary skill in the art are deemed to be within the scope of the present
20 invention, the nature of which is to be determined from the above description.

The Claims Defining the Invention are as follows:

1. A system for testing the liquid permeability of a façade of a building or like structure, said system:
 - 5 a reservoir for holding a supply of a liquid having an outlet;
 - a modular liquid distribution means in fluid communication with said reservoir, said modular liquid distribution system comprising one or more
 - 10 interconnectable liquid distribution modules, and at least one clamping device for securing said modular liquid distribution system to said façade.
2. A system according to claim 1, wherein each
15 interconnectable module comprises a conduit wherein the conduit is configured to be interconnectable with a like conduit so as to be in fluid communication.
3. A system according to any one of the preceding
20 claims, wherein at least one of said interconnectable modules comprises at least one spray nozzle.
4. A system according to any one of the preceding
25 claims, wherein said at least one spray nozzle may be manually or automatically adjusted to vary or regulate a spray pattern thereof.
5. A system according to any one of the preceding claims wherein said modular liquid delivery system has a flow
30 velocity or flow volume or flow pressure sensing system to measure one or more flow characteristics of liquid distributed by said modular liquid distribution system.
6. A system according to any one of the preceding claims
35 wherein said flow sensing system comprises at least one sensor in each of said interconnectable modules.

7. A system according to any one of the preceding claims, wherein said flow sensing system is used to regulate the spray pattern of liquid through said spray nozzles.

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8. A system according to any one of the preceding claims, further comprising a central processing unit ("CPU") for controlling the distribution of liquid through and from the modular liquid distribution system.

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9. A system according to claim 8 wherein the flow sensing system is coupled to the CPU to provide flow characteristics to the CPU.

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10. A system according to any one of the preceding claims, wherein there is provided a pump for pumping liquid in fluid communication between said outlet of said reservoir and at least one inlet of said modular liquid distribution system.

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11. A system according to claim 10, wherein said pump is controlled by said CPU for the supply of said liquid to said modular liquid distribution system.

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12. A system according to any one of the preceding claims, wherein said CPU is programmed to control said pump and the or each nozzle so as to regulate the flow of liquid in accordance with at least one specific flow regime.

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13. A system according to any one of the preceding claims, wherein said clamping device comprises a clamping portion.

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14. A system according claim 13, wherein said clamping device comprises a body portion adjacent and proximal the clamping portion.

15. A system according to claim 14, wherein said clamping device further comprises a fixed portion extending substantially parallel said clamping portion and located
5 at a distal end of said body portion.

16. A system according to any one of the preceding claims, wherein said clamping portion is securably movable along a longitudinal axis of said body portion.

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17. A system according to any one of the preceding claims, wherein said clamping portion may be fastened to said body portion using at least one mechanical fastener.

15 18. A system according to any one of the preceding claims, wherein said clamping device further comprises one or more screw threaded members for tightening said clamping device to said parapet.

20 19. A system according to claim 18, wherein said body portion further comprises at least one holder configured to receive an interconnectable module of a modular liquid distribution system.

25 20. A system according to claim 19, wherein said holding portion comprises a first holder positioned proximal said body portion and configured to receive an interconnectable module or distribution conduit, over which a retaining portion is positioned to secure said interconnectable
30 module or distribution conduit, said retaining portion engageable with said first holder by a fastener means.

21. A method for testing the permeability of a façade of a building or like structure, said method comprising the
35 steps of:

(i) providing a reservoir of liquid;

- (ii) attaching at least one clamping means to at least one parapet façade or portion thereof;
 - (iii) securing a modular liquid distribution system to said clamping means at a position where liquid sprayed from said modular liquid distribution system impinges the facade;
 - (iv) establishing a fluid communication path between said reservoir and said modular liquid distribution system;
- wherein liquid from the reservoir is supplied to the modular liquid distribution system to impinge on the façade.

22. The method according to claim 21, further comprising the step of providing a pump in fluid communication with an outlet of said reservoir and at least one inlet of said modular liquid distribution to regulate the flow of liquid for dispersal.

23. A system for testing the liquid permeability of a façade of a building or like structure as hereinbefore described and with reference to the accompanying Figures.

24. A method for testing the liquid permeability of a façade of a building as hereinbefore described and with reference to the accompanying Figures.