

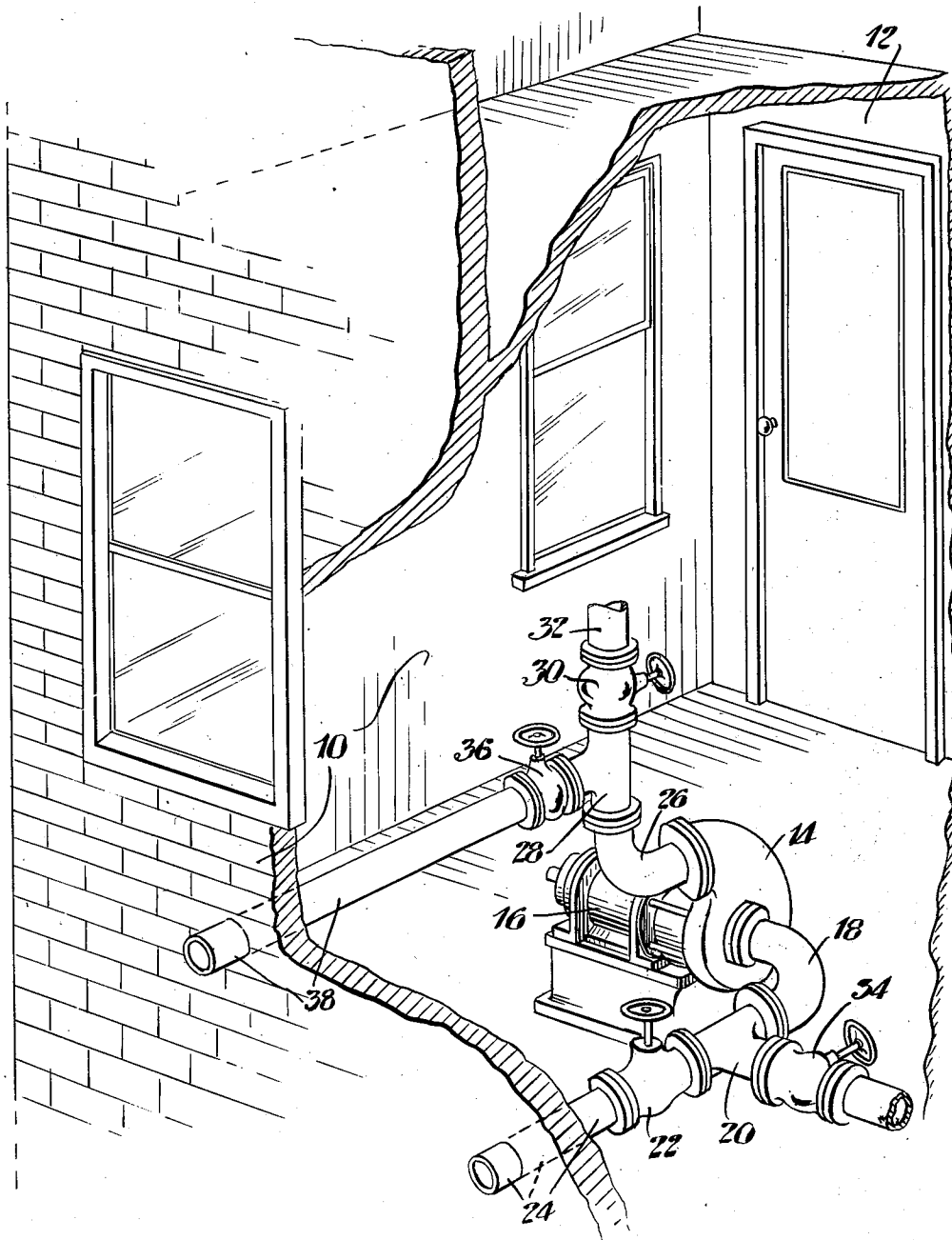
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METHOD OF WATERPROOFING MASONRY STRUCTURES

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METHOD OF WATERPROOFING MASONRY STRUCTURES

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This invention relates to rendering masonry structures waterproof.

All masonry structures are porous depending upon the sizes of pores, the number and sizes of cracks and fissures in the structure. The leakage of vertical masonry walls generally occurs when rain is driven against a wall by wind pressure. The inside of the wall may often become damp because the temperature gradient through the wall will produce such a low temperature on the inside face of the wall that moisture will condense on it.

In the course of observation of many structures for the purpose of waterproofing, and through laboratory experimentation, I have proved that one of the greatest factors influencing masonry wall penetration by water is the differential static pressure on opposite sides of the wall.

I have found that parapet wall leakage is greatly increased by this influence. A windward parapet wall protruding above the roof line has a positive pressure on the windward face and a negative pressure on the roof side due to Venturi action of wind passing across the parapet. The sum of these pressures gives a large differential pressure between the opposite faces of the wall and greatly increases the infiltration of water. By air-sealing the roof side of this parapet, I have consistently reduced and frequently eliminated leakage.

I have proved that a factory building, with badly cracked brickwork and many other defects from a waterproofing viewpoint, will exhibit no leakage in spite of severe weather exposure, when through the use of large intake fans a constant positive static pressure is produced within the building.

One object of the present invention, is to provide a method of waterproofing a wall by artificially producing a differential static pressure condition to approximately correspond to the conditions, existing during a rain storm. Under such conditions, any waterproofing treatment application to the high pressure side of which involves the use of liquids or any materials capable of flow will be greatly benefited as these materials will follow the same channels that the water followed in entering the building. If solid materials are entrained with the liquid they will be drawn into the apertures and fill them.

Some of the best waterproofing materials are quite viscous and therefore if the outside of the wall is heated while applying, or just prior to the

application, the materials will penetrate further and more effectively in the wall.

This effect may be accomplished by placing a suitable exhaust type fan in a building aperture, such as a window or door, and then so far as practical seal up windows, doors and other opening in the area involved. The operation of the exhaust fan will produce a low pressure inside the building, and the penetration of the waterproofing materials capable of flow will be greatly improved when applied on the exterior face of the wall.

I have conclusively proved that cracks in the masonry are most severely affected by differential static pressure. For example, an ordinary common brick was placed with the bottom face exposed to a vacuum chamber, four side faces sealed with mastic and the top face exposed to the atmosphere. By keeping the top face just barely submerged in water and applying 13 inches water head vacuum to the underside for one hour, it was found that the moisture had penetrated approximately $\frac{3}{8}$ " into the brick when it was removed and very carefully fractured by a sharp blow while laying on sand. The same brick was dried, carefully re-set along the fracture line, securely banded together and replaced as before. Water applied to the top surface as before without vacuum on the reverse side showed dampness but did not drip after one hour. Vacuum was then applied and the water dripping through carefully measured. Numerous tests showed that the rate of penetration varied as the square of the differential pressure applied. Average values for this single brick showed penetration at the rate of $1\frac{1}{2}$ cubic centimeters per minute under a differential pressure of .75 inch water head. This value is mentioned specifically as water manometer tests on opposite sides of building parapet walls has repeatedly shown differential pressures of more than .75 inch water head under moderate wind conditions.

To further establish the principles involved, I applied a positive pressure to the bottom side of the same brick and proved that water poured on the top side of the brick to varying depths could be prevented from dripping through the crack by applying the previously determined differential pressure.

Another object of this invention is to resist penetration of water during a rain storm or when moisture is applied to the outside of a wall under pressure. This is accomplished by equipping the building with intake fans of sufficient volume to produce positive static pressures within the

building greater than the pressures formed on the outside faces of the wall during the rain storm. I have proved that the pressure required is not impractical to obtain and have successfully controlled this condition in a large factory. I do not limit myself to the particular means of obtaining this pressure. For the sake of economy and automatic control this equipment is electrically controlled so as to make contact and operate only when rain is actually falling through the use of suitable moisture reacting membrane exposed to the atmosphere.

The accompanying drawing is a perspective view illustrating a room of a structure having walls to be waterproofed and showing an apparatus within the room by which a desired pressure condition may be maintained for waterproofing the outside walls of the room.

In this drawing 10 represents outside walls having a window therein and 12 represents an inside wall having a door therein. The present invention contemplates closing the doors and windows and sealing them tight so that a super-atmospheric pressure may be developed within the room or a partial vacuum may be developed within the room. To develop a pressure or vacuum a centrifugal blower 14 is mounted within the room which is arranged to be operated by a motor 16. An inlet 18 of the blower is arranged to be connected through a T 20 and valve 22 with a pipe 24 leading to the outside of the wall. The outlet of the blower is connected by means of an L 26 with a T 28 and communicates through a valve 30 with a pipe 32 opening into the room. With these connections just described the centrifugal blower may be operated to draw in air from the outside and pump it into the room. Centrifugal blowers of this type have a large capacity and are capable of developing up to 25 to 30 pounds pressure. Such a pressure, of course, cannot be developed in a room of masonry structure on account of leakage but pressures of from five to ten pounds may be developed. At the time that a driving rain is beating against the outside walls 10 the blower may be operated to develop a pressure within the room, the gases escaping through the openings by which water might enter through the walls. This outwardly escaping air will prevent the infiltration of water through the walls.

To develop a partial vacuum within the room the T 20 is connected by means of a valve 34 and the T 28 is connected by means of a valve 36 and a pipe 38 extending out through the wall 10. If the valves 22 and 30 are closed then the operation of the centrifugal blower will tend to draw air through the valve 34 into the blower and then out through the valve and pipe 38 to the outside. Such an operation will develop a subatmospheric pressure in the room, and tend to draw air into the room through the fissures and small cracks and pores in the wall. When the wall is being waterproofed by the usual wax waterproofing solutions the centrifugal pump 14 is operated to create a vacuum effect within the room in order to draw the waxy waterproofing materials into the pores, fissures and other openings in the wall. The wax solidifies therein and tends to seal the wall to make it waterproof.

It will be understood, of course, that when the blower 14 is operated to develop a pressure within the room the valves 34 and 36 will be closed and the valves 22 and 30 open. When the blower is used to develop a vacuum within the room the

valves 34 and 36 are open and the valves 22 and 30 are closed.

If the rain is accompanied with a wind of high velocity it may be necessary to increase the pressure within the building to overcome the pressure developed by the wind pressure. To accomplish this an anemometer may be used to measure the wind velocity and by means of a potentiometer and electrical relays increase the fan or blower speed as the wind velocity increases to build up the pressure within the building.

It has been found that interior sizings to building walls, and all similar treatments with materials subject to flow, will be greatly benefited by application under positive interior pressure conditions as outlined above.

Another object of this invention is to control the dewpoint within any wall through production of positive flow of properly conditioned air through the pores or cracks in any wall. Every wall under condition of different temperatures between the interior and exterior face has a definite temperature gradient through the wall. As the dewpoint temperature may exist within the wall for a given moisture content in the atmosphere, condensation will frequently take place within the wall. Present practice in the art of air conditioning does not include the controlling of this condensation through application of static pressure and air conditioning is frequently producing harmful damage through condensation; because as the vapor pressure within a building is increased, the dewpoint line becomes nearer to the inside face of the wall. By controlled increase of the static pressure, I can cause an outward flow of warmed air through existing cracks and pores and thereby cause the dewpoint line to recede from the inside face of the wall. This outward flow will likewise prevent condensation from flowing inward as previously established. In the claims the term "waterproofing liquid" is used and it is understood by this term to mean a waterproofing liquid which is a true liquid or which is a liquid containing solids or containing components which will become solid by drying or evaporation.

The preferred form of the invention having been thus described, what is claimed as new is:

1. A method of waterproofing a masonry wall of an exposed hollow structure or building comprising sealing the building, or a room or a section of the room of the building, having an exposed wall, maintaining a partial vacuum within the structure or the inside of the exposed wall of the room or section of the room, applying a low viscosity waterproofing liquid to the exposed side of the masonry wall while the vacuum pressure is maintained on the inside of the wall and continuing the maintenance of the vacuum and the application of the waterproofing liquid until the liquid has penetrated into the pores, cracks and fissures of the wall.

2. A method of waterproofing a masonry wall of an exposed hollow structure or building comprising sealing the building, or a room or section of the room of the building having an exposed wall, maintaining a partial vacuum within the structure on the inside of the exposed wall of the room or section of the room, applying a low viscosity waterproofing liquid to the exposed side of the wall while the vacuum pressure is maintained on the inside of the wall, heating the exposed surface of the wall prior to, or while applying the waterproofing liquid and continuing the maintenance of the vacuum and the

application of the waterproofing liquid until the liquid has penetrated into the pores, cracks, and fissures of the wall.

3. A method of waterproofing a masonry wall of an exposed hollow structure or building comprising, sealing the building, or a room of the building, or a section of the room having an exposed wall, maintaining a partial vacuum on the inside of the exposed wall to draw air through

cracks and fissures of the wall, applying a low viscosity waterproofing liquid to the exposed side of the wall to locate the points of penetration of the liquid into the cracks and fissures and continuing the maintenance of the partial vacuum and the application of the waterproofing liquid until the air movement has filled the cracks and fissures with the waterproofing liquid.

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