A weatherseal arrangement around a door cooperates with a threshold under the door to drain away water blown against the door. Weatherseals along vertical edges of the door prevent water from passing inward and also conduct water downward to the threshold which has an enclosed chamber under the door. The downward draining water is guided into a top opening of the chamber, preferably by pile material over the top opening, and a drain opening leads from the bottom of the chamber and empties onto the outside sill of the threshold. The top opening of the chamber is about ¼ inch or more above the drain opening so that wind pressure against the drain opening opposes a head of water within the chamber beneath the door.

16 Claims, 10 Drawing Figures
DOOR AND THRESHOLD WEATHERSEAL SYSTEM

THE INVENTIVE IMPROVEMENT

Watertight, airtight, and lighttight seals around a door involve many problems. These include construction tolerances, warping, sagging of the door, effective drain-off of water blown against the door, and the changing of many parameters during use and wear of the system. The invention involves a full analysis of these problems and a better combination of weatherseals cooperating with a threshold to solve the problems. The invention aims at passing an industry established test for leakage while using simple and economical materials that are easily installed and have a long effective wear life.

SUMMARY OF THE INVENTION

The inventive door and threshold weatherseal weatherseal system includes weatherseal means arranged along a vertical edge of the door to prevent water from passing inward past the edge of the door, and the edge weatherseal is shaped to conduct water downward along the edge of the door. The threshold has an enclosed chamber under the door and having a top opening, and the downwardly drained water is guided from the bottom of the edge weatherseal means into the top opening of the chamber. The chamber has a drain opening leading from the bottom of the chamber to a region outside the door, and the top of the chamber is about ½ inch or more above the drain opening so wind pressure against the drain opening opposes a head of water within the chamber beneath the door.

DRAWINGS

FIG. 1 is a fragmentary elevational view of a preferred embodiment of the inventive door and threshold weatherseal system;
FIG. 2 is an enlarged, fragmentary cross-sectional view of the system of FIG. 1 taken along the line 2 — 2 thereof;
FIG. 3 is an enlarged, fragmentary cross-sectional view of the system of FIG. 1 taken along the line 3 — 3 thereof;
FIG. 4 is an enlarged view similar to the view of FIG. 2 with the door open;
FIG. 5 is a perspective view of the lower corner of the door and frame embodiment of FIG. 1;
FIG. 6 is a fragmentary partially cut-away, front elevational view of a preferred variation on the embodiment of FIG. 1;
FIG. 7 is a perspective view of a tube usable for closing off the chamber of the threshold of the inventive system; and
FIGS. 8 — 10 are cross-sectional views of alternative threshold constructions for the inventive system.

DETAILED DESCRIPTION

The inventive door and threshold weatherseal system as shown in FIGS. 1 — 5 is applied to a conventional door 10 formed of any convenient material and hung within a jamb or frame 11 to close against a stop 12 over a threshold 15. Frame 11 can be wood, plastic, or metal, and threshold 15 is preferably extruded of plastic or metal. Door 10 and frame 11 can be pre-assembled and installed as a unit at the building site, or can be built up part-by-part on the building site. The invention involves an improved weatherseal system around door 10 as described below.

A weatherseal 16 is preferably arranged along the vertical edges of door 10, and preferably also extends over the top of door 10. Weatherseal 16 includes a leaf seal 17 positioned against frame 11 and engaging door 10 for a tight, even seal along the vertical edges of door 10. Seal 16 also preferably includes a face leaf seal 18 resiliently engaging the outer face of door 10 along its edges. Then with door 10 closed as best shown in FIG. 2, face leaf 18 presses against the outer face edge of door 10, and leaf seal 17 presses against the side edge of door 10. Leaf 18 diverts most of the water blown against the outside of door 10 to keep the door edge dry, and any water that gets past leaf 18 is trapped by leaf 17. Also, leaf 17 is arranged to be open toward the outside of door 10 and closed toward the inside of door 10 to provide a solid barrier to any inwardly directed water being forced around the edge of door 10. Such water is caught in the closed angle of leaf seal 17 and flows downward along the side edges of door 10. Face leaf 18 can be omitted, and the entire weatherseal can be accomplished by leaf 17 if desired. Also, weatherseal 16 can be mounted on frame 11 in several different ways, including the mountings shown in FIGS. 2 and 4 and an adhesive, staple, or fastener mount directly to an unnotched frame 11.

Threshold 15 cooperates with weatherseals 16 to dispose of the downwardly draining water along the edges of door 10 without any leakage. Threshold 15 is preferably formed as a single piece of extruded plastic or metal as best shown in FIG. 3 with a downwardly sloping outer sill 19 and an enclosed chamber 20 extending from the length of threshold 15 under door 10. Longitudinal openings 21 in threshold 15 serve as screw receptacles for fastening threshold 15 between frame parts 11 in factory assembly. Threshold 15 can also be fastened in place in other ways such as by fasteners driven into frame pieces 11 from the underside of threshold 15 or fasteners driven downward through threshold 15 and into an underlying surface.

Chamber 20 has a top opening 22 near each end and below leaf seal 17 for receiving downwardly drained water inside leaf seal 17. A tube or other guide can be used to direct water from the bottom of leaf seal 17 into top opening 22, but a preferred water guide is a patch of pile material 23 laid over the base of seal 16 under the bottom of leaf 17 and over the top opening 22 of chamber 20. Water draining downward inside of leaf 17 then drains into pile patch 23 and works its way downward into top opening 22. Meanwhile, pile 23 engages the bottom edge of door 10 to serve as a weatherseal in addition to a water guide.

Chamber 20 also has a drain opening 24 leading from the bottom of chamber 20 and emptying out onto sill 19. Water running into chamber 20 then drains out over sill 19 and runs off outside of door 10. Wind pressure against drain opening 24 can hold water back in chamber 20, and chamber 20 is preferably tall enough so that its top opening 22 is about ¾ inch or more above drain opening 24 so that a head of water can accumulate inside chamber 20 if the wind pressure against drain opening 24 is sufficient. It has been found in experiments with the inventive system that a 34 mile-an-hour wind directed against drain opening 24 creates sufficient pressure to hold a head of water ¾ inch tall in chamber 20, so top opening 22 is preferably ¾ inch.
above drain opening 24 where a water head resistance to a 34 mile-an-hour wind is desired. The effect of such an arrangement is to provide a water seal against wind pressure blowing against drain opening 24 so that an air draft cannot pass through the water and reach the inside of door 10. When wind pressure does not prevent it, water drains freely from drain opening 24. Then if a gust of wind occurs when no water is accumulated in chamber 24, a draft can blow upward from top opening 22. However, such a draft enters pile material 23 which seals against the air and prevents the draft from reaching the inside of door 10. Also, any water blown upward through top opening 22 is merely forced into pile material 23 which can hold a considerable amount of water without leaking into the inside of door 10.

The bottom of door 10 preferably has a weatherseal 36 engaging the top of chamber 20 of threshold 15, and weatherseal 36 is preferably clear of top opening 22 when door 10 is closed. Weatherseal 36 includes a pair of spaced-apart, resilient foam strips 37 and flexible fins 38 so that fins 38 flex and sweep along the top of chamber 20 and foam strips 37 compress against the top of chamber 20 for a firm and secure weatherseal. The space between fins 38 leaves clearance over top opening 22 so that water can drain in between fins 38 and enter top opening 22. A single piece of weatherstripping can also be used along the bottom edge of door 10 to clear top opening 22 when door 10 is closed.

The preferred way of installing threshold 15 in pre-existing door frames is to fit threshold 15 in place and screw it down with screws passing through chamber 20. For such an arrangement it is desirable to keep the central region of chamber 20 dry and limit the water to the end regions under weatherseal 16. To accomplish this, a drain guide box 25 as shown in FIG. 6 is preferred. Box 25 is closed around its sides except for an opening 26 that registers with drain opening 24 when box 25 is fitted into the end of chamber 20. Box 25 also has a top opening 27 that fits into top opening 22 of chamber 20. Then water can drain into opening 27 of box 25 and out through drain openings 26 and 24 and onto sill 19 without entering the central region of chamber 20.

FIG. 7 shows an alternative to drain box 25 in the form of a tube 28 that is flexible and curved as illustrated to extend between top opening 22 and drain opening 24 at the end of chamber 20. Tube 28 is preferably dove-tailed in cross-section as illustrated, and top opening 22 and drain opening 24 preferably have a corresponding dove-tail shape for securely fitting tube 28 in place without any fastening.

FIG. 8 shows an alternative cross-sectional view of a threshold 30 usable in the inventive system and having a different drain arrangement. Drain opening 31 is formed in the bottom of chamber 32 of threshold 30, and leads under sill 33 in a drain passageway 34 that opens at the outer end of sill 33. The bottom of drain passageway 34 is closed by a trough piece 35 secured to the underside of threshold 30. One advantage of such an arrangement is an increase in the vertical distance from the open end of drain passageway 34 to the top opening 35 by taking advantage of the downward slope of sill 33. This can be used either to increase the vertical height between top openings 35 and the open end of drain passageway 34, or to reduce the height of chamber 32 above sill 33.

FIG. 9 shows another alternative cross-sectional view of a threshold 40 usable in the inventive system. Chamber 41 extends outward under sloping sill 42 and has a drain opening 43 at the outer end of sill 42. This helps increase the vertical height from drain opening 43 to top opening 44 without a very tall ledge above sill 42. Screw receptacle openings 45 are used as previously described, and baffles 46 help trap a head of water in the bottom of chamber 41 to resist wind pressure against drain opening 43.

FIG. 10 shows another alternative cross-sectional view of a threshold 50 usable in the inventive system. Chamber 51 extends under sill 52 supported by legs 53 as illustrated, and a tube 54 similar to the tube of FIG. 7, extends from top opening 55 through chamber 51 along notches formed in legs 53 and to a drain opening 56 at the outer end of sill 52. Screw receptacle openings 58 are used as previously described, and the only drain water in chamber 51 is confined within tube 54. A ramp 57 slopes upward from the inside edge of threshold 50 to minimize the likelihood of tripping over threshold 50. Ramp 57 can also be added to any of the previously described thresholds.

Many variations are possible within the scope of the inventive system. For example, different weather seals can be arranged along the edges of door 10 to stop any water blown inward and guide the water downward. Pile and other drain guides can be arranged in various ways at the bottom of the edge weatherseals to direct the downwardly drained water into the chamber of the threshold. The threshold can have small chambers at each end rather than a chamber extending along its length, and its top openings can be notches at or near its ends or openings spaced from the ends with recesses leading toward such openings. For double doors, weatherseals can be arranged where the door edges join, and the threshold can have a central opening under the door edges in addition to openings at its ends. Drain openings from chamber 20 can be shaped in many ways and placed in different locations either to drain out over a sill, under a sill, or through a passageway to some other external outlet. The top of door 10 can be sealed with the same seal used along the edges, or with a different sort of seal; and seal variations are possible at the corners of the door and around the lock and latch, and along the bottom. Those skilled in the art will appreciate many of these variations and know how to apply them to specific desired constructions.

Persons wishing to practice the invention should remember that other embodiments and variations can be adapted to particular circumstances. Even though one point of view is necessarily chosen in describing and defining the invention, this should not inhibit broader or related embodiments going beyond the semantic orientation of this application but falling within the spirit of the invention. For example, those skilled in the art will understand the many variations possible in weatherseals, materials, threshold construction, and drain arrangements within the scope of the invention.

I claim:
1. A door and threshold weatherseal system having weatherseal means along a vertical edge of said door for conducting water downward along said edge of said door and comprising:
a. said threshold being formed as a single piece extrusion having a sill sloping downward and outward from said door, the inner edge of said threshold ex-
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5 tending above said sill to form a generally closed chamber formed above said sill and arranged under said door with the bottom of said chamber communicating with the top of said sill;
b. means above said sill for closing the ends of said chamber adjacent the frame of said door;
c. said chamber having a top opening on the opposite side of said end closing means from said frame;
d. means for guiding water from the bottom of said edge weatherseal means into said top opening of said chamber;
e. said chamber having a drain opening leading from the bottom of said chamber to empty onto said sill; and
f. said top of said chamber being about ½ inch or more above the top of said drain opening so wind pressure against said drain opening opposes a head of water within said chamber beneath said door.
2. The system of claim 1 including means for closing off the end regions of said chamber so no water enters the central region of said chamber.
3. The system of claim 2 wherein said closure means is a box fitted into the end of said chamber and having an opening registered with said drain opening.
4. The system of claim 2 wherein closure means is a tube leading from said top opening to said drain opening.
5. A door and threshold weatherseal system comprising:
a. weatherseal means arranged along a vertical edge of said door to prevent water from passing inward past said edge of said door, said edge weatherseal means being shaped to conduct water downward along said edge of said door;
b. a sill sloping downward and outward from said bottom wall of said chamber;
c. said chamber having top openings in said top wall arranged in the region of each end of said threshold to receive water draining downward along the edges of said door;
d. said chamber having a drain opening leading through the outer one of said vertical walls from said bottom wall of said chamber to empty onto said sill;
e. means above said sill for closing the ends of said chamber adjacent the frame of said door; and
f. said top opening being about ½ inch or more above the top of said drain opening.
6. The system of claim 5 wherein said top opening is a notch in the end of said chamber under said pile material so any upward drafts from said top opening enter said pile material.
7. The system of claim 6 wherein the bottom of said door has a weatherseal means comprising a pair of spaced apart seals engaging the top of said chamber on opposite sides of said top opening when said door is closed.
8. The system of claim 7 wherein said threshold includes a sill sloping downward and outward from said chamber, and said drain opening leads under said sill.
9. The system of claim 7 wherein said threshold includes a sill sloping downward and outward, said chamber extends under said sill, said drain opening is in the outer end of said sill, and a tube leads from said top opening to said drain opening.
10. The system of claim 7 wherein said threshold includes a sill sloping downward and outward from said chamber, and said drain opening empties onto said sill.
11. The system of claim 10 wherein said weatherseal means comprises a leaf seal open toward the outside of said door and closed toward the inside of said door, and seal means engaging the outer face edge of said door.
12. The system of claim 11 wherein said threshold is a single piece of extruded plastic with said chamber extending for the length of said threshold under said door, and said weatherseal means is arranged along both vertical edges of said door and said pile material is arranged at each end of said chamber.
13. The system of claim 12 including means for closing off the ends of said chamber so no water enters the central region of said chamber.
14. A door threshold comprising:
a. a single piece of extruded plastic material having a generally closed chamber formed of a bottom wall, a top wall, and a pair of vertical walls extending for the length of said threshold to underlie a door;
b. said threshold having a chamber under said door;
c. said chamber having a top opening;
d. means for guiding water from the bottom of said edge weatherseal means into said top opening of said chamber;
e. said chamber having a drain opening leading from the bottom of said chamber to a region outside said door;
f. said top of said chamber being about ½ inch or more above said drain opening so wind pressure against said drain opening opposes a head of water within said chamber beneath said door; and
g. said water guiding means includes pile material arranged to engage said edge of said door between said top opening and said bottom of said weatherseal means.
15. The threshold of claim 14 including screw receptacles formed as longitudinal openings open at the ends of said threshold.
16. The threshold of claim 14 including means for closing off the end regions of said chamber so no water enters the central region of said chamber.

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