

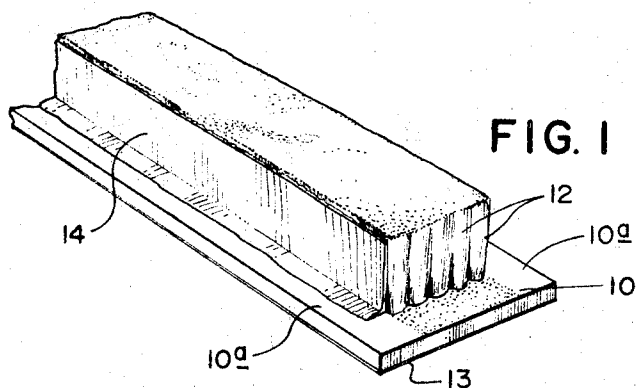
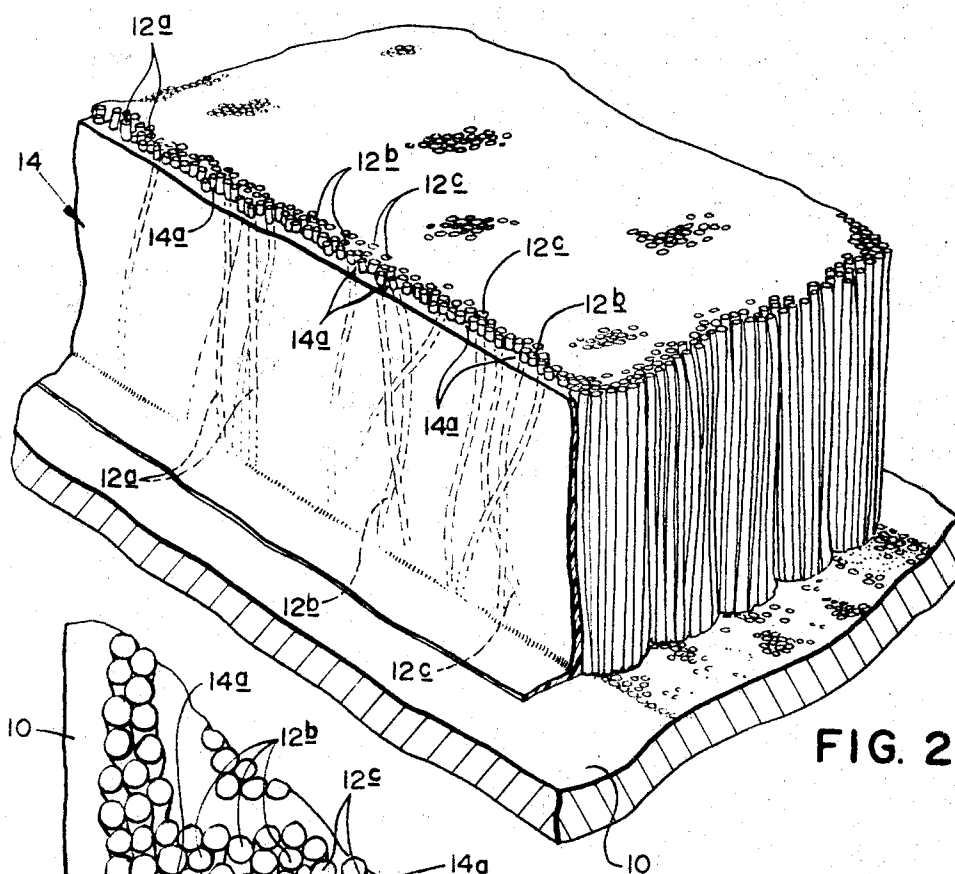
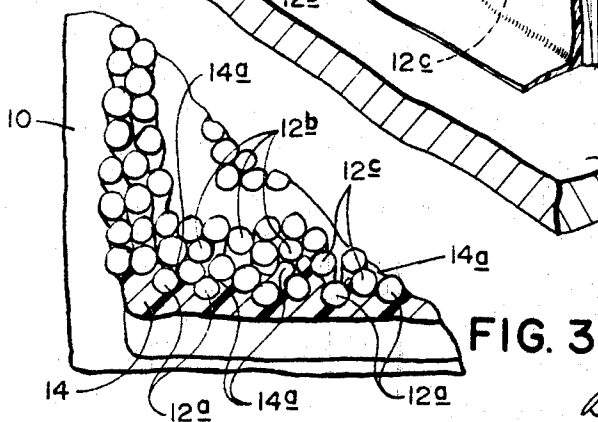
Oct. 8, 1968

L. W. JOHNSON
WEATHERSTRIPPING

3,404,487

Filed Aug. 1, 1966

2 Sheets-Sheet 1



INVENTOR
LEONARD W. JOHNSON

BY

Blair, Buckles & Casari
ATTORNEYS

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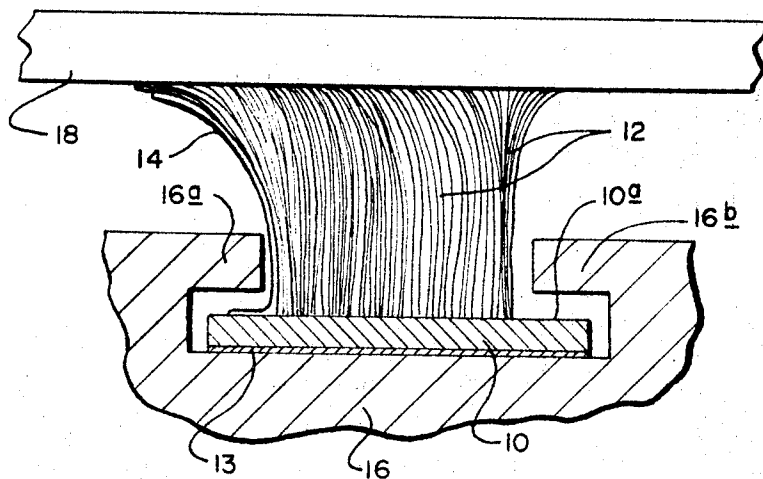


FIG. 4

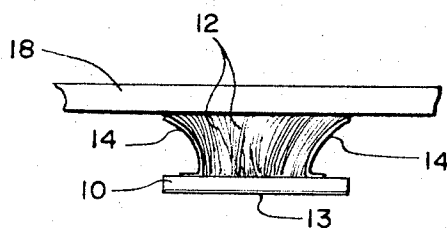


FIG. 5

INVENTOR
LEONARD W. JOHNSON

BY

Blair, Buckles & Cesari
ATTORNEYS

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WEATHERSTRIPPING

Leonard W. Johnson, Amesbury, Mass., assignor to
The Bailey Company, Inc., Amesbury, Mass.
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ABSTRACT OF THE DISCLOSURE

A weatherstrip for sealing the joint between relatively moving members has a backing strip for securing to one of the members and a body of upstanding flexible and resilient fibers attached to one face of the strip and for resiliently engaging the other of the members. A flexible film adhering to the fibers at one side of the fiber body bridges the gaps between adjacent fibers to form a continuous moisture barrier along the weatherstrip at one side thereof. The film engages around a multiplicity of fibers so that the fibers form an integral matrix-like reinforcement for the film over its entire area which maintains the film in a flexible and resilient condition against adjacent fibers.

This invention relates to weatherstripping and a method of making same. It relates more particularly to weatherstripping having improved sealing and sliding characteristics.

The weatherstripping involved here is used in the openings around panels, doors and windows and other closures of both the stationary and moving variety to seal out the weather, prevent rattles, etc. Another very important function of the weatherstripping is to take up tolerances between the closure and its support so that even with substantial tolerance variation, the closure will consistently open and close with a smooth gliding motion and have the feel and sound of a precisely machined and mounted part. Thus, it has extensive application, particularly in the building and automobile industries.

Conventionally, such weatherstripping comprises a backing strip which supports a more narrow row of upstanding pile threads or fibers. The backing strip is attached to a support and the pile projecting therefrom compresses and bears against an opposite mating element to provide the desired seal in the gap between the support and the opposite element. The weatherstrip may also have an upstanding fin or ribbon extending along or through the pile. Generally this fin or ribbon also engages the mating element to give added protection against infiltration of water, drafts, etc. through the gap. In practice, the fin is quite stiff in order to maintain a sealing engagement with the mating element when the latter is closed.

In one conventional construction, the fin or ribbon is of plastic, extruded and secured in place along the center of the weatherstrip by an edge connection to the backing. A second construction consists of a plastic ribbon of double width folded longitudinally in the middle and sewn along the fold to the center line of the backing between rows of pile. In a third construction, a plastic ribbon is wrapped around the backing and up alongside the pile filaments, forming self-supporting skirts adjacent to the pile. The formed ribbon is held in place by an additional metal backing piece which is wrapped around the backing and cinched to it along the edges thereof.

Certain of these prior constructions have serious drawbacks. The plastic fin of the first such construction can only be extruded relatively thick and when the pile is compressed, this thick fin, coming to bear against the mating surface, creates excessive sliding friction or noise between the fixed and sliding elements. The second construction is expensive. The third of these prior constructions also suf-

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fers from the extra cost of the additional metal backing and a high friction or noise problem. Specifically, the plastic skirts must be stiff and strong enough to support themselves against the sides of the pile. This stiffness causes the sides of the skirts to bear strongly against the sliding mating surface when the pile is compressed, causing disagreeable scraping or rubbing noises. Noise is also a problem with other weatherstrips incorporating fins. Also, the third construction is disadvantaged because the skirts, being exposed, self-supporting and separate from the pile, are more subject to cracking and breaking off as deterioration takes place with time.

Accordingly, a principal object of this invention is to provide a weatherstrip having superior sliding and sealing characteristics.

Another object of this invention is to provide a weatherstrip having one or more integral film-like water barriers which remain relatively flexible, resilient and functional despite long exposure to the elements.

A still further object of the invention is to provide a weatherstrip having an integral film-like water barrier which is less subject to breakage.

Another object of the invention is to provide a weatherstrip which is capable of taking up substantial tolerance variations between a support and its mating element so that they move relatively with a quiet, smooth, gliding action.

Another object of this invention is to provide a weatherstrip having improved friction and noise characteristics.

A further object of this invention is to provide a low-cost pile weatherstrip having an integral, long-lived, low friction water barrier.

Another object of this invention is to provide a method for making a weatherstrip having one or more of the above properties.

A further object of this invention is to provide a method for forming an integral low-friction water barrier on a weatherstrip.

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others, and the features of construction, combinations of elements, and arrangements of parts which are exemplified in the constructions hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

FIG. 1 is a fragmentary perspective view of a weatherstrip embodying the principles of my invention;

FIG. 2 is a fragmentary perspective view on a larger scale showing a portion of my weatherstrip;

FIG. 3 is a top plan view on a still larger scale of my weatherstrip;

FIG. 4 is a vertical section of the weatherstrip as installed in a channel; and

FIG. 5 is a vertical section of a modified form of my improved weatherstrip.

In general, my improved weatherstripping employs a backing strip supporting a body of upstanding pile threads or fibers on one face of the backing strip. An adhering and resilient film or coating is applied to one or both sides of a row of upstanding fibers extending along the weatherstrip. Preferably the coating is in the form of a plastisol, although other coatings may be used also. The coating adheres to the fibers to which it is applied and spans the space between adjacent fibers and between the backing and pile ends so as to form a continuous film having approximately the same height as the fibers.

When the film or coating is cured, it forms a highly effective draft and water barrier which extends the length

of the weatherstrip. The adhered-to fibers form a web-like matrix integral with the film which further reinforces and supports it over its entire area. As a result, the reinforced film stands more erect than it would otherwise.

With the overall support afforded by the film and the fiber matrix, the film can be made much more thin and flexible than was formerly the case. Consequently, it more readily flexes or yields when the mating element is closed. Moreover, the pile acts as a bearing surface between the film proper and the mating element, thereby reducing sliding friction and making for smooth and silent movement of the mating parts. The same integral fiber-bearing matrix also greatly improves the strength, resiliency and durability of the film.

There results then a weatherstrip which possesses at one and the same time superior air and water infiltration characteristics and excellent sliding and noise characteristics. Yet its cost is comparable to or less than that of prior weatherstripping. Using my technique, exactly the same procedures are followed to form the film or moisture barrier on woven, tufted or flocked pile weatherstripping and the characteristics of the film are easily changed to suit a given application.

Referring now more specifically to FIG. 1, my improved weatherstrip comprises a backing strip 10 which may be of any conventional material. A body of upstanding, densely-packed fibers 12 is attached to the front face of the backing strip 10. Generally, the marginal edges 10a of strip 10 are left free of fibers to facilitate installation of the weatherstrip in a holding slot. The fibers 12 are assembled in the form of woven, tufted or flocked pile. They may consist of any suitable flexible and resilient, weather-resistant, natural or synthetic fiber. A coating 13 of vinyl, polyester, polypropylene or the like is commonly applied as a stiffening or binder layer to the rear face of backing 10.

In the preferred embodiment of my invention, a single adhering barrier coating or film 14 is applied to the sides of the pile fibers 12 adjacent to one edge of the backing 10. This coating 14 is approximately the same height as the fibers 12 and extends along the length of the weatherstrip, forming a highly effective barrier against water and drafts. This single barrier coating, if on the weather side of the strip, acts as a baffle to keep the fibers 12 dry and thereby effectively retards water infiltration into the interior space. Yet any dampness that may be present in the body of fibers can evaporate through the lee side of the gap.

Referring now to FIGS. 2 and 3, barrier coating 14 is formed of a plastic or resinous substance which when cured or set forms a flexible, resilient and hydrophobic body or film. Plastics have been found to be particularly flexible and therefore suitable because of their high plasticizer content. Also, they require no additional solvent which must be removed during curing. Consequently, the mechanical characteristics of the barrier coating 14 of plastisol can be carefully controlled. However, substances such as organosols and other plasticized vinyl resins as well as natural and synthetic rubber may also be employed to form the barrier coating 14.

The material of coating 14 is applied by spreading, spraying, extruding or other equivalent well-known techniques, to the outermost fibers 12a at one side of the weatherstrip. At that point, the coating 14 material is preferably in a semi-liquid, partially set, viscous state so that it will hold its shape for a time and will not run, sag or settle. However, the coating material is sufficiently liquid to flow into the gaps between adjacent fibers 12a until it encounters fibers 12b and 12c successively more removed from the edge of the strip. Such flow may be accomplished by application of sufficient force when spreading or spraying on the coating.

As seen particularly in FIG. 3, the inflowing of the coating 14 material between adjacent fibers forms in the coating nodes or ribbing 14a between adjacent outer fib-

ers 12a. Also, the coating 14 spans the gaps between the adjacent fibers 12-12c, forming a continuous upstanding film which extends from one fiber to the next along the weatherstrip and into the joint between the fibers and the backing 10.

The materials of the film 14 and fibers 12 are preferably chosen so that the adherence of the film 14 to the fibers 12 is achieved both by flowing around and engaging the individual fibers as well as by penetrating the fibers themselves, depending upon the fibers and the film material used. In this way, a strong, resilient matrix is formed.

In a typical embodiment of my invention, the coating material is a plastic which is heated to a temperature above its curing point. Then it is extruded onto the fibers 12. Finally, a cold roller is applied to the coated fibers to smooth the coating and cool it down. The consistency of the coating 14 is such that it spreads evenly onto the outer fibers 12a-12c, yet does not strike through to the main body of fibers. When set, the coating on film 14 forms a highly effective, flexible and resilient water barrier.

Still referring to FIGS. 2 and 3, the fibers 12 are not all perfectly perpendicular to strip 10. On the contrary, they lean at various angles, crisscrossing one another. Therefore, the fibers 12a-12c, to which the film 14 is adhered when set, form an integral, web-like, three-dimensional reinforcing matrix which supports the film 14 over its entire height and length. Also, the aforementioned small nodes 14a form reinforcing ribbing over the entire inside area of the film 14, giving it even more dimensional stability. In toto then, even though the film 14 is thin and flexible, it is still rugged and resilient. Most importantly, it does not separate from the fibers 12.

It is a feature of this invention that film 14 remains effective as a water barrier even after the weatherstrip has had long exposure to the elements. More particularly, due to exposure to the sun and age, the water barrier film may tend to lose its plasticizer. It may thus become brittle and crack. When this occurs in conventional weatherstripping in which the film is supported by an edge connection to the backing, the film simply breaks away from the rest of the weatherstrip and no longer functions as a barrier. In the present weatherstrip, however, even if the film 14 cracks, each segment thereof remains in place because it is supported by the adjacent fibers 12a-12c. Despite the cracks, the totality of film segments is still effective as a water barrier.

Refer now to FIG. 4, which shows my improved weatherstrip installed in a conventional channel member 16 having a T-slot and bearing against an associated sliding or closing member, herein mating element 18. The overhanging flanges 16a and 16b of the channel member 16 engage over the bare shoulders 10a of strip 10. The film 14 is normally on the weather side of the gap between the support member 16 and mating element 18. The film 14 greatly reduces the amount of water reaching the pile while allowing moisture in the pile to dry out from the other side. It is very desirable to keep the pile dry in order to prevent seepage of water through it. While pile does restrict air and water flow, it does not entirely prevent it. Therefore, if the pile becomes wet, a wind of any force suffices to push the water through the weatherstrip. If the pile can be kept dry, i.e. no water is present, no seepage can take place.

The fibers 12 resiliently engage the mating element 18, which usually slides in a plane perpendicular to the surface of the drawing sheet. Because of its aforementioned flexible construction, film 14 is able to yield readily. There are no fibers adjacent its outer face to impede its bending. Moreover, the fibers adjacent its inner face act as a low-friction interface between the film and the mating element. More particularly, as seen in FIGS. 2 and 4, the film 14 preferably does not extend beyond the ends of fibers 12, though this may be desirable in some appli-

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cations. Even when the weatherstrip is crushed by mating element 18, the fibers 12 still intervene between the element 18 and film 14. Consequently, the weatherstrip as a whole offers no increased resistance to the sliding of the mating element due to the film 14 and it creates no disagreeable noises by its sliding engagement therewith. At the same time, however, the weatherstrip maintains a relatively firm sealing engagement with the mating element 18. This is a consequence of its thinness and flexibility, which enables it to conform closely to the surface of mating element 18; it is due also to the extra resilience built into it by the matrix of fibers 12a-12c and the ribbing 14a described above. As a direct result of these characteristics possessed by my improved weatherstrip, the fibers 12 and especially the film 14 tend to stand erect and are able to take up relatively wide tolerance variations between support 16 and mating element 18. The mating element 18 moves with a particularly smooth, quiet gliding action characteristic of sliding window and door constructions of high quality and sturdy construction.

FIG. 5 illustrates a modified form of my weatherstrip employing a barrier coating or film 14 at each side of the pile for double protection against drafts and moisture. When the fibers 12 are compressed by engagement with the mating element 18, films 14 are free to splay or flare out in opposite directions. Consequently, the fibers 12 still present themselves to the mating element 18 as a low-friction medium making for maximum sliding with minimum noise. In addition to providing double air infiltration protection, the two films 14 cooperate to hold the fibers 12 erect and to give the pile better resistance to compression. As a result, the pile pushes even more firmly against the mating element so that the element is able to move particularly quietly and smoothly.

Thus, it will be seen from the foregoing that my improved weatherstrip has a moisture barrier or film which stands erect and does not separate from the fibers even after long exposure to the elements. The film is able to yield readily when the mating element is slid open or closed, yet it presses firmly against the mating element, separated from it by a few pile filaments so that the mating element moves with a smooth, quiet, gliding motion.

It will also be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and, since certain changes may be made in carrying out the above method and in the constructions set forth without departing from the

scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

I claim:

1. A weatherstrip for sealing the joint between relatively movable members, said weatherstrip comprising

(A) a backing strip for securing to one of said members,

(B) a body of upstanding flexible and resilient fibers attached to one face of said strip and for resiliently engaging the other of said members, and

(C) a flexible film adhering to the fibers at one side of said fiber body, said film

(1) bridging the gaps between adjacent fibers so as to form a continuous moisture barrier along said weatherstrip at said one side thereof, and

(2) engaging around a multiplicity of said fibers so that said fibers form an integral matrix-like reinforcement for said film over its entire area which maintains said film in a flexible and resilient condition adjacent said fibers.

2. A weatherstrip as defined in claim 1 wherein said backing strip has fiber-free marginal portions at each side thereof.

3. A weatherstrip as defined in claim 1 wherein said fibers extend slightly above said film.

4. A weatherstrip as defined in claim 1 and further including a second flexible film adhered to the fibers at the other side of said fiber body, said first and second films being free to splay out in opposite directions when said fiber body is crushed against said other member.

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DAVID J. WILLIAMOWSKY, *Primary Examiner*.

P. C. KANNAN, *Assistant Examiner*.