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R. SMITH-JOHANNSEN

2,602,408

EXPANSION JOINT

Filed Feb. 17, 1949

Fig. 1.

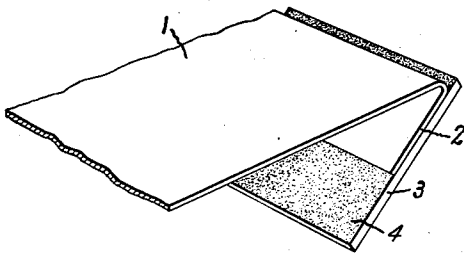


Fig. 2.

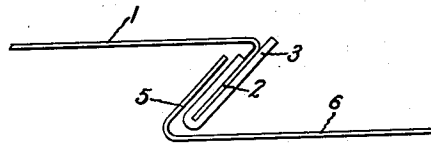


Fig. 3.

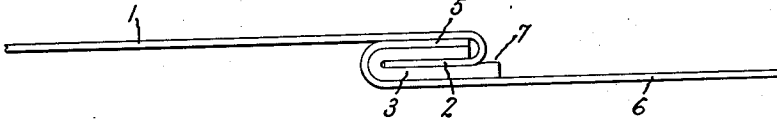
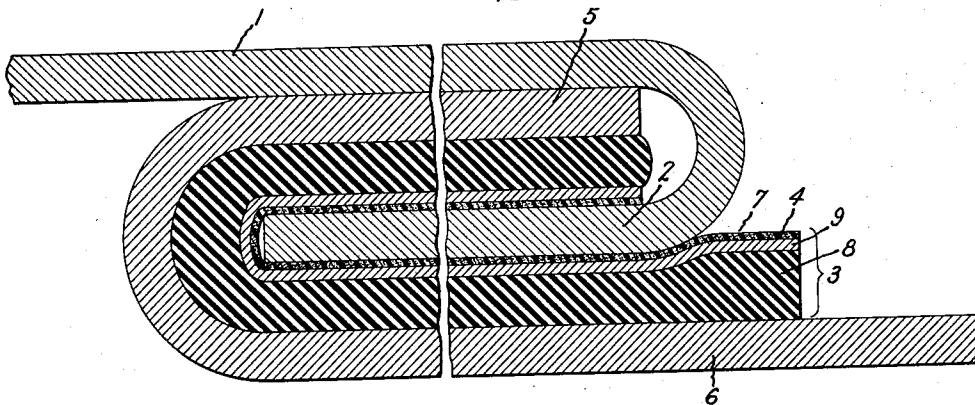


Fig. 4.



Inventor:
Robert Smith-Johannsen,

by *Alfred E. Johnson*
His Attorney.

UNITED STATES PATENT OFFICE

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EXPANSION JOINT

Robert Smith-Johannsen, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York

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2 Claims. (Cl. 108-17)

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This invention relates to expansion joints and metal coverings containing such joints as, for instance, roofs, walls, etc., as well as methods of preparing the same. More particularly, the invention is concerned with a metal covering comprising a series of plates having interlocking contacting surfaces or joints containing as packings for the interlocking joints a flexible member comprising (1) a flexible backing or support and (2) a cured, solid, elastic organopolysiloxane adhered firmly to one side of the backing.

In the manufacture of metal coverings, particularly metal roofing, it has been the custom to interlock the contacting edges of the individual plates or shingles comprising the roof and apply to the joints some means for rendering the joint water-proof and, in some cases, to maintain the flexibility of the joint in harmony with the degree of expansion and contraction of the individual plates due to changes in temperature caused by variation of the seasons and settling of the house.

The above-mentioned metallic roofs which usually comprise either shingles or plates of copper, tin, aluminum, etc., and recently sheets of stainless steel, are formed by interlocking, usually by what is known as a lock joint, sheets or shingles of the particular metal, hammering the joint in place and applying as a sealer for the joint, for example, solder, tar, or other similar compositions usually employed for the purpose. Although metal roofs have been in use for a long time, they have nevertheless been subject to certain disadvantages which, up to the present time, have remained unsolved and which have rendered roofs subject to leakage without notice.

One disadvantage in using solder as a sealing agent for the interlocked metallic plates or shingles is that even after the solder has been applied, it has often been difficult to detect small holes not closed by the solder which, during use, permit water to enter underneath the roof with the attendant, well-known, undesirable results. In addition, because of the unyielding characteristic of the solder, there has been a conspicuous lack of flexibility in the joints to permit easy expansion and contraction of the individual plates with variations in temperature. Because of the rigidity of such soldered joints, it has been necessary to use thicker sections of plates and complicated expansion joints some places in the roof in order to overcome possible buckling of the plates.

Another attempt to obviate some of the difficulties described above comprised sealing the joints between the individual plates with a tarry

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or resinous material which had some semblance of flexibility under the varying expansion and contraction conditions described above. However, such sealing agents, which are usually in the nature of tars, resins, etc., are subject to the serious disadvantage that at the elevated temperatures to which roofs are ordinarily subjected during hot summer days, they tend to flow and decompose with the result that the original protection intended for such joints becomes inadequate. In addition, such materials at low temperatures tend to become brittle and crack, thereby again failing in the very purpose for which they were intended. Finally, such joints do not age well and when exposed for long periods of time to the effects of sunlight, they deteriorate and crack, become brittle or peel, leaving the joint unprotected.

I have now discovered that all of the above difficulties which have been so prevalent in the roofing art can be avoided by employing as a sealing agent or packing for the interlocked joints of the individual metal plates or shingles, a flexible tape interposed between the contacting surfaces of the interlocked edges of adjacent metal plates comprising (1) a flexible backing and (2) a cured, solid, elastic organopolysiloxane adhered firmly to a side of the flexible backing. The various flexible tapes and silicone rubbers (i. e., solid, elastic organopolysiloxanes) which may be employed in the practice of this invention are more particularly disclosed, described and claimed in my copending applications Serial No. 77,045 and Serial No. 77,044 filed concurrently herewith and assigned to the same assignee as the present invention, which applications, in order to avoid prolixity, by reference are made a part of the instant application.

By means of my invention, I am able to obtain flexible joints which remain flexible at almost any temperature encountered under usual or unusual roofing conditions, which are not subject to decomposition or deterioration by heat or cold or sun or rain, which are moisture-resistant and water-repellent, which do not become brittle at low temperatures, do not flow at elevated temperatures and which, by one of the preferred constructions of the claimed invention, serve as indicators to roofers as to whether in laying down the roof, the interlocking joints are adequately protected to obtain the leak-proof, weather-resistant, substantially permanent roofing so long the subject of roofing research.

In accordance with my invention, a flexible member such as a tape prepared according to the

directions disclosed in my aforementioned copending applications is applied around an edge or a preformed flange of a metal sheet, and while maintained in this position the interlocking flange or joint of an adjacent metal sheet is positioned in place to contact the free surface of the flexible tape. Thereafter, the complete assembly is hammered down in a manner well known in the art to yield a water-tight, heat-resistant, cold-resistant, non-decomposable, essentially permanent joint.

The accompanying drawing shows the application of my claimed invention to a simple lock joint employed in the roofing art. Fig. 1 is a perspective view of the flexible tape being laid in position along one side of the flange of a metal sheet. Fig. 2, which is a side view, shows the tape being folded over the flange and a flange of an adjacent metal sheet being positioned in place. Fig. 3 is a side view of the components of Fig. 2 hammered into position showing the interrelationship of the flange of one metal shingle with the flange of another shingle separated by the flexible tape, the tape being held under pressure by the work-hardened metal. Fig. 4 is a detailed cross-sectional view of the elements of the sealed joint in Fig. 3.

More particularly, Fig. 1 shows a metal sheet or shingle 1 having a flange or fold 2 in the form of a substantially U-shaped portion positioned in close proximity with a flexible tape 3, preferably, though not essentially, containing a pressure-sensitive adhesive 4 on one side of the tape in order to permit attachment of the tape to the side of the flange for ease in working. It is intended that the scope of the invention contemplates merely placing the flexible tape free of an adhesive on the flange and bending it around so as to contact the flange closely in a manner shown in Fig. 2 where the flange 5 of an adjacent metal shingle 6 has been positioned around the flexible silicone rubber-faced tape 3.

Fig. 3 discloses the individual gross elements making up a simple lock joint after the joint has been hammered into position. The small extension or tab 7 which extends beyond the curved end of the flange permits visual inspection of the sealed joint to determine if all points along the seam have been protected.

In Fig. 4 the whole joint is shown under compression; a greater detail of the flexible tape 3 is shown, including the silicone rubber 8, i. e., the solid, elastic organopolysiloxane adhered on one side of a solid, flexible backing 9 (which may be, for instance, aluminum, copper, tin, lead, etc., sheet or foil or thin glass cloth tape, etc.), and, in this case, the pressure-sensitive adhesive 4 covering the opposite side of the flexible tape which permits the flexible tape to be held in place over one flange of a metal shingle for a time sufficient to place the flange of the adjoining sheet and hammer it in place.

In order to describe a more specific embodiment of the claimed invention, the following description concerns the preparation of a roofing joint between adjoining sheets or shingles of copper which are often employed as roofing elements. It will, of course, be understood that I do not intend to be limited by this description and that other forms of my invention which will be described later are also included within its scope.

A copper foil approximately two inches wide and about 2 mils thick was dipped in an aqueous solution comprising phosphoric acid and chromium trioxide maintained at around the boiling

point of the solution. After immersion in the bath for about 30 seconds, the copper tape was removed, washed thoroughly with water and dried with jets of cool air.

The treated copper surface was coated with an uncured silicone rubber paste comprising a titanium dioxide filler, a solid, elastic, curable methylpolysiloxane obtained by condensing liquid polymeric dimethylsiloxane with a condensing agent, and benzoyl peroxide as a vulcanizing accelerator for the solid methylpolysiloxane.

The coating of silicone rubber which was about 20 mils thick was applied by calendering the latter onto one side of the copper foil. This tape was then heated at about 150° C. for about one hour to effect curing of the silicone rubber and to produce a flexible tape in which the silicone rubber was firmly bonded to the copper backing.

A pressure-sensitive adhesive was then applied in the form of a very thin coating (about 1 to 2 mils) to the uncoated side of the copper tape. Thereafter this tape was applied to the flange of a copper sheet in the manner shown in the accompanying drawing, the flange of an adjacent copper sheet positioned around the copper tape in the same manner as described in the aforementioned drawing and the total assembly hammered into place using a mallet. Tests of this bond under severe weather conditions, changes in temperature and a variety of accelerated aging tests indicated that the joint was essentially unchanged despite the severity of the tests and that the joint was as water-tight and temperature-resistant as when first prepared.

The foregoing general directions for making the silicone rubber-coated copper tape whereby a strongly adherent coating of silicone rubber to copper foil is obtained, are more particularly disclosed and claimed in my aforementioned copending application Serial No. 77,044 filed concurrently herewith.

In place of the thin, flexible, copper foil, I may also use such other flexible backings as, for instance, aluminum, tin, lead, alloys of these various metals and of copper; glass cloth or tape, etc. More detailed methods for adhering the silicone rubber to many of these flexible backings, especially inorganic backings are more particularly described in my aforementioned copending application Serial No. 77,045 filed concurrently herewith.

The essential feature to be observed in the practice of my invention is that some suitable backing to which the silicone rubber can be adhered is employed so that reinforced or strengthened silicone rubber tapes are used for the gasketing means employed herein. Although examples have been given above wherein only one side of the flexible backing is covered with silicone rubber and the other side is covered with a pressure-sensitive adhesive, it is also within the scope of this invention that both sides of the flexible backing be coated with the silicone rubber in the form of a sandwich or laminate. It is conceivable that such types of tape may be of great value, although the general roofing tapes which are normally employed for roofing applications need only be coated on one side with the silicone rubber in order to reduce the cost of the tape.

As pointed out previously, the individual metal sheets or shingles comprising the protective surface which is bound together by the individual lock joints containing the silicone rubber flexible tape may also be, for instance, aluminum, tin, stainless steel, etc. In using a particular flexible

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tape containing a metal as a backing with any of the aforementioned metallic sheets or shingles, caution must be exercised in the combination of metal backing and metal shingle in accordance with the electrochemical series to avoid corrosion or replacement of one metal by the other.

In addition to employing my claimed invention for roofing purposes, it can also be used in applications adapted for wall surfacings, floorings, etc., as well as in many other applications which may be suggested by a reading of the disclosures of this invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. The method of making an expansible roofing joint which comprises (1) placing around a folded flange of a metal shingle a flexible tape comprising a flexible backing to which is adhered a silicone rubber, (2) positioning the flange of another metallic shingle in close proximity around the aforesaid flexible tape, and (3) bending the flange members upon each other so as to compress the latter onto the resilient silicone portion of the flexible tape.

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2. The method of making an expansible roofing joint which comprises (1) placing around a folded flange of a copper shingle a flexible tape comprising a flexible copper backing to which is adhered silicone rubber, the aforesaid flexible tape extending beyond the folded portion of the flange, (2) positioning the flange of another copper shingle in close proximity around the aforesaid flexible tape, and (3) bending the flange members upon each other so as to compress the latter onto the resilient silicone rubber portion of the flexible tape.

ROBERT SMITH-JOHANNSEN.

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The following references are of record in the file of this patent:

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