Nov. 26, 1935.　　　P. A. VOIGT　　　2,021,929

FLASHED BUILDING STRUCTURE

Filed May 20, 1932　　　3 Sheets-Sheet 1

Fig. 1.

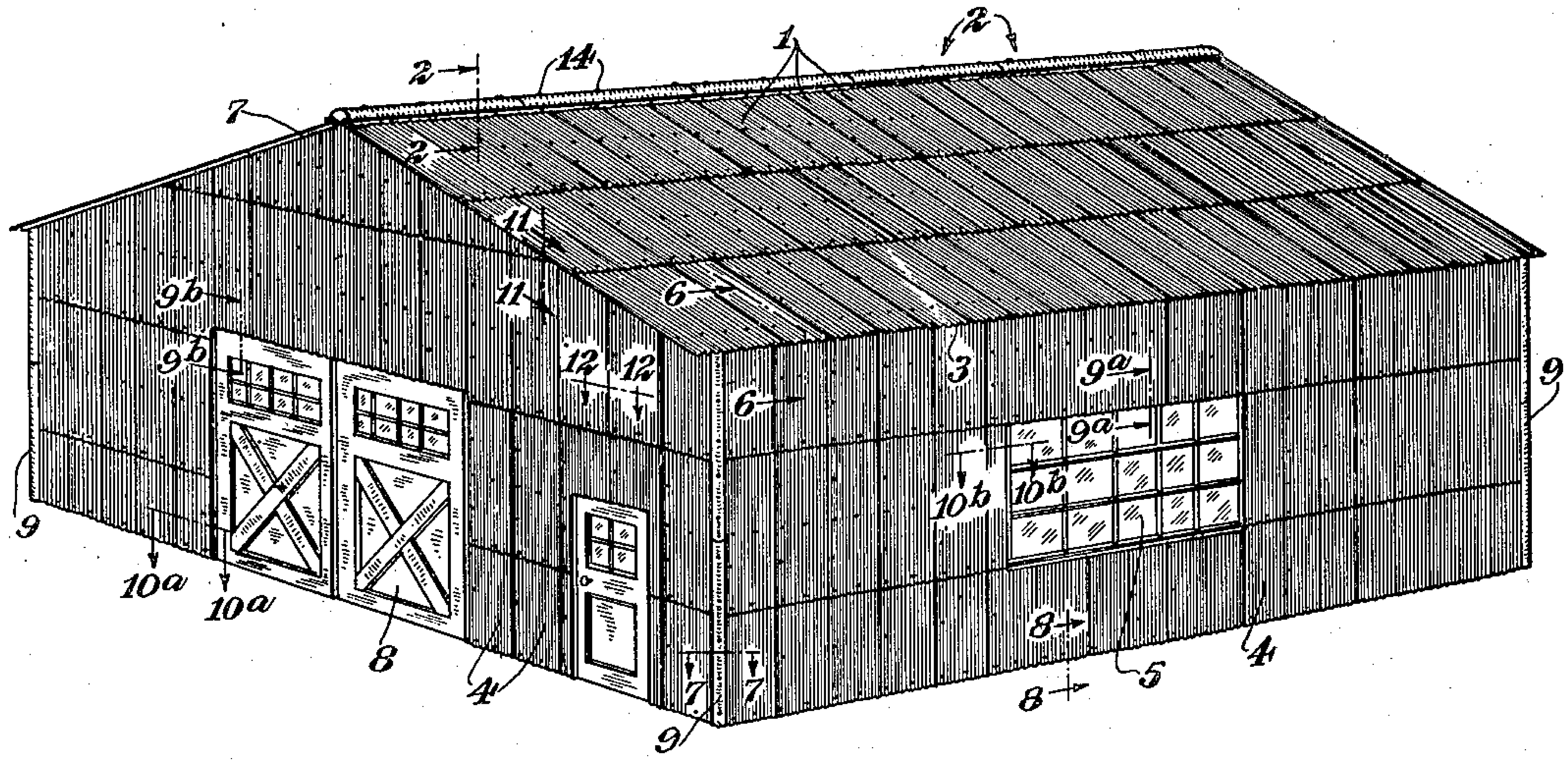


Fig. 2.

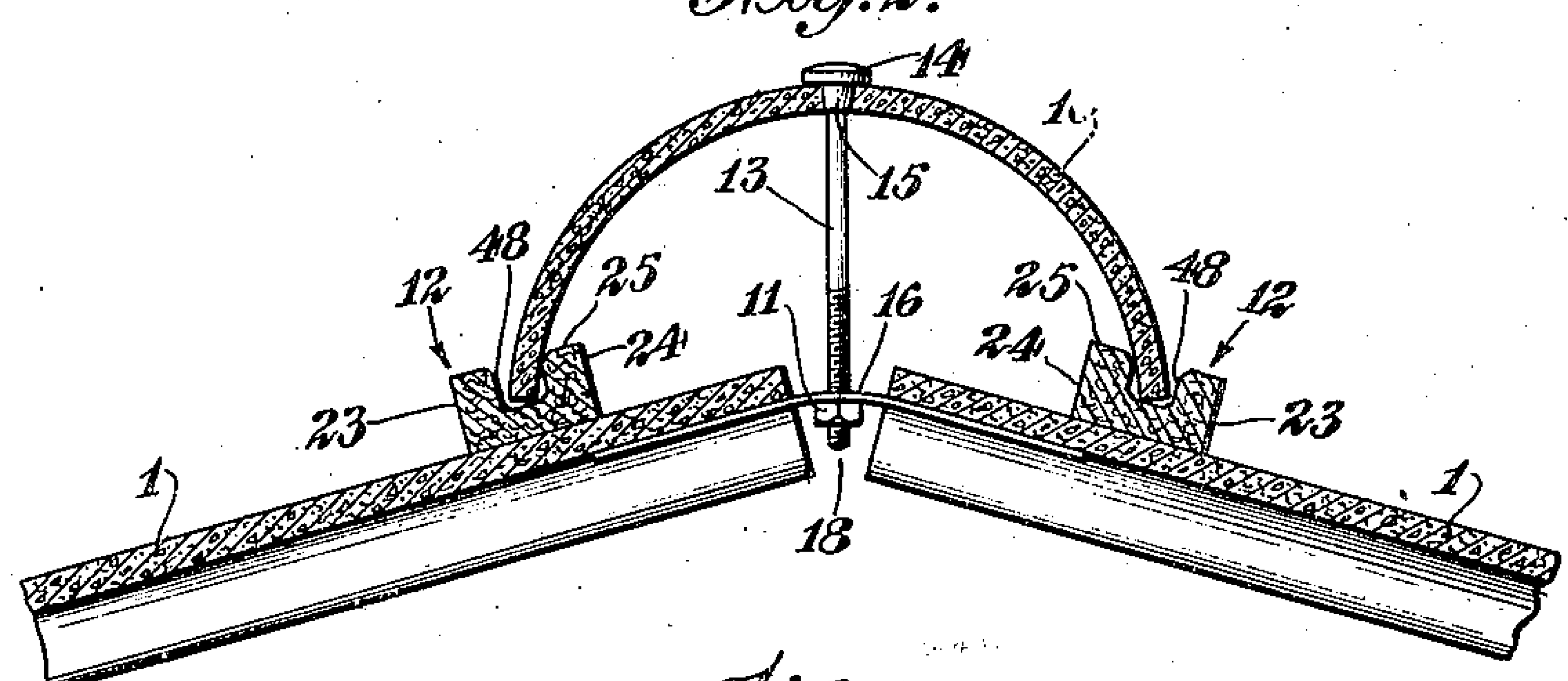
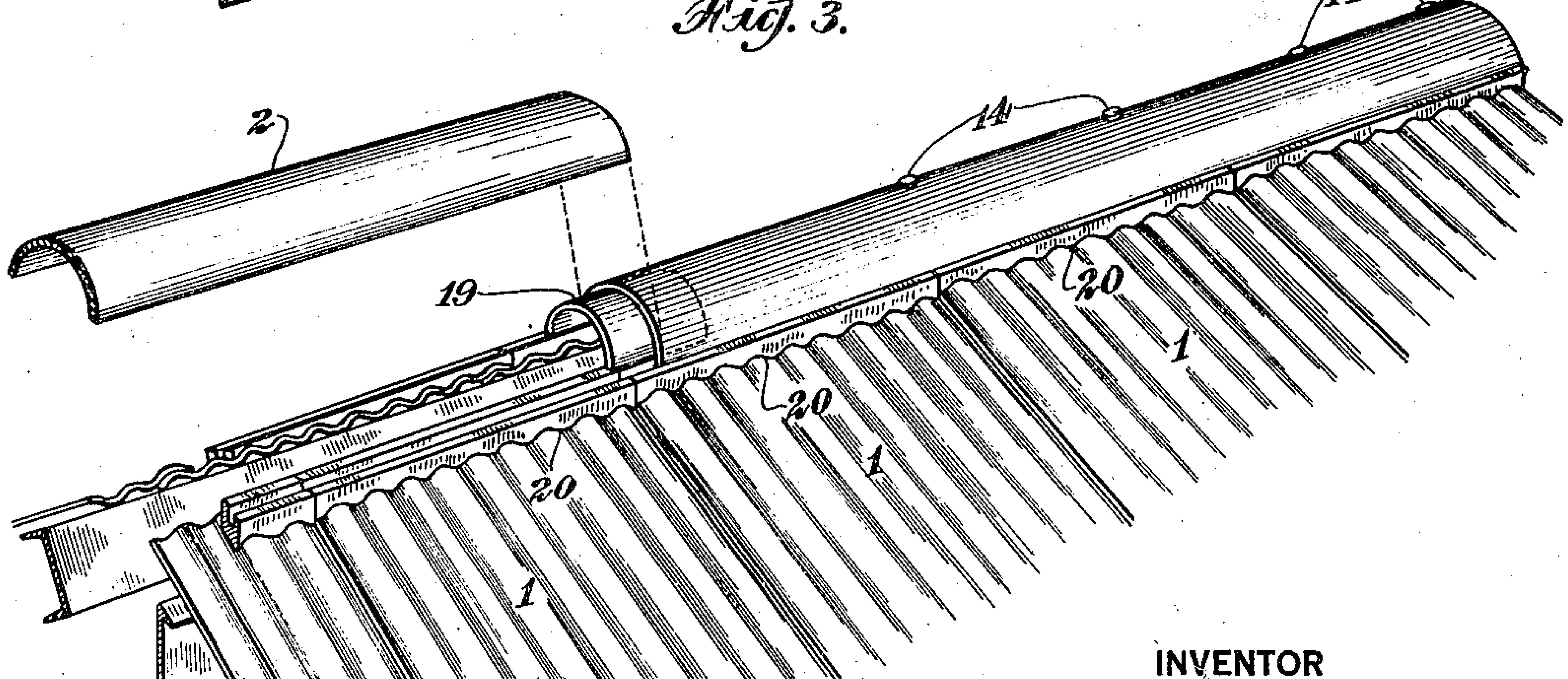


Fig. 3.



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FLASHED BUILDING STRUCTURE

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Fig. 4.

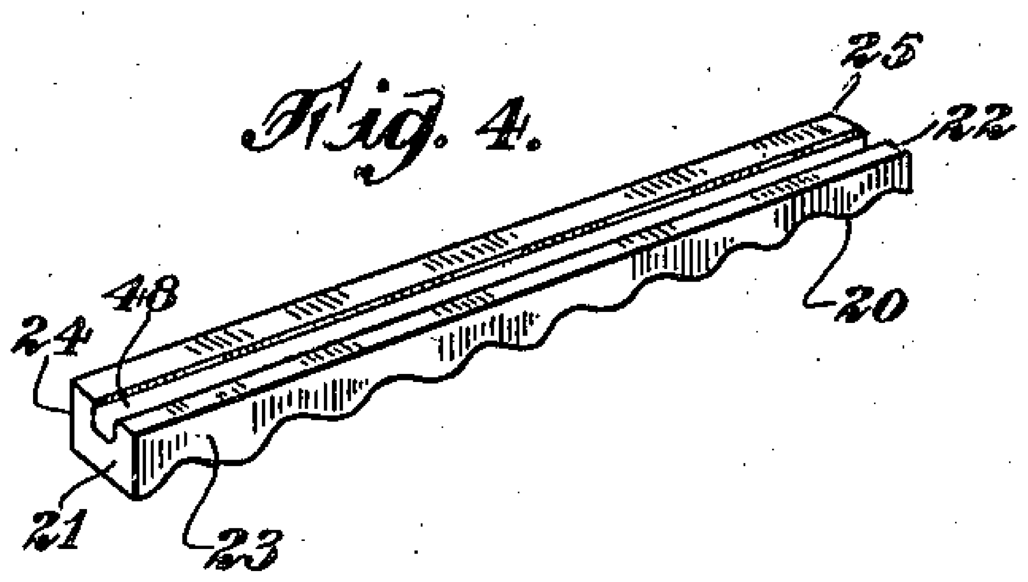


Fig. 5.

Fig. 6.

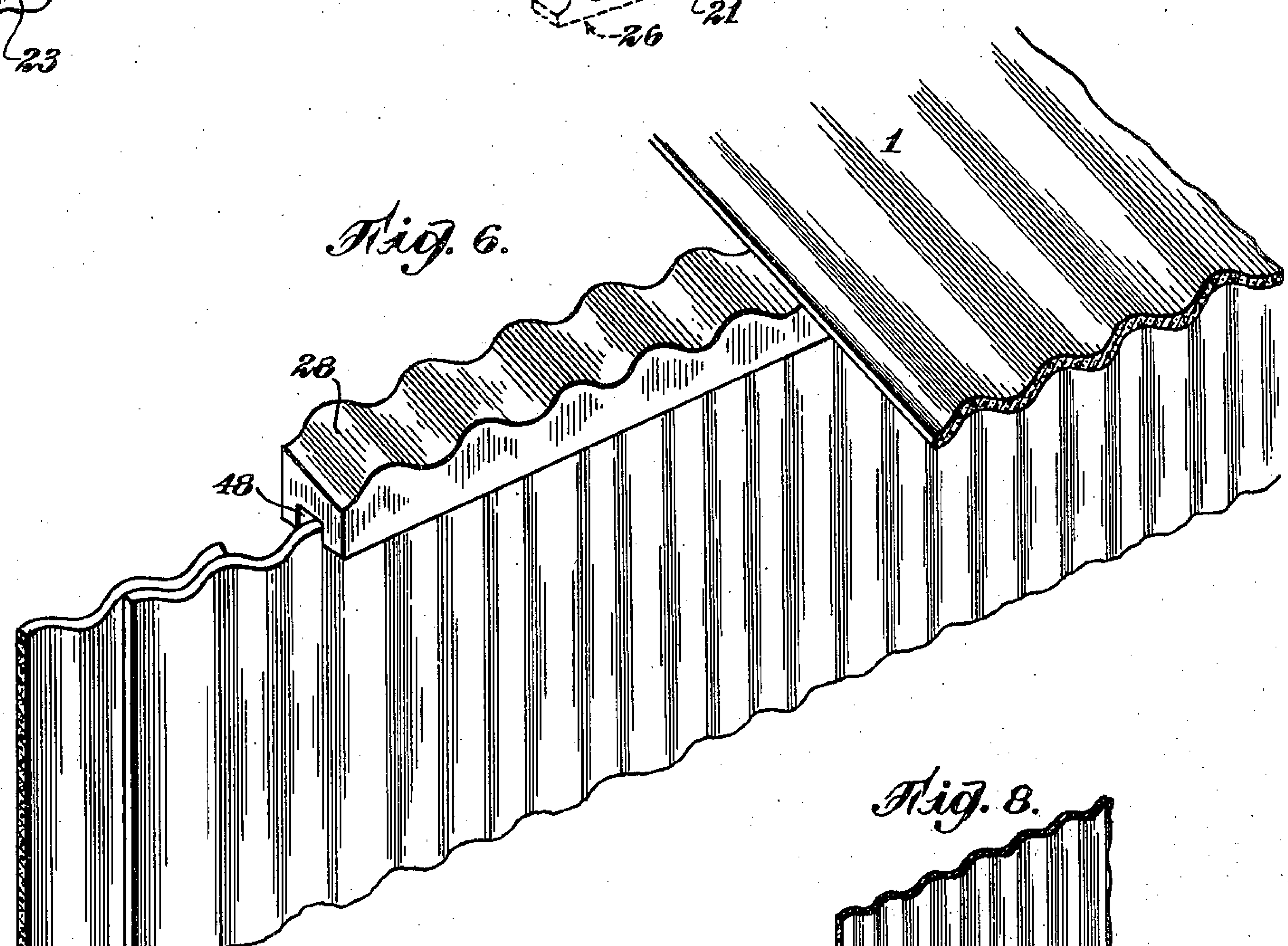


Fig. 7.

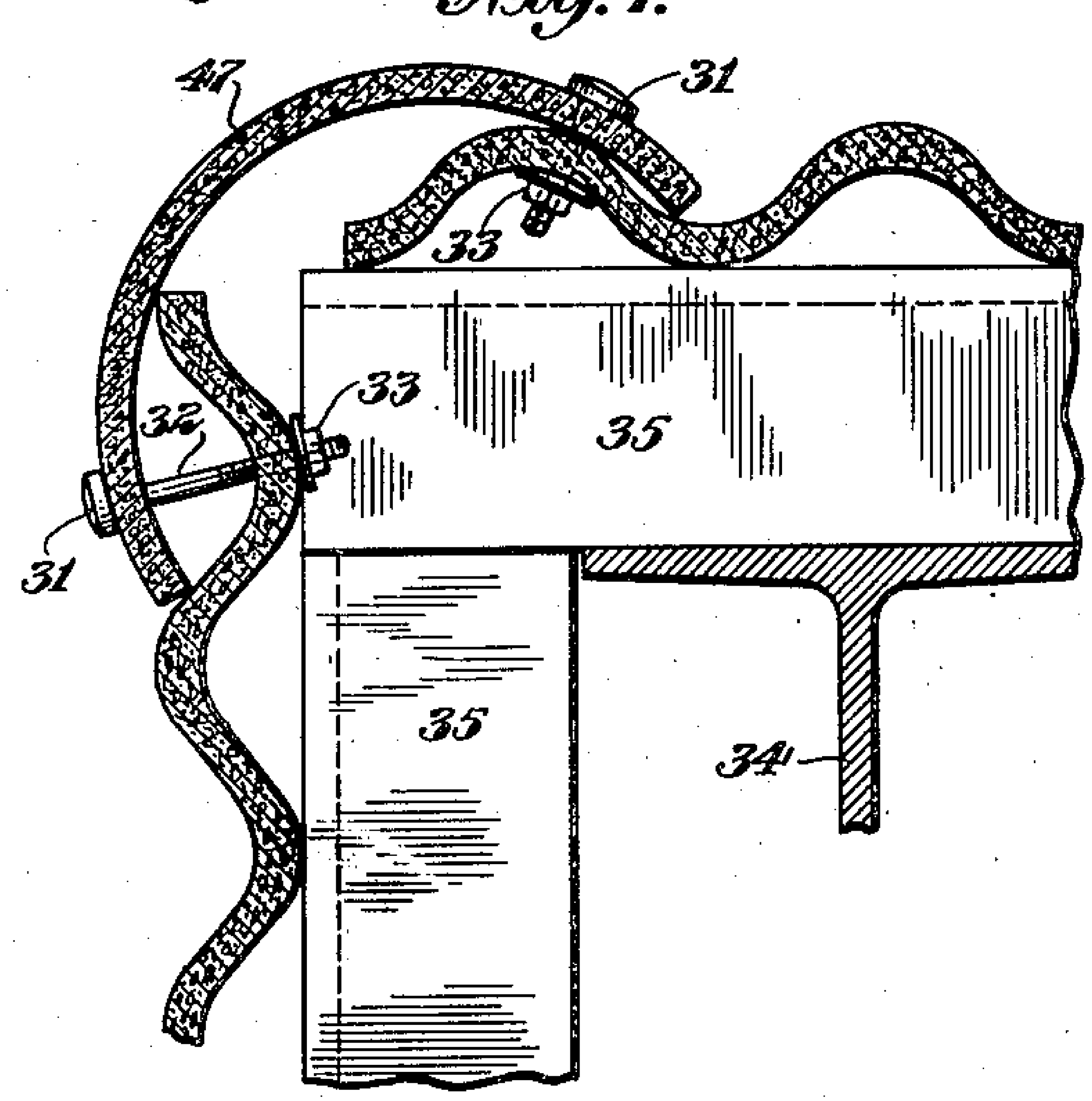


Fig. 8.

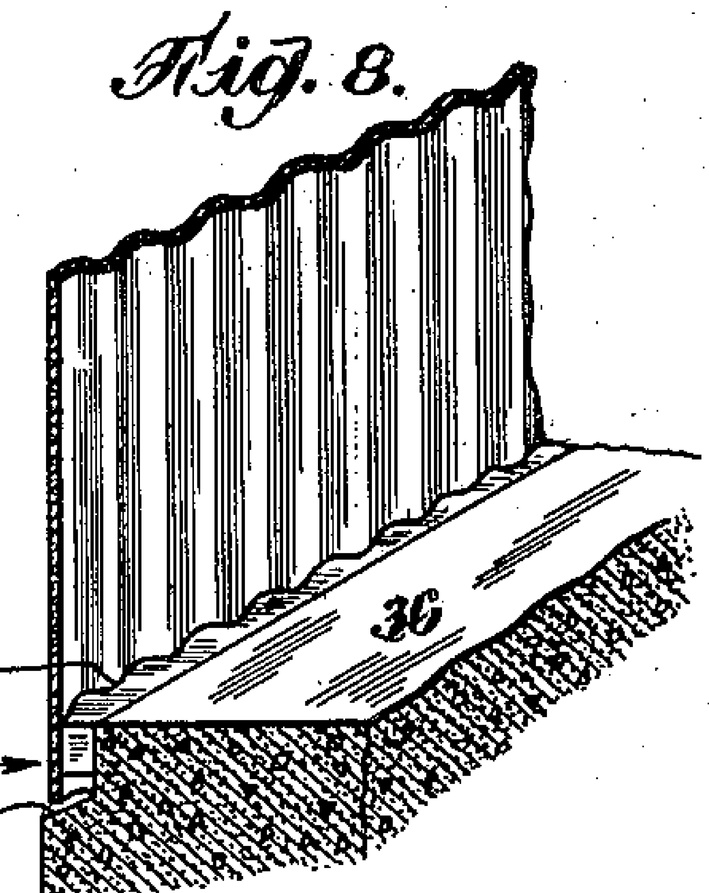
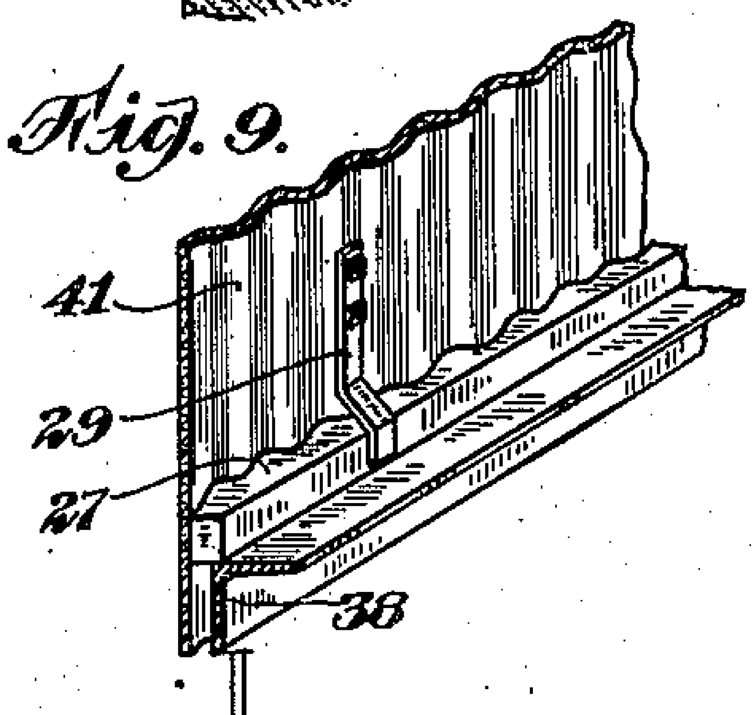


Fig. 9.



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FLASHED BUILDING STRUCTURE

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Fig. 10.

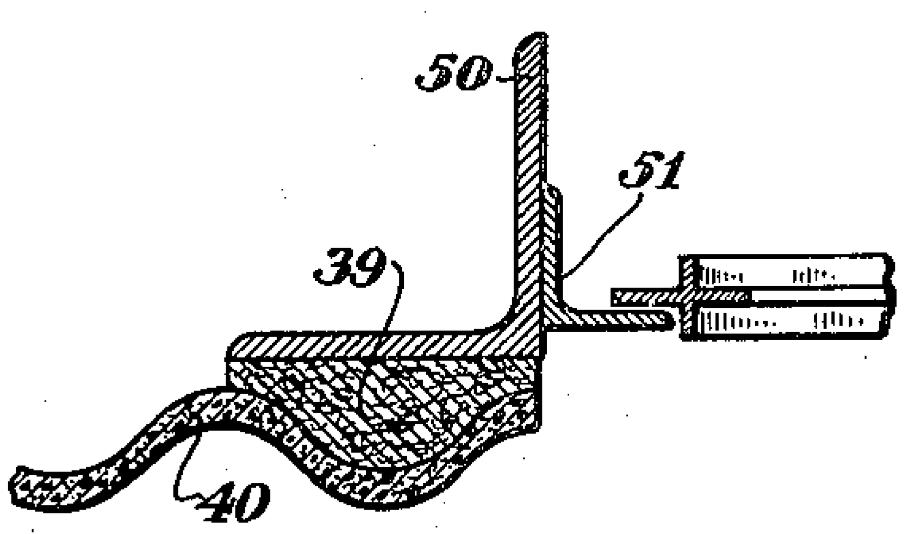


Fig. 11.

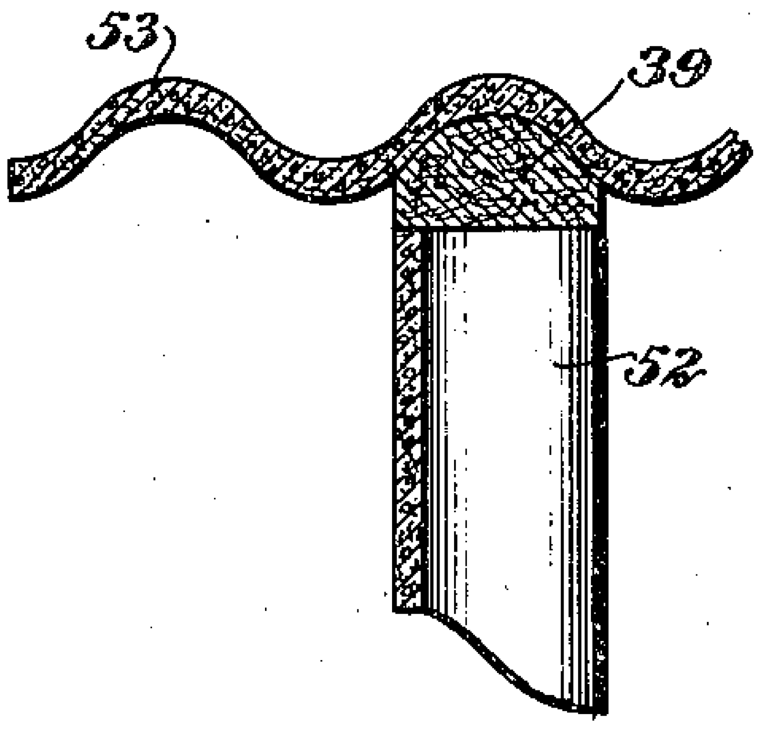
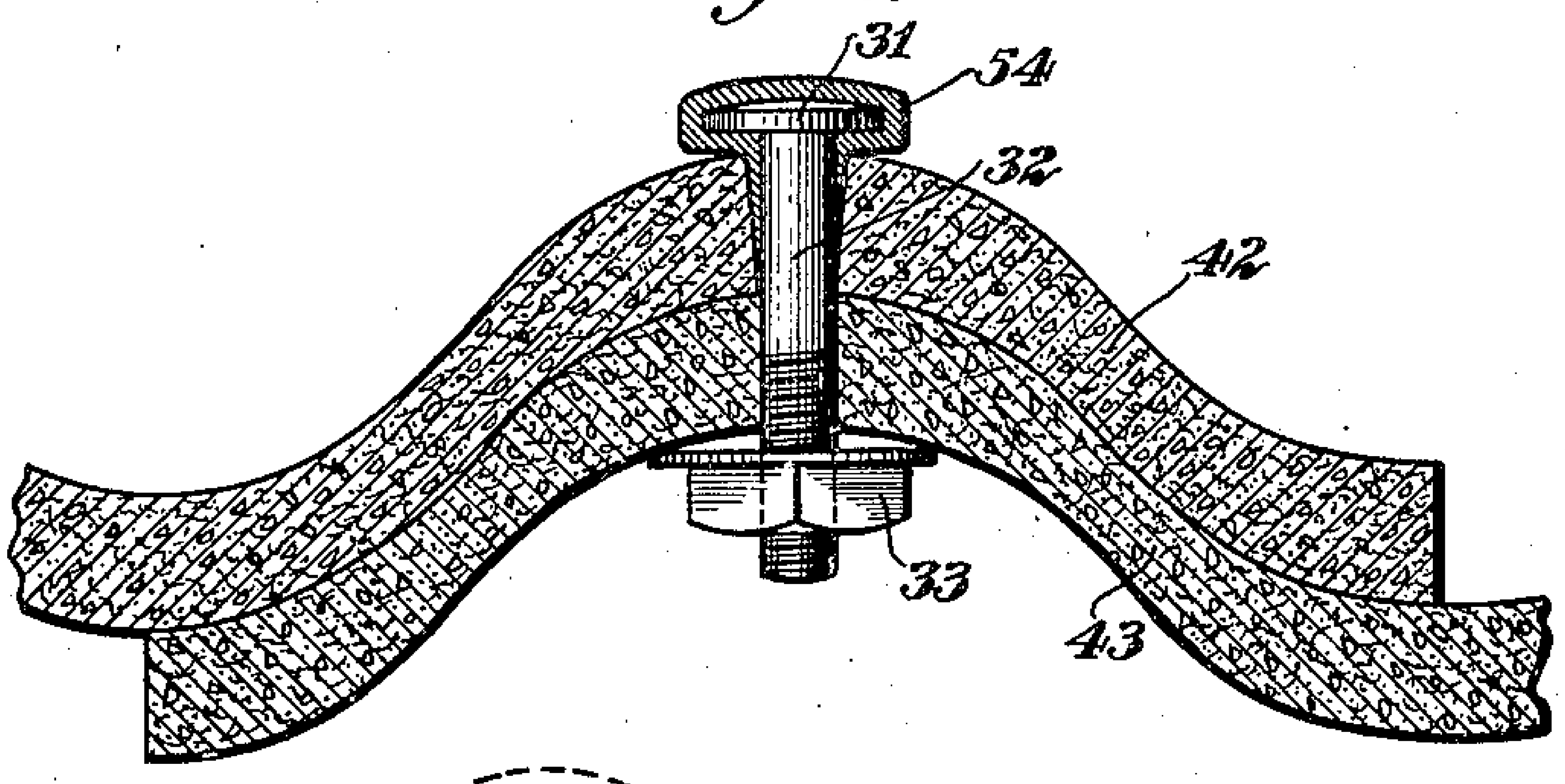


Fig. 12.



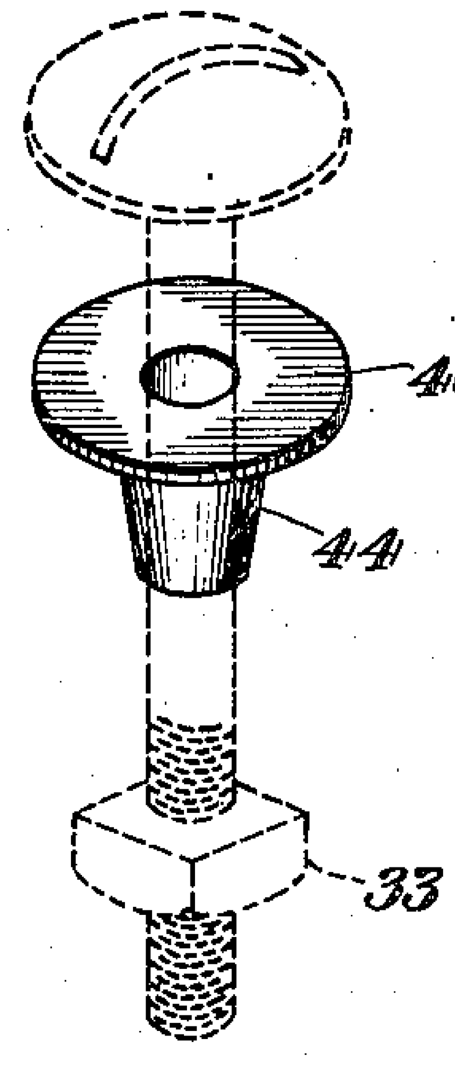
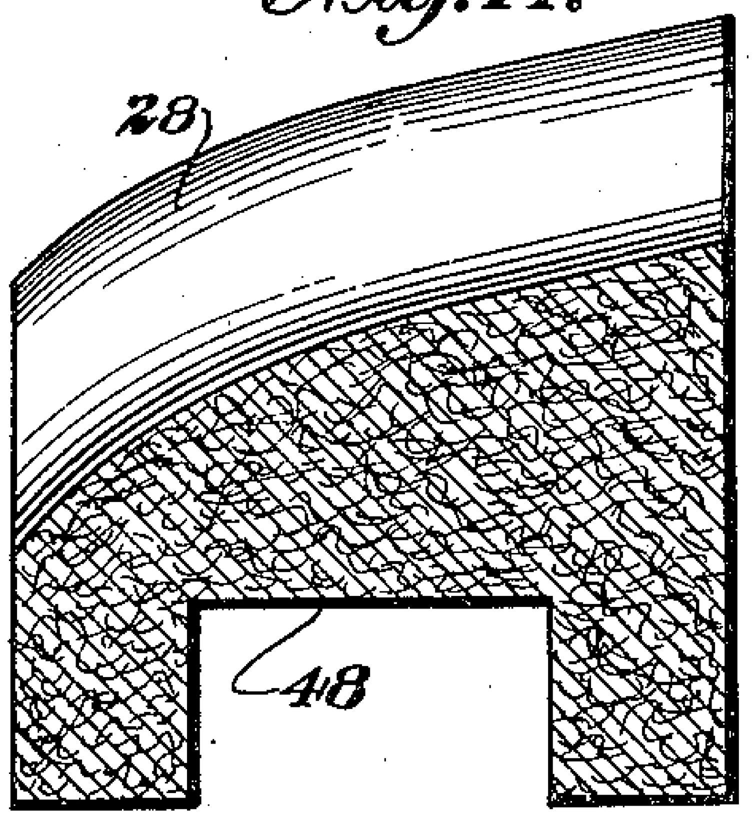


Fig. 13.

Fig. 14.



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UNITED STATES PATENT OFFICE

2,021,929

FLASHED BUILDING STRUCTURE

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Application May 20, 1932, Serial No. 612,439

10 Claims. (Cl. 108—24)

This invention relates to a flashed structure comprising corrugated sheets or the like and particularly to such a structure comprising flashing strips of semi-rigid material. A preferred embodiment is a building structure including corrugated sheets forming joints with other sheets and flashing strips comprising bituminous fibrous material closing the said joints.

Advantages in the use of corrugated sheets of structural material are well known. Thus, it is understood that the corrugation adds strength to the sheet. Corrugated sheets of rigid, strong, non-corrodible material, made, for example, by highly compressing and shaping a wet mixture of Portland cement and asbestos fibers and then allowing the resulting sheet to harden, are especially desirable in building construction.

On the other hand, there have been encountered certain difficulties in the use of corrugated sheets, particularly stone-like sheets such as those of Portland cement and asbestos fibers, in building structures. For example, there has been, up to the present time, no completely satisfactory method of closing or flashing the joints between such corrugated sheets and plane surfaces, or between the corrugated sheets and other corrugated surfaces which, because of the angle of joining or other reasons, do not mesh or conform with each other. This difficulty may be illustrated by the case of a typical building structure including corrugated sheets. Such a building contains a joint between the corrugated sheets and a ridge roll or cover, usually with either an edge or a plane surface. If the crests of the corrugations contact with the straight edge or plane surface, there will remain openings corresponding to the depressed portions of the corrugated sheet. Again, there will be open spaces between the crests of the corrugations and the edge of an upright wall at the eaves and usually also at the gables. Furthermore, flashing the corrugated sheets against plane surfaces will be necessary in cases of door and window jambs, heads and sills and also at the water table of the foundation.

In flashing corrugated surfaces against flat surfaces, there has heretofore been used one of several expedients, none of which is entirely satisfactory. Thus a strip of felt may be used. More commonly, in constructing buildings with corrugated stone-like units, there has been used a soft material which is inserted in plastic form in the space between the corrugated and the plane surfaces and then allowed to harden. Thus, there have been used compositions comprising a cementitious material such as plaster or concrete, sawdust, and/or other ingredients. Also, putty has been used.

Felt is not impervious to water or wind. Furthermore, unprotected vegetable fibers are subject to decay when exposed to weather.

Concrete, plaster, and putty compositions are inconvenient to apply and, after final hardening, are brittle and readily cracked. Also, if successful in closing a joint, they tend to bind the various parts of a building into a structure adapted to vibrate as a whole.

It is an object of this invention to overcome the disadvantages of corrugated structures that have been mentioned, to provide a completely flashed building comprising corrugated sheets, and/or to provide a novel flashing strip. Other objects and advantages will appear from the detailed description that follows.

An embodiment of the invention that is preferred at this time is illustrated by reference to the drawings in which

Fig. 1 shows a perspective view of a building comprising corrugated sheets.

Fig. 2 is a sectional elevation of the ridge portion of the roof along the section line 2—2 of Fig. 1.

Fig. 3 is a perspective view of a ridge portion of the roof, with parts broken away for clearness of illustration.

Fig. 4 is a perspective view of a semi-rigid flashing or filler strip.

Fig. 5 is a perspective view of a modified shape of flashing or filler strip, with adjoining strips in phantom.

Fig. 6 is a perspective view, with parts broken away for clearness of illustration, of an assembly at the eaves portion of the building along the section line 6—6 of Fig. 1.

Fig. 7 is a horizontal sectional view of a corner assembly along the section line 7—7 of Fig. 1.

Fig. 8 is a perspective sectional view of the water table flashing of the corrugated siding against the foundation, the view being taken along the section line 8—8 of Fig. 1.

Fig. 9 is a perspective sectional view illustrating the method of flashing the corrugated sheeting against the head of either a door or a window and taken along the section line 9*a*—9*a* or 9*b*—9*b* of Fig. 1.

Fig. 10 is a horizontal sectional view illustrating the flashing of corrugated sheeting against either a door or a window jamb and taken along the section lines 10*a*—10*a* or 10*b*—10*b* of Fig. 1.

Fig. 11 is a vertical sectional view illustrating the flashing of corrugated roofing against corrugated siding at the gable portion of the building and taken along the section line 11—11 of Fig. 1.

Fig. 12 is a horizontal sectional view illustrating the flashing of two overlapping corrugated sheets with each other, and taken along the section line 12—12 of Fig. 1.

Fig. 13 is a perspective view of a modified form of fastener comprising a lead thimble and a bolt (in phantom) that may be used in place of the bolt in the assembly shown in Fig. 12.

Fig. 14 shows a transverse sectional view of a modified form of flashing or filler strip in which the upper surface is sloped and also arched in a direction transverse to the length of the flashing strip.

In the various figures, like reference characters denote like parts.

The building structure may have corrugated roofing sheets 1, ridge portion 2, corrugated siding 4 adjoining the roofing along an eaves portion 3, a window 5, a sill or water table portion 6 (Fig. 8), corrugated upright end walls meeting the roof along the rake 7, a door 8, and a corner portion 9.

The ridge portion may include an angular or inverted trough-like cover piece 10 extending over the joint 18 formed between two corrugated roof sections 1, adjoining at an angle, a filler or flashing strip 12, a fastener such as the bolt 13 with head 14, and shank portion 15 adjacent to the head, that are covered with non-fragile, non-corrodible, non-vibratile material, as, for example, lead, and a member such as the ridge toggle plate 16 bearing on the undersurface of the two sections of roofing. The fastener or bolt passes through a hole in the angular cover and also through a hole in the ridge toggle and is secured therebeneath, as by means of the nut 11.

This structure makes possible holding the angular cover or ridge roll and the corrugated sheeting tightly against opposite faces of the flashing strip.

The angular cover or ridge roll is suitably semi-tubular, made in long sections, say 10 feet long, rigid, and of impervious material. It may be formed by sawing longitudinally, into two halves, a pipe comprising a compressed and then hardened wet composition of Portland cement and asbestos fibers. In the finished assembly, the ridge roll may comprise a plurality of the semi-tubular sections abutting in end to end, non-overlapping relationship.

Under the joint between abutting ends of the ridge roll there may be inserted an internal batten 19. This batten is a separate member of short length, say 6 inches, and of cross section of dimensions and shape to adapt the batten to fit snugly under the abutting ends of the two sections of the ridge roll. For example, when the ridge roll consists of long sections of semi-tubes of 3½ inches radius, the internal batten may be a short semi-tube of smaller radius than the ridge roll, say 3 inches. The semi-tubular ridge roll corresponds approximately to an arc of 180°, whereas the semi-tubular batten member may be something less, say 150°, this difference being especially desirable when the ridge roll rests in grooves in the filler strips and the batten rests on a shoulder of the strip, as illustrated in Fig. 3.

The flashing or filling strip 12 may have a transversely undulated or corrugated surface 20 which meshes with or conforms to the corrugations in the sheets of roofing material. Also, the strip may have a longitudinal notch or groove 48 in the surface or face oppositely disposed from the said undulated or corrugated surface, to receive and seat an edge of the semi-tubular ridge roll or flashing member 10. The strip has two other sides, 23 and 24, that are suitably flat.

Since the sheets of corrugated roofing material that are stone-like have appreciable thickness and since these sheets have longitudinal (side) overlaps, the average space between the side of a corrugated sheet that lies over an edge of an adjacent sheet and the edge of the ridge roll may be less than the average space at the side of the sheet that lies under the edge of an adjacent sheet. To offset this gradual narrowing of the space towards one side of a sheet, the filler strip, extending transversely with respect to the overlapping side portions of the sheet, has a thickness that is less at one end of the strip than at the other, that is, the average distance between the face 25, which is placed towards the plane surface (in this case, the ridge roll), and the corrugated face 20, which is placed towards the corrugated sheeting, is tapered. For example, the average thickness of the filler strip illustrated in Fig. 4 is tapered and becomes less towards the end 22. The amount by which the filler strip is thinner at the end 22 than at the end 21 may correspond approximately to the thickness of a sheet of the corrugated material. When this is the case and the strip is made as long as the distance between an edge of the corrugated sheeting and the edge of the next sheeting which overlaps the first, say nearly 3 feet when the full width of the individual sheets is 3 feet, the strip is adapted to close the space or joint between the ridge roll and the end of an underlying corrugated sheet.

In some cases, when the notch 48 is not necessary to maintain contact or engagement with a surface, as, for example, when it is not necessary to engage an edge of a member such as a ridge roll, the notch or groove may be omitted from the face of the filler strip. Thus there may be used a strip of a pattern illustrated in Figs. 5. This strip 27 has a corrugated surface 20 and an opposite face that is plane. Fig. 5 shows a strip abutting at ends 21 and 22 with similar strips 26. It will be noted that the strips are tapered in thickness from one end to the other. When overlapping sheets are laid over an assembly of filler strips such as illustrated in Fig. 5, the lower sheet at an overlapped joint will have an edge abutting the portion of a filler strip projecting above the end of an adjacent filler strip, as at ends 21 and 22.

It should be added that the filler strips need not be tapered, even in an assembly comprising overlapping thick sheets of corrugated material, if both sides of each of the said sheets are equidistant from the surface with which they are flashed.

In the eaves assembly, illustrated in Fig. 6, there is shown again a filler strip with one face grooved, at 48. In this case the groove is sufficiently wide to receive the undulating edge of the upright corrugated sheet or siding. The upper surface of the strip is transversely corrugated to conform with the surface of an overlying sheet. The upper surface 28 may have certain features which were not described in connection with the filler strips above. Thus, the upper surface of the strip may be sloped in the direction of the pitch of the roof, to give to the filler strip a cross section that is a right trapezium, suitably with the base thereof notched. Furthermore, the sloping side or top of this trapezium may be substituted by an arch extending transversely with respect to the length of the strip, as illustrated in Fig. 14, in order to adapt the surface of the said top to conform at some position with roofs of different pitches. Thus, a steeply pitched roof would contact with the arched surface of the filler strip in one position or zone, whereas a less steeply pitched roof would contact in a different position, neither position being suitably an edge of the strip.

Where desired there may be used a metal clip such as the "Z-clip" 29 for assisting in holding the filler strip in position. Such a clip may be secured at one end to a wall or roof of the building and may project at the other end alongside the filler strip in such a manner as to limit the movement of the latter.

The corner assembly illustrated in Fig. 7 shows a semi-tubular flashing element 47 placed over the vertical joint between two corrugated sheets meeting at an angle, with the corrugations in each extending in the same direction. In the case illustrated, the two sheets meet, that is, actually meet or approach each other at approximately a right angle and the corrugations extend upwardly. The semi-tubular flashing element is held firmly to sheets on each side of the joint by means of a bolt with head 31, shank 32, and a nut 33, as illustrated. Here again, the head of the bolt and the portion of the shank adjacent to the head are suitably covered with non-fragile, non-corrodible, non-vibratile material, preferably a metal, such as lead, tin, or the like. The covering on the shank may be tapered to adapt the shank to fit snugly into an oversize hole. The bolt may be ¼ inch in diameter of the uncovered portion of the shank, for example, and it may fit snugly at the covered portion of the shang into a hole of $\frac{5}{16}$ inch diameter.

In this corner assembly there is illustrated a portion of the supporting column 34, as well as girts 35, these composing a part of the supporting substructure of the building. Other parts of the substructure such as rafters, beams or studs are not illustrated, inasmuch as the supporting substructure may be of conventional design. Conventional means of attachment of the sheets to the substructure may also be used.

In the sill detail shown in Fig. 8, there is a concrete base or foundation 36 of the building, with sloping water table 37 against which vertically corrugated sheets are flashed by a filler strip of the type 27.

The same type of filler strip may be used in flashing another plane surface to a corrugated surface, in which the corrugations of the surfaces run vertically to the direction of the joint between the two types of surfaces. Thus, in Fig. 9 there is shown the flashing of a door or window head 38 to upright corrugated sheeting 41 by means of the flashing strip 27.

The flashing of a door or window jamb 50 (Fig. 10) with vertically corrugated sheeting 40 and vertical studding 51 illustrates the condition in which a plane surface is flashed against another surface that is provided with corrugations extending in a direction parallel to the zone of flashing. In this case there is used a filler strip 39 that is corrugated or undulated in a direction parallel to its length.

A filler strip 39 of the same type is useful in flashing the edge of the end wall or gable 52 to corrugated roofing 53 at the rake portion, as illustrated in Fig. 11.

The method of flashing overlapping corrugated surfaces that conform to each other is illustrated in Fig. 12. Through a hole in the two conforming sheets in the zone of overlapping, there is inserted a bolt with head 31 and shank 32, both being covered with non-corrodible, inelastic material, the covering on the shank being preferably tapered. The bolt is provided with a nut 33 which is engaged below the underside of the overlapping sheets whereby the sheets 42 and 43 are held tightly together. Since the bolt is preferably inserted with the head portion exposed to the weather, if any part is to be exposed, the parts below the head and the portion of the shank adjacent to the head need not be completely non-corrodible. The inelastic lead contact with the structural units minimizes the transmission of vibrations from one unit to another. The lead being a difficultly flowable solid adapts the coated shank to be fitted tightly into a hole. By using such a construction I have found that electrolysis and corrosion under the conditions of use are not serious. The bolt may be constructed of any suitable, strong material with an exterior that is corrosion resistant, as, for example, zinc or chromium-plated iron or steel, aluminum, or brass. The structure with the bolt, as illustrated in Fig. 12, for example, has important advantages over a nail with lead-covered shank. The close, permanent fitting of the lead taper on the shank of the nail is jeopardized either by probable injury to the soft shank as the nail is pounded into position or by the gradual but appreciable flowing of the lead under pressure and vibration in the finished assembly, with no means of correction. In the applicant's structure referred to, the lead covered shank is tightened in position by the means 33. With this type of fastening member, there is no need of hard driving of the member into place, with possible attendant injury to the soft lead; by tightening of the nut 33 at intervals any looseness occasioned by the flowing of the lead may be corrected and the tightness of the fit reestablished.

A modification of the fastening element that is illustrated in Fig. 13 comprises a bolt (shown in phantom), suitably cadmium-plated iron, inserted through a lead thimble including the sleeve 44 and the attached washer portion 46. After the bolt is inserted through members that the bolt is to hold together and has been secured by means of the nut 33, the exposed head of the bolt is suitably covered with a non-corrosive and non-corrodible putty. However, such covering is usually unsatisfactory in that it is occasionally cracked off, for example, with consequent exposure of the iron bolt head. The head then rusts.

The flashing or filler strip is preformed and may be composed of a bituminous or other plastic composition, suitably with a fibrous reenforcing and stiffening material. Thus, the strip may be composed of bitumen and asbestos fibers. A composition that is preferred at this time is one comprising asphalt and rag fibers, in about the proportion commonly used in asphalt saturated roofing paper. Such a composition may contain an admixed finely divided inorganic filler, to decrease the susceptibility of the asphalt to change in viscosity with temperature. For this purpose, there may be used ground limestone or comminuted diatomaceous earth in the proportion of a few percent, say 3 to 5 percent, of the weight of the other ingredients. Compositions and processes used in making so-called "asphalt planks" may be used. Sheets or planks so made may be cut, finally, into flashing strips of shape and size desired.

Thus, a bituminous fibrous composition adapted for use in making asphalt planks may be warmed, say to about 150° F., and extruded in the form of a sheet of thickness approximately equal to the width desired between the two oppositely disposed flat faces of the filler strips illustrated, for example, in Fig. 5. After being cooled, the sheet is cut transversely into strips of the desired dimensions and shapes of surfaces. Strips averaging 2½ inches square in cross section and about 3 feet long have been used.

Such strips used in flashing have several important features in addition to those that have been mentioned.

Being non-vibratile, that is, not readily set in vibration, they minimize the transmission of vibration from one section of a building to another flashed thereto. Also, they serve to a certain extent to damp vibration within a given section.

The strips are semi-rigid.

They are sufficiently plastic to conform in time to a slightly uneven surface over which they are placed.

Also, they seat themselves on a rough surface, such as one of Portland cement and asbestos, and develop in time considerable adherance thereto or footing therein.

On the other hand, the strips made as described are not so plastic as to flow out of a joint and thus leave an empty space.

The asphalt impregnation of the fibers in the strips is so thorough as to produce impermeability to wind and water and to protect the fibers from decay.

The strips are of low first cost.

They are reusable. Thus they may be removed from one assembly and installed in another.

The impregnated strips are not subject to deterioration on aging to the extent that rubber, for example, is. However, vulcanized rubber strips may be used in a structure in which it is not essential to have a strip possessing great durability, a strip that will deform gradually of its own weight to fill a minor underlying space, or a strip that will slowly "foot" itself in a rough surface.

In general, compositions usable in the filler strip should be weatherproof and waterproof, non-corrodible, somewhat yieldable or semi-rigid, that is, deformable to a limited extent at least without cracking, and non-vibratile, that is not adapted to be set in vibration by impulses applied thereto. Other properties mentioned in connection with the description of the asphalt-rag fiber compositions are desirable but may be omitted if their functions are not desired in a given structure.

Since the flashing strips in the preferred embodiment of the invention are provided with a corrugated surface that conforms with the corrugations of the corrugated roof or side wall sections and since another face of the flashing strip conforms with the surface with which the said corrugated sheeting is being flashed, a closed joint is obtained. The flashing strip being weatherproof and water-tight, entrance of moisture through the joint is minimized or entirely eliminated.

On the other hand, the flashing strip does not bond itself to the surfaces that are being flashed in such a manner as to give an elastic or rigid bond that, if formed, might transmit vibrations.

It will be observed that the structure illustrated in Fig. 1 and in detail in certain of the other figures, is completely flashed at every position where a corrugated sheet meets another unit of the structure.

Since many variations from the details that have been given may be made without departing from the scope of the invention and since the details given are for the purpose of illustration and not restriction, it is intended that the invention should be limited only by the terms of the claims.

What I claim is:

1. A preformed semi-rigid strip adapted for use in flashing a joint between sheets of building material and being of lesser average thickness at one end of the strip than at the other end.

2. A preformed semi-rigid strip adapted for use in flashing a joint between a sheet of building material and another structural unit and being of lesser average thickness at one end of the strip than at the other end and being provided on a surface thereof with a longitudinally extending groove.

3. A preformed semi-rigid strip adapted for use in flashing a joint between sheets of building material and having one face of the strip arched in a direction extending transversely with respect to the length of the strip.

4. A preformed semi-rigid strip adapted for use in flashing the joint between a corrugated sheet and another member, the said strip being provided with a corrugated surface adapted to conform with the said sheet and with another surface provided with a longitudinally extending groove adapted to engage the said member.

5. A preformed semi-rigid strip adapted for use in flashing a joint between a corrugated sheet and another member, the strip being provided with a surface that is corrugated and adapted to conform to the said sheet and having an average thickness that tapers from one end of the strip to the other.

6. In a structure adapted for use at the ridge portion of a roof of a building, the improvement comprising two corrugated roof sections meeting at an angle to form a joint therebetween, an angular cover piece overlying the said joint, and preformed semi-rigid flashing strips closing the space between the said cover piece and the roof sections and provided each with a longitudinal groove seating an edge of the said cover piece.

7. A preformed bituminous fibrous strip adapted for use in flashing a joint between a corrugated and a plane surface, the strip being provided with a surface that is corrugated and having an average thickness that tapers from one end to the other.

8. A weather-proof and water-tight structural assembly adapted for use at the ridge portion of a roof, comprising a sheet provided with corrugations adjoining another sheet at an angle to form a joint transverse to the direction of the corrugations, an angular cover for the said joint, a semi-rigid flashing strip closing the joint between the angular cover and the corrugated sheet, fastening means including a plate bearing against the lower surface of the corrugated sheet and a fastening member holding the angular cover and the corrugated sheet tightly against opposite faces of the flashing strip, the fastening member comprising a bolt with a non-corrodible head and a shank passing through a hole in the angular cover and also through a hole

in the said plate and being tightly engaged below the plate.

9. A weather-proof and water-tight structural assembly, adapted for use at the ridge portion of a roof, comprising roofing sheets terminating at the said ridge portion and leaving therebetween a space to be flashed; semi-rigid flashing strips disposed over the said sheets, adjacent to the end portions thereof, the said strips being provided each with upstanding shoulders, on the upper surface thereof, defining grooves between them; a plurality of sections of angular cover pieces disposed above the said space, abutting at their ends, and engaged at their side edges in the said grooves; and an internal batten of the type of a separate angular cover piece of short length and of cross section of shape and size adapting the said separate member to fit snugly under abutting ends of the said cover pieces, the said batten at its side edges resting upon shoulders in the upper surfaces of the said semi-rigid strips.

10. In a building assembly, the combination of rigid elements disposed one above the other and provided with registering holes and a fastening member extending through the said holes and holding the said elements to each other, the fastening member including a head portion of non-corrodible exterior, a sloped shank portion fitting tightly in the hole in the upper of the said elements and having a non-corrodible, vibration-damping exterior, of the type of lead, that is slowly flowable under pressure and vibration, a stem portion extending through the other of the said holes, and means for tightening at will the fit of the tapered shank within the hole in the upper element.

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