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SECURING MEANS FOR CORRUGATED SHEETS

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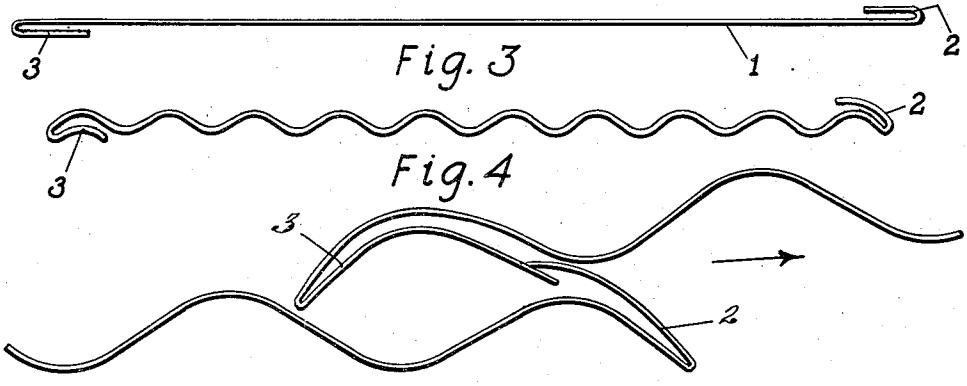


Fig. 3

Fig. 4

Fig. 5

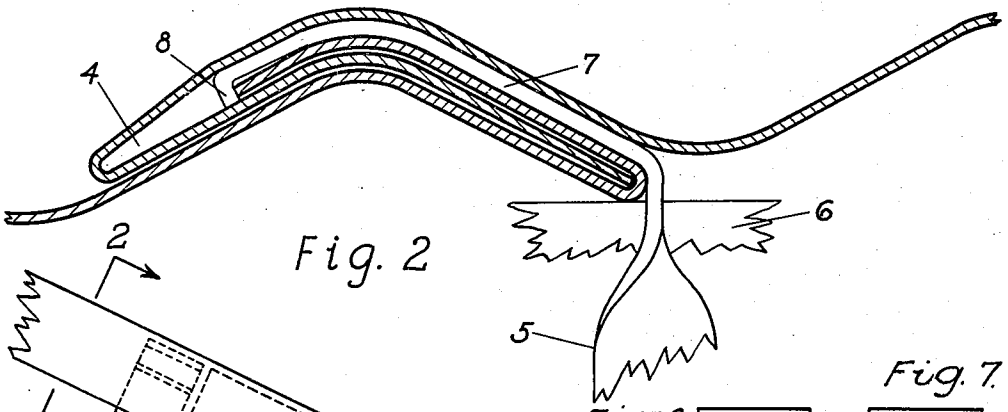


Fig. 2

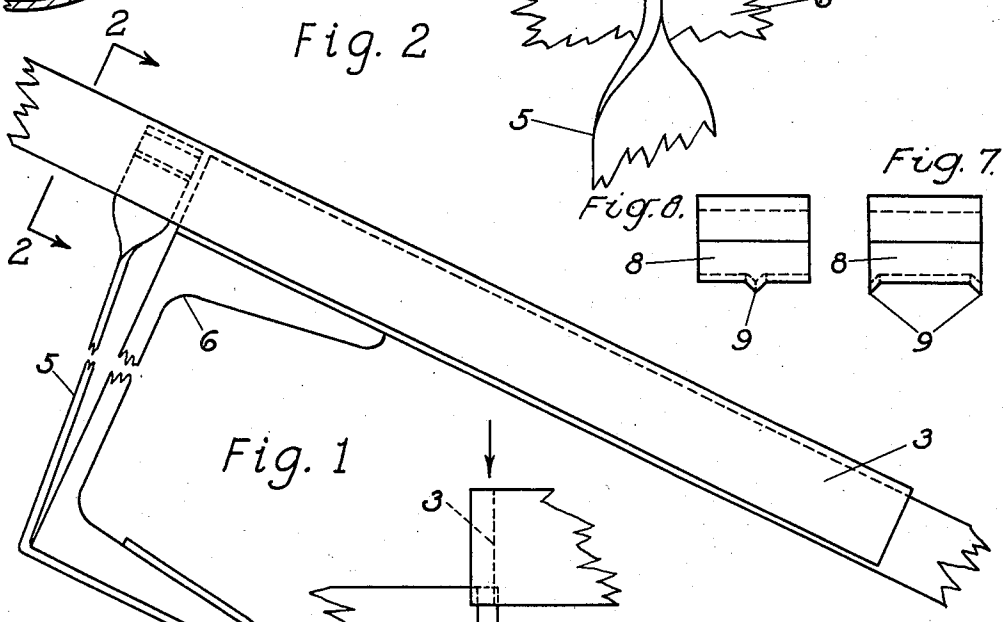


Fig. 1

Fig. 7.

Fig. 8.

Fig. 6

INVENTOR.
HARRY R. ANSEL
BY
W S Babcock
ATTORNEY.

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SECURING MEANS FOR CORRUGATED SHEETS

Harry R. Ansel, Columbus, Ohio

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14 Claims. (Cl. 108—33)

The invention to be hereinafter described relates to corrugated sheet construction, method of forming the same, and securing means.

The use of sheet material and especially sheet metal is very old in the trades. The use of galvanized sheet iron, though more recent, is many years old. Corrugated sheet iron has long been known. There are many known devices for securing these sheets in place in various structures.

Roofs and galvanized sheet sidings should, of course, be leak proof, draft proof, capable of withstanding high wind pressures, and positively, permanently maintained in place.

In the past, many varied constructions have been resorted to aiming at the above goals. Many types of lock-joints, as they are known in the industry, have been developed. As yet, a thoroughly acceptable construction has not been produced. Those so far known are either complicated, costly, leaky, draughty, weak, difficult or slow of assembly, short lived, require special parts or members for assembly, require special machinery to manufacture, or are incapable of withstanding strains of wind or of their own weight, or they have several or all of these objections.

No known construction in this field provides any means for audibly indicating completion of locking assembly of the interengaged sheets and the cooperating securing means.

The main aims of the present invention are to overcome the above and other objections and provide a simple, efficient, compact, economical, strong, durable, leakproof, wind resisting, rust proof, self sustaining, readily and quickly assembled, interengaged and positively and frictionally locked corrugated sheet construction, together with a simple, efficient, inexpensive, positive, quick-acting securing means, audibly indicating its operative position.

In order to more clearly disclose the construction, operation and use of the invention, the method of manufacturing the sheet, and the assembly of the sheet, reference should be had to the accompanying drawing forming part of the present application. Throughout the several figures of the drawing, like reference characters designate the same parts in the several views.

In the drawing:—

Fig. 1 is a fragmentary view of part of a roof, with the invention applied;

Fig. 2 is a cross section of Fig. 1, on line 2—2, looking in the direction of the arrows, with purlin and strap-hook broken away;

Fig. 3 is a diagrammatic edge view of an uncorrugated or plain sheet, with oppositely folded edges;

Fig. 4 is a similar view of the same sheet, corrugated;

Fig. 5 is a diagrammatic view of the edges of two sheets in process of assembling;

Fig. 6 is a fragmentary diagrammatic plan view of the corners of two sheets in position for a different manner of assembly;

Figs. 7 and 8 are detail front views of a modified form of toe of the anchor arm.

In Fig. 2 of the drawing, the dimensions of the parts are greatly exaggerated to more clearly bring out the construction and relative positions when assembled.

Corrugation may be done with ordinary rolls in well known manner, and requires no further description or illustration.

It is to be understood that the terms sheet and corrugation and corrugated sheet are used in this case in their broad sense and are not to be limited to galvanized sheet iron, or to curved corrugations. Galvanized iron, however, is the material most generally used and to which the present invention is best adapted. Galvanized sheet iron has considerable resiliency. Folds or bends formed in it may be spread or sprung apart, and when released, will return to their former relative positions, as will be readily understood. On the other hand, galvanization is subject to rather easy separation wherever the sheet is cut, broken or punctured. If the sheet is nailed or riveted to a structure, or riveted to another sheet, or if other punctures are made, at any such puncture, the protecting surface is torn away, rust sets in, and the sheet soon works loose from the fastening. It is very common practice to nail or rivet the sheets. In fact, the practice of riveting the sheets together is so general and well known that a special term has become widely and generally used and accepted as describing the relation. It is called "stitch-riveting", the rivets connecting the metal sheets being considered analogous to the stitches connecting cloth sheets. All such injurious punctures are completely eliminated by the present invention.

Also, all unusual or otherwise special rolls, folds and bends in the sheet, heretofore considerably used, are wholly eliminated. The same is true as to separate seam closing or covering elements and the devices for attaching them or securing them in place. They are all eliminated by this invention.

A simple flat galvanized sheet 1 of the desired weight or gauge and standard or other acceptable dimensions is first folded along two opposite edges. The folds are made inwardly toward each other but on opposite faces of the sheet, so that they lie on opposite faces of the sheet and open in opposite directions. In lateral cross-sections they constitute oppositely directed hooks each of which, in assembled relation, is adapted to engage the cooperating oppositely directed fold of the next adjacent sheet. They are not of the same length, for a purpose to be later disclosed. Fold 2 is appreciably shorter, in cross section than fold 3. The sheet, thus folded, may be passed between a pair of ordinary corrugating rolls. The entire sheet, folds included, may be run through and corrugated, producing the sheet shown in Fig. 4. The branches of the folds after corrugating, are spaced approximately the thickness of the sheet. They may be spaced very slightly less but not appreciably more. On reference to that view it will be seen that fold 3 extends the full length of the arc or curve of one corrugation, whereas fold 2 is considerably shorter. Therefore, when assembled, as in Fig. 2, there is a considerable clear and unobstructed gutter or drainage channel 4 in the closed end of fold 3. As the free edge of fold 3, in assembling, engages the closed end of fold 2, the free edge of fold 2 will be positively spaced from the closed end of fold 3, thus absolutely assuring ample unobstructed gutter space 4. Both folds are on the same radius and may be on the same radius as all other corrugations of the sheet. Consequently they may be very compactly and exactly nested, so that their total assembled thickness will be only that of the four layers of the sheet, as will be readily understood. These sheets are resilient. The folds and sheet may be splayed, spread or sprung apart about the bends as the pivotal centre or hinge. This permits successive sheets to be hooked together or connected by slipping the edge of fold 3 of one sheet under the edge of fold 2 of the next sheet and then pulling in the direction of the arrow in Fig. 5 until the sheets are interlocked as in Fig. 2. Because of the relative length and width of most sheets, this will be the simplest and usual manner of assembly. With shorter sheets, assembly may be made in the manner of a slip joint. In that case, the fold of one sheet is alined with that of the adjacent sheet, with the end of the free member of each fold within the fold of the other. Then one sheet is slid bodily along the other until the two are completely engaged and the movable sheet is in its position. They are then in the position of Fig. 2, just as they are by the other manner of assembly.

To securely and permanently hold this assembly down and in place, a securing device in the form of a strap-hook 5 is provided. In the instance illustrated, the sheets are applied to a roof supported on purlins 6. The strap-hooks are of regular malleable strap metal—comparatively thin, narrow, resilient and long enough to have one end clamped about the toe—or free side of a purlin, while the opposite end is nested between the folds of the assembled sheets—see Figs. 1 and 2. For this purpose, the upper, operative, or anchoring end of the strap-hook is twisted, in usual and well known manner, at right angles to the body, and then curved to provide an anchoring arm 7. This curve is an arc or other bend of substantially the same dimensions as that of the short fold 2. In operative position, it lies between short fold 2 of one sheet and the next adjacent connected sheet. Its free end is offset abruptly to provide a locking toe 8 to engage the free edge of the short fold 2, so that the closed end of fold 2 abuts the junction between the anchor arm and its stem at the same time that the locking toe engages the free edge of the same fold. Consequently, the two sheets of each pair will be positively and inseparably locked in place and together as long as those parts are in the relative positions of Fig. 2. The resiliency of the sheets permits the long fold 3 to be sprung or spread sufficiently for the anchor arm 7 to be slipped into operative position. In this connection it might be well to bear in mind that a preferred manner of assembling is to have the sheet which covers the anchor arm as the free sheet, so that its free end (having the short fold 2) may be swung to spread the long fold for insertion of the anchor arm. With the curved form of arm 7, of Fig. 2, it may be forced into position without lifting the top sheet, if desired. Then, when that sheet is seated and in position and its short fold (previously free) edge, is engaged by its respective anchor arm, the whole sheet will be drawn down on the anchor arm 7, along the opposite edge, thereby applying the full weight of the sheet and its full resiliency downwardly on the anchor arms to rigidly hold them in position. It then becomes impossible for toe 8 to be moved out of the path of the free edge of the short fold. In addition to this, the strap-hook 5 is, preferably, made of resilient metal, so that the resiliency of anchor arm 7, in addition to its downward pull, increases the holding and locking effect. In this way, there is a simple, positive, resilient lock, acting both positively by the sheet and by the toe, and resiliently by both the sheet and the anchor arm. Three nested thicknesses of the sheet are engaged by the entire surface of arm 7 and these nested thicknesses rest upon the purlin at the junction of arm 7 with the stem of the strap-hook 5. This provides the greatest possible strain resistance to the pull of the arm 7, at the point most needed. If and when the arm 7 is forcibly slid into place, the resilient force of the sheet and the arm 7, together with the weight of the sheet, will snap the toe 8 against the long fold 3 as it clears the free edge of the short fold 2, with a very distinctly audible "click", indicating definitely and clearly that the parts are not only in proper assembled relation, but that they are positively locked so. Where each strap is applied, of course, the folds are very slightly spread or bulged. They are spread a distance equal to the thickness of the arm 7. Throughout the rest of the interlocked folds, the thickness is equal to the total thickness of the folds, only. At the juncture of toe 8 with arm 7, the outer sheet will be forced outwardly very slightly. To make the lock even more positive, an operative may strike the point with a wooden mallet or maul, thereby forcing toe 8 to correspondingly indent and seat itself in the surface of the fold 3. To further assist in such additional anchoring, the toe 8 may be toothed, as at 9, with one or more sharp prongs which could actually pierce the sheet. On the other hand, the back of toe 8, where it joins arm 7, may be rounded and its length slightly shortened, so that no raising of the sheet at that point will occur.

On reference to Fig. 2 it will be seen that fold 3 is a full corrugation, while the opposite and cooperating fold 2, while being over half of a corrugation, is considerably less than a whole corrugation. Under unfavorable conditions, water

collects in the outer or exposed corrugations. Because of the close nesting of the folds, there can be no free flow of water between the folds. There might be very slight capillary seepage. It would not be likely to cross the entire corrugation to the free edge of fold **3**. Even then, there could be no leak. It would still have to work its way back by capillary attraction in the reverse direction, toward its starting point, finally seeping out into the gutter or drain **4**, and flowing off, if sufficient to flow. Consequently, the joint is absolutely leak proof. The same features making the joints leak proof render them draught tight, as will be readily understood.

It is hardly necessary to state that in assembling on a roof or inclined surface, the gutter portions will constitute the lower edges of the respective sheets.

It will be understood, of course, that other sheets than galvanized may be used, that various degrees of curvature may be used in the corrugations, that other cross sectional outlines may be used in place of the curved corrugations—triangular, rectangular, etc.—that variations in types of corrugations in the same sheet may be used, that the folds need not have the same degree or even type of bend or cross sectional shape of corrugation as the other bends or corrugations of the same sheet, provided the cross sectional shape of the corrugation, etc., of the folds in one sheet are capable of the cooperation herein disclosed with the complementary folds of the cooperating sheet or sheets. The term corrugation or corrugated, as herein used is intended to include all such variations. And, of course, the anchor arm **7** may be modified in form and shape according to the form or shape of corrugation, etc., with which it is to engage. The stem of the strap-hook will be designed to cooperate properly with whatever structural member it is to be used to secure the plates in place. The strap-hook as a whole, will be designed to adequately withstand all probable wind-stresses and strains that may be imposed upon it, including the weight of the sheets, and with ample additional safety-factor allowance. With this in view, an adequate number will be used being properly spaced to meet all requirements of each individual case.

An important consideration of the present construction—the construction of this invention—is the high degree of frictional hold between the parts. The narrowness of the folds, combined with the resiliency of the metal, and the weight of the sheet, provide a high degree of frictional hold throughout the full extent of the entire engaging six surfaces of the folds of every joint. This is added to and increased by the resiliency of arms **7** and their wedging action at intervals between the folds. The invention is both positive and frictional in its holding action.

In assembling, the most practical and simple way, even for sheets of very short length, is to lay a sheet across the purlins or other supports, take the next sheet and engage the free edge of its longer fold **3** beneath the free edge of the shorter fold **2** of the previously laid sheet, and then very slightly raise the sheet about the closed edge of the fold **3**, as a center, to open or spread the fold **3**, slightly. The sheets will then have the position of Fig. 5. Next, draw the top, or unlaid, sheet in the direction of the arrow until the folds are completely interlocked and the free end of fold **3** of the second sheet engages the closed end of fold **2** of the first sheet. Then slip the arm **7** into position between the second sheet and the short arm of the fold **2** of the first sheet, with the toe **8** engaging the free edge of the fold and the closed end of fold **2** of the first sheet engaging the stem of the strap-hook, as in Fig. 2, and, finally, let the second sheet down flat on the anchor arm. Now, it is only necessary to bend the stem of the strap-hook **5** tightly about the foot of the purlin and the whole assemblage is secured and permanently bound in place. A slight variation is, allowing the second sheet to drop down flat before positioning the anchor arm. In that case, the anchor arm will be pushed in laterally to its place, slightly springing the second sheet from the fold **2** and, as the toe **8** passes beyond the free edge of fold **2**, the weight and resiliency of the second sheet will very audibly snap toe **8** into its positive, locking position engaging that edge. This, of course, is a definitely clear and instant indication of the exact moment that reliable locked position is reached. There is a distinct "click" clearly heard. The stem is then secured in place, as before.

When so assembled, the sheets are securely held together against the strains and stresses of wind, gravity and all other forces, by multiple frictional contact over the entire surfaces of both of their cooperating folds, by resilient spring action of each pair of sheets throughout the same areas, by positive interengagement of each pair of folds, by their weight, as increasing friction; by the pull, frictional hold and resiliency of anchor arms **7** and strap-hook **5**; and by the positive engagement of the free edge of fold **2** with toe **8**.

Manufacture and assembly has been reduced to the least possible number of parts, each part is of the simplest possible design, and the assembly total is of the highest efficiency and least cost.

It is thought that the construction, operation and use of the invention, and the method of forming the sheets will be clear from the preceding detailed description.

Many changes may be made in the construction, arrangement and disposition of the various parts of the invention, within the scope of the appended claims, without in any degree departing from the field of the invention and it is meant to include all such within this application, wherein only a preferred construction and arrangement has been illustrated, by way of example, without in any way intending to limt the invention thereby, in the least degree.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:—

1. A sheet metal structure comprising a pair of sheets each having an edge portion folded thereupon and parallel therewith and spaced therefrom approximately the thickness of said sheet, the fold of each sheet being oppositely directed relatively to that of the other and overlying the opposite face of its respective sheet relatively to the other, said folds being separably nested each within the other, said folds all being corrugated with a single, simple, concentric curve at the corrugation apex, all branches of said folds extending on both sides of said apex, and an anchor arm having a corresponding curvature and insertable within said nested folds, extending beyond the apex of said curve and provided with a toe positively engaging the free edge of a branch of one of said folds, embracing said branch, and overlying three nested branches of said folds.

2. A corrugated joint for metal sheets compris-

ing a connecting flange extending along the full length of one edge of each sheet and folded over on the respective sheet in position to be interengaged, said flanges and opposed sheet portions for the full length of the sheets being substantially correspondingly corrugated and the free edges of the interengaged flanges overhanging on opposite sides of the apex of the joint corrugation.

3. A corrugated joint for sheet metal comprising a connecting flange extending along the full length of one edge of each sheet and folded over on the respective sheet in position to be interengaged, said flanges and opposed sheet portions for the full length of the sheets, being correspondingly corrugated and the overlying joint flange terminating high up on the side of the corrugation in position to expose its free edge for the ready insertion thereunder of the underlying joint flange.

4. A corrugated joint for metal sheets comprising a connecting flange extending along the full length of one edge of each sheet and folded over on the respective sheet in position to be interengaged, said flanges and opposed sheet portions for the full length of the sheets, being provided with substantially corresponding single corrugations, whereby the sheets may be laterally, slidably, separably engaged with their corrugations nested and their free edges overhanging on opposite sides of the joint apex, one of said flanges extending the full length of the corrugation, laterally, and, in assembled relation, engaging the fold of the other to act as a stop.

5. A corrugated joint for metal sheets comprising a connecting flange extending the full length of the edge of each sheet and folded over on the respective sheet in position to be interengaged, said flanges and opposed sheet portions for the full length of the sheets, being provided with substantially corresponding single corrugations, whereby the sheets may be laterally, slidably, separably engaged, with their corrugations nested and their free edges overhanging on opposite sides of the joint apex, one of said flanges extending laterally a short distance beyond the corrugation apex and terminating between the apex and the adjacent corrugation edge to facilitate the entry of the cooperating flange.

6. A corrugated joint for metal sheets comprising a connecting flange extending the full length of one edge of each sheet and folded over on the respective sheet in position to be interengaged, said flanges and opposed sheet portions for the full length of the sheets, being provided with substantially corresponding single corrugations, whereby the sheets may be laterally, slidably, separably engaged, with the corrugations nested and their free edges overhanging on opposite sides of the joint apex, one of said flanges extending laterally the full measure of the corrugation, in assembled relation, and engaging the fold of the other corrugation, and the other flange extending laterally a short distance beyond the corrugation apex and terminating between the apex and the adjacent corrugation edge to facilitate entry of the first flange and provide a drainage gutter.

7. A corrugated metal joint sheet provided with connecting flanges extending the full length of the opposite edges and folded over in opposite directions on opposite sides of said sheet one flange being laterally shorter than the other, said flanges and opposed sheet portions being provided with substantially corresponding single corrugations, the laterally longer flange extending the full width of the corrugation, while the shorter flange terminates a short distance beyond the apex of the corrugation, whereby cooperating flanges of said sheets may be laterally, slidably, separably engaged in a leak proof joint with the corrugations nested and the edge of one flange engaging the fold of the other to space the other from the fold of the first and provide a drainage gutter.

8. A corrugated metal joint sheet provided with connecting flanges extending the full length of opposite edges and folded over in opposite directions on opposite sides of said sheet, said flanges and opposed sheet portions being provided with substantially corresponding single corrugations, extending from end to end of the flanges and adapted when interengaged to become nested with the free edges of said flanges overhanging on opposite sides of the apex of the nested corrugations.

9. A corrugated joint for metal sheets comprising a connecting flange extending along the full length of one edge of each sheet and folded over on the respective sheet in position to be interengaged, said flanges and opposed sheet portions for the full length of the sheets, being provided with substantially corresponding single corrugations, whereby the sheets may be laterally, slidably, separably engaged with their corrugations nested and their free edges overhanging on opposite sides of the joint apex, and an anchor arm adapted to interfit between said nested corrugations and provided with a flange edge engaging part for securing said flanges in interengaged relation.

10. A corrugated joint for metal sheets comprising a connecting flange extending along the full length of one edge of each sheet and folded over on the respective sheet in position to be interengaged, said flanges and opposed sheet portions for the full length of the sheets, being provided with substantially corresponding single corrugations, whereby the sheets may be laterally, slidably, separably engaged with their corrugations nested, and in an anchor arm insertable between said nested sheets and provided with a flange edge engaging portion locking the sheets in assembled relation.

11. An anchor arm for corrugated sheets comprising a resilient curved portion adapted to be forced into operative position in the direction of the plane of the sheet between two nested corrugations to embrace one of them and having a toe extending at an angle and positioned to engage a sheet edge in the direction of the curvature of the sheet corrugation.

12. A corrugated joint for metal sheets comprising a connecting flange extending along one edge of each sheet and folded over on the respective sheet in position to be interengaged, said flanges and opposed sheet portions being provided with corresponding corrugations freely, laterally, slidably, nesting, and an anchor arm having a resilient curved portion insertable between said nested sheets in the direction of the plane of the sheet and having a toe extending at an angle and positioned to engage a sheet edge in the direction of its curvature, said toe being maintained in operative position by resiliency of said curved portion.

13. A corrugated joint for metal sheets comprising a connecting flange extending along one edge of each sheet and folded over on the respective sheet in position to be interengaged, said flanges and opposed sheet portions being provided

with corrugations spaced approximately the thickness of a sheet and having a curvature permitting free, lateral, slidable, relative movement of said corrugations in a plane approximately parallel with the sheet to and from nested interengaged position, and an anchor arm having a resilient portion of corresponding curvature insertable approximately in the direction of the plane of said assembled sheets between the nested sheets and having a toe extending at an angle and positioned to engage a sheet edge in the direction of its curvature, said toe being maintained in operative position by resiliency of said curved portion.

14. A corrugated joint for metal sheets comprising a connecting flange extending along one edge of each sheet and folded over on the respective sheet in position to be interengaged, said flanges and opposed sheet portions being provided with corrugations having a curvature permitting free, lateral, slidable, relative movement of said corrugations in a plane approximately parallel with the sheet to and from nested interengaged position with the overlying joint flange terminating beyond the apex and in position to expose its free edge for the ready insertion thereunder of the underlying joint flange.

HARRY R. ANSEL.