

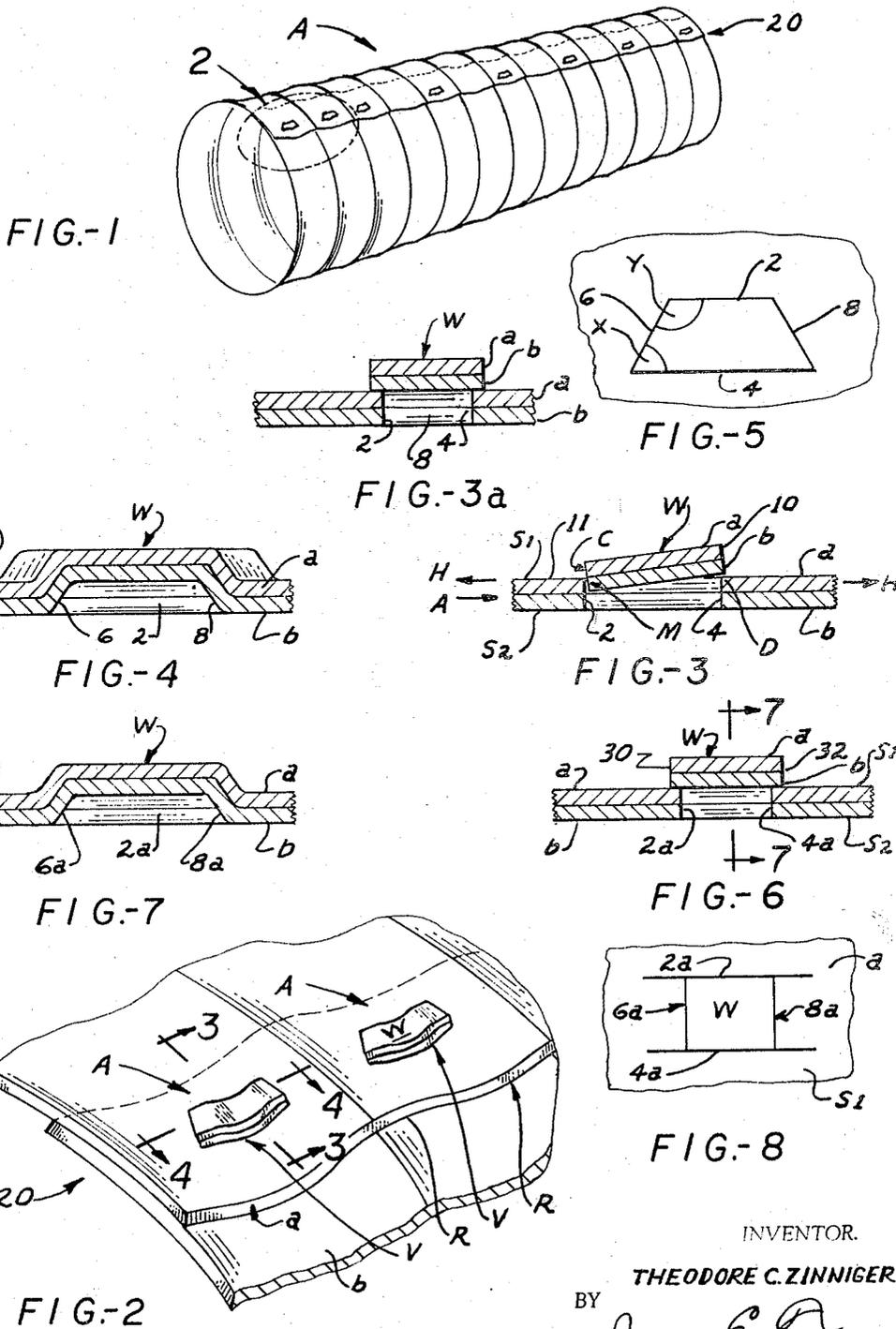
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CORRUGATED SHEET METAL CULVERT

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**CORRUGATED SHEET METAL CULVERT**

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This invention relates to a stitched locking arrangement for culvert pipe. More particularly it is concerned with a stitched locking arrangement for metallic culvert pipe, wherein fastener elements formed integrally with the respective portions of the culvert pipe being secured together are utilized. This application is also a continuation-in-part of my previously filed application S.N. 261,648 filed February 28, 1963, now Patent No. 3,251,617 granted May 17, 1966.

Accordingly, it is a primary purpose of this invention to provide a novel stitched locking arrangement for fastening together overlapped portions of a section or sections of metallic culvert pipe by means of fastening elements formed integrally with the portions of the culvert pipe section or sections being locked together.

Other purposes and advantages of the instant invention will become more apparent by reference to the following detailed description when taken in conjunction with the appended drawings, wherein:

FIG. 1 is a perspective view of a typical section of culvert pipe overlapped portions of which are locked together by the stitched fastening arrangement of the instant invention;

FIG. 2 is an enlarged fragmentary view of the encircled area of the culvert section of FIG. 1;

FIG. 3 is an enlarged partial sectional view with parts removed for the sake of simplicity when taken generally along the line 3-3 of FIG. 2;

FIG. 3a is a view similar to FIG. 3 of a modified form of fastener arrangement for the section of culvert pipe shown in FIG. 1;

FIG. 4 is a cross-sectional view of the fastener shown in FIG. 2 when taken generally along the line 4-4 thereof;

FIG. 5 is a plan view of a fastener of the type shown in FIGS. 1 and 2;

FIG. 6 is a cross-sectional view similar to FIGS. 3 and 3a of another form of fastener that can be used in practicing the instant invention;

FIG. 7 is a cross-sectional view of the fastener shown in FIG. 6 when taken generally along the line 7-7 thereof; and

FIG. 8 is a fragmentary plan view of the fastener shown in FIGS. 6 and 7.

FIGS. 1 through 5 of the drawings disclose the preferred forms of fastener that can be used to lock together the overlapped portions *a* and *b*, which in effect constitute an upper sheet *S*<sub>1</sub> and a lower sheet *S*<sub>2</sub> of the joint or seam 20, of a conventional section of culvert pipe made from a piece of corrugated metal sheet.

This preferred fastener or stitching arrangement used to secure overlapped portions *a* and *b* of a culvert pipe section together involves the use of integral parts of the sheets *S*<sub>1</sub> and *S*<sub>2</sub> of the culvert pipe section joint which are displaced out of the respective normal planes of the said sheets *S*<sub>1</sub> and *S*<sub>2</sub>. As indicated in the drawings, each of the pieces of displaced material of sheets *S*<sub>1</sub> and *S*<sub>2</sub> is comprised of a web *W* generally defined by a pair of laterally, spaced-apart incisions 2 and 4 in the sheets *S*<sub>1</sub> and *S*<sub>2</sub>, said incisions being preferably arranged parallel to each other, and a pair of spaced-apart folds 6 and 8 in the sheets *S*<sub>1</sub> and *S*<sub>2</sub>, said folds being preferably arranged in angularly disposed converging relationship

to each other. Each of the folds 6 and 8 also fully intersects with each of the laterally spaced-apart incisions 2 and 4 in the pieces such that one of the interior angles *X* of intersection is less than 90°, while the other interior angle *Y* of intersection is greater than 90°. As indicated in FIG. 3 portions of each displaced piece of material in sheets *S*<sub>1</sub> and *S*<sub>2</sub> adjacent at least one of the incisions is displaced completely above and overlies the top surface of the topmost sheet *S*<sub>1</sub>. As further indicated in FIG. 3 the part of the fastener adjacent the other incision can be comprised of portions of each sheet *S*<sub>1</sub> and *S*<sub>2</sub> which are displaced only above the top surface of a lower piece of material *S*<sub>2</sub>. In the case of the fastener shown in FIG. 3a the portions of sheets *S*<sub>1</sub> and *S*<sub>2</sub> adjacent each incision are fully displaced above and overlie the top surface of the topmost sheet *S*<sub>1</sub>.

As indicated in my previously mentioned Patent 3,251,617, the fastener of FIGS. 1-5 is capable of transmitting its maximum load when it is designed to fail in shear along the fold lines 6 and 8 or when shear loads are applied in the direction of the arrows *A*. When, however, these fold lines are arranged or oriented in converging fashion or on diagonals in the manner shown in FIGS. 1 and 4, the overall shear area of the folds 6 and 8 of the fastener is substantially increased.

In addition to increasing the shear area, sloping of the sides or folds 6 and 8 of the fastener 1 decreases the shear loads on each of the folds.

In connection with the fastener shown in FIGS. 1-3, it is made in such a way that the integral portions of the pieces of material *S*<sub>1</sub> and *S*<sub>2</sub> that are displaced out of the normal planes of the respective pieces of material, *S*<sub>1</sub> and *S*<sub>2</sub>, in the form of the composite web *W* would be so displaced that the fastener would have a tapered configuration in a plane normal to the incisions 2 and 4, such as in the plane *H* of FIG. 3, and only a portion 10 of the fastener adjacent one of the incision lines would be located completely above the top surface 11 of the topmost sheet *S*<sub>1</sub> and thereafter spread above this top surface in the area *D* with the portion of the fastener displaced along the other incision line having only a partial thickness *C* located above the top surface of the uppermost sheet *S*<sub>1</sub>. By making the fastener in this way, the high unit loading at the point *M* by loads applied in the direction of the arrow *A* is lessened since the bearing area between the different thicknesses of material is increased simply by sloping the pierced segment or composite web *W*.

The fastener elements of the instant invention are preferably disposed on the corrugated culvert section of FIG. 1 such that the incisions 2 and 4 of the fastener are disposed in planes parallel to the seam 20 of the culvert section and generally normal to the shear loads indicated by arrows *A* while the folds 6 and 8 are located at an angle to seam 20. The reason for this is because in normal use the major compressive loads imposed on the culvert section are applied in a direction normal to the seam 20. These compressive loads are translated into shear loads at the fasteners in the manner indicated in FIGS. 1 and 2. The aforesaid compressive loads are due to the earth fill located on top of the culvert during its usage as a fluid drain or conduit. The outwardly displaced composite web *W* is also preferably located within a valley *V* so that it is protected on both sides by outwardly projecting ribs *R*. When a series of these fasteners is employed, the opposed overlapped portions are stitchingly locked together. The individual fasteners or stitches can be fabricated and the seam portions *a* and *b* of sheets *S*<sub>1</sub> and *S*<sub>2</sub> of the culvert section joint lockingly stitched together by means of the apparatus disclosed in my previously mentioned Patent 3,251,617. The instant stitching arrangement can also be used in the fabrication of culvert sections comprised of

two or more corrugated sheets which are overlapped and secured together to form a single culvert section as well as a means for securing together individual fully formed culvert sections together adjacent their ends.

Although the fasteners of FIGS. 1-5 are the preferred type of fasteners or stitching elements used to secure together the seam edges or portions *a* and *b* of a culvert pipe section and in particular large diameter culvert pipe sections, there may be times when a simple stitching or fastening element, such as the fastening element of FIGS. 6-8 can be employed. The stitching element shown in FIGS. 6-8 can be advantageously used on small size culvert pipe sections not subjected to severe shearing loads and where close tolerances in the dimensions of the finally fabricated stitch or fastener is not required. In this instance the fastener or stitch would generally comprise a pair of spaced incisions *2a* and *4a* and a pair of spaced folds *6a* and *8a* located at right angles to incisions *2a* and *4a*. The web *W* made up of displaced material from the top and bottom sheets *S*<sub>1</sub> and *S*<sub>2</sub> of the seam *20* is fully disposed above the top surface of sheet *S*<sub>1</sub> and after being displaced the peripheral portions *30* and *32* are compressed or spread laterally and down against the top surface of the topmost sheet *S*<sub>1</sub> in the stitched seam of the culvert pipe section.

The stitching arrangement of the instant invention provides for simple automated culvert pipe manufacture by eliminating cumbersome riveting operations which frequently had to be done by hand.

Inasmuch as the web *W* can be displaced such that it is located either above the top surface of a topmost sheet *S*<sub>1</sub> or below the lower surface of the lowermost sheet *S*<sub>2</sub> in a stitched seam or joint made in accordance with the instant invention, depending on the location desired for a given fastener, the use of the term "top surface" and "topmost sheet" when used in the instant specification and claims is intended to cover and include surfaces and sheets which constitute the bottom surface and bottom sheet, respectively, in a given stitched joint structure.

Advantageous embodiments of the invention have been herein disclosed and described. It is obvious that the various changes and modifications may be made therein without departing from the spirit and scope thereof, as defined in the appended claims, wherein

What is claimed is:

1. In a stitched metallic culvert pipe seam made up of overlapping corrugated sheets, a stitch for said seam located in a pair of mated valleys at a point of overlap of said sheets and comprised of integral portions of the overlapping sheets displaced out of the respective normal planes of said integral portions of said sheets, each of said displaced integral portions of said sheets forming a displaced composite web defined by a pair of laterally spaced-apart incisions in said sheets and a pair of folds in said sheets, each of said folds fully intersecting each of said incisions in said sheets at other than interior angles of 90°, said laterally spaced-apart incisions being arranged generally parallel to the culvert seam and the folds being arranged at angles to the culvert pipe seam to resist the shear forces to which said stitch is subjected during use and said displaced composite web lying wholly within the confines of the said pair of mated valleys at the point of overlap of said sheets whereby said displaced composite web is protected on both sides by the outwardly projecting ribs of the corrugations in the overlapping sheets.

2. A culvert seam stitch as set forth in claim 1 wherein the incisions and folds define a stitch of substantially trapeziform configuration.

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