Feb. 29, 1944. O. W. SCHMIDT ET AL 2,343,029

CULVERT

Filed April 12, 1941 2 Sheets-Sheet 1

Fig. 1.

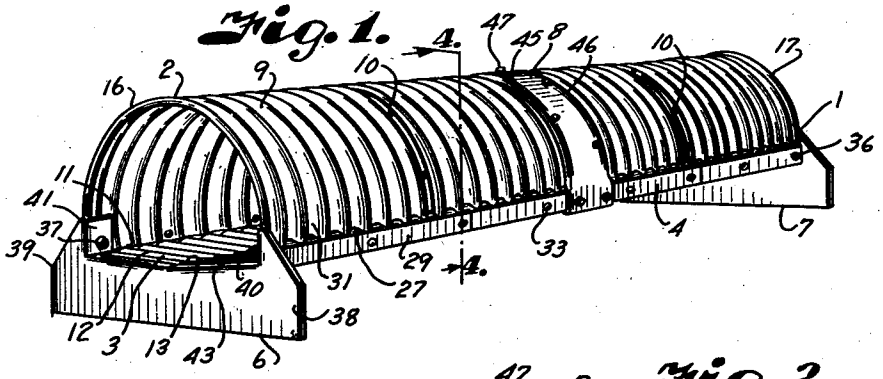


Fig. 2.

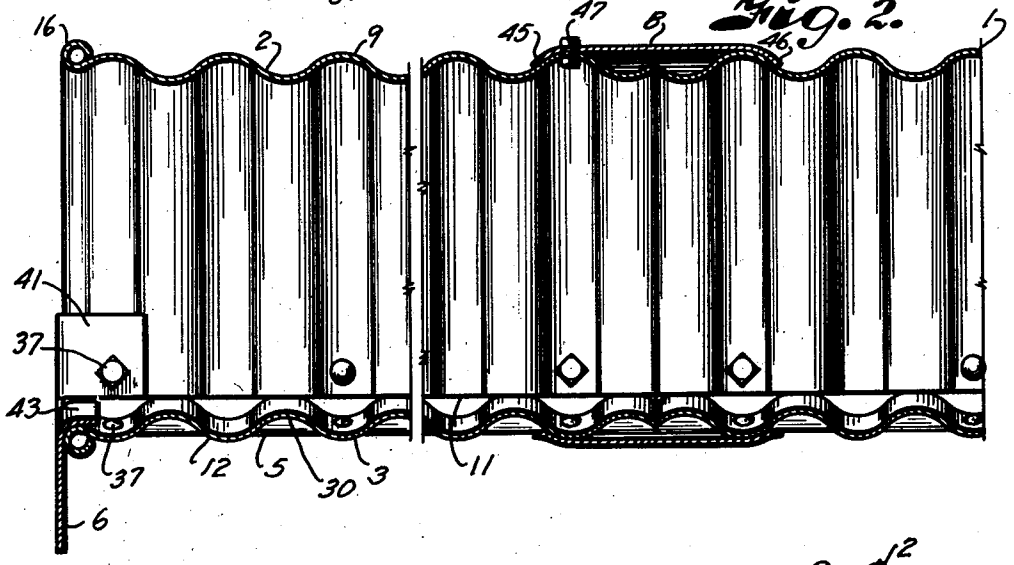


Fig. 3.

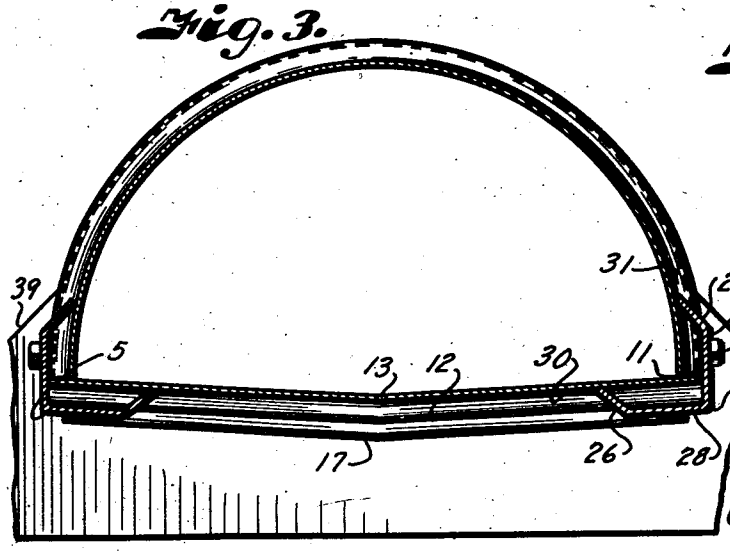
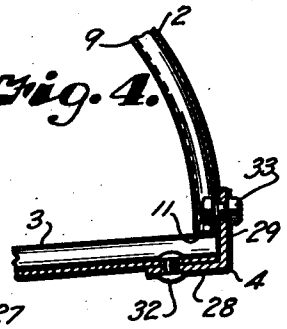


Fig. 4.



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CULVERT

Filed April 12, 1941 2 Sheets-Sheet 2

Fig. 5.

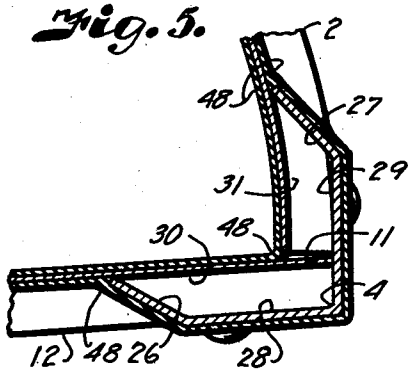


Fig. 6.

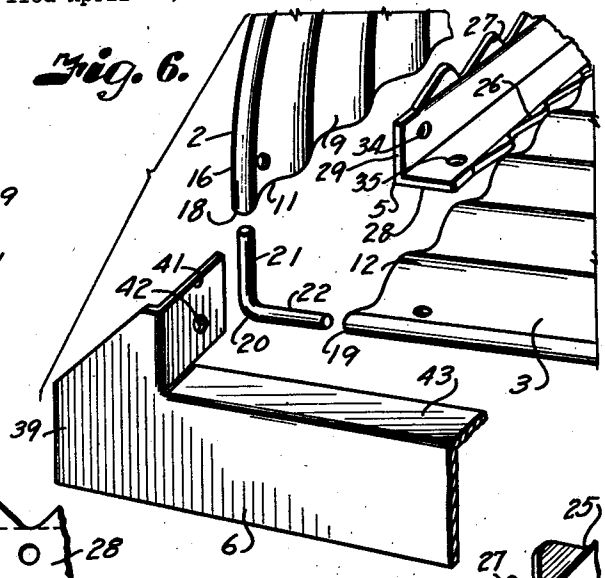


Fig. 7.

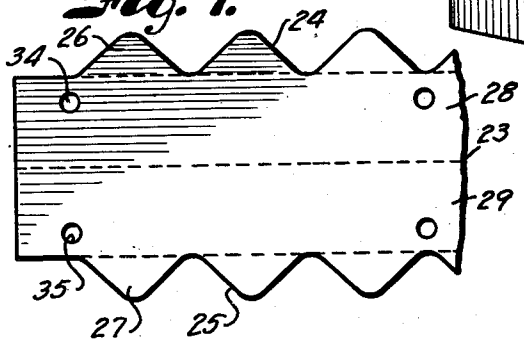


Fig. 8.

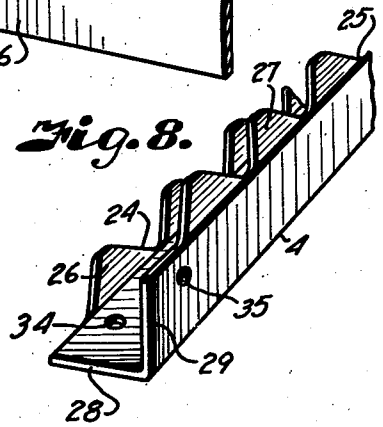


Fig. 9.

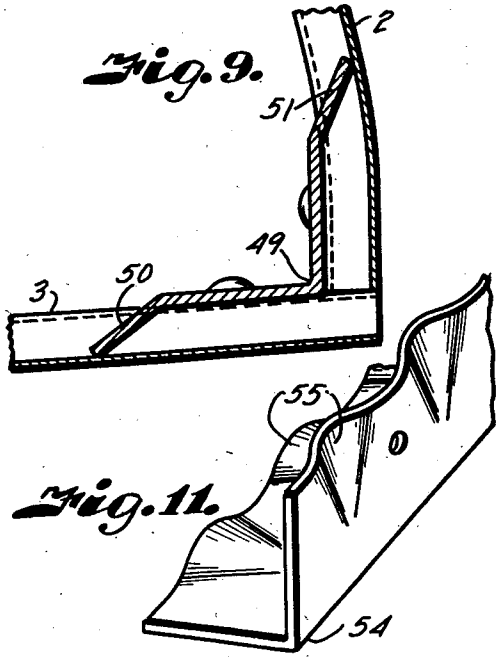


Fig. 10.

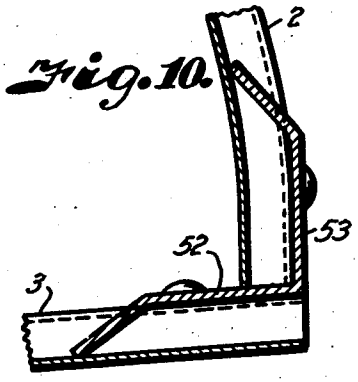


Fig. 11.

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UNITED STATES PATENT OFFICE

2,343,029

CULVERT

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Application April 12, 1941, Serial No. 388,294

4 Claims. (Cl. 138—71)

This invention relates to culverts, and more particularly to those of the arch type. It is well known that this type of culvert is more satisfactory because of the greater flow capacity at low water levels and less head space required for their installation. Other advantages are that they are of stronger construction and better capable of withstanding traffic loads and washes under flood conditions. However, arch culverts have the disadvantage in that they are more expensive and difficult to install because they require a foundation structure to support the load. For this reason the present trend is toward economy by the installation of ducts having integral bottoms similar to the old style corrugated conduits, but which are elongated or flattened in cross-section to give greater flow capacity at low water levels. The deformation required to produce elongated cross-section results in a weakened structure because of flattening of the corrugations at points where the greatest loads are to be sustained. Flattening of the corrugations also results in warping of the culvert in the longitudinal direction thereof.

It is, therefore, the principal object of the present invention to provide a relatively inexpensive arch type culvert with an integral bottom having substantially all the advantages of the customary arch and in which the undesirable characteristics of a conduit are eliminated.

Other objects of the invention are to provide an arch-shaped culvert with an integral bottom having reinforcement at points of greater stress; to provide a culvert construction which is capable of accurate alignment, capable of easier installation, and more resistant to washes during times of flood conditions.

In accomplishing these and other objects of the invention, as hereinafter pointed out, we have provided improved structure, the preferred forms of which are illustrated in the accompanying drawings, wherein:

Fig. 1 is a perspective view of an arch type culvert constructed in accordance with the present invention.

Fig. 2 is an enlarged longitudinal section through one end of the culvert.

Fig. 3 is a cross-sectional view.

Fig. 4 is a detail section on the line 4—4 of Fig. 1.

Fig. 5 is an enlarged fragmentary section through the culvert at the juncture of the arch with the culvert bottom, and showing the securing and reinforcing member which enhances the rigidity of the arch and eliminates necessity of a foundation.

Fig. 6 is a detail perspective view of the ends of the members composing the culvert shown in disassembled spaced relation.

Fig. 7 is a plan view of the blank from which the longitudinal connecting and reinforcing members are constructed.

Fig. 8 is a detail perspective view of the longitudinal member formed from the blank.

Fig. 9 is a detail section through a modified form of the invention.

Fig. 10 is a similar section through a further modified form.

Fig. 11 is a perspective view of a further modified form of longitudinal member.

Referring more in detail to the drawings:

1 designates a culvert constructed in accordance with the present invention and which includes an arch 2, a bottom 3, longitudinal connecting members 4 and 5, and wash preventive aprons 6 and 7. In culverts which are short enough to handle and ship conveniently, they will consist of a unitary assembly when the parts are connected. However, in longer culverts, and those too large to handle conveniently, they are preferably formed in sections, as shown in Fig. 1, and the sections interconnected by a coupling band 8, later described.

The arch member 2 of the culvert is preferably formed of corrugated metal sheets rolled to arch form and having the corrugations 9 extending transversely of the culvert. To make a culvert of the desired length, the edges of the sheets are overlapped and riveted as in conventional practice, as indicated at 10. Since the sheets may usually be obtained in ample lengths to form the arch of the culvert, the arch preferably extends continuously from one side to the other and over an arc of substantially that of a semicircle, although the present invention may contemplate a deeper culvert by providing tangential extensions at the ends thereof. Therefore we do not wish to be limited to the particular shape of the culvert illustrated.

The ends of the sheets are cut squarely across the corrugations, as indicated at 11, to seat upon the corrugations of the bottom member 3. The bottom member 3 is also preferably formed of corrugated sheets with the corrugations 12 extending transversely of the culvert and having a slight dip 13 in the center thereof to direct flow of water to the center of the culvert and provide drainage of the corrugations. The bottom 3 conforms in length to the arch member and

is of sufficient width so that the sides 14 and 15 provide support for the edge faces 11 of the arch member, as shown in Fig. 3.

In order to provide a finished end for the arch and bottom members, the endmost sheets are rolled retractively, as indicated at 16 and 17, shown in Figs. 2 and 6. The rolled edges provide sockets 18 and 19 to receive angle-shaped rods 20, one leg 21 of which extends into the socket 18 and the other leg 22 into the socket 19 to form a continuation of the finished rim. The longitudinal members 4 are to reinforce the culvert at the bearing point of the arch member on the bottom member and at the same time provide connections whereby the bottom member is rigidly attached to the arch member in forming a unitary structure.

The preferred form of angle member is illustrated in Fig. 8 and is formed of flat metal blanks 23 as shown in Fig. 7. The blanks 23 are formed in convenient lengths and have serrated side edges 24 and 25 with the serrations being spaced in conformity with the spacing of the corrugations of the culvert members to provide wings 26—27 when the blanks are bent on their longitudinal centers to form angle-like shapes having longitudinally straight legs 28—29 with the wings 26 and 27 extending inwardly in substantially parallel relation, as shown in Figs. 5 and 8. The leg 28 underlies the corrugations at the side edges of the bottom member and the vertical leg 29 engages the terminal ends of the outer corrugations of the arch member, as shown in Fig. 5. The legs 28 and 29 of the angle bars thus extend tangentially of the outwardly extending corrugations and side edges of the wings 26 and 27 are shaped so that they enter the valleys 30 and 31 formed by the intermediate corrugations so as to close the spaces between the bottoms thereof and the upper edges of the leg portions of the angle members, as shown in Fig. 1. The juncture of the legs of the angle members extend along the sides of the culvert in substantially linear relation therewith so as to provide a relatively strong joint braced by the angle-shaped construction of the connecting members.

As above stated, the longitudinal members are preferably formed in convenient sections and the ends thereof are overlapped. The angle members are secured to the top and bottom members by fastening devices, such as rivets or bolts 32 and 33, extending through openings 34 and 35 in the leg portions and through registering openings in the corrugated arch and bottom members, as best shown in Fig. 4, the openings in the arch and bottom members being formed in the centers of the outwardly projecting corrugations so that the corrugations are drawn tightly against the legs of the angle members. The endmost fastening devices designated 36 and 37 are preferably removable and therefore consist of bolts which are adapted to anchor the aprons 6 and 7 to prevent under-wash and erosion at the respective ends of the culvert. The aprons 6 and 7 are preferably formed of sheet metal and of sufficient width to provide wings 38 and 39 extending beyond the sides of the culvert. The aprons are of sufficient height to extend below the bottom of the culverts and into wings extending thereabove, and are provided with inwardly extending ears 40 and 41 to engage the inner faces of the arch members, as shown in Fig. 1, the ears being provided with openings 42 to receive the bolts. The upper edge of each apron is preferably provided with an inwardly directed flange 43 overlying the end of the bottom member, as shown in Fig. 2.

Where the culvert is of extremely long length it is made of sections, as above described, and the sections are secured together by bands 8, having downwardly turned side edges 45 and 46 engaging over outwardly projecting corrugations in the abutting ends of the sections, the bands being secured to the corrugations by fastening devices, such as bolts 47, as shown in Fig. 2, whereby the bands may be readily applied at the site of the installation.

After the culvert has been constructed, but before the aprons 6 and 7 have been applied, it is preferably dipped in a coating material such as asphalt or the like to apply a coating 48 to seal the joints between the longitudinal members and the corrugations of the arch and bottom members of the culvert, as shown in Fig. 5. The coating material not only protects the culvert from corrosion but also seals the culvert and prevents leakage of water flowing therethrough.

The form of the invention shown in Fig. 9 is substantially the same as the preferred form with the exception that the longitudinal members 49 are applied on the inner faces of the arch and bottom members of the culvert and the wings 50 and 51 thereof are struck outwardly to close the spaces between the corrugations which engage the legs of the members, as shown in Fig. 9.

The form shown in Fig. 10 is of similar design with the exception that the horizontal legs 52 of the longitudinal members are supported on the upper face of the bottom member, while the vertical legs 53 are engaged with the outer face of the arch member. In this instance the wings on the vertical legs are struck inwardly and the wings on the horizontal legs are struck downwardly to cooperate with the legs of the angle members in closing the corrugations.

Fig. 11 shows a further form of longitudinal member. This longitudinal member is formed of an angle 54 having the upper portions of the horizontal and vertical legs struck inwardly, as at 55, to close the spaces between the vertical legs of the corrugations.

From the foregoing it is obvious that we have provided an arch-shaped culvert wherein the arch member is rigidly supported on the bottom member and retained by the reinforcing longitudinal members so that the necessity of a foundation is eliminated, the bottom member forming sufficient bearing to support the weight of the arch and at the same time forming the transverse member of a truss over which the arch member is the upper chord. The longitudinal members also distribute loads on the culvert in the longitudinal direction. A culvert formed as described may be readily assembled and all the parts aligned to provide a duct-like culvert which is of straight formation so as to provide adequate drainage of the water therethrough.

Our improved construction also provides for making the culvert with a bottom of heavier gage metal than the top if such is found to be necessary in larger culverts, such as those used in railroad work. Another advantage with our improved culvert is that the bottom corners thereof conform to the shape of the ditch and therefore have positive bearing in supporting the load and preventing water from washing under the bottom thereof.

What we claim and desire to secure by Letters Patent is:

1. A culvert including an arch-shaped top

member, a substantially flat bottom member having longitudinal edges in juxtaposition with sides of said arch-shaped member, said arch-shaped member being formed of corrugated material having the corrugations extending transversely thereof, angle bars having longitudinally straight legs extending tangentially across the corrugations in lapping relation with sides of the arch-shaped top member and a face of the bottom member, said angle bars having the juncture of the legs extending in linear relation with the sides of said culvert, wings projecting from said legs which extend tangentially across the corrugations of the top member and arranged to close space between the corrugations intermediate tangent points of said legs, and means securing the legs of said angle bars to the respective top and bottom members.

2. A culvert including an arch-shaped top member, a substantially flat bottom member having longitudinal edges in juxtaposition with sides of said arch-shaped member, said members being formed of corrugated material having the corrugations extending transversely thereof, angle bars having longitudinally straight legs extending tangentially across the corrugations in lapping relation with sides of the arch-shaped top member and a face of the bottom member, said angle bars having the juncture of the legs extending in linear relation with sides of said culvert, wings projecting from said legs and arranged to close the space between the corrugations intermediate tangent points of said legs, and means securing the legs of said angle bars to the respective top and bottom members.

3. A culvert including an arch-shaped top member, a substantially flat bottom member having longitudinal edges in juxtaposition with sides of said arch-shaped member, said arch-shaped member being formed of corrugated material having the corrugations extending transversely thereof, angle bars having longitudinally straight legs extending tangentially across the corrugations in lapping relation with sides of the arch-shaped top member and a face of the bottom member, said angle bars having the juncture of the legs extending in linear relation with sides of said culvert, wings projecting from said legs which extend tangentially across the corrugation of the arch-shaped top member and arranged to close the space between the corrugations intermediate tangent points of said legs, means securing the legs of said angle bars to the respective top and bottom members, and a plastic coating material covering said members to seal the joints between said members including spaces between the wings and said corrugations.

4. A culvert including an arch-shaped top member, a substantially flat bottom member having longitudinal edges in juxtaposition with sides of said arch-shaped member, said members being formed of corrugated material having the corrugations extending transversely thereof, angle bars having longitudinally straight legs extending tangentially across the corrugations in lapping relation with sides of the arch-shaped top member and a face of the bottom member, said angle bars having the juncture of the legs extending in linear relation with sides of said culvert, wings projecting from said legs and arranged to close the space between the corrugations intermediate tangent points of said legs, means securing the legs of said angle bars to the respective top and bottom members, and a plastic coating material covering said members to seal the joints therebetween including any spaces between the wings and said corrugations.

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