June 15, 1926. 1,588,897

A. MARSTON

METHOD OF PROTECTING CONDUITS PROJECTING INTO FILLED AREAS

Filed Sept. 12, 1924

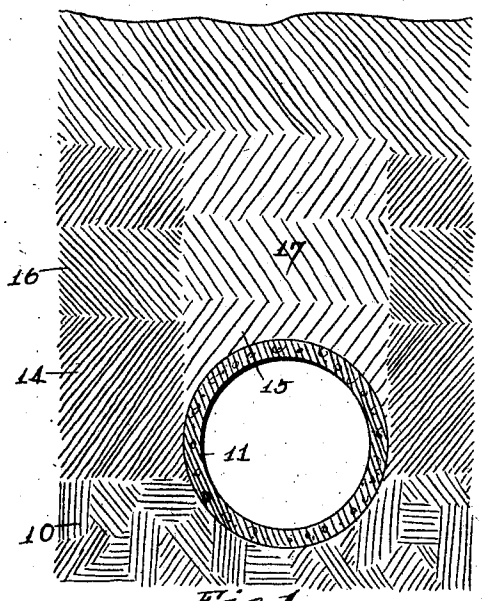


Fig. 1.

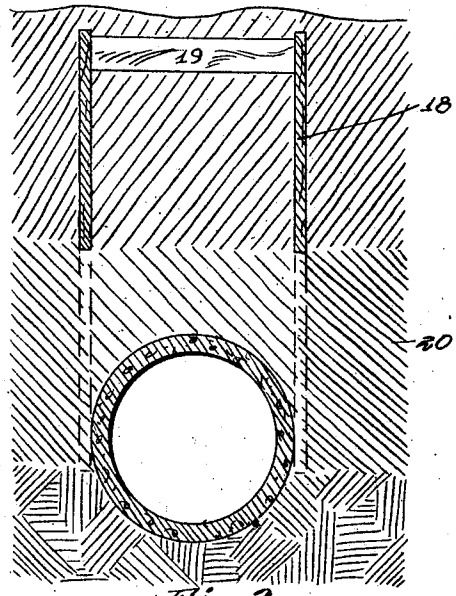


Fig. 2.

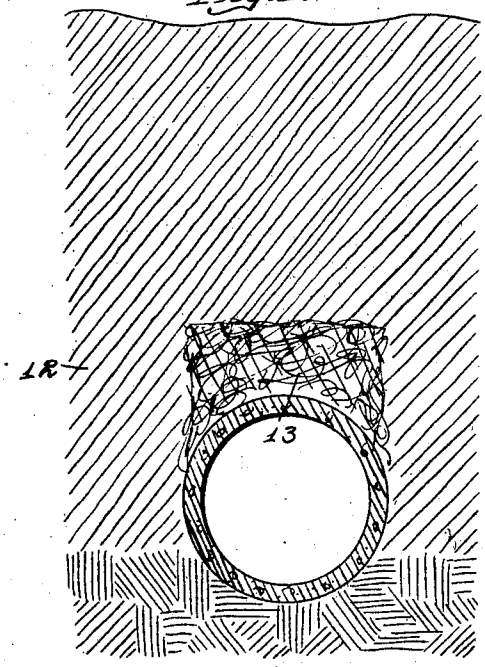


Fig. 3.

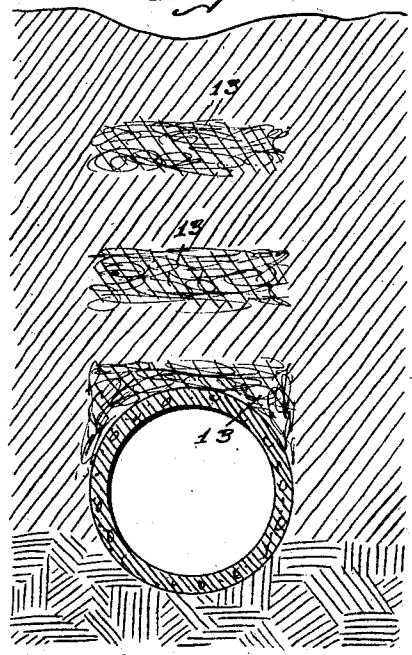


Fig. 4.

Inventor
Anson Marston

by Quigg & Teague, Attys.

Patented June 15, 1926. 1,588,897

UNITED STATES PATENT OFFICE.

ANSON MARSTON, OF AMES, IOWA, ASSIGNOR TO IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS, OF AMES, IOWA, A CORPORATION OF IOWA.

METHOD OF PROTECTING CONDUITS PROJECTING INTO FILLED AREAS.

Application filed September 12, 1924. Serial No. 737,370.

When conduits of concrete, tile or other material are laid in ditches, and the ditches filled with earth, the subsequent settling of the earth fill subjects the conduits to such strains only as are applied by reason of part of the weight of the earth in the ditch above the conduit. When, however, these conduits are laid on or only partly below the ground surface and then a fill of considerable depth is placed on top of them, then as the earth settles the conduits will be subjected to strains due not only to the weight of the earth immediately above the conduit, but also to part of the weight of the adjacent earth fill. The reason that, under such conditions, the conduits are subjected to an additional crushing strain is the fact that the conduits themselves are relatively incompressible, so that the earth fill alongside moves downwardly in settling to a greater extent than the earth immediately above the conduit, with the result that part of the strains or pressure due to settling of the earth fill at the sides of the conduit are applied to the top of the conduit, by reason of the adhesion of the earth at the sides of the conduit to the earth immediately on top of the conduit. In my experiments I have found that the total load on the conduit frequently is doubled, or even more than doubled, in this manner.

My object is to provide an inexpensive method which may conveniently and easily be practiced in any locality and with materials that are inexpensive and readily obtainable in any locality, whereby a conduit laid projecting into a filled area will be subjected to such strains only as are occasioned by a part of the weight of the earth fill immediately above the conduit, and will not be subjected to additional crushing strains from the body of earth fill alongside.

My invention consists in the various steps of the method by which the objects contemplated are attained, as hereinafter more fully set forth, pointed out in my claims, and illustrated in the accompanying drawings, in which:

Figure 1 shows a sectional view of a conduit resting upon solid earth and having an earth fill of considerable height above it. In this figure I have illustrated the manner in which my method may be practiced, which consists in loosening successive layers of earth fill directly above the conduit after the layers have settled.

Figure 2 shows a similar view illustrating another embodiment of my invention, which consists in providing movable frames at the sides of the culvert which may be raised from time to time as the fill progresses.

Figure 3 shows a similar view illustrating an embodiment of my invention in which I utilize a material which is capable of settling much more readily and extensively than the earth fill at the sides thereof; and in

Figure 4 I have shown a modification of this embodiment of my invention which consists in employing vertically separated layers of readily compressible material above the conduit.

Referring to the accompanying drawings, I have used the reference numeral 10 to indicate the solid earth upon which the conduit 11 is permanently located.

In the form of my invention illustrated in Figure 3, I have used the reference numeral 12 to indicate the ordinary earth fill in the area into which the conduit projects. Immediately on top of the conduit, I have placed a fill which may be of straw or the like, and which is indicated by the reference numeral 13, and is capable of settling to a much greater degree than is the earth fill 12 surrounding it.

In practice I have found that it is necessary to provide this filling material 13 only for a fraction of the distance upwardly from the culvert, and then above it the area may be filled with the earth material 12 in the ordinary way.

In the modification illustrated in Figure 4, I have provided a series of layers of readily compressible filling material 13 spaced vertically one above the other and all in layers above the conduit. In practice

with this modification, the earth is filled to a point nearly level with the top of the conduit. Then a layer of highly compressible material 13 is placed on top of the conduit. Then a layer of earth is filled in over the material 13 and over the fill at the sides of the conduit. Then an extra layer of highly compressible material 13 is placed on top of the last mentioned fill, and so on.

In the form of the invention illustrated in Figure 1, the earth fill indicated by the section lining 14 is completed to a point not very far above the top of the culvert with material compacted by the method of construction or by time to such extent as may be practicable. Then the material 15 immediately above the culvert is spaded or plowed or otherwise loosened. Then a second layer 16 of filling material is placed throughout the area of the fill and over the conduit, and this layer likewise is compacted to such extent as practicable. Then the portion 17 of said layer is loosened in the same manner as the portion 15 before described just prior to the time the third fill is made, and so on.

In the modified form shown in Figure 2, I provide movable frames 18 with opposite sides vertically over the sides of the conduit and spaced apart by the brace 19 and extended a short distance above the conduit. The first layer of filling material 20 is applied over the entire area to be filled except the area within the movable frames 18 and then is permitted to settle, unless already well compacted by the method of making the fill. After this is done, the area within the movable frames is filled with very loose material, using precaution against compacting, after which the movable frames 18 are raised to the position shown by solid lines in Figure 2. Then a second layer is filled over the area outside the movable frames and permitted to settle, and so on.

I have demonstrated by experiment that the ordinary large conduits are seldom made strong and rigid enough to resist such strains as are applied to them when they are placed on the solid earth and the entire area over and around them is filled with a considerable depth of earth, which subsequently settles, and by repeated experiments and tests I have found that even when placed in a ditch which is subsequently filled, there is practically no breakage or cracking of a conduit, yet if the same conduit projects into a filled area, a very great amount of breakage and cracking of the conduit is occasioned after settling.

I have also demonstrated by experiment and test that in the case of conduits projecting into filled areas, strains to which a conduit is subjected upon settling of the filled material, include strains caused by the weight of the material directly above the conduit, and in addition part of the weight of the filling material alongside. The amount of filled material, the crushing weight of which is thus thrown upon the conduit, depends to a great extent upon the nature of the material, its degree of adhesion and the extent of the projection of the conduit into the filled area. In extreme instances, I have found that the crushing strains upon the conduit projecting into a filled area are several times more than the crushing strains upon a corresponding conduit laid in a ditch.

When my improved method is employed, for instance the method illustrated in Figure 3, the earth is filled up to a point near the top of the conduit and then directly above the conduit I place a layer of readily compressible material, such for instance as straw. This need extend only a fraction of the distance to the top of the fill. Then when settling occurs, the material at the sides of the culvert can settle down to its normal condition. The straw fill will settle more readily and to a greater extent than will the earth fill at the sides. Hence, none of the weight of the material at the sides of the culvert will have been thrown upon the culvert proper. In fact part of the weight of the earth fill immediately over the conduit will be thrown upon the filling material alongside, leaving the conduit to carry only a fraction of said weight of the filling material immediately overhead.

In localities where it is impractical or too expensive to obtain a highly compressible material, such as straw, I have found that I can obtain satisfactory results by filling the material in layers, consolidated to such extent as may be found practicable, and then spading, plowing or otherwise loosening the filled material directly above the culvert, and continuing this method during the successive layers of fill material.

In the modified form illustrated in Figure 2, the movable frames permit the attainment of such loose condition of the filling material immediately over the conduit without subsequent spading or plowing or other loosening process.

I claim as my invention:

1. A method of protecting conduits projecting into filled areas, which consists in placing directly above the conduit a material having a greater degree of compressibility due to settling than that of the filling material alongside.

2. The method of protecting conduits projecting into filled areas, which consists in placing a filling material in layers compacted as far as practicable, and then loosening the material that lies directly above the conduit so that it shall have a greater degree of compressibility than that of the material alongside.

3. The method of protecting conduits projecting into filled areas, which consists in placing movable frames at the sides of the conduit, then filling in material against the outer surfaces of said movable frames and also between the sides of said movable frames, then permitting or causing the material outside of the frames to settle or pack to a greater extent than the material between the sides of the frames, than elevating the frames and continuing the process until the fill is completed.

ANSON MARSTON.