May 29, 1928. 1,671,679

A. MARSTON

METHOD OF INCREASING THE SUPPORTING STRENGTH OF CONDUITS

Filed Sept. 12, 1924

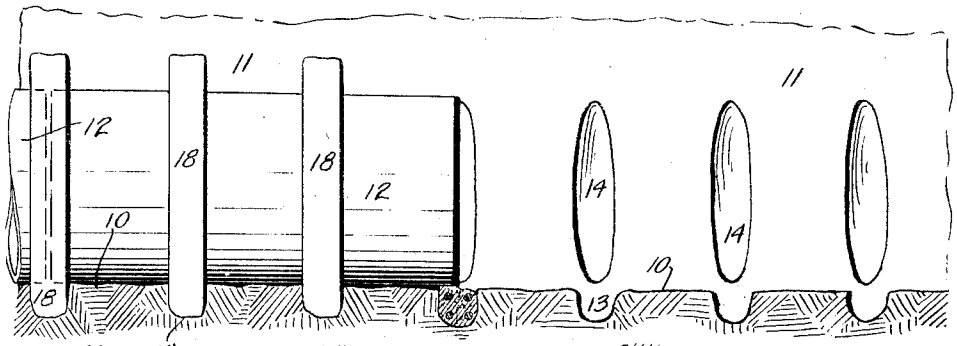


Fig. 1.

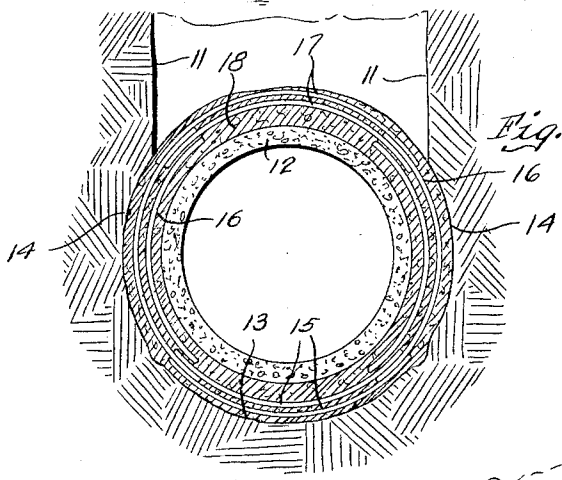


Fig. 2.

Fig. 3.

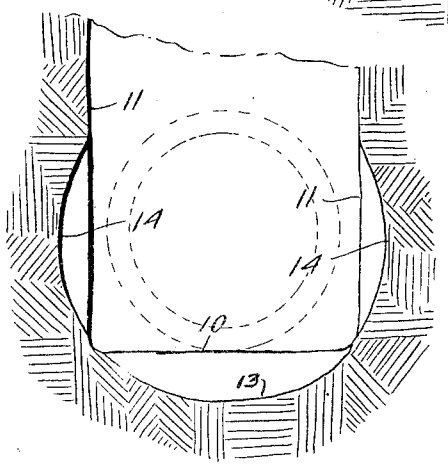
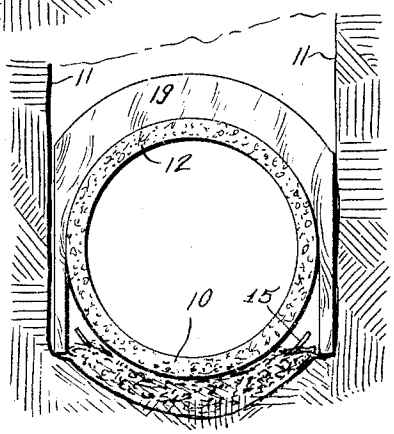


Fig. 4.



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UNITED STATES PATENT OFFICE.

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METHOD OF INCREASING THE SUPPORTING STRENGTH OF CONDUITS.

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When large conduits of concrete or other material are laid in trenches and the trenches are subsequently filled with earth or other material, and also when such conduits are laid on any solid surface projecting upwardly into filled areas, it frequently occurs that the conduits will be cracked or crushed after the earth settles. This is owing to insufficient supporting strength of the conduit, which at times is often partly due to the fact that it frequently happens that a conduit is supported upon the bottom of the trench or other solid surface upon which it is laid, not uniformly throughout its entire under surface.

My object is to provide a method of laying large conduits in trenches or projecting into filled areas whereby the bottom of the conduit is firmly and uniformly supported throughout its length, so that crushing strains applied to the upper surfaces will be resisted by the entire body of the conduit, and will not be unevenly distributed upon certain points or parts thereof.

A further object is to provide an improved method of reinforcing the top portion as well as the sides and bottom portions of conduits so as to give greater inherent supporting strength to resist crushing strains.

My invention consists in the method of preparing the trench to receive reinforcing metal and concrete at the bottom and sides of a conduit, whereby the conduit is uniformly and evenly supported at its bottom, and also in the improved method of applying reinforcing metal and concrete around the conduit, whereby 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 vertical, longitudinal, and partly sectional elevation of a trench having therein a section of conduit reinforced by my improved method, with a portion of the trench adjacent thereto prepared in accordance with my improved method to receive a conduit and reinforcing metal and concrete.

Figure 2 shows a transverse sectional view through a trench and a conduit provided with reinforcements applied in accordance with my improved method.

Figure 3 shows a transverse sectional view of a trench having portions of its bottom and sides cut away as required in carrying out my improved method; and

Figure 4 shows a transverse sectional view through a trench and culvert showing a device for retaining the reinforcing concrete and metal at the upper portions of the conduits, and illustrating one means by which my improved method may be carried out.

Referring to the accompanying drawings, I have illustrated an ordinary trench formed in the earth to receive a conduit. The bottom of the trench is indicated generally by the numeral 10 and the sides are indicated generally by the numeral 11. My method is also used for conduits not laid in trenches, but the conduit which is of the ordinary kind now in common use is indicated by the numeral 12.

Before laying each section of conduit, the operator employs a rounded spade or other implement and scoops out from the bottom of the trench, or from any other solid surface on which the conduit is to be laid, two or more rounded curved depressions 13. When the conduit is laid in a trench so narrow as to require it, he also, directly above each end of the depression 13, scoops out a rounded semi-circular recess 14 from the earth at the sides of the trench. He then places metal reinforcing wires, rods or bars 15 in the depressions 13, and also other reinforcing wires, rods or bars 16 and 17 respectively at the sides and top of the conduit. The reinforcing wires, rods or bars 15, 16 and 17 may be combined. The double lines of reinforcing bars 15, 16 and 17 should be used as shown in the drawings, when the reinforcing rings 18 are cast before the culvert is put into position, but when the reinforcing is applied after the conduit is laid, the outside reinforcing bars 15, 16, 17 and 18 may be omitted.

The operator then places a quantity of concrete material in the depressions 13, and then he places the conduit in position resting upon said concrete material, and also upon the bottom of the trench, or other solid surface on which the conduit is laid, between the depressions 13. After this has been done, he places concrete material around the sides and top of the conduit and around the reinforcing bars 16 and 17 to form projecting rings 18 of reinforced concrete around the body of the conduit, as shown in Figure 1.

When placing this concrete material to form reinforcing rings 18, it is sometimes desirable to employ a series of concrete retaining forms 19 in the trench on opposite sides of the particular ring 18 which is then being formed of concrete material, and this is necessary when the conduit is not laid in a trench. These retaining forms 19 may be shaped as illustrated in the drawings, with their side edges of a width to loosely fit the interior of the trench, and their lower ends shaped to project downwardly between the conduit and the adjacent sides of the trench, to thereby prevent the concrete material from moving in directions longitudinally of the conduit. The retaining forms must have an outer member when the conduit is not laid in a trench. When the concrete material has set, these retaining forms may be removed and repeatedly used. The various reinforcing wires, rods or bars 15, 16 and 17 are arranged with their ends in overlapping position within the concrete material, thus forming the reinforced continuous rings 18 completely encircling the conduit.

In practice with my improved method of increasing the supporting strength of conduits, I have found that the supporting strength of the conduits may be increased to a very considerable extent at a comparatively slight cost, because the work of preparing the depressions and recesses at the bottom and sides of the trench can be very quickly and easily done by ordinary workmen, and these recesses and depressions perform the double function of providing a means whereby the reinforcing concrete material may be easily positioned under and at the sides of the conduit, and they also form a sort of mold or receptacle in which this concrete material and reinforcement can be retained while setting and hardening. However, in some cases I find it desirable to construct my reinforcing rings 18 around the conduit before laying it in position.

The results, as to increasing the supporting strength of the conduits when my improved method is practiced, are much greater than though the corresponding amount of reinforcing concrete and metal were applied to the conduits otherwise, because no matter how much reinforcement is applied to the conduits, their resistance to crushing strains depends to a material extent upon whether or not their bottom and side portions rest firmly and uniformly upon a solid foundation, which cannot be obtained by simply laying the reinforced conduits on the bottom of an ordinary trench. In cases where I find it desirable to construct my reinforcing rings 18 around the conduit before placing it in position, I make the depressions 13 slightly larger than the exterior of the rings 18 and insert soft concrete between the rings and the earth.

Furthermore, the strength added to a conduit by metal reinforcing depends to a large degree upon the distance between the outer and inner reinforcing bars, which in my improved method may be very large in the reinforcing rings 18 as compared with the small distance available in the comparatively thin shell or wall of the conduit.

Furthermore, according to my improved method, the conduits are firmly held against longitudinal movement in the trench.

When the bottom and sides of a conduit are supported in such a way that the sides cannot be distorted outwardly by pressure from above, then the strength of the conduit in resisting crushing strains from above is materially increased, and according to my method, the concrete reinforcements that engage the sides of the culvert are held together by the reinforcements imbedded in concrete that extend across the top of the culvert. Hence, pressures applied on top of the culvert will be resisted in their tendency to distort the sides of the culvert outwardly by such reinforcements at the top.

I claim as my invention:

1. The method of increasing the supporting strength of conduits in trenches or projected into filled areas, which consists in first forming in the earth a trench having a bottom surface and side walls, said bottom surface being formed to receive and support precast conduits, then cutting into the earth in said bottom and sides of the earth trench a series of spaced transversely extended depressions, then placing a conduit in position with portions thereof resting upon the bottom of the trench which had previously been shaped to receive it, and other portions thereof projecting across said transverse depressions, and whereby the conduit itself forms a top for the transverse depressions in the bottom of the trench and an inner wall for the transverse depressions at the side of the trench, and finally placing plastic concrete material in the depressions and recesses at the bottom and sides of the conduit, said plastic concrete filling said transverse depressions and engaging both the earth at the bottom and sides thereof and the concrete at the top and inner face thereof.

2. The method of increasing the supporting strength of conduits in trenches or projected into filled areas, which consists in first forming in the earth a trench having a bottom surface and side walls, said bottom surface being formed to receive and support precast conduits, then cutting into the earth in said bottom and sides of the earth trench a series of spaced transversely extended depressions, then placing a conduit in position with portions thereof resting upon the bottom of the trench which had previously been shaped to receive it, and other portions

thereof projecting across said transverse depressions, and whereby the conduit itself forms a top for the transverse depressions in the bottom of the trench and an inner wall for the transverse depressions at the side of the trench, and finally placing plastic concrete material in the depressions and recesses at the bottom and sides of the conduit, said plastic concrete filling said transverse depressions and engaging both the earth at the bottom and sides thereof and the concrete at the top and inner face thereof, and then placing concrete material over the top portion of the conduit in line with and forming a continuation of the concrete material in said depressions at the sides of the trench.

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