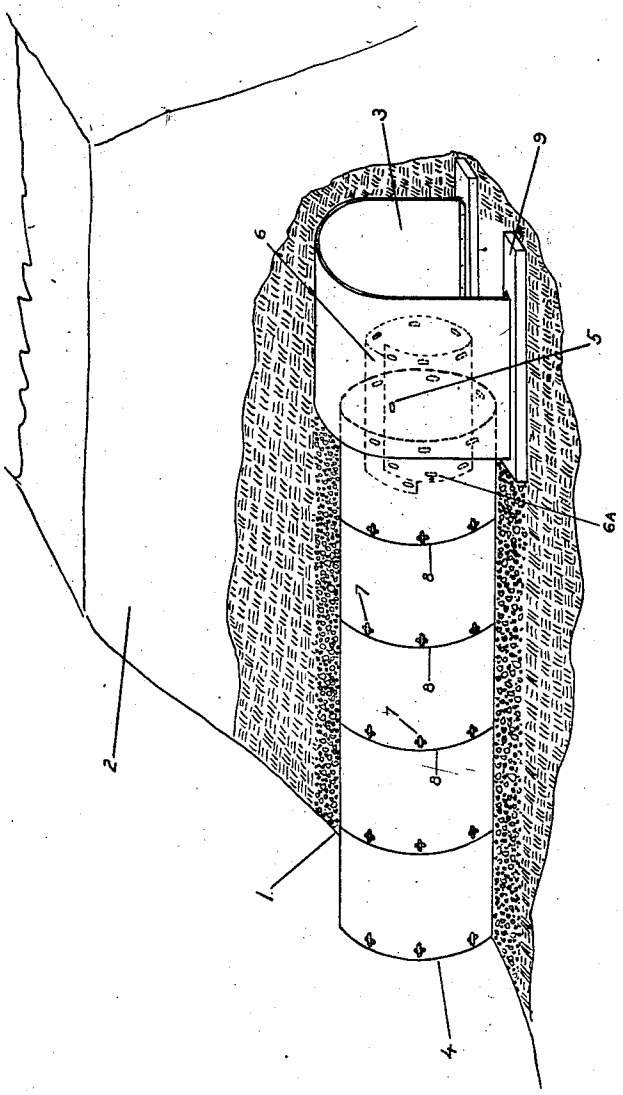
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METHOD OF CONSTRUCTING METAL CULVERTS OR TUNNELS

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METHOD OF CONSTRUCTING METAL CULVERTS OR TUNNELS

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My invention relates to an improved method of constructing metal culverts or tunnels.

The customary practice is to force these culverts through an embankment or fill or other natural or artificial earth mass, if possible, starting from one side, and the required pressure is obtained through the use of a jack. This process is often unsatisfactory and has to be abandoned because the material of which the culvert is made is not of sufficient strength to overcome the resistance of the frictional contact of the culvert in the hole as it is formed, especially where the culvert is of considerable length.

The culvert jacking process is definitely restricted as to the length of the culvert that may be laid, because the overlying mass presses upon the culvert until friction prevents further penetration. However, with the present invention, the culvert or tunnel may be extended indefinitely, the only restriction being that the diameter of the pipe must be sufficient to permit a man to operate in it. A very short culvert or tunnel could be constructed by this method with pipe as small as twenty-four inches in diameter. The larger the size of the pipe, the easier the operation, and the only limit to increase in size would be that imposed by the overlying earth mass and the strength of the pipe.

Ordinarily, culverts and perforated pipe for drainage, or water collecting, are laid in trenches. But often they are needed in earth mass too deep for trenching, and they must be placed by tunneling or be driven by the jacking method, which has limited application. It is often necessary to place pipe beneath highways, railroads, canals, or other structures where trenching is impossible or too expensive, but in all of which instances the present method would make installation practicable and relatively inexpensive.

It is therefore the object of my present invention to obviate these difficulties and greatly reduce the difficulties and expense as well as the time required to lay or construct a culvert of this type.

My method consists in building the culvert or equivalently extending a tunnel section by section at the forward end by passing each culvert-section in a partially expanded condition through the completed culvert from the outside as earth excavation proceeds for each section of pipe, and, when in position at the advancing end, expanding the section and securing the inner end to the forward end of the completed culvert, and then fastening it in its expanded or normal condition, or accomplishing these two fastenings in the reverse order.

The accompanying drawing is a perspective view partly in section illustrating a partially completed culvert of this type showing the section of pipe in dotted lines being passed through the completed culvert just preparatory to being expanded, completed and fastened to the advancing end of the culvert.

In carrying out my improved method of culvert construction, a hole 1 is formed in the side of the fill or embankment 2 of a size to receive one or more sections of the culvert.

In some instances dependent largely on the condition of the embankment or earth mass to be penetrated, and whether or not it is desired to surround the culvert with a layer of filtering material, what is known as a shield or curbing 3 is employed, in which case an excavation is made large enough to receive this shield in advance of the culvert, as the same is completed. This shield to rest, to prevent depression of its lower ends into underlying unconsolidated material, and to promote ease of advancing it as installation of culvert or conduit sections progresses, upon wood (preferably) or metal planks which may be abandoned without detriment to culvert, 9. Such a shield is used where the ground has a tendency to cave, and it affords a protected area for the workmen at the end of the culvert which is being built and extended. Where such a shield is employed, gravel, broken stone or other material may be employed to fill the space between the wall of earth and the culvert as the building of the latter progresses, and when drainage is an objective.

I do not claim the use of the shield as being in itself an essential part of my method.

My improved method consists in the build-

ing or construction of the culvert or tunnel by adding sections to the inner or advancing end of the culvert while in the earth, and this is done by passing each new section of culvert through the culvert 4 from the outer end to a point where it reaches the inner end, as indicated in dotted lines in the drawing illustrating this invention. This new section of culvert designated by the numeral 6 must initially be reduced in diameter, so that it can be passed freely through the constructed culvert 4 to the inner end. After this section 6 has been passed through the culvert, it is expanded to normal size by the use of any approved form of expanding device or devices, and is provided with holes or slots 5 on its outer or overlapping longitudinal edge which are adapted to register exactly with similar slots on the other or underlapping longitudinal edge of this same section 6. When thus expanded, one end of this newly-expanded section of culvert is then bolted to the adjacent end of the formed culvert, either by overlapping or underlapping as the case may be, and secured thereto by the bolts 7, extending through the end slots 6A, thus forming a joint such as has previously been formed in the same way at the overlapping edges 8 of the completed culvert, and by bringing the slots in the longitudinal edges into registry, bolts or other fastening means are passed through them and secured, forming the complete section of the pipe of approximately the same size as the completed portion 4. Both longitudinal and end slots are placed for registry, for the processes of fastening, in one case adapted for end fastening by overlapping, and in the other for underlapping.

This method of procedure is repeated until the culvert has progressed through to the other side of the fill or embankment, or to any objective point in an unconsolidated mass.

In this way, there is no forcing of the culvert through the bank, or unconsolidated mass, but, on the contrary, the culvert is built or constructed section by section from the inside of the fill or embankment, or unconsolidated mass, as contradistinguished from all known methods hitherto, in which the culvert is either laid in a trench, or is jacked into an unconsolidated mass of material so that any additional sections of culvert required are always from the outside, with the attendant jacking or forcing of the culvert by pressure applied at the outer end, with the result that the entire culvert must be moved with a constantly increasing length and corresponding frictional resistance as sections are added from the outside, and its length is increased.

Therefore, with the present invention, culverts or tunnels may be constructed where it would otherwise be impracticable or expensive to construct the same. It eliminates timbering or the construction of a frame in building tunnels. It permits the construction of culverts or tunnels where it is too deep for trenching. It makes practicable, in many materials, the excavation of tunnels and lining them with flexible pipe, firmly constructed, without the necessity of timbering. It also makes possible the surrounding of the pipe with any desired thickness of gravel, crushed stone, or other filtering substance and packing it in place, where the structure is placed for drainage or water collecting purposes.

The culvert may be made of plain cylindrical sections, or of corrugated metal, this being entirely a matter of choice, and it being understood that my method applies to one form of culvert just as much as it does to another.

My invention also includes, and pertains to, any form of section, and side or end fastening means, where it is necessary to reduce the diameter of the section, in order to pass it through completed portion of culvert or tunnel, thereafter to be expanded to its normal form and shape, for fastening longitudinally, and to the end of completed part of culvert or tunnel, and also it includes, and pertains to, any suctions consisting of two or more initially separate parts, if any one such part must be reduced in diametrical dimensions in order to pass it through completed part of culvert or tunnel, to be thereafter expanded into its normal form and dimensions.

I claim:

1. A method of constructing a culvert comprising moving convolved culvert sections through a completed portion of the culvert, forcibly expanding said sections, securing said expanded sections to the completed portion of the culvert and securing said expanded sections in a predetermined expanded position.

2. A method of constructing a culvert or the like comprising moving normally contracted longitudinally split tubular sections thereof through a completed portion of the culvert, expanding said sections, securing said sections in a predetermined expanded position and securing the expanded section to the completed portion of the culvert.

3. A method of constructing a culvert from complete sections, each of said sections being potentially a complete tube and in normally convoluted form, comprising passing the convoluted sections through a completed portion of the culvert into position at the end thereof, and expanding said section to full tubular form.

4. A method of constructing a culvert from complete sheet-metal sections, each of said sections being potentially a complete tube and in normally convoluted form, comprising passing the convoluted sections through a completed portion of the culvert into position at an end thereof, expanding said section

to full tubular form, and fastening the edges of the section together and to the completed portion of the culvert.

5. A method of constructing a culvert from complete sheet-metal sections, each of said sections being potentially a complete tube and in normally convoluted form, comprising passing the convoluted sections through a completed portion of the culvert into position at the end thereof, expanding said section to full tubular form, and fastening the edges of the section together and to the completed portion of the culvert by inserting fastening devices radially outwardly from within the culvert through overlapped edges of the culvert section and completed portion.

6. A method of constructing culverts composed of sections, comprising building the culvert section by section by passing each new section in a normally contracted, substantially convoluted form through the completed portion of the culvert, and when in position, expanding said section to approximately the normal diameter of the completed portion of the culvert, and finally fastening the longitudinal edges of the section permanently together.

7. A method of constructing culverts composed of sections, comprising building the culvert section by section by passing each new section in a normally contracted, substantially convoluted form through the completed portion of the culvert, and when in position expanding said section to approximately the normal diameter of the completed portion of the culvert, and finally fastening the longitudinal edges of the section permanently together by the insertion of fastening-devices from the interior outwardly and securing the adjacent edges of the completed culvert and the newly inserted section together.

8. The herein-described method of constructing metal culverts which consists in building the culvert under ground by passing a tubular section longitudinally split with edges overlapping, so that it is initially of less diameter than the potential diameter of the culvert, and thereafter expanding the said section to approximately the diameter of the completed portion of the culvert, and joining the contiguous ends of the completed portion of the culvert and the new section together.

In testimony whereof I affix my signature.

GEORGE E. LADD.