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MANUFACTURE OF CONCRETE PIPE AND LIKE BODIES

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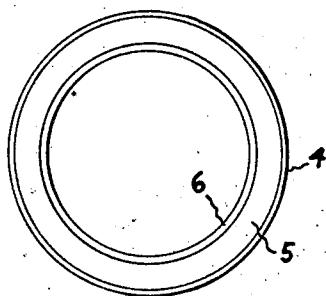


Fig. 1.

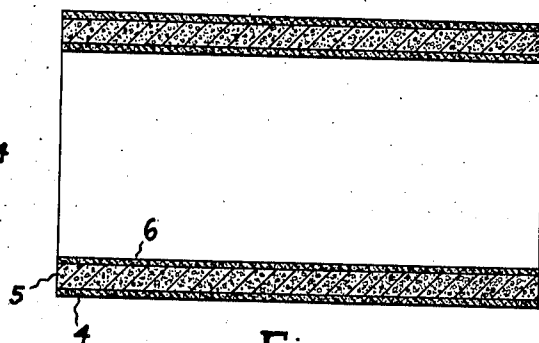


Fig. 2.

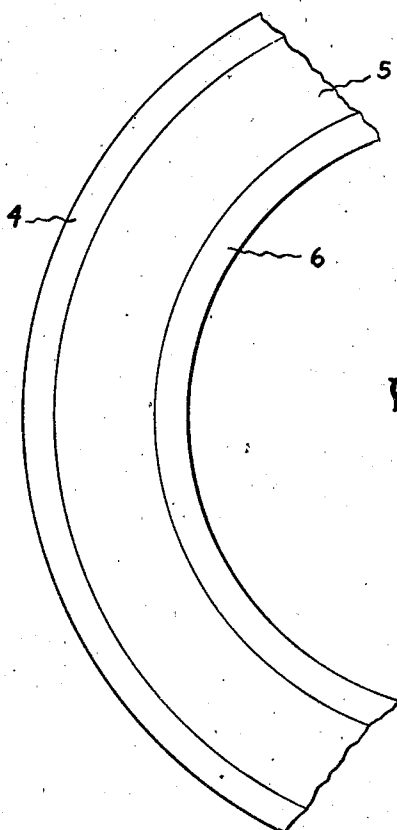


Fig. 3.

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MANUFACTURE OF CONCRETE PIPES AND
LIKE BODIES

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1 Claim. (Cl. 138—86)

This invention relates to the manufacture of concrete pipes and like bodies.

At present it is customary practice for concrete pipes to be produced from a single cementitious mixture so that the pipe wall is of one and the same composition throughout its length and thickness. Such pipes have frequently been found to be unsatisfactory for sewerage, water supply and similar duties, where they require to be embedded in, or laid upon the ground, due to the fact that deleterious influences acting upon the exterior of the pipe differ radically from those acting upon the interior. For example, the inner surface of the pipe may be attacked by sewer gases, oils, acids, salt water and so on, while the exterior of the pipes may be in contact with soil that has high sulphate content or high humic acid content. In such cases, the inner and outer surface layers of the concrete pipe being of precisely the same material as each other, are not best adapted to resist the different influences to which they are subject.

It has been proposed to coat concrete pipes with various paints and preparations in order to render them more resistant to attack, both externally and internally, but such surface treatment has not been found satisfactory.

Again, it has been proposed to make the pipes wholly from concrete mixtures incorporating special highly resistant cements, such as aluminous cement, commonly known as "ciment fondu," but as these cements are relatively costly, their use is often uneconomical.

The primary object of the present invention is to provide for the production of concrete pipes of a composite nature, i. e., that include at least two annular layers or bodies of different mixtures which are so selected as to give the utmost protection both internally and externally against the different deleterious influences to which the pipes are subjected in actual use. In other words, the inner layer or strata will be formed from a concrete mixture embodying, for example, aluminous cement, which renders the internal surface of the pipe highly resistant to those influences that attack the internal surface, while the outer layer will be formed from a concrete mixture incorporating cement that renders the outer surface highly resistant to attack by the influences to which it is exposed.

In most cases, it will be preferred for the pipe to be formed of three layers, namely, an outer layer which is relatively thin, an inner layer which is also relatively thin and may be composed of a mixture either the same as, or different from,

the outer layer, and an intermediate layer which is relatively thick and constitutes the bulk of the pipe wall and which may be formed of a relatively inexpensive concrete mixture.

The cement concrete mixtures to be employed for the various layers will to some extent depend upon particular requirements and conditions, the underlying feature of the invention being to use concrete mixtures including special or high resistant cements for the exposed or surface layers of the pipe where the properties of the cements are made best use of and, at the same time, to practise economy by using only so much of such special cements as are necessary for the desired protective action, the remaining bulk of the pipe being formed from cheaper mixtures.

Thus, as ordinary Portland cement is comparatively cheap and satisfies requirements from the strength standpoint, the main body or bulk of the pipe wall, i. e., that portion between the inner and outer surface layers, may advantageously be made from a concrete mixture including Portland cement. The inner and outer layers which may be relatively thin can be composed of appropriate mixtures that include special or highly resistant cements, such as aluminous cement (ciment fondu). In some cases, the outer layer may be formed from a mixture incorporating an acid resistant and sulphate resistant cement or a Portland cement in conjunction with an aggregate selected for its high resistance to wear and moisture penetration.

In the case of relatively small diameter pipes, having a thickness of wall up to about one and a half inches ($1\frac{1}{2}$ ") the inner and outer layers need not be more than about one-quarter of an inch ($\frac{1}{4}$ ") thick, while for relatively large pipes where the thickness of the wall or lining is much greater, the inner and outer layers may be of a thickness as great as three-quarters of an inch ($\frac{3}{4}$ ").

Although it is not feasible to lay down any hard and fast rule the thickness of the inner and outer layers may, with advantage, constitute say from one-sixth to one-third of the total wall thickness.

One embodiment of the invention is illustrated in the accompanying drawing wherein

Figure 1 is an end view of a composite pipe. Figure 2 is a longitudinal section, and

Figure 3 is a fragmentary end view on an enlarged scale.

The pipes may be made by the well-known centrifugal method of moulding although in some cases, as will be hereinafter apparent, it is pre-

ferred to use the combined centrifugal and concussion method of moulding as disclosed by United States Patent No. 2,023,381.

In producing pipes according to the invention the mixture of which the outer layer 4 of the pipe is to be formed is placed within a mould which is spun about a horizontal axis until the mixture has set to a sufficient extent.

In the majority of cases the mixture for the outside layer will have a high water to cement ratio with a high proportion of cement (ordinary Portland or high resistant) and include a comparatively fine aggregate. In any event when this outer or first applied layer has set sufficiently, any excess water and slurry should be withdrawn from the mould. The exposed surface of the outer layer is then scored slightly or otherwise roughened to provide a key or bonding effect for the next layer that is to be formed.

The second layer 5 will in most cases constitute the main body of the pipe and provide the greater part of the strength thereof. In such cases, therefore, the mixture for the second layer will preferably comprise standard Portland cement and a well graded and coarser aggregate and will have a low water to cement ratio. In other words, this mixture will be in a semi-dry or non-liquid condition and as such will be particularly adaptable to moulding by the combined actions of centrifugal force and concussion as disclosed in the aforesaid United States Patent No. 2,023,381.

After such second layer has been moulded and has set sufficiently any surplus moisture and slurry which may have accumulated at its inner surface, are withdrawn, and the internal surface of the layer is scored or otherwise roughened to provide a key or bonding effect for the third or inner layer.

This third or inner layer 6 may be applied by centrifugal action in the ordinary way and may be composed of a mixture having an appropriate high resistant cement selected in order to provide the utmost protection against the influences that will attack the internal surface of the pipe when it is in use.

It should be noted that the layers 4, 5, 6 are all part of the pipe wall, they all contribute to the ordinary functions thereof, and they are all of concrete although of different kinds of concrete and merge into each other, although for

convenience of representation the layers are shown in the drawing with definite junctions.

While the improved pipes are described as being formed of a plurality of layers or strata, it will be appreciated that owing to effective keying or bonding together of adjacent layers, the moulded pipe wall will constitute an integral unitary mass.

In circumstances where the different layers are composed of mixtures that include aluminous cement and Portland cement, it is important that any water, slurry or loose mortar that may remain after the moulding of one layer should be removed before the mixture for the next layer is introduced. Preferably the surface of the first formed layer should be allowed to dry to a considerable extent before the mixture for the next layer is placed within the mould.

Immediately the innermost or final layer has been moulded, the mould with the pipe therein should be placed in a damp or humid atmosphere so that moisture will not readily evaporate from the pipe. Generally speaking, after the pipe has set, the surface thereof should be maintained in a damp condition for at least twenty-four hours especially if the inner or finally applied layer contains aluminous cement. Furthermore, when the pipe has been taken from the mould it should be protected from too rapid evaporation and kept watered for a further period, the length of which will depend upon the prevailing temperature and/or humidity of the surrounding atmosphere, and/or the thickness of the pipe wall.

Having now described my invention what I claim as new and desire to secure by Letters Patent is:

A centrifugally formed concrete pipe built up of a plurality of annular strata successively moulded from different concrete mixtures and constituting an integral or unitary pipe wall, said strata comprising an outer stratum of highly resistive concrete forming the external surface of the pipe, an intermediate stratum of normal concrete, and an inner stratum of highly resistive concrete which forms the internal surface of the pipe, the inner surfaces of said outer and intermediate strata being scored to insure bonding said intermediate stratum constituting the main bulk of the pipe and said inner and outer strata providing integral protective surfaces.

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