Oct. 15, 1963 E. LE ROY TUNSEN 3,106,760

APPARATUS FOR PRODUCING CAST-IN-PLACE PIPE

Filed July 6, 1961 2 Sheets-Sheet 1

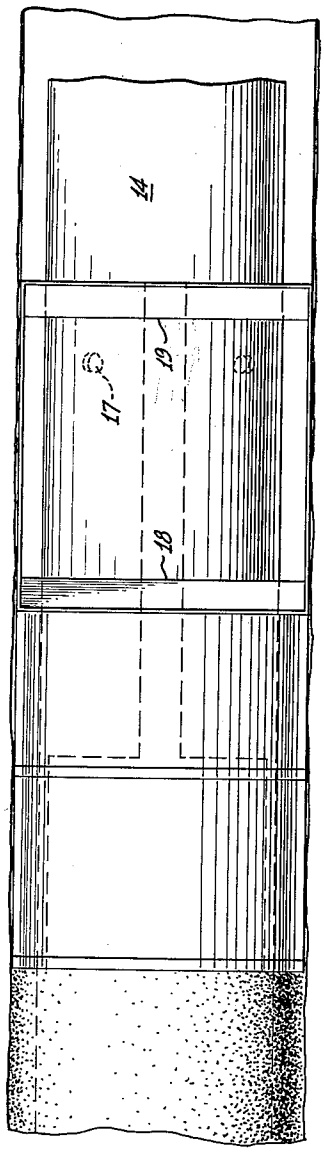


FIG. 2

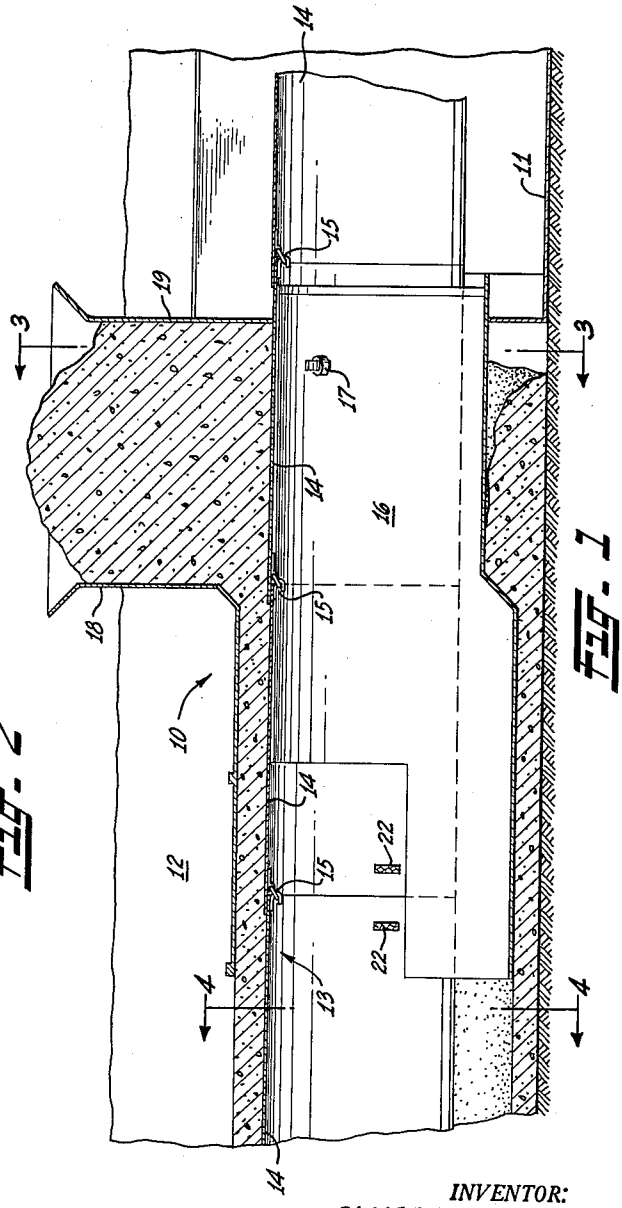


FIG. 1

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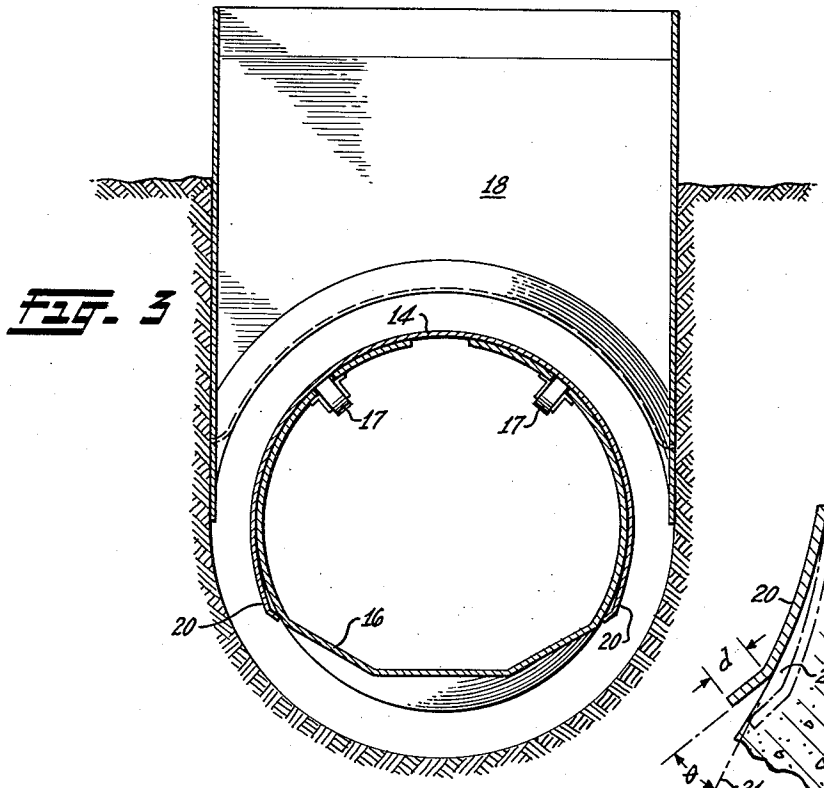


Fig. 3

Fig. 5

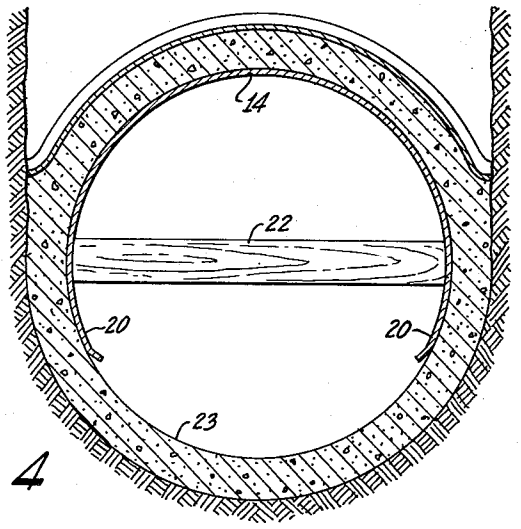


Fig. 4

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APPARATUS FOR PRODUCING CAST-IN-PLACE PIPE

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5 Claims. (Cl. 25—32)

This invention relates to apparatus for making cast-in-place pipe and having removable interior form members that sustain the cementitious crown portion of a newly formed pipe while the material "sets-up." The invention, in particular, involves an improvement in the form members that will prevent the formation of objectionable longitudinal ridges, which are normally formed in cast-in-place pipe made by conventional prior art apparatus.

The most pertinent prior art forms of apparatus to which this invention relates, and as fully described in my United States Patent No. 2,731,698, employ form sections that are substantially arcuate. The interior surfaces of these form sections are initially supported upon an inner form member that is continuously advanced along a trench and into which the pipe is cast. As the machine is advanced, new form sections are added to an ever increasing length of form, and each newly added section is internally braced with a spreader before it slides off the inner support form. It has been found that as the cementitious material is setting-up its weight tends to push the depending edges of the form members into the invert portion of the pipe. As a consequence, longitudinal ridges are often times formed on the interior surface of the pipe, said ridges presenting an obstruction to laminar fluid flow and introducing considerable amounts of turbulence, especially along pipe sections having multiple grade variations or changes.

In brief, this invention contemplates a novel type of upper form member having lower depending edges that are resiliently flexed outwardly by engagement with the lower supporting form member but which will spring inwardly when the lower form member is advanced. More particularly, the upper form member is provided with lower depending edges that are bent inwardly at an angle less than 90° measured from the tangentially projected line of form curvature. It has been found that relatively small amounts of inturning, as for example ¼", may produce sufficient flexing and accomplish the desired purpose. Also, by using upper form members having arc portions of approximately 240° it has been found that the lateral weight forces of the cementitious material while in a stage of setting-up will produce greater amounts of inward form flexure about the fulcrum points of the conventional spreaders, thereby insuring that the lower depending edges do not engage the lower invert portion of the pipe.

Therefore, it is a primary purpose of this invention to provide apparatus including form members that will produce cast-in-place pipe having a relatively smooth interior surface.

Another object is to provide cast-in-place pipe making apparatus including upper form members having lower depending edges turned inwardly which engage the outer surface of a lower form member, said engagement causing the lower extremities of the upper form members to be resiliently bowed until an advancement of said lower form allows the lower extremities to move inwardly.

It is another object of this invention to provide upper form members of the kind described wherein the lower depending edges thereof are turned inwardly at an angle less than 90° measured from the tangentially projected line of form curvature.

A further object is to provide upper form members of

the kind described wherein the lower depending edges thereof are turned inwardly approximately ¼" distance normal to the outer surface and curvature of a supporting inner form.

It is still another object of this invention to provide form members of the kind described wherein the lower depending and inturned edges of said form member sections are approximately 1" in circumferential length being turned inwardly approximately ¼" distance normal to the outer surface and curvature of said inner form.

Yet another object is to provide upper form members of the kind described wherein said upper form sections define an arc portion of an outer substantially circular cylinder, said arc portion being approximately 240° and wherein each form section is internally fitted with a spreader member that subtends a smaller arc of form curvature, said spreader member providing a fulcrum point for inward flexing of the depending edges of the form sections.

Other objects of this invention will become apparent in view of the drawings and the following detailed description.

In the drawings forming a part of this application and in which like parts are identified by like reference numerals throughout the same,

FIG. 1 is a longitudinal center section of a portion of a cast-in-place pipe machine such as contemplated to be used in connection with this invention;

FIG. 2 is a top plan view of the apparatus shown in FIG. 1;

FIG. 3 is a section taken on lines 3—3 of FIG. 1 showing a structural cooperation contemplated by this invention;

FIG. 4 is a section taken on lines 4—4 of FIG. 1; and

FIG. 5 is an enlarged detail of a portion of the section shown in FIG. 4.

Referring now to the drawings and FIGS. 1 and 2 in particular, there is shown a portion of a cast-in-place pipe laying machine **10** comprising a skid support **11** which may be moved longitudinally along the bottom of a trench **12** by means of a tow rope (not shown). Skid **11** supports a form member **13** comprised of a plurality of arcuate sections **14** releasably secured together by hook connections **15**. Lower form member **16**, having support rollers **17**, temporarily supports each section **14** as it is placed upon the skid, the bottom surface of said form member also serving as a screed for forming the invert or bottom portion of the cast-in-place pipe. As is also customary, a hopper **18** is mounted upon the skid providing a barrier wall **19** above and around the form members. In operation, skid **11** is advanced along the bottom of a trench **12** by a tow rope or other conventional apparatus, and while the skid is being advanced, cementitious material is deposited into hopper **18** spilling around form members **13** and **16**. Also, it will be understood that form sections **14** are continually added to prelaid form sections that make up form **13**. Thus, the process of form member encasement is intended to be continuous, the length of form **13** being increased as the skid is advanced. Inasmuch as the above detailed structures are already known in the prior art, having been more particularly described in United States Patent No. 2,731,698, no further explanations of these structures or their functions is believed necessary. However, a general description of this prior art apparatus is given to facilitate and enhance a description of the invention and to clarify precise points of novelty.

The present invention is more especially directed to a novel type of upper form member **13** and sections **14**, best illustrated in FIGS. 3–5. It will be noted that form sections **14** are initially provided with an arcuate con-

tour and having lower depending edges 20 that are inturned at an angle indicated as θ, said angle being measured from the tangentially projected line 21 of form curvature. As each form section 14 is placed upon lower form 16, depending edges 20 come into engagement with the sides of said lower form causing the lower extremities of the upper form to be flexed outwardly and slightly enlarging its contour. The degree of flexing and contour enlargement will of course depend upon the angle θ and the length of the form inturn d indicated in FIG. 5. The weight of cementitious material deposited through hopper 18 will tend to force the inner surface of form section 14 against the lateral sides of form 16 and onto roller 17. This will serve to sharpen and localize the form flexure to the depending sides and downwardly from the fulcrum points of a bracing or spreader member 22 which is installed as shown in FIG. 4. The condition of outward flexing is maintained until the inner form has been advanced along the trench and edges 20 are no longer restrained by engagement therewith. Thus it will be evident, particularly in view of FIG. 4, that after each form section 14 is braced and the inner form is advanced, lower edges 20 will move inwardly to define a substantially continuous curvature with the inner surface of invert portion 23 of the pipe as formed by lower form 16. Preferably, angle θ should be less than 90° for in this instance, and after lower form member 16 has been advanced, the inclined surfaces of inturned edges 20 will be cammed inwardly against the inclined top edge of invert portion 23 by the supported weight of cementitious material. As previously explained and indicated above, it has been found that relatively small amounts of inturning will produce sufficient outward flexing to accomplish the effect desired. For example, one preferred embodiment of this invention may be provided by inturning the last one inch of each depending edge ¼" distance normal to the curvature of said inner form. In such event, the distance d will be 1". Of course, much larger or somewhat smaller inturns may be utilized to produce an acceptable flexing action of the form sections. It will be evident, however, that inasmuch as the volume change attributable to the form flexure (indicated by reference numeral 24) must eventually be filled by the cementitious material, exceptionally large inturns may not eliminate the appearance of ridges in the pipe but in fact such large degree inturns may themselves produce longitudinal ridges. It is also to be understood that the plasticity of the cementitious material will be a major factor in setting suitable limits to the amount of flexure needed. A more fluid type material will have greater ability to fill the volume change, but in now conventional practices a relatively dry concrete mix is preferred since it is more rapid setting and will provide superior strength characteristics.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred example thereof, and that various changes may be made in the shape, size and arrangement of certain parts without departing from the spirit of the invention or the scope of the attached claims, and each of such changes is contemplated.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In apparatus for producing cast-in-place conduits and having a skid support adapted to be moved longitudinally along the bottom of a trench, an inner form comprising a lower screed member secured to said skid and having an outer surface above the bottom and inwardly of the sides of said trench thereby defining a space with the bottom of said trench for receiving cementitious material and forming the bottom contour of a conduit, said inner form also including an upper member comprised of a plurality of sections releasably secured together and disposed in overlapping slidable relationship with respect to the lower screed member, the improvement wherein said upper form member sections have lower depending edges turned inwardly adapted for slidable engagement with the outer surface of said lower member, said engagement causing the lower extremities of said upper form member to be resiliently bowed outwardly, and whereby upon forward advancement of said lower form and removal from within the lower portion of encasing cementitious material, said lower edges move inwardly and the outer surface of said upper form defines a substantially continuous curvature with the inner surface of the lower portion of the conduit formed by said lower screed member.

2. The apparatus of claim 1 wherein said lower depending edges are turned inwardly and engage said lower member at an angle less than 90° measured from the tangentially projected line of form curvature.

3. The apparatus of claim 1 wherein said lower depending edges are turned inwardly approximately ¼ inch distance normal to the outer surface and curvature of said inner form.

4. The apparatus of claim 1 wherein the lower depending and inturned edges of said upper form member sections are approximately 1-inch in circumferential length, being turned inwardly approximately ¼ inch distance normal to the outer surface and curvature of said inner form.

5. The apparatus of claim 1 wherein said upper form sections define an arc portion of an outer substantially circular cylinder, said arc portion being approximately 240° and wherein each form section is internally fitted with a spreader member that subtends a smaller arc of form curvature, said spreader member providing a fulcrum point for inward flexing of the depending edges of said form sections.

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