May 14, 1963 G. D. WILLIAMSON 3,089,213

APPARATUS FOR PRODUCING CEMENTITIOUS CONDUITS

Filed Jan. 12, 1959 4 Sheets-Sheet 1

FIG-2

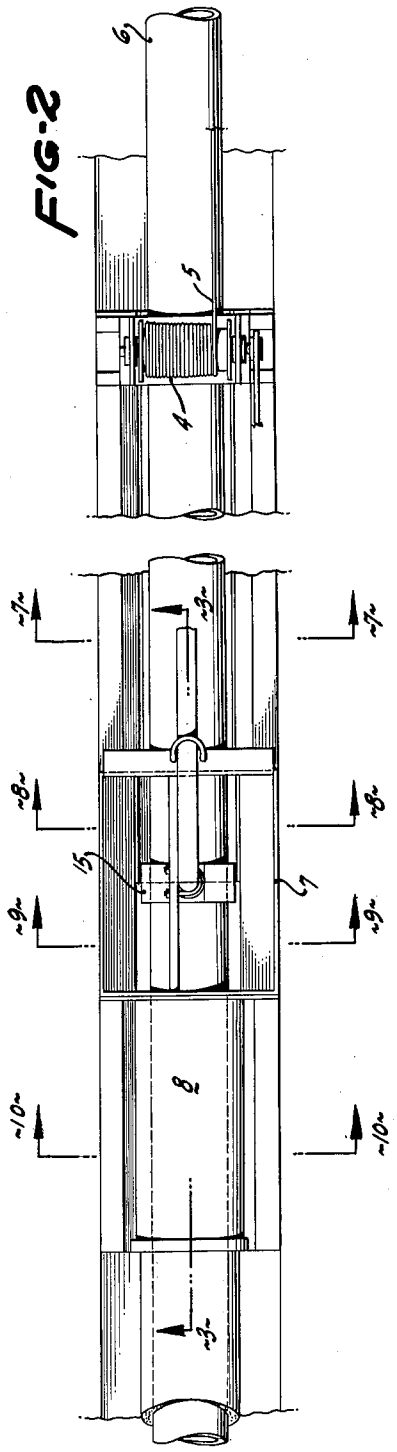
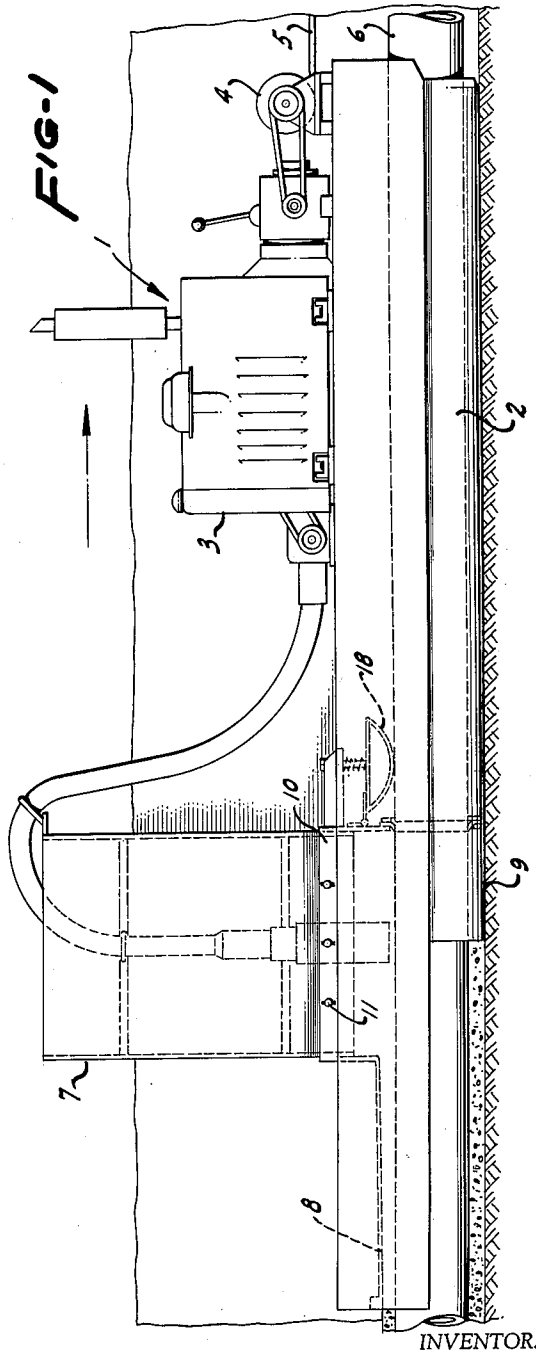


FIG-1



INVENTOR.
GILBERT D. WILLIAMSON

BY

Mellin and Hanscom

ATTORNEYS

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Filed Jan. 12, 1959 4 Sheets-Sheet 2

FIG-3

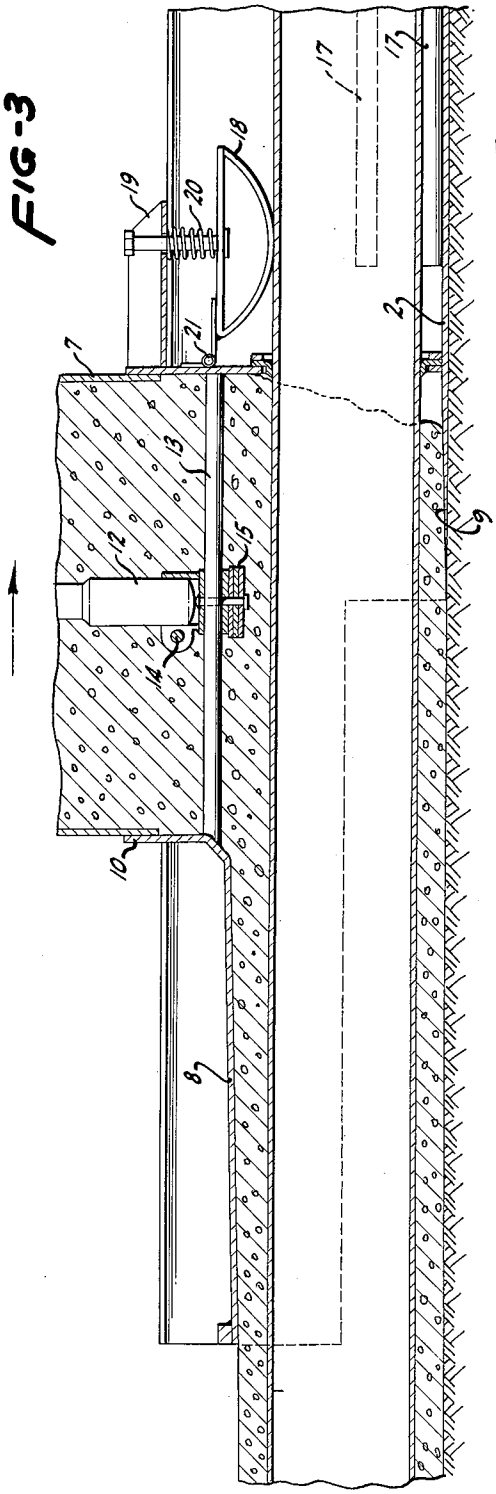


FIG-5

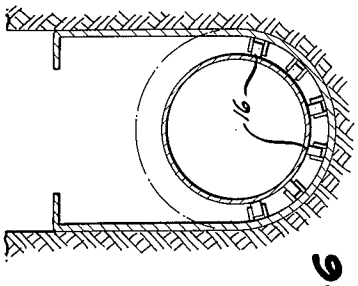


FIG-6

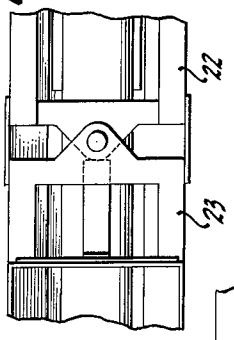
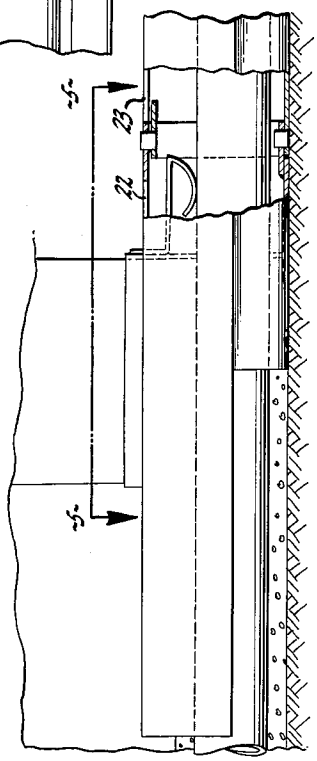


FIG-4



INVENTOR.
GILBERT D. WILLIAMSON

BY

Mellin and Hanscom

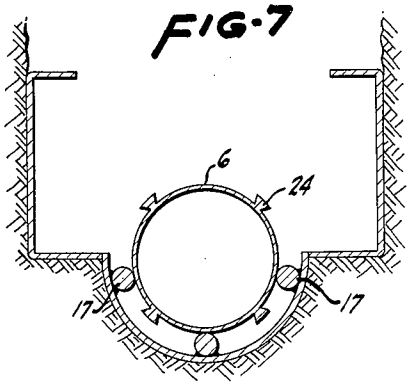
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APPARATUS FOR PRODUCING CEMENTITIOUS CONDUITS

Filed Jan. 12, 1959 4 Sheets-Sheet 3

FIG-7



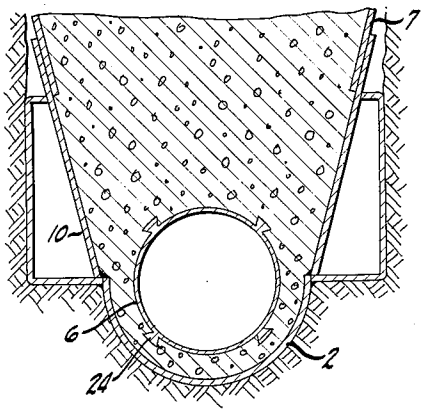


FIG-8

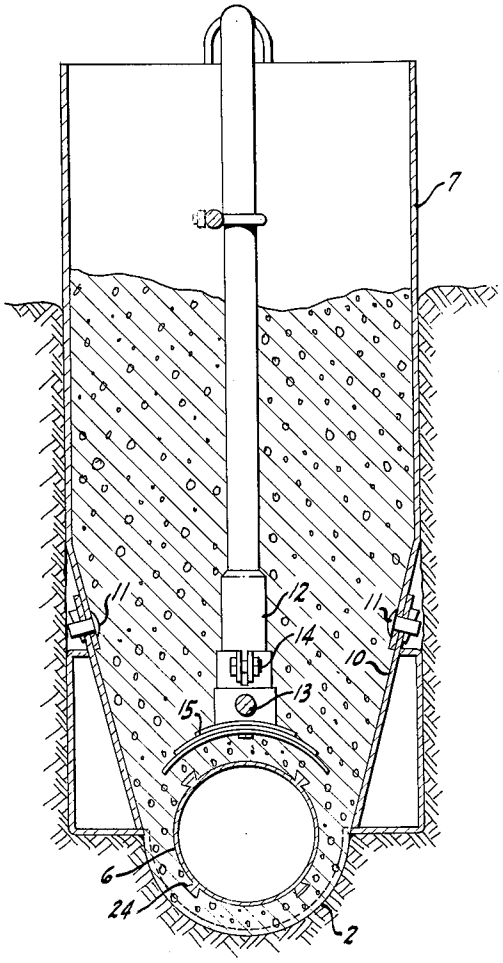


FIG-9

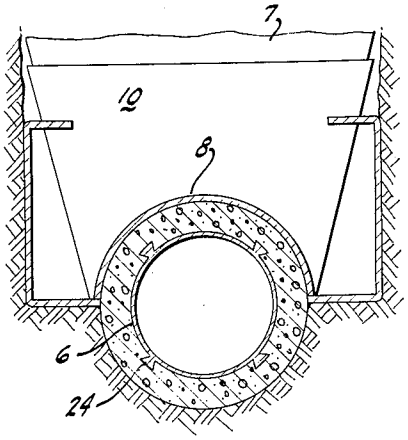


FIG-10

INVENTOR.
GILBERT D. WILLIAMSON

BY

Mellin and Hanscom

ATTORNEYS

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APPARATUS FOR PRODUCING CEMENTITIOUS CONDUITS

Filed Jan. 12, 1959 4 Sheets-Sheet 4

FIG-11

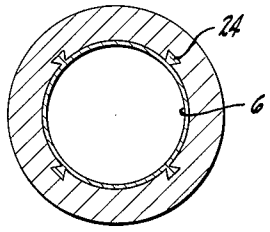


FIG-12

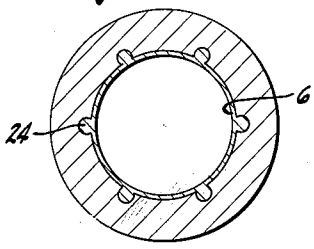


FIG-13

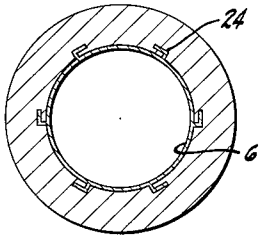
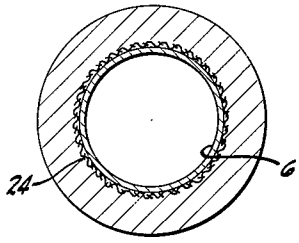


FIG-14



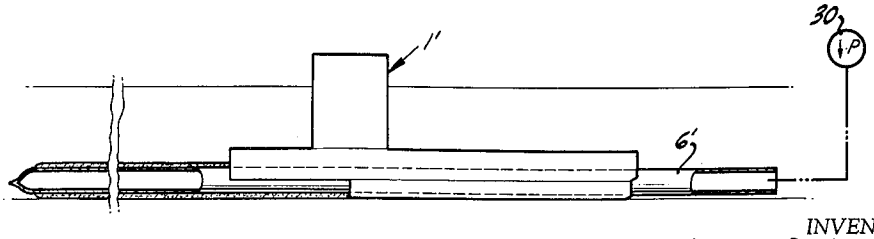


FIG-15

INVENTOR.
GILBERT D. WILLIAMSON

BY

Mellin and Hanscom

ATTORNEYS

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3,089,213

APPARATUS FOR PRODUCING CEMENTITIOUS CONDUITS

Gilbert D. Williamson, Yuba City, Calif., assignor to Plasti-Con Pipe Co., a corporation of California

Filed Jan. 12, 1959, Ser. No. 786,291
3 Claims. (Cl. 25—32)

This invention relates to the manufacture of cast-in-place pipe conduits and more particularly involves new and improved apparatus for producing cementitious conduits in a trench or ditch.

It is one object of this invention to generally improve upon prior art apparatus, thereby improving the manufactured conduit and effecting substantial savings in time and expended labors.

More specifically, it is an object of this invention to provide apparatus for producing cementitious conduits in a trench including a novel arrangement of a vibrator device in a hopper chute.

Another object is to provide apparatus for producing cementitious conduits in a trench and having a removable hopper assembly which may be disconnected from its supporting skid.

A further object of this invention is to provide in apparatus for producing cementitious conduits a skid support, said skid having an arcuately shaped trailing edge portion formed with an upwardly facing concave surface for receiving cementitious material thereon.

Another object is to provide an apparatus for producing a cementitious conduit in a trench, including a skid having a support means for a continuous inner casing, and also including means for biasing said casing toward said support means, thereby positioning said casing in spaced relation to the skid and the trench.

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

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

FIG. 1 is a side elevation of an apparatus for producing cementitious conduits in one continuous operation;

FIG. 2 is a plan view of the apparatus of FIG. 1 with the power equipment broken out;

FIG. 3 is a sectional view taken on lines 3—3 of FIG. 2;

FIG. 4 is a second embodiment of apparatus having a pivot connection between the hopper chute and the power assembly;

FIG. 5 is a sectional view taken on lines 5—5 of FIG. 4;

FIG. 6 is an alternate embodiment of a roller support means for an inner casing, to be used optionally for the longitudinal rod members shown in FIG. 3;

FIGS. 7–10 are transverse sections through the apparatus of FIG. 2, corresponding section line numbers being used to identify respective figures;

FIGS. 11–14 are various kinds of pipe sections which may be produced with different casing protuberances.

FIG. 15 illustrates the use of the above apparatus in combination with means for inflating a thin tubular casing.

Referring more particularly to FIG. 1 of the drawings, there is shown one form of improved pipe machine, generally indicated by reference numeral 1, and comprising a support skid 2, a power supply 3, and a winch 4 with tow line 5. The arrangement of these parts is substantially similar to apparatus known in the prior art and operates in the conventional manner; i.e., the pipe machine is disposed in the bottom of a trench and the tow line is anchored in advance thereof; power is developed by an engine to drive the winch, winding up the tow line and moving the apparatus along the bottom of the trench.

A continuous tubular casing 6 is disposed longitudinally of the trench in advance of the machine; and as the machine moves forwardly, the casing is supported by the skid in spaced relation to the bottom and sides of the trench. Cementitious material is deposited in a hopper 7, disposed near the rear portion of the skid, and the material is fed downwardly over and around the tubular conduit, thereby enveloping the casing in a continuous outer layer of material. The arch-like form of the conduit is produced in conventional manner by an upper screed means 8 which is carried rearwardly of the hopper chute. Various stages in the manufacturing process are illustrated in FIGS. 7–10 which are transverse sections of the embodiment shown in FIGS. 1–3.

One improvement over prior existing apparatus is providing the skid with an arcuately shaped trailing edge portion 9 formed with an upwardly facing concave surface for receiving cementitious material thereon. It will be noted that the discharge opening of the hopper overlies the trailing edge 9, and will deposit the cementitious material onto the concave surface, substantially as shown by the hidden lines. The prior art devices, which similarly utilized the gravity feed from a hopper, deposited the material directly onto the bottom of the trench. Since the earth bottom offered much resistance to the flow of material beneath the casing, the cementitious conduit was often either incomplete or possessed defective void spots, thus impairing the quality and strength of the conduit. However, the smooth surface provided by the trailing edge portion greatly enhances the flow of material around and beneath the tubular casing, thereby insuring a complete homogeneous encasement of the tubular casing.

Hopper assemblies of similar types of apparatus are formed integrally with the skid. This construction was largely dictated by requirements of rigidity between the hopper and skid support to insure uniform placement of the cementitious material in the trench. However, such a construction reduces the mobility of the apparatus, for, as the pipe machine approaches a roadway or other low-bridge, it must be removed from the trench and transported to the other side. Accordingly, there is provided in the illustrated embodiment of FIGS. 1–3 and 9 means for removably connecting the hopper to the skid support, and yet, there is no sacrifice in rigidity.

As best shown in FIG. 9, a hopper chute 10 is provided integrally with the skid and has vertically inclined plate members disposed near either side of the trench. The chute, including its plate members, extends upwardly from the region in which the conduit is to be produced. The hopper 7 is correspondingly provided with vertically inclined depending plate members which overlap the plate members of chute 10 and are removably connected thereto by a row of bolts 11, substantially as shown.

While vibrators are conventionally utilized in pipe casting machinery to aid in the compaction of cementitious material, the improved apparatus employs a novel arrangement of vibrating parts to enhance this function. FIG. 3 illustrates the specific means for securing a vibrator 12 to the hopper chute in which it is disposed. It includes a horizontal support member 13 extending across the chute centrally thereof, and a clamping means 14 for fastening the vibrator to the support member. A plurality of arcuately shaped leaf spring plate members 15 are connected by the clamping means to the vibrator device and its supporting member, best illustrated in FIGS. 3 and 9. The vibratory movement is transmitted to the plate members and accentuated by the resilient tips of each plate, thereby forcing the cementitious material downwardly and inwardly around the inner casing 6. By such arrangement, a single vibrator device is utilized to vibrate the

hopper chute and also act directly upon the cementitious material, thereby obtaining maximum benefits for compacting the material around the casing.

As indicated above, the apparatus shown supports the casing 6 in spaced relation to the trench, and, while it is known in the prior art that roller members 16 (FIG. 6) or, alternatively, rod members 17 (FIG. 7) may be used on the skid to accomplish this purpose, there is also provided herein a means for biasing the casing toward the support means. This has been done to properly align the casing as it is fed off the end of the skid. It should be evident that there would be a strong tendency for the casing to be buoyed upwardly by the cementitious material, tending to raise the casing off the support and displacing it from proper alignment. Also, the inclined angle of a continuous casing supported above the trench bottom would tend to displace the casing. Consequently, there is provided a resiliently mounted bow member 18 having a convex surface for making contact with the casing as it passes over the support means. The bow is preferably mounted from a projecting support 19 rigidly connected to the skid, and a coiled bumper spring 20 urges the bow member downwardly against the casing 6 as shown in FIG. 3. The bow is also pivoted about a horizontal axis 21, said axis being transverse to the casing's line of travel. Therefore, while the bow is restrained from moving longitudinally with the casing, it may pivot upwardly to accommodate abnormal displacements or protruding obstructions on the outer surface of the casing. An alternative arrangement of a bow member is shown in FIG. 4, and while not being as durably constructed, it would perform the same function.

FIGS. 4 and 5 also illustrate a pivot connection which may be utilized to shorten the length of the skid. Inasmuch as the skid must be able to travel along the bottom of a trench the utility of the apparatus is limited by the severity of the trench curves. For, if the apparatus is extremely long it can travel only those trenches which are perfectly straight; whereas, if the apparatus is comprised of several units, each pivotally connected to adjacent sections, the apparatus can be made to turn corners. Accordingly, another form of this invention teaches a skid support which is sectionalized and provided with a pivot juncture. Referring more particularly to FIG. 4, there are shown sections 22 and 23 of a skid support. Each section is provided with plate members, top and bottom, the plate members of each section overlapping the respective plate members of the other. As illustrated, the plate members of section 22 have an opening for receiving a projecting pin member therein, and a pin member is provided on the plate members of section 23 for this purpose.

Another aspect of this invention is the formation of a cementitious conduit about an inner casing which has a plurality of protuberances 24 projecting radially from its outer surface. FIGS. 11–14 show various forms of protuberances which may be provided for insuring rigid encasement of the casing within the cementitious conduit. In order to produce a product of this character, the protuberances on the casing are arranged circumferentially to define continuous longitudinal portions of casing surface without such obstructions. Then, the support means of the skid, such as the rod member as shown in FIG. 7, will contact certain of the casing surfaces described and the casing will pass freely over the skid. The circumferential spacing of these surfaces likewise enables the biasing means to engage the casing without encountering a major obstruction such as a protuberance.

The protuberances of FIGS. 11, 12 and 13, respecively, illustrate a T-lock, rounded hobs, and a projected flange. FIG. 14 shows a coarse wrapping material, such as burlap, which also may be utilized to obtain the desired effect. In the latter instance, it is preferable to provide the roller support means illustrated in FIG. 6 in place of the rod members.

The inner tubular casing 6 may be formed of metallic, plastic or pulp products, and each substance has been utilized at various times in the prior art to obtain a particular quality of conduit. In each instance, however, the body of the casing thus utilized has been of sufficient thickness to support the crown portion of the cementitious material, and this is true whether a one or two step process be employed. It is, of course, desirable to use only that thickness of material which is necessary to support the crown, since additional material is usually wasteful and proportionately more costly.

Therefore, a method is provided which utilizes a thin plastic casing 6′ which, by itself, could not sustain the crown portion of the cementitious conduit, FIG. 15. The end of the casing is initially sealed as shown to form an enclosed chamber. This may be done by fusing shut the end of a plastic casing, or, in the case of other materials, a transverse sheet may be sealingly connected across the tubular opening. The casing is then inflated by means of an air pump 30 until sufficient fluid pressure is obtained to sustain a predetermined thickness of cementitious material. Thereafter, apparatus 1′, such as described hereinabove but not limited thereto, can be utilized to envelop the casing with a layer of cementitious material. As the apparatus approaches the end of the pressurized casing, the operation is briefly interrupted; and after the crown portion of the cementitious material has sufficiently solidified, the casing is relieved of fluid pressure; then another casing is sealingly connected to the preceding one, the pressure is re-established and the operation is continued. When the prescribed length of conduit is formed, the fused end of the casing, or other closing means, is removed.

If desired, the conduit may be manufactured in sections. The beginning of each section is provided with a tube casing closure which is subsequently removed after that section is completed. Thereafter, connecting joints may be formed between the adjacent sections by conventional methods already known in the pipe manufacturing art.

The application of fluid pressure on the casing will produce some expansion, or inflation. The amount of such expansion will depend largely upon the kind of material, the thickness of the casing, and the operating pressures utilized. But the fact that some expansion will result allows the manufacture of a prestressed re-inforced cementitious conduit. This conduit is formed in the following manner: Before applying a source of fluid pressure to the casing, a metal cage, such as would be formed with a coiled wire, is placed therearound. Then, the fluid pressure is applied, and the casing will tend to expand, stressing the wire coils. Sufficient pressure is applied to expand the metal cage until it permanently deforms, thereby prestressing the metal. Thereafter the tubular casing is enveloped with the cementitious material as described above.

The above described methods, which include the steps of applying fluid pressure to a casing, have the additional advantage in that the casing will simultaneously be tested for leaks. Any serious break in the casing will allow fluid to escape and thereby prevent the necessary pressures from being attained. The leak may be detected by introducing a colored fluid, or other such methods as have been utilized, to trace or detect fluid flows.

It will be obvious to those skilled in the art of manufacturing cast-in-place pipe conduits that various combinations and arrangements of apparatus may be employed, and it is to be understood that the forms of this invention herewith shown and described are to be taken as preferred examples thereof; and, various changes in the shape, size and arrangement of certain parts may be made without departing from the spirit of this invention or the scope of the attached claims.

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

1. Apparatus for producing cast-in-place conduits in a trench, comprising a skid support adapted to be disposed in and moved longitudinally along the bottom of a trench; means on said skid for supporting a continuous tubular casing in spaced relation to the bottom and sides of said trench, said casing having been disposed longitudinally in advance of said skid; means mounted on the skid support for resiliently biasing said conduit toward said support means including a resiliently mounted bow member having a convex surface for making contact with said casing; a hopper chute mounted to said skid support and adjacent to but rearwardly of said bow member having a discharge opening overlying the continuous tubular casing, whereby cementitious material deposited in said hopper chute will envelop and enclose the casing; and means for advancing the skid and hopper chute in the trench and relative to the continuous tubular casing, whereby said casing remains stationary relative to said trench and is resiliently held upon said support means by engagement with the convex surface of said bow member as said hopper chute passes over and along said casing upon advancement of said skid support.

2. In apparatus for producing cast-in-place conduits in a trench comprising a skid adapted to be disposed in a trench and moved longitudinally along the bottom surface thereof; means on said skid for supporting a conduit form in spaced relation to the bottom and sides of said trench, means defining a conduit form and adapted to be supported upon said support means; a hopper chute mounted to said skid above said conduit form and rearwardly of said supporting means for depositing cementitious material into said trench and enveloping said conduit form, a support member disposed within and extending longitudinally across said chute, a vibrator means disposed centrally within said hopper chute and supported from said support member, said vibrator means

including at least one arcuately shaped leaf spring connected to a vibrator device, said leaf spring having laterally extending resilient tips on either side of said conduit form to accentuate vibratory movement, thereby forcing cementitious material downwardly and inwardly around the conduit form as said hopper chute is being advanced thereover and longitudinally of said trench.

3. The apparatus of claim 1 wherein said bow member is pivotally mounted upon a horizontal axis transverse of said skid and further including a spring member urging said bow member downward against said casing and holding said casing upon said support means.

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