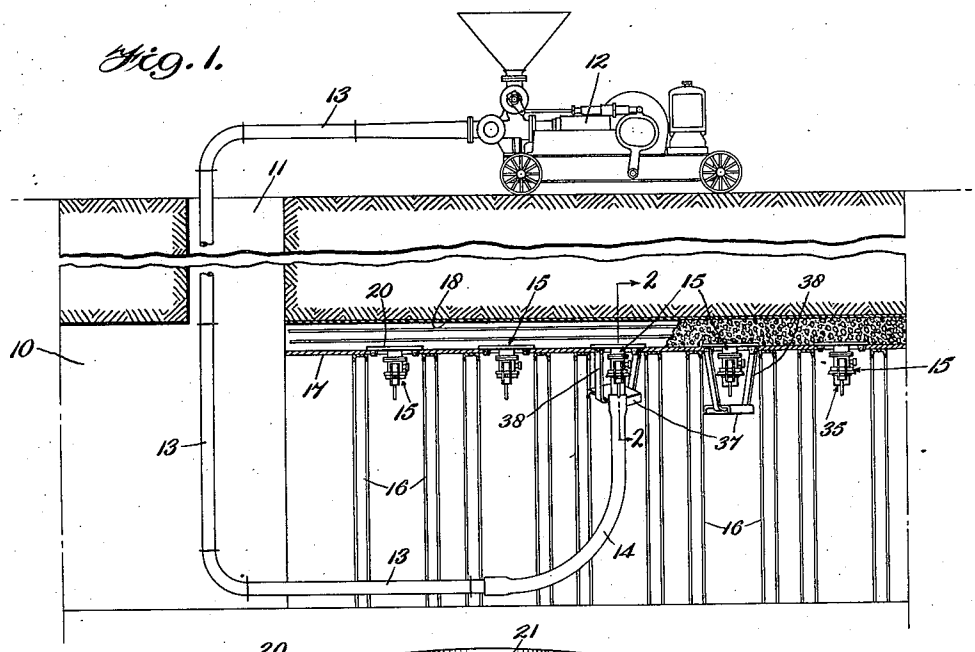
Aug. 3, 1937. C. I. LONGENECKER 2,089,149

PLASTIC CONCRETE INDUCTION APPARATUS FOR TUNNEL FORMS

Filed Aug. 17, 1934 2 Sheets-Sheet 1

Fig. 1.



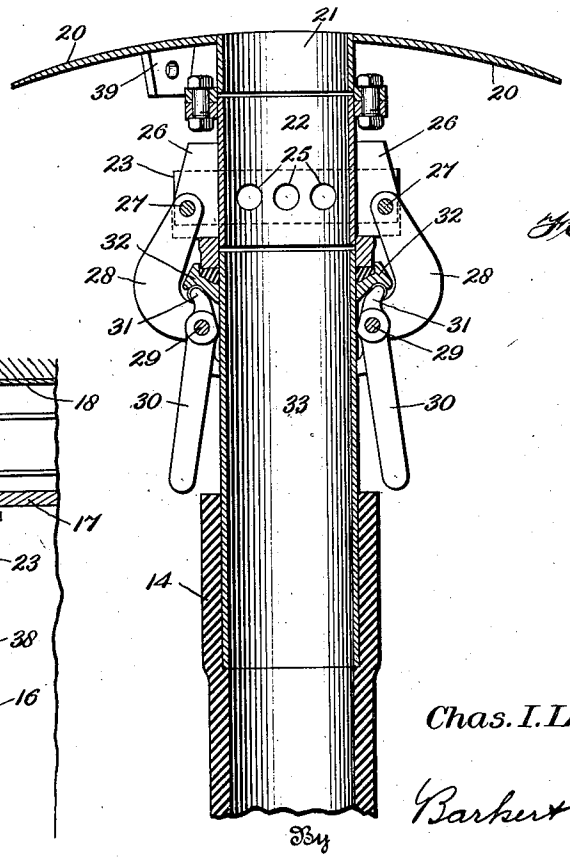
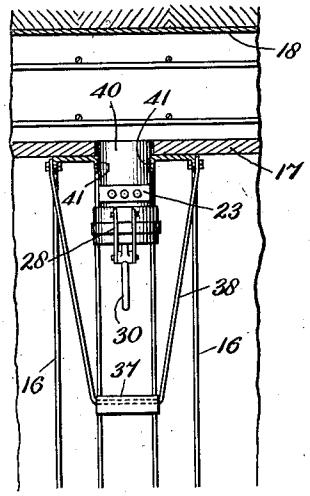


Fig. 2.

Fig. 5.



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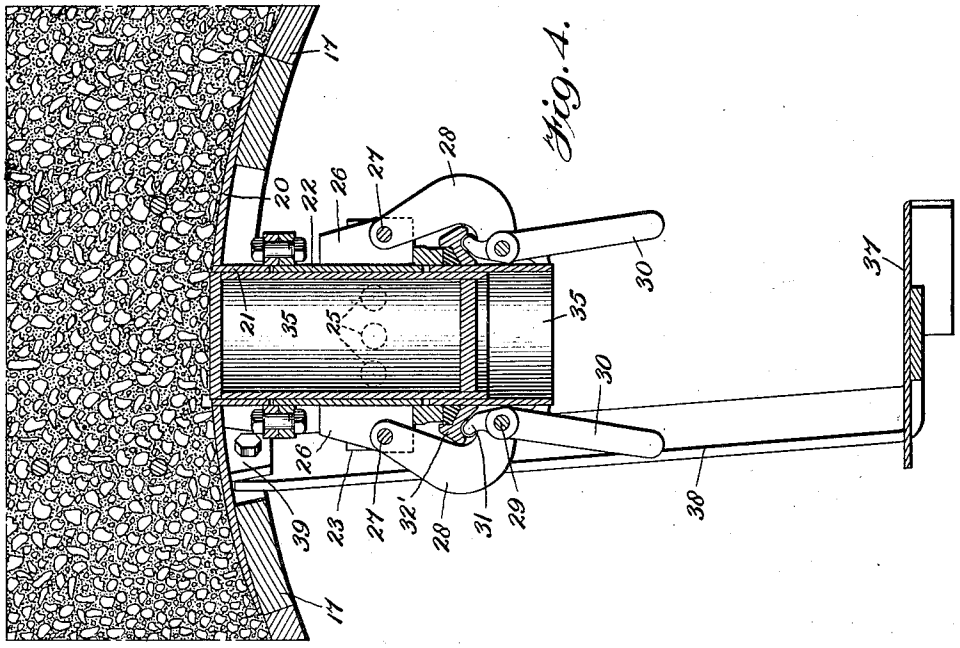


Fig. 4.

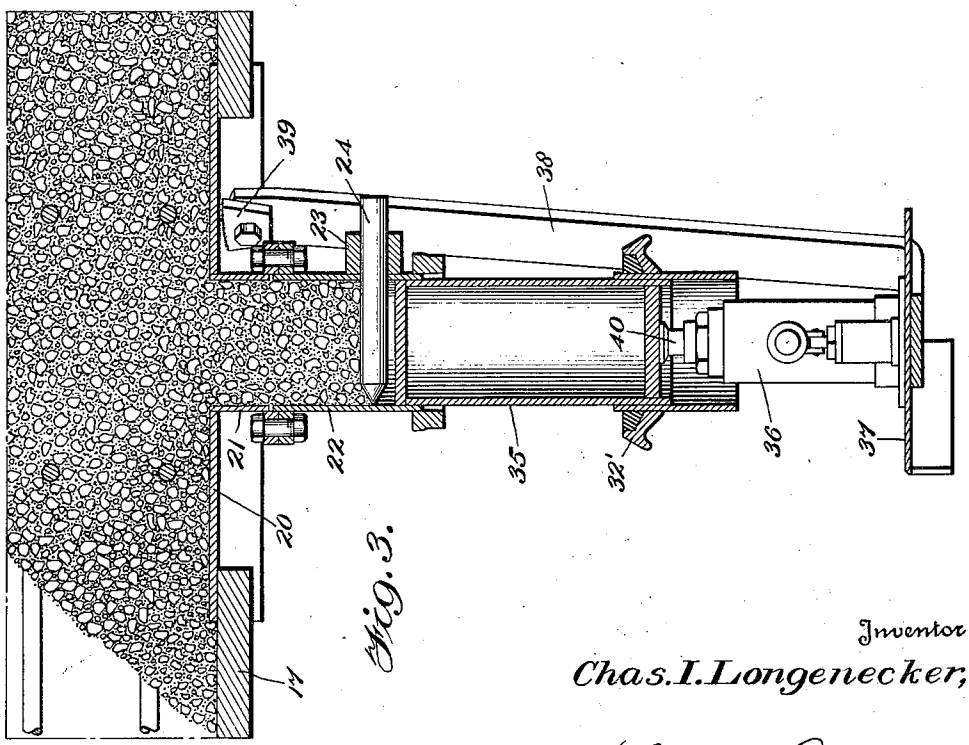


Fig. 3.

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Patented Aug. 3, 1937

2,089,149

UNITED STATES PATENT OFFICE

2,089,149

PLASTIC CONCRETE INDUCTION APPARATUS FOR TUNNEL FORMS

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Application August 17, 1934, Serial No. 740,352

7 Claims. (Cl. 25—1)

This invention relates to apparatus for introducing plastic mixtures into forms and has for its principal object to provide means for facilitating the introduction of plastic concrete mixtures into the forms employed in the construction of underground tunnels, sewers and similar conduits.

In the construction of underground conduits of the type referred to, the forms frequently contain heavy reinforcements of steel rods or shapes which interfere with the placement of the plastic mixture, more especially in the arched portions thereof, and the present invention has for a further object to facilitate the placement of such concrete mixtures in these arched portions.

The invention has been primarily developed for use in connection with pressure pipe line concrete transportation systems wherein the plastic mixture is forced through a pipe line by means of a mechanical pump of the reciprocating type known to the trade as Pumpcrete, but as will appear more fully below it is susceptible of use with other forms of pressure inducing means.

With the above and other objects in view, which will appear as the description proceeds, the invention consists in the novel details of construction and combinations of parts more fully hereinafter described and particularly pointed out in the appended claims.

Referring to the accompanying drawings forming a part of this specification, in which like reference characters designate like parts in all the views,

Figure 1 is a diagrammatic longitudinal vertical sectional view of a tunnel bore, showing the concrete forms in place therein and illustrating the use of the present invention in connection with a pressure pipe line distribution system which is fed by a Pumpcrete.

Figure 2 is an enlarged vertical sectional view through the apparatus constituting the present invention, taken approximately upon the plane indicated by the line 2—2 of Figure 1, looking in the direction of the arrows, and showing the mixture supply conduit connected to the induction apparatus.

Figure 3 is a vertical sectional view taken at right angles to Figure 2, the supply conduit having been disconnected, the shut off valve closed and the plunger or piston which is employed for permanently closing the induction conduit until the mixture has set being shown in its initial position.

Figure 4 is a view similar to Figure 2 but illustrating the closing plunger in its final position, and

Figure 5 is a fragmentary view similar to Figure 1, showing a slightly modified form of the invention.

Referring more particularly to Figure 1, 10 indicates a horizontal underground bore for a tunnel, sewer or other similar conduit, which may be connected by a vertical shaft 11 with the surface of the ground. A suitable pressure inducing means 12, here shown as being a reciprocating concrete pump, is arranged to force the plastic mixture through a pipe line 13 which may descend through the shaft 11 to the horizontal bore 10 substantially as indicated. Said pipe line 13 may terminate in a flexible hose section 14 which is adapted to be successively connected with a series of induction devices 15, which are supported at suitably spaced intervals by means of the forms which are to give the concrete its final shape. These forms are more or less diagrammatically indicated in Figure 1 as comprising channel shaped arch members 16, which support the sheathing 17 a suitable distance below the lining 18 to provide the desired thickness of concrete in the tunnel arch, all as is well known by those skilled in this art.

Referring more particularly to Figures 2, 3 and 4, the induction means comprises a curved plate 20 to which is secured by welding, or otherwise, a short section of pipe 21 of substantially the same diameter as that of the pipe line 13. The said short pipe section 21 has readily detachably secured to it second pipe section 22, which includes a shut off valve 23 of any suitable type but here shown as being of a construction similar to that described and claimed in the co-pending application of John C. Merwin and Rudolph F. Lindow, filed November 18, 1933, Serial No. 698,716 entitled Valve for controlling plastic concrete mixtures. It may be briefly explained here that this valve comprises a plurality of pins 24, see Figure 3, which are manually insertable through the spaced transverse openings 25 provided in the pipe section 22, and which pins because of the stowing property of the plastic concrete mixture will effectively prevent back flow of the mixture through the induction conduit, when flow through the pipe line is stopped, and the supply conduit disconnected as will be explained more fully below.

The pipe section 22 is also provided with a plurality of ears 26 to which are pivotally connected as at 27 curved links 28. The said links have pivotally connected to them at their lower

ends as at 29 hand levers 30, which are provided with extensions 31 adapted to engage an annularly grooved flange 32 which is rigidly carried by a pipe section 33 received within the discharge end of the flexible hose 14, as clearly shown in Figure 2. The members 28 and 30, with their connections, constitute a quick operating clamping means for providing a tight joint between the hose nipple 33 and the valved pipe section 22, all as is set forth in the co-pending application of Charles F. Ball, filed May 26, 1933, Serial No. 673,059, entitled Pipe coupling, now Patent No. 1,991,343, granted February 12, 1935.

From what has been thus far disclosed it will be obvious that concrete mixtures forced by pump 12 through the pipe line 13 will pass by way of the flexible hose 14 and nipple 33 to the short pipe sections 22 and 21 and into the space between the form sheathing 17 and the tunnel lining 18. The internal diameter of all of the elements making up this concrete conduit being the same throughout, the flow of the mixture will be free and unimpeded. The operation is continued until the space between the sheathing 17 and lining 18 all around the induction conduit has become filled with the plastic mixture, and when this is indicated by undue laboring of the pump 12 the latter may be stopped and the pins 24 inserted through the openings 25 to partially restrict the pipe section 22 and through stowing of the mixture at such restrictions to prevent the back flow of the mixture. The clamping levers 30 of the joint between the nipple 33 and the pipe section 22 may then be moved to unlock the joint, whereupon the flexible hose 14 and nipple 33 may be disconnected from this particular induction device and transferred to the next one where the operation will be repeated.

If the concrete in the pipe sections 21 and 22 was allowed to remain therein until it set, these said sections, together with the curved plates 20 and the valve pins 24 would be rendered unfit for further use, at least until after the hardened concrete plug had been drilled therefrom. In order that such concrete as occupies the pipe sections 21 and 22 when the valve 23 is closed and the nipple 33 is detached may be removed therefrom while still plastic, I provide a closed plunger or piston 35, see Figures 3 and 4, of a suitable diameter to enter into the said pipe sections 21 and 22. Inasmuch as the pins 24 of valve 23 are spaced somewhat above the lower end of section 22, the closed end of the plunger 35 may be started into the section 22, as is illustrated in Figure 3. A suitable hydraulic or other jack 36 is positioned beneath the plunger 35, being seated upon the platform 37 of a stirrup 38 which is pivotally hung from suitable ears 39 rigidly carried by the plate 20.

By operating the jack 36 in the well known manner, its movable element 40 may be forced upwardly, whereby the plunger 35 may be likewise forced upwardly with great pressure, so that when the pins 24 are withdrawn, the concrete above them will not only be prevented from dropping out through the induction conduit, but on the contrary will be forced upwardly and into the space between the plate 20 and the lining 18 thereby further compacting the mass in the form.

The plunger 35 is provided with an annularly grooved flange 32' similar to the flange 32 of the nipple 33, and when the said plunger has been forced upwardly to the position illustrated in Figure 4, the locking levers 30 may be again manipulated to cause their extensions 31 to engage the flange 32' of the plunger, whereby the latter may be securely held in its raised position with all of the concrete forced out of the induction passage. The plunger 35 is permitted to remain in this position until the concrete mixture has set, and may be removed with the rest of the apparatus when the supporting forms are taken down. Inasmuch as all the concrete has been forced out of the induction passage by the plunger 35, the apparatus is in condition for immediate re-use, without the necessity of having to remove any hardened concrete plug.

Instead of making the induction passage of two separate pipe sections, such as 21 and 22 illustrated in Figures 2, 3 and 4, it is obvious that it may be made of a single pipe section such as 40 in Figure 5, which section is provided adjacent its lower end with the cut off valve 23 and with the clamping levers 30 substantially as shown. In this modified form of the invention, section 40 instead of being provided with a curved plate which rests upon the form sheathing, is instead welded as at 41 to the channel shaped form members 16. The stirrup 38 is also carried by these form members 16, substantially as indicated.

It is obvious that those skilled in the art may vary the precise details of construction, as well as the arrangement of parts, without departing from the spirit of the invention, and therefore it is not wished to be limited to the above disclosure, except as may be required by the claims.

What is claimed is:

1. Apparatus for facilitating the pressural introduction of plastic concrete mixtures into forms, comprising a conduit section arranged to feed the mixture into the form under an initial pressure; a shut-off valve for preventing back-flow of the mixture when said initial pressure is relieved; and pressure means independent of said initial pressure arranged when said shut-off valve is opened to force into the form that portion of the mixture remaining in said conduit section when said initial pressure was relieved.

2. Apparatus for facilitating the pressural introduction of plastic concrete mixtures into forms, comprising a conduit section arranged to discharge the mixture into the form under an initial pressure; a shut-off valve in advance of the discharge port of said section, for preventing back-flow of the mixture when said initial pressure thereon is relieved; and pressure means movable in said conduit independently of said initial pressure when said shut-off valve is opened, to discharge the portion of the mixture remaining in the conduit section between the valve and the discharge port.

3. Apparatus for facilitating the pressure placement of plastic concrete mixtures into forms, comprising a conduit section arranged to be positioned to discharge the mixture into the form; a shut-off valve in advance of the discharge port of said section, for preventing back-flow of the mixture when forward pressure thereon is relieved; means arranged to be forced through said section when said valve is opened to discharge the mixture remaining in said section; and means for holding said last named means in advanced position while the concrete mixture is setting.

4. Apparatus for facilitating the pressure placement of plastic concrete mixtures into forms, comprising a conduit section arranged to be positioned to discharge the mixture into the form; a shut-off valve for temporarily preventing back-flow of the mixture when forward pressure there-

on is relieved; a plunger arranged to be forced through said conduit section when said valve is opened, to discharge the mixture remaining in said section into the form; means for forcing said plunger; and a stirrup arranged to be positioned to support the plunger forcing means.

5. Apparatus for facilitating the pressure placement of plastic concrete mixtures into forms, comprising a plate arranged to be supported by the form; a conduit section carried by said plate, for discharging the mixture into said form; a shut-off valve in said section for temporarily preventing backflow of the mixture through said section when forward pressure thereon is relieved; a plunger arranged to be forced through said section when said valve is opened, to discharge the mixture remaining in the section into the form; and a quick-detachable coupling between said conduit section and plunger, for maintaining the latter in advanced position during setting of the concrete mixture.

6. The method of placement of plastic concrete mixtures into forms, which comprises introducing said mixture into the form in a confined stream under pressure; breaking said stream at a point removed from the form, while restraining that portion thereof adjacent the form against reverse movement; subsequently forcing said adjacent portion into the form by pressure which is independent of that employed to move the original stream; and retaining said last named portion in the form while the mixture is setting.

7. The method of placement of plastic concrete mixtures into forms, which comprises introducing a confined stream of the mixture under pressure into the form until the latter is substantially filled; breaking said stream at a point removed from the form, while restraining that portion thereof adjacent the form against reverse movement; subsequently removing said restraint and applying pressure independent of that which moves the original stream to said adjacent portion to force it into the form and thereby further compact the mass therein; and maintaining said last named portion in the form while the mixture is setting.

CHARLES I. LONGENECKER.