Aug. 8, 1967 H. STEIRO 3,334,390

END RING TROWELLING ATTACHMENT FOR CONCRETE PIPE MAKING APPARATUS

Filed Jan. 4, 1965 2 Sheets-Sheet 1

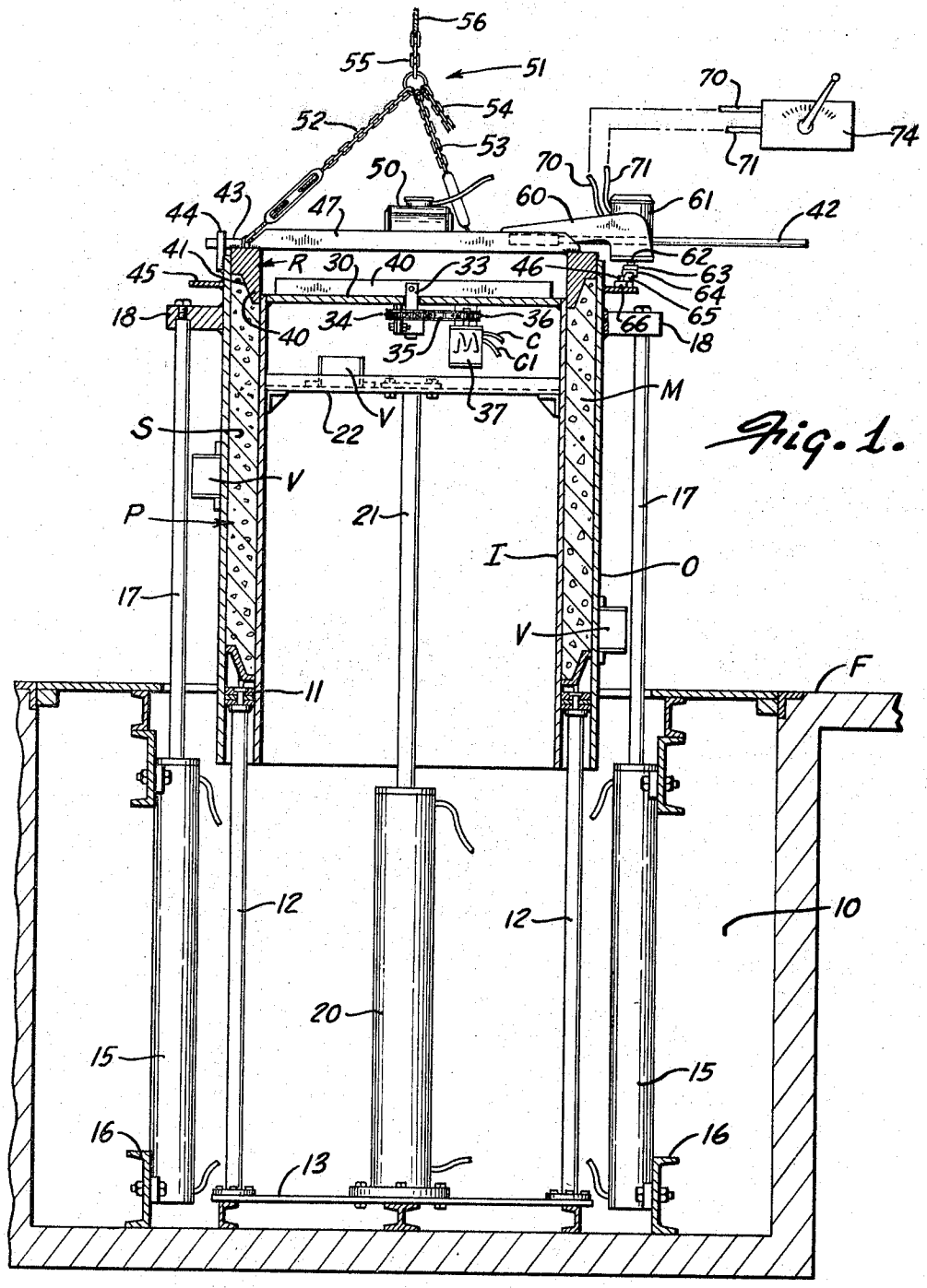


Fig. 1.

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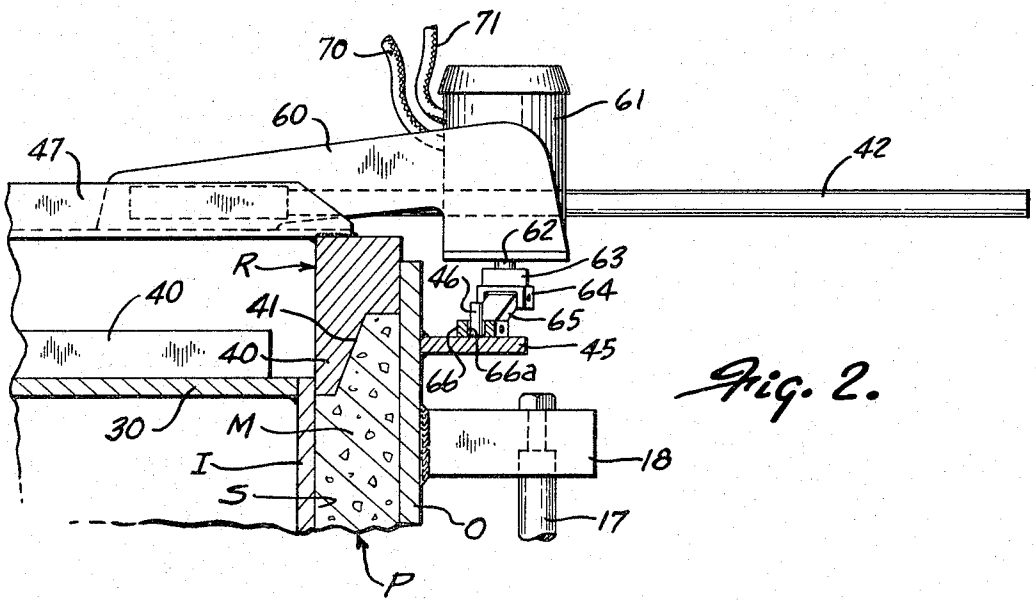


Fig. 2.

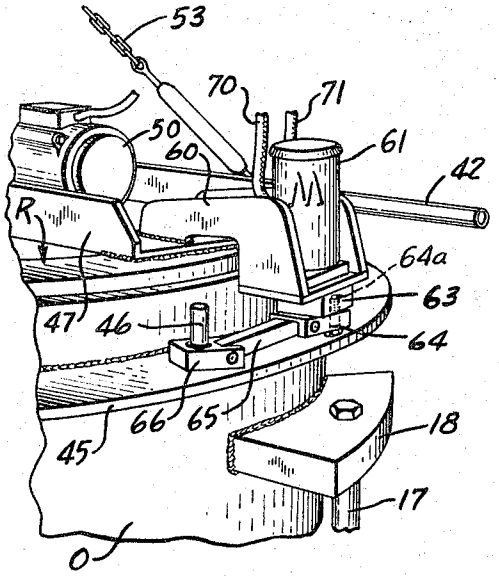


Fig. 3.

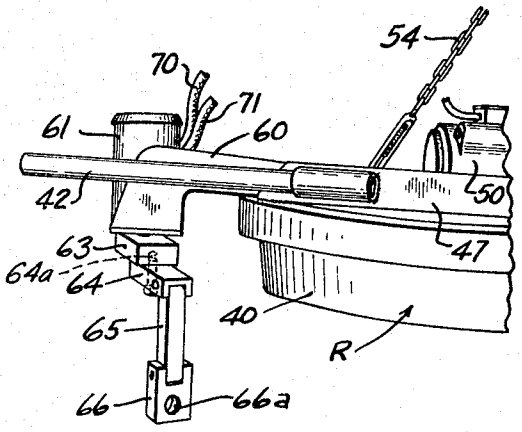


Fig. 4.

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END RING TROWELLING ATTACHMENT FOR CONCRETE PIPE MAKING APPARATUS

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9 Claims. (Cl. 25—39)

This invention relates generally to apparatus for making concrete pipe from no-slump concrete and utilizing inner and outer concentric molds disposed in a vertical position. No-slump concrete is poured into the annular space between the molds and vibrated so it will be quickly settled and compacted, and the molds are then stripped from the finished but uncured pipe.

The present invention finds particular utility in the manufacture of large sizes of pipe and is in the nature of an improvement in the apparatus shown in my U.S. Patent No. 3,047,929, issued Aug. 7, 1962, and No. 3,141,222, issued July 21, 1964, both entitled, "Concrete Pipe Making Apparatus."

Large diameter pipe of the type made on the above type of apparatus must be quickly settled in the forms and smoothly finished for good strength, high density and low permeability. The end sections of this pipe must also be quickly and accurately formed and smoothly finished. Pipes made while the molds are positioned with their axes in a vertical position presented no particular problem as to the proper formation and finish of the lower end of the pipe. This lower end was the first end to be poured and received not only the full period of vibration of the molds, but also had the entire weight of the rest of the concrete between the molds bearing downwardly on it. The space between the top ends of the molds, however, was the last to be filled with the concrete mix, received vibration during a considerably shorter period of time and required the application of auxiliary pressure on the top forming ring, usually by means of the operator simply bearing down on the ring or by the use of tamper rings or a ring having compression flanges. The top edge of the pipe thus required considerably more attention, but nevertheless was not properly trowelled to insure closing of the void spots and a smooth finish.

Accordingly, the present invention provides concrete pipe making apparatus of the type using vertically disposed, concentric inner and outer molds for making large size pipe of no-shlump concrete, which apparatus overcomes the above noted shortcomings of the prior art concerning the formation of the upper end of the pipe.

A more specific aspect of the present invention relates to apparatus of the type mentioned above having a top end forming header with means to oscillate the latter while it is in position between the molds. The action is such that the top end of the pipe is quickly compacted, the molds held in properly spaced position and the pipe accurately formed, and a smooth finish imparted thereto.

Additionally, the header itself carries vibrator means which quickly settles the concrete between the upper ends of the molds.

Still another more limited aspect of the invention is to provide apparatus of the above type which is capable of use together with a mechanical distributor attached to the upper end of the inner mold, and without removing or altering either the header or the distributor attachments.

These and other objects and advantages of the present invention will appear hereinafter as this disclosure progresses, reference being had to the accompanying drawings, in which:

FIGURE 1 is an elevational view, in section of apparatus embodying the present invention;

FIGURE 2 is a fragmentary, sectional view of part of the apparatus of FIGURE 1, but on an enlarged scale;

FIGURE 3 is a fragmentary perspective view of the connection between the outer mold and the end ring;

FIGURE 4 is a fragmentary perspective view of the connection shown in FIGURE 3, but in the disconnected position with the ring removed from the molds.

FIGURE 1 shows the apparatus with the molds filled with concrete and the end ring has then been lowered into position between the upper ends of the molds.

Referring in greater detail to the drawings, a large pit **10** is formed below the level of the floor F, and it is into this pit that the inner core mold I and the outer mold O can be lowered after the pipe P is completed, to thereby fully expose the finished pipe at the floor level for immediate conveyance elsewhere. The pipe is supported on the stationary support ring **11** which is fixed to the upper ends of the support columns **12**. The columns are rigidly fixed to the base member **13**, and are located between the inner and outer molds when the latter are retracted downwardly into the pit.

A pair of large hydraulic cylinders **15** are rigidly fixed in the pit to the channel iron braces **16**. The piston rods **17** of these large cylinders are secured to the outer mold O by the braces **18** and are extendable from their cylinders to raise the outer mold as shown in FIGURE 1.

A large central hydraulic cylinder **20** is fixed at its lower end to base **13** and its piston rod **21** is rigidly fixed at its free end to the inner mold I by the rigid cross brace **22**.

Appropriate hydraulic conduits (not shown) are connected to the ends of the double acting cylinders **15** and **20**, and to suitable hydraulic pressure source and controls (not shown). If a more complete description of the structure and operation above referred to is deemed to be either necessary or desirable, reference may be had to the above mentioned Patent No. 3,047,929.

The inner core mold I has a flat top **30** comprised of a sheet steel plate rigidly secured in any suitable manner, as by welding. A central shaft **33** extending through top **30** has a sprocket **34** secured adjacent its lower end beneath the top **30**. The shaft is rotatably driven through its sprocket by an endless chain **35** from a sprocket **36** of a hydraulic motor **37**. Motor **37** provides a power means and is rigidly secured to the top and shaft **33** is rotatably mounted in suitable bearings (not shown) rigidly fixed to the lower side of the top **30**. Flexible conduits C and C1 extend downwardly from the motor for connection to the hydraulic system (not shown) and act as supply and exhaust lines for the fluid of the motor to which they are detachably connected in the conventional coupling manner.

The upper end of shaft **33** forms a connection with an outwardly extending distributing arm **40** which extends in radially opposite directions from the shaft and at each end terminates short of the diameter of the inner core. The arm is shown as being a straight flat blade which is positioned in a vertical direction on one of its longitudinal edges.

The motor **37**, the bearing mountings for the shaft, and the drive connection between the motor and shaft are all located on the underside of the top and are protected by it from the concrete mix which is dumped onto the flat top of the inner mold.

When the apparatus is in the position shown in FIGURE 1, the mix material M is deposited (for example by automatic conveying equipment as shown in said Patent No. 3,047,929) on the top of the inner core mold at a rapid rate. As this material is being deposited, the motor **37** rotates the distributor arm **40** which acts to distribute the material equally around the top and si-

multaneously pushes it outwardly into the annular space S between the inner and outer molds. This loading and distributing process is continued until the molds are filled, and during which time vibrators V act to rapidly settle the no-slump concrete into the concentric molds.

The above described mechanical distributor insures continual and even distribution of the material as the latter is dumped at a considerable rate onto the top of the inner core. No build up of material occurs to spill over the sides of the apparatus, and the time of loading and labor required has been substantially reduced over prior apparatus.

After the space between the molds has been filled the top end of the pipe is formed by means of a tamping ring R and associated means to be described. In the embodiment shown for illustrative purposes, the top end is formed as the so-called "groove" end because the ring has an inner projection 40 which forms an inner groove 41 in the finished pipe. Other shapes could be formed on the top end of the pipe with the present invention, such as a spigot end of a pipe. The term "top end" of the pipe is used herein as a matter of convenience and is used to denote the position of the pipe end while being made.

The ring R may be and is shown here as being cross-sectional shape as shown in my U.S. Patent No. 3,047,929 in FIGURES 4 and 6 thereof. The ring R of the present invention is also pressed downwardly into the concrete by the operator bearing down on the handle 42 attached by welding to one side of the ring while the other side of the ring is held in place by an arm 43, welded to the ring and held captive under a bracket 44 which is fixed to the top end of the outer mold. Thus the operator can bear downwardly with the desired degree of pressure during the trowelling action now to be described. The operator can also periodically lift the ring by the handle 42 to inspect the top edge of the pipe to be sure there is sufficient concrete in between the molds and also to determine when the top end has been properly formed.

A radially extending flange 45 is welded around the top edge of the outer mold. This flange is located a small distance below the uppermost edge of the outer mold. This flange reinforces the upper end of the outer mold and may be made of steel and on the order of one-half inch in thickness and three inches in width. A vertical pin 46 is welded to the top surface of this flange and has a free end extending upwardly therefrom.

The ring R has a support 47 which extends centrally across the ring at its upper side and is rigidly welded at either end to the ring. Support 47 takes the form of a large steel channel of U shape cross section. An electric motor vibrator 50 is fixed to the center portion of the support 47 for vibrating the ring while it is in end forming position.

The entire ring including its associated parts is suspended centrally above the molds by the block and tackle chain hoist indicated generally as 51 and suspended from the ceiling (not shown) or other overhead structure. Three chains 52, 53 and 54 connect the ring to the single chain 55 attached to the tackle 56. This suspension means permits the ring to be vertically moved between the operative position shown in FIGURE 1 and an inoperative position away from the molds. By means of this suspension, the ring is also capable of being oscillated about a vertical axis extending centrally through the ring and while between the molds as will now appear.

Power means are provided for oscillating the ring while it is in operative position between the molds as follows. A bracket 60 is welded to the channel support 47 and, when the ring is in operative position, the member 47 protrudes radially outward of the ring and just above the flange 45. A hydraulic motor 61 is rigidly fixed on bracket 60 and its drive shaft 62 extends downwardly therethrough and has an eccentric arm 63 fixed thereto for rotation with the shaft. A series of pivotally connected links 64, 65, and 66 connect the arm 63 with pin 46.

More specifically, link 66 has a hole 66*a* which slips over the pin, thus forming a convenient and quick detachable connection between the ring and the outer mold. Arm 63 is pivotally connected to link 64 in a conventional manner by a cap bolt 64*a* extending freely through link 64 and threaded into arm 63 (FIGURES 3 and 4) or as shown, for example, like the pivotal connection between members 44 and 45 in U.S. Patent No. 3,108,421, issued Oct. 29, 1963.

Fluid conduits 70 and 71 connect the hydraulic motor with a conventional fluid pressure source (not shown) and the operator can cause rotation of the motor shaft when the ring R is in position between the molds. This causes the ring to be quickly oscillated through a short travel, such as about two inches, as determined by the flexible linkage formed by the pivoted links. While this oscillation is taking place, the vibrator is also turned on and the operator bears down with sufficient pressure to cause compaction of the concrete mix within the molds.

The excess concrete works its way past the ring before the latter assumes its final position and is forced out the top of the molds. The ring is of such cross-sectional size that it fits snugly between the molds and thereby insures proper relationship between the molds and a finished pipe of uniform wall thickness and precise shape at the top end.

The oscillation of the ring under power provides excellent trowelling action and results in a particularly good finish on the the pipe end.

The speed of the oscillation can be regulated by a control valve 74 which controls the rate of flow of the oil to the motor. The oscillation process takes only a short time on the order of a minute more or less.

With the above combination, the mechanical distributor distributes the concrete mix to fill the space between the molds and when this is done, the distributor need not be removed in any way. The trowelling and forming ring can be lowered into position above the distributor and extends downwardly therearound. If more mix is needed during the formation of the pipe top end, the ring can be momentarily lifted and the distributor arm then actuated to again fill the mold space.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention:

What is claimed is:

1. Apparatus for making concrete pipe from no-slump concrete comprising, a vertically positioned tubular outer mold and an inner mold concentric therewith to form an annular space between said molds into which no-slump concrete can be poured to form a pipe, a separate end ring adapted to be positioned independently of and between the upper ends of said molds so as to hold them in proper radially spaced relationship, said ring being of such cross sectional shape so as to form the finished top end of said pipe, and power means to oscillate said ring relative to each of said molds and about a vertical axis extending centrally through said ring and while said ring is between said molds to thereby form and trowel the top end of said pipe.

2. Apparatus as defined in claim 1 including detachable connecting means between said ring and one of said molds and including said power means.

3. Apparatus as defined in claim 1 including power lift mechanism for vertically positioning said ring between a position away from said molds and a position between the top ends of said molds, said mechanism also arranged to support said ring for oscillation while between said molds.

4. Apparatus as defined in claim 1 further characterized in that said power means is a fluid motor carried on said ring, and including a detachable connection between said motor and one of said molds.

5. Apparatus for making concrete pipe from no-slump concrete comprising, a vertically positioned tubular outer mold and an inner mold concentric therewith to form an annular space between said molds into which no-slump concrete can be poured to form a pipe, a separate end ring adapted to be positioned independently of and between the upper ends of said molds so as to hold them in proper radially spaced relationship, said ring being of such cross sectional shape so as to form the finished top end of said pipe, a fluid motor mounted on said ring, a detachable connection between said motor and one of said molds to oscillate said ring relative to each of said molds and about a vertical axis extending centrally through said ring and while said ring is between said molds to thereby form and trowel the top end of said pipe, and power lift mechanism for vertically positioning said ring between a position away from said molds and a position between the top ends of said molds, said mechanism also arranged to support said ring for said oscillation while between said molds.

6. Apparatus for making concrete pipe from no-slump concrete comprising, a vertically positioned tubular outer mold and an inner mold concentric therewith to form an annular space between said molds into which no-slump concrete can be poured to form a pipe, a separate end ring adapted to be positioned independently of and between the upper ends of said molds so as to hold them in proper radially spaced relationship, said ring being of such cross sectional shape so as to form the finished top end of said pipe, a fluid rotary motor carried on said ring, and an eccentric and link connection between said rotary motor and one of said molds to oscillate said ring relative to each of said molds and about a vertical axis extending centrally through said ring and while said ring is between said molds to thereby form and trowel the top end of said pipe.

7. Apparatus for making concrete pipe from no-slump concrete comprising, a vertically positioned tubular outer mold and an inner mold concentric therewith to form an annular space between said molds into which no-slump concrete can be poured to form a pipe, means for causing relative vertical shifting movement between said inner mold and said pipe, a top across the upper end of said inner mold, an outwardly extending distributing arm mounted on and for rotation around said top to thereby push mix outwardly and into said annular space, a separate end ring adapted to be positioned independently of and between the upper ends of said molds so as to hold them in proper radially spaced relationship, said ring being of such cross sectional shape so as to form the finished top end of said pipe, said ring having a support extending thereacross and above said distributing arm of said inner mold, a fluid motor mounted on said support, and a connection between one of said molds and said motor whereby the latter oscillates said ring relative to each of said molds and about a vertical axis extending centrally through said ring and while said ring is between said molds to thereby form and trowel the top end of said pipe.

8. Apparatus as set forth in claim 7 including power lift mechanism for vertically positioning said ring between a position away from said molds and a position between the top ends of said molds, said mechanism also arranged to support said ring for oscillation while between said molds.

9. Apparatus as defined in claim 7 including an electric motor vibrator mounted on said support for vibrating said ring while the latter is oscillating.

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