

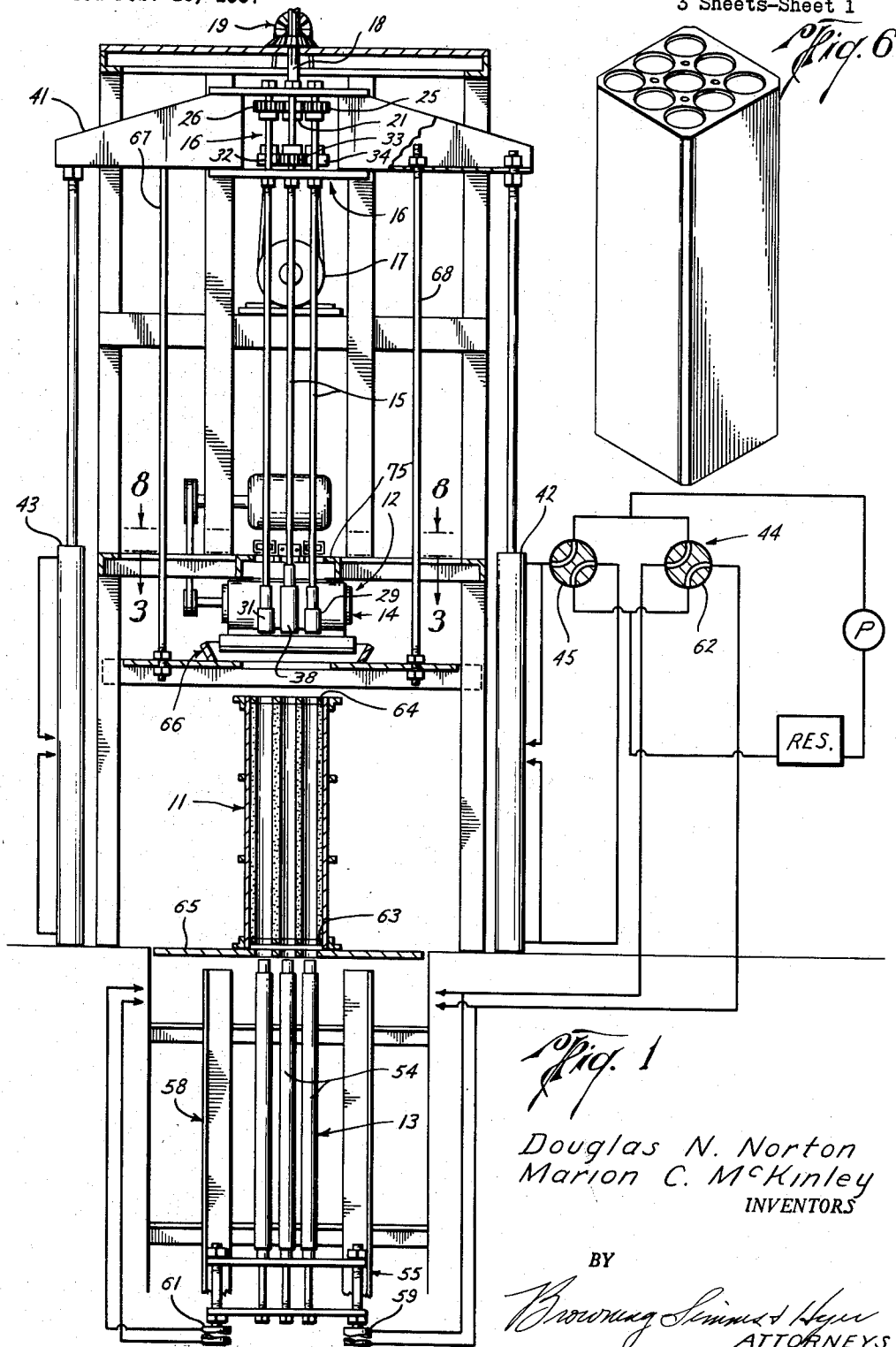
July 2, 1963

D. N. NORTON ETAL
CONDUIT FORMING MACHINE

3,095,628

Filed Feb. 15, 1957

3 Sheets-Sheet 1



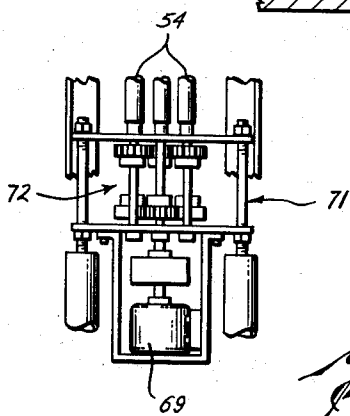
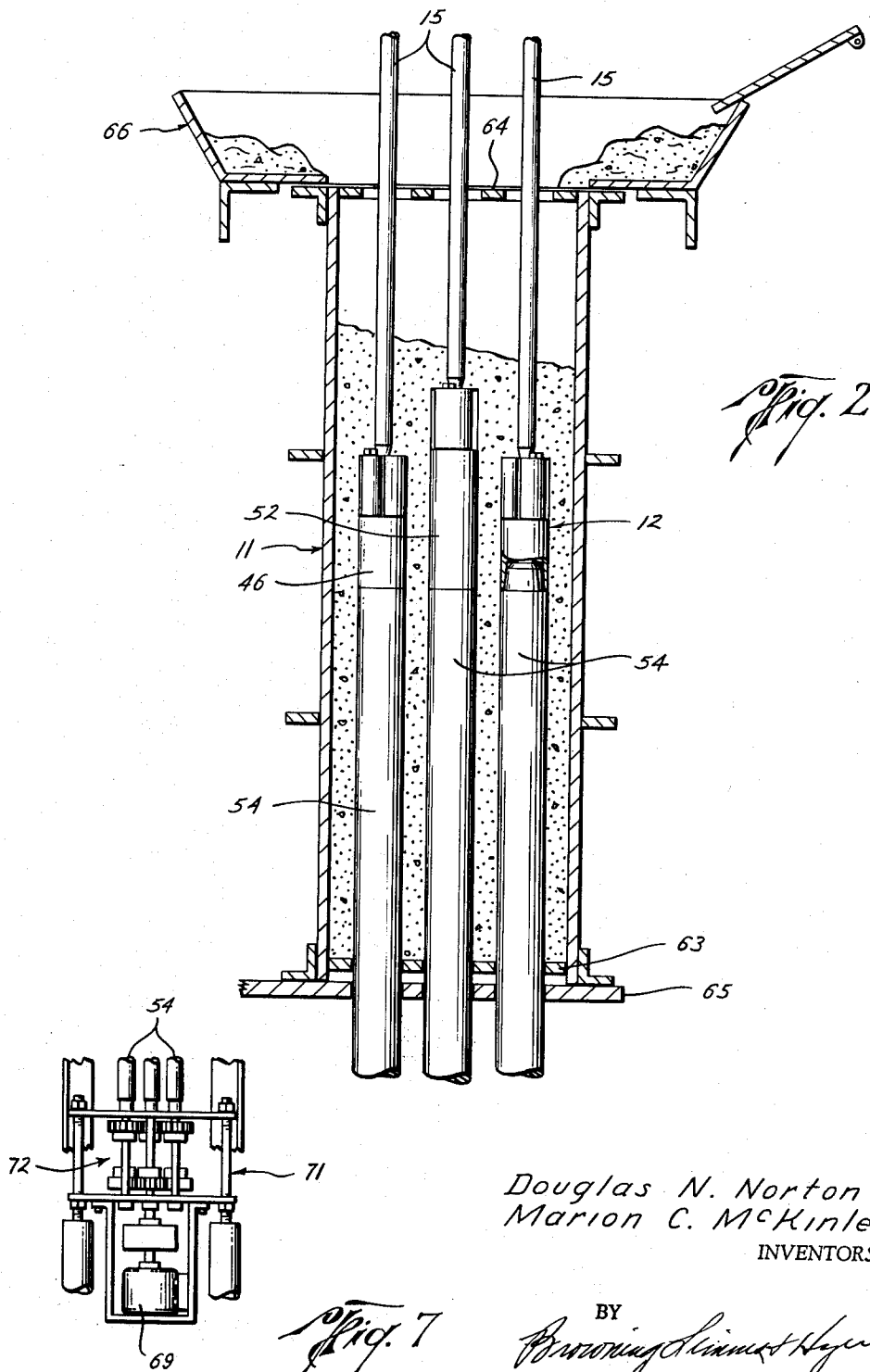
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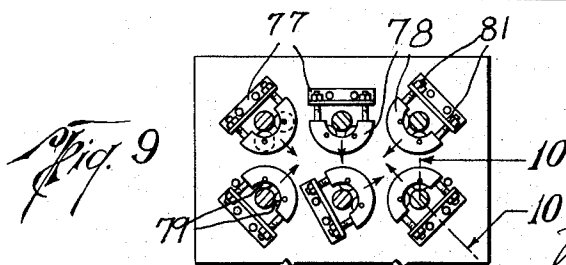
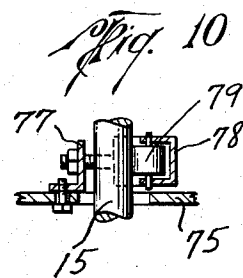
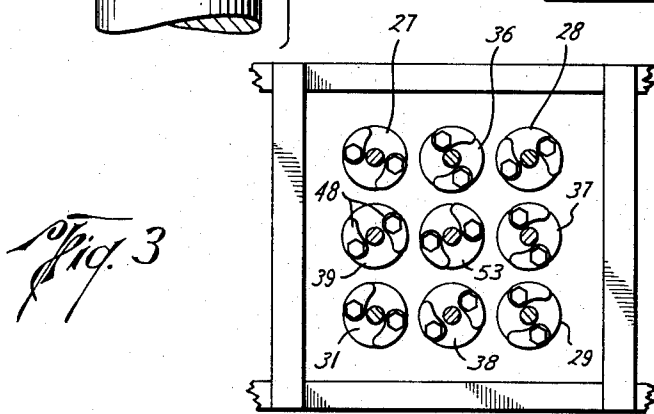
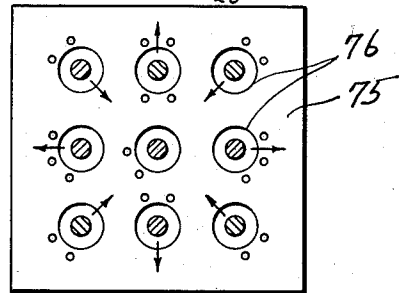
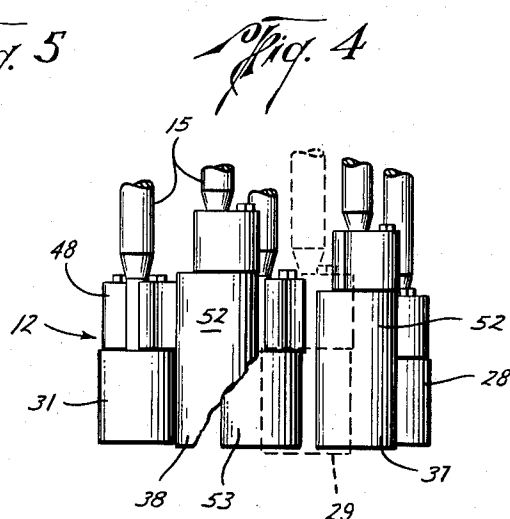
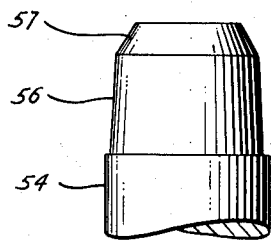
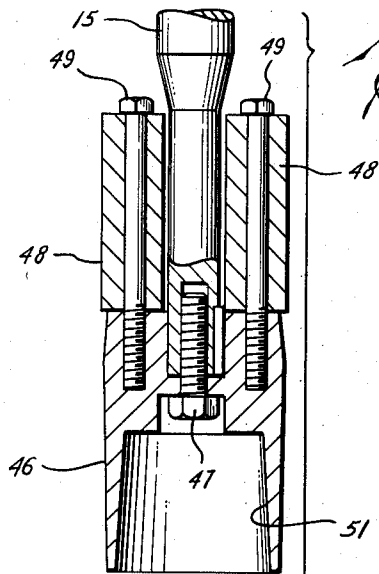
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3 Sheets-Sheet 3



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3,095,628

CONDUIT FORMING MACHINE

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3 Claims. (Cl. 25—36)

This invention relates to machines for manufacturing multihole conduit such as the conduit utilized in laying underground communication cable or the like.

The present general practice in laying underground cable for communication lines is to run cables through buried conduit. Multicell conduit is utilized.

The conduit employed in the past has been a fired clay. This product required a clay of very particular qualities. This clay is available in very limited quantities. Heretofore there has not been an adequate alternate for this product.

By this invention we provide a machine for manufacturing multihole conduit from concrete or the like which may be utilized in running cable and will provide an alternate conduit.

For carrying out this invention, a plurality of packer heads of substantially the form used in fabricating single bore concrete conduit are mounted for rotational and axial movement in a single mold.

We have discovered that the rotating packer heads in effect provide packing walls for each other; that is, one packer head in rotating packs against an adjacent packer head, and it is not necessary to have a wall of the mold surrounding each packer head.

In molding small diameter bores, it is necessary to mount the packer heads on relatively small diameter shafts and these shafts will tend to whip resulting in an unsatisfactory product. In order to stabilize the packer heads against whipping, there may be provided followers which follow the packer heads through the bores as the conduit is being formed. These followers may be of sufficient diameter to stabilize the packer heads against whipping, and, if desired, may be of a diameter which will trowel the walls of the bore to further smooth them.

In instances where it is desired to form a conduit having a bore whose web is not in contact with the wall of the mold such as a square or round conduit having nine symmetrically arranged holes, it is desirable to arrange the packer heads with the slinger bits of some heads opposite the troweling skirts of other heads and for the most satisfactory results alternate packer heads should be so arranged.

Where followers are used and it is desired to provide a polished bore, the followers may be provided with separate motor means for rotating them to insure their troweling action. Where a high finish is not desired, the followers may be rotated by a simple frictional contact with the packer heads.

It is an object of this invention to provide a machine for fabricating conduit from concrete or the like with a plurality of small holes therethrough which will be suitable for running underground communication cables as an alternate for the fired clay conduit heretofore used.

Another object is to provide a machine for fabricating multihole conduit from concrete or the like.

Another object is to provide a machine for fabricating multihole conduit from concrete or the like in which one or more of the holes is surrounded by a web which is not supported by a mold in fabricating the conduit.

Another object is to provide a machine for making multihole conduit of concrete or the like in which the

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bores through the conduit are troweled smooth by the machine.

Another object is to provide a machine for fabricating multihole conduit of concrete or the like with a plurality of packer heads carried by relatively small diameter shafts in which the packer heads are stabilized against whipping.

Another object is to provide a machine as in the preceding object in which the stabilizing means also functions to trowel the bores through the conduit smooth after they have been formed by the packer heads.

Other objects, features and advantages of this invention will appear from the specification, drawings and appended claims.

Referring now to the drawings wherein there is shown an illustrative embodiment of this invention and wherein like reference numerals indicate like parts:

FIG. 1 is a view in elevation of a machine constructed in accordance with this invention with portions of the supporting framework broken away and with the mold shown in vertical cross section;

FIG. 2 is a fragmentary enlarged sectional view through the mold showing the conduit in the process of manufacture;

FIG. 3 is a view along the lines 3—3 of FIG. 1 in the direction of the arrows;

FIG. 4 is a perspective view of the group of packer heads of the machine;

FIG. 5 is a sectional view of one of the packer heads and an elevational view of the upper end of a follower disengaged from the packer head;

FIG. 6 is a schematic view of a conduit formed by the machine of FIG. 1;

FIG. 7 is a fragmentary elevational view illustrating a modified follower section for use in the machine illustrated in FIG. 1;

FIG. 8 is a view along the lines 8—8 of FIG. 1 with collars removed illustrating forces set up in the mold;

FIG. 9 is a view similar to FIG. 8 when the machine is making six hole conduit and showing the collars for supporting the shafts in place; and

FIG. 10 is a view along the lines 10—10 of FIG. 9.

In the form of this invention illustrated in FIG. 1, the multihole conduit is formed in a mold indicated generally at 11. The holes in the conduit are formed by a plurality of packer heads indicated generally at 12 and a plurality of followers indicated generally at 13 which move upward through the material for which the conduit is formed. Material for filling the mold is fed to the mold by a conventional conveyer belt indicated generally at 14.

The individual packer heads rotate and move longitudinally along their rotational axes in forming a conduit. To permit this action, the packer heads are each mounted on shafts 15. The shafts 15 are carried by a movable gear box indicated generally at 16. The shafts are of sufficient length to permit the packer heads to reach the bottom of the mold with the gear box 16 above the upper end of the mold.

It is preferred to form the conduit shown in FIG. 6 with fairly thin webs between adjacent holes and between the holes and the outer walls of the conduit, and, therefore, the packer heads 12 are positioned fairly close together and close to the outer wall of the form. As a matter of fact, such webs are required to be of a thickness only a minor fraction of the diameters of the holes or ducts, as shown in FIG. 6. However, it is desirable, particularly in forming conduit having relatively small holes, to have a larger amount of material to be packed immediately above the packer head. For this reason the several rods to which the packer heads are secured are relatively small in diameter.

The gear box 16 may be in any desired form and may be driven in any desired manner which will impart rotary movement to each of the packer heads. In the illustrated form, the prime mover 17 is mounted stationary in the framework for the machine and for this reason the gear box is driven by a spline shaft 18. Power is transmitted from the prime mover 17 to the spline shaft 18 through a suitable power transmission train indicated generally at 19. This power transmission train may include a clutch and a brake to disengage the motor from the gear chain to permit the operator to quickly stop the rotary movement of the packer heads as they come out of the mold.

The spline shaft 18 carries a pair of vertically spaced drive gears in the gear box. The uppermost of these gears is shown at 21 and engages four symmetrically spaced gears carried by rods 15 and causes rotation of same. Two of these gears are shown at 25 and 26. These four driven gears rotate the packer heads 27, 28, 29, and 31 (FIG. 3).

In like manner the lower drive gear drives four symmetrically spaced gears. Three of these gears are shown at 32, 33, and 34. These four gears drive packer heads 36, 37, 38, and 39 (FIG. 3). Thus all the outer packer heads rotate in a single rotational direction. It will be understood that each of the supporting rods 15 is journaled in the top and bottom of the gear box 16. The central packer head 53 is carried by a rod 15 which forms a continuation of spline shaft 18.

Provision is made for movement of the several packer heads along their rotational axes by mounting the gear box on a crosshead 41. The crosshead 41 is contained by the framework of the machine against all but vertical sliding movement and is mounted on jacks for vertically reciprocating the crosshead. These jacks are preferably two-way hydraulic pistons shown at 42 and 43 in FIG. 1. A suitable hydraulic system of any desired form such as that illustrated schematically at 44 and controlled by a four-way valve 45 may be provided to alternately pressurize and vent opposite sides of the pistons 42 and 43 to raise and lower the crossheads and thereby raise and lower the packer heads.

The packer heads (FIG. 5) generally follow the conventional form used to make single hole conduit. Each packer head includes a skirt portion 46 which is secured to a rod 15 as by the stud 47. Mounted on top of the skirt portion are a plurality of bits 48 for slinging concrete. (Note FIG. 3 wherein these bits are shown in plan.) Each bit is mounted so that at least a portion of the bit extends outwardly beyond the skirt 46. Thus, as the packer head rotates, the bits form a bore through the concrete slurry of larger diameter than the diameter of the skirt 46. These bits are adjustably mounted as by studs 49 to permit compensation for wear.

The skirt 46 has a downwardly and inwardly inclined peripheral surface to prevent it sticking in the concrete as it passes upwardly therethrough. It has been found that when the wall wears to a substantially cylindrical surface, the packer head has a tendency to stick and should be replaced. The skirt 46 has an inverted cup-like socket 51 in its lower end for receiving one of the followers indicated generally at 13 as will be more fully explained hereinafter.

As the packer heads move upwardly through the slurry and mold 11, the bits which are always below the level of slurry, as best shown in FIG. 2, tend to sling the slurry away from the packer heads. However, the slurry is wet, and in the process of packing it tends to reduce in diameter as the bits pass therethrough. The skirts 46 then engage the bore through the packing slurry and trowel it smooth while maintaining the desired shape and size of bore.

It has been found that when making conduit having one or two rows of holes that the packer heads may be uniform in construction and positioned at the same horizontal level. However, when fabricating conduit having

three rows of holes which cross each other at substantially right angles, there being more than two rows extending in each direction, the form of the packer heads should be modified for best results. In this form and, of course, in other arrangements which could be made of the plurality of packer heads, there is relatively less form per packer head against which the packer heads can pack. Therefore, it is preferred to modify the packer heads so that they can better pack against each other. In other words, one packer head in effect provides a form wall against which other packer heads may pack slurry. This may be accomplished by arranging at least a portion of the skirt of one packer head directly opposite the bits of another packer head. Preferably, this is accomplished by extending the skirt length of alternate packer heads as shown in FIG. 4. Thus, the bottom of the packer heads will all be at the same level but alternate ones will have a skirt length equal to substantially the combined length of skirt 46 and bits 48 as shown by skirts 52 in FIG. 4. For instance, in the nine packer head form of machine illustrated, the center packer head 53 and each of the corner packer heads 27, 28, 29, and 31 have short skirts. The remaining packer heads 36, 37, 38, and 39 have long skirts. This arrangement permits the skirts of packer heads 36, 37, 38, and 39 to both trowel the slurry and provide in effect form walls against which the slinger bits of the remaining packer heads may sling slurry.

Since all of the outer packer heads rotate in the same direction, they impart to the concrete mixture between them and the walls of the form along the entire inner periphery of the form a circulation in a single directional sense and produce a uniformity of texture and density in the outer web. At the same time, the adjacent surfaces of the adjacent outer packer heads move in opposite directions and thus neutralize any tendency they would otherwise have to produce flow toward or from the outer wall of the form. This reduces the tendency toward producing more and less dense portions of the outer web of the conduit.

As has been previously mentioned, it is necessary to mount the packer heads on rather slender shafts when forming small diameter holes. This results in a tendency of the packer heads to whip and results in formation of a rough hole through the conduit. Therefore, in order to prevent this whip and hold each packer head to a substantially constant rotational axis, there are provided the followers 13 which engage the packer heads and hold them against whipping. The followers 13 are provided by a plurality of long cylindrical members 54 which are rotatably mounted in a supporting head indicated generally at 55.

The upper end of each follower 54 has a reduced diameter section 56 which is adapted to engage with the inverted cup 51 of each packer head (see FIG. 5). The peripheral wall of the reduced diameter section 56 has a taper which is complementary to the taper of the inverted cup to provide for rotation of the follower by the packer head. The extreme end of the follower may be beveled as at 57 to insure entry of the follower into the packer head as the two elements move toward each other. It is particularly desirable to taper the follower and inverted cup of the packer head as slurry will frequently find its way into this joint. Due to the taper it will not prevent the follower moving into the packer head and a connection will be established regardless of whether slurry is present in the joint or not.

While most of the packing of the slurry has taken place after the packer head moves through the slurry, there is still some slight amount of packing in the conduit. Therefore, it is preferred to fashion the followers 54 with a diameter slightly less than the diameter of the lower end of each packer head. This will permit the slurry to continue packing and slightly decrease the size of each hole through the conduit without sticking of the fol-

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lowers. However, the followers will limit the amount the holes can be reduced by packing of the slurry. Additionally, as the followers rotate, they trowel the bores and provide a smoother bore than the bore left by the packer head.

Provision is made for moving the followers vertically through the mold 11 by mounting the crosshead 55 in a slideway indicated generally at 58. The followers are reciprocated by operation of two-way fluid pistons 59 and 61 with hydraulic fluid from source 44. Control of these pistons is had by manipulation of four-way valve 62.

In operation, an empty mold 11 is provided with templates 63 and 64 at its lower and upper open ends. The mold is positioned in the machine on a turntable 65 or the like. The valves 45 and 62 are operated to lower the packer heads 12 through the mold and into engagement with the followers 54 below the mold. As the crosshead 41 moves downwardly, the table indicated generally at 66 comes to rest on top of the mold. Thereafter, the crosshead 41 moves downwardly relative to the two suspension rods 67 and 68 for the table. The table stabilizes the mold.

The conveyer 14 is operated to bring slurry to the table 66 and an operator controls operation of the conveyer to determine the amount of slurry delivered to the table and to the mold. As soon as the packer heads are covered in the mold, the packer heads are energized and begin to rotate. Then the control valves 45 and 62 are positioned to start the packer heads and followers ascending through the mold 11. As the packer heads move upward, the operator continues to introduce slurry into the mold to keep them covered. As the packer heads clear the top of the mold, the upward movement of the followers is stopped and valve 62 is reversed to lower the followers. Continued upward movement of the crosshead 41 will cause lifting of the table 66 to the position illustrated in FIG. 1 to clear the mold. Thereafter, the mold may be removed from the machine and taken to a storage point for cooling.

On some occasions it may be found that one or more of the followers are not rotating as they move upwardly through mold 11. The nonrotating follower does not trowel the hole through which it is passing. In order to insure that each follower rotates and obtain a uniform troweling action, the modified follower assembly shown in FIG. 7 may be employed. In this embodiment, the followers 54 are identical with those of the FIG. 1 embodiment but are rotated by a prime mover 69. The prime mover 69 is carried by the crosshead 71 which contains the gear assembly indicated generally at 72 for transmitting rotary movement for the motor to each of the followers. This gear assembly may be identical with the assembly for driving the packer heads or may take any other desired form. When the packer head motor 17 is energized, the follower motor 69 will be energized and positive rotation of the followers 54 as they pass through the mold will be assured.

It has been found that even when employing the followers 54 it is desirable to support the shafts 15 closely adjacent the top of mold 11. The action of the packer heads on the slurry tends to set up counterforces on the packer heads which urge the packer heads away from the desired axis of rotation. These forces act in the direction of the arrows in FIGS. 8 and 9. It will be noted that the direction of some of these forces are different when the machine is making 9 hole conduit (FIG. 8) from the forces set up in making 6 hole conduit (FIG. 9). In passing it may be noted that one outside row of packer heads 12 and shafts 15 may be removed from the machine illustrated to fabricate 6 hole conduit, using, of course, a different mold.

Preferably, the shaft supporting means referred to above is carried by the framework closely adjacent the

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top of mold 11. A plate 75 having a plurality of holes 76 to receive shafts 15 may be secured to the framework. Angle iron supports 77 are secured to the plates. Collars 78 are carried by the supports and provide stabilizers for the packer heads. Each collar has a pair of spaced rollers 79 which engage the shafts 15 and support the shafts. Limited adjustment of the orientation of the collars may be provided by running up in different amounts the nuts 81 holding each collar.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects herein above set forth, together with other advantages which are obvious and which are inherent to the apparatus.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. A conduit forming machine comprising, a form having in-line openings in opposite ends thereof, a plurality of packer heads mounted for rotational and axial movement in said form, said packer heads entering and leaving the form through one of said openings, each of said heads having a slinger section and a trowel section with the slingers arranged to precede the trowels in forming conduit and certain of said slinger sections being radially opposed to a trowel section of an adjacent head, cylindrical followers mounted for rotational and closely guided axial movement along the axes of rotational and axial movement of the heads, said followers entering and leaving the form through the other opening in the form and each having a releasable concentric engagement with one of the heads, said followers being of slightly less diameter than the troweling sections of the heads and providing trowels, and means anchored relative to said form for driving the heads and followers including means separately connected to the heads and followers, respectively, for rotating the heads and followers and simultaneously moving them along said axes with the heads preceding the followers to form slurry in the mold into a multi-hole conduit.

2. A conduit forming machine comprising, a form having an opening in one end thereof, a plurality of packer heads mounted for rotational and axial movement in said form and entering and leaving the form through said opening, each of the heads having a slinger section provided by bits and a trowel section provided by an annular skirt with the slinger section preceding the troweling section when forming conduit, means interconnecting at least two of the heads, with the slinger section of one of the heads throughout its operative length axially fixed relative to and opposite a portion of the troweling section of the other head, and means anchored relative to the form and having rotatable parts connected to said heads for rotating the heads and reciprocating parts connected to said heads for moving them along their rotational axes to form slurry in the mold into a multi-hole conduit.

3. A conduit forming machine comprising, a form having in-line openings in opposite ends thereof, a plurality of packer heads mounted for rotational and axial movement in said form, said heads entering and leaving the form through one of said openings, each of said heads having a slinger section provided by bits and a troweling section provided by an annular skirt with the

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slinger section preceding the troweling section when forming a conduit, means interconnecting said heads, with the slinger sections of some of the heads having their operative lengths axially fixedly positioned with respect to and opposite a portion of the troweling sections of the other heads, followers mounted for rotational and axial movement along the axes of rotational and axial movement of the heads, said followers entering and leaving the form through the other opening in the form and engaging the heads, and means anchored relative to the form and including parts separately connected to the heads and the followers, respectively, for rotating the heads and followers and simultaneously moving the heads and followers along their rotational axes in the molds with the heads preceding the followers to form slurry in the mold into a multi-hole conduit.

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References Cited in the file of this patent

UNITED STATES PATENTS

106,424	Stockwell	Aug. 16, 1870
1,036,618	Hartwell et al.	Aug. 27, 1912
1,374,392	Roosa	Aug. 12, 1921
1,921,237	McDonough et al.	Aug. 8, 1933
1,937,350	LaDue	Nov. 28, 1933
2,244,750	Weisenburg	June 10, 1941
2,525,275	Schmidt	Oct. 10, 1950

FOREIGN PATENTS

32,135	Sweden	Jan. 12, 1912
35,388	Sweden	Aug. 27, 1913
210,872	Great Britain	Feb. 8, 1924
141,821	Switzerland	Nov. 17, 1930
631,701	Great Britain	Nov. 8, 1949