May 16, 1950 W. E. POWELL 2,508,293

MACHINE FOR FORMING CONCRETE PIPE BENDS

Filed Sept. 28, 1949 3 Sheets-Sheet 1

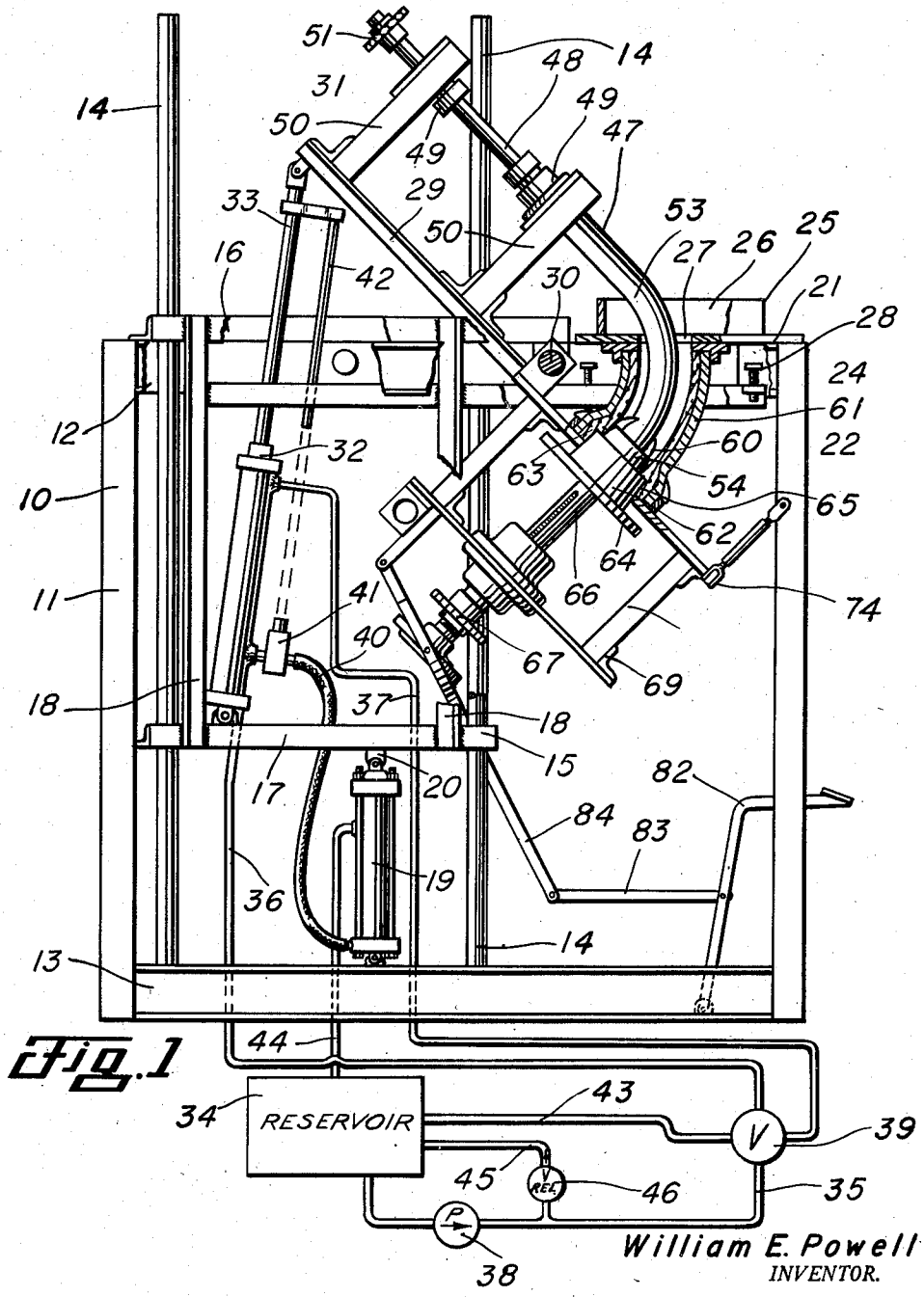


Fig. 1

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Filed Sept. 28, 1949 3 Sheets-Sheet 2

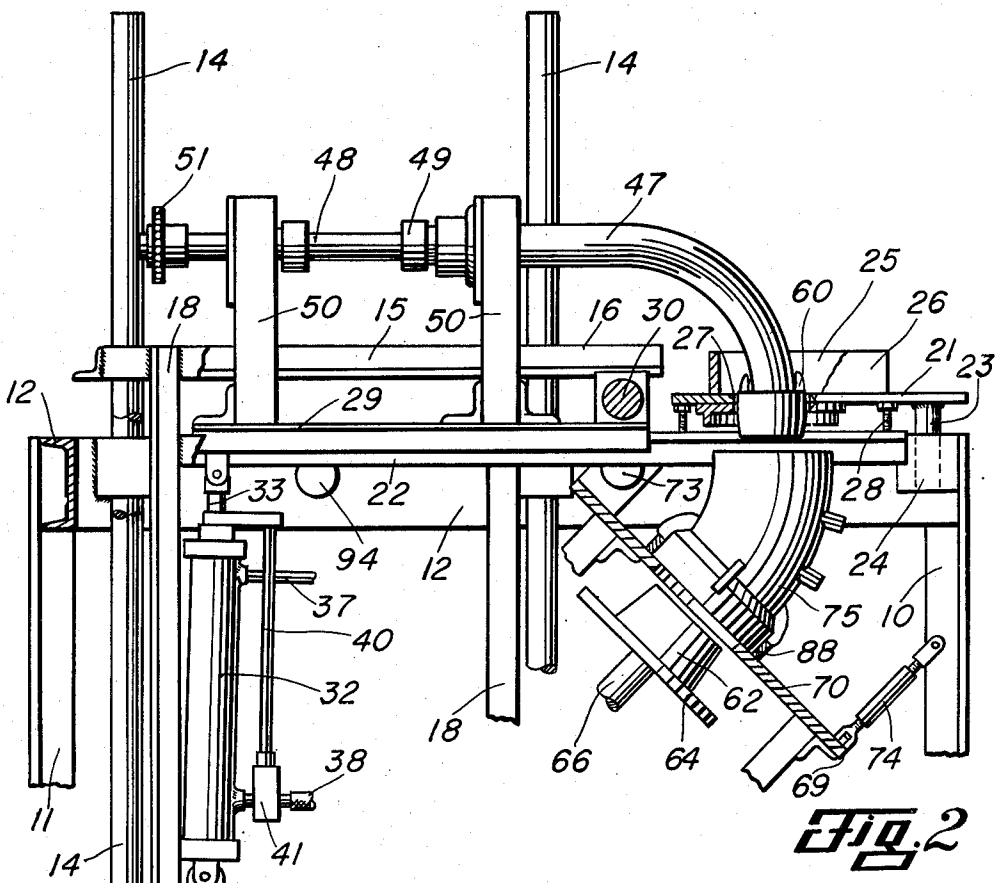


Fig. 2

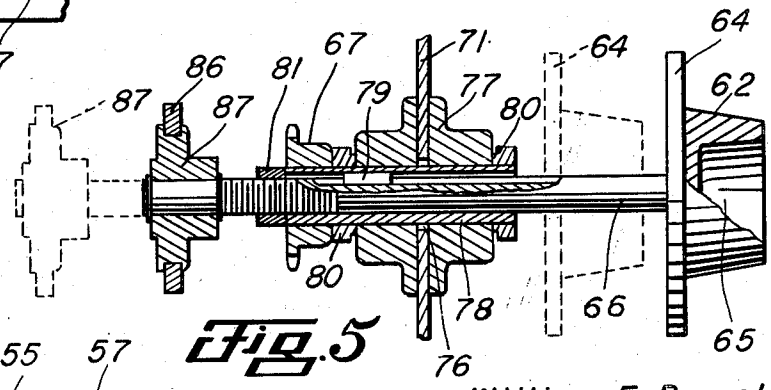


Fig. 5

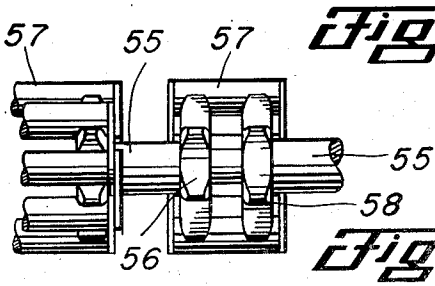


Fig. 6

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MACHINE FOR FORMING CONCRETE PIPE BENDS

Filed Sept. 28, 1949 3 Sheets-Sheet 3

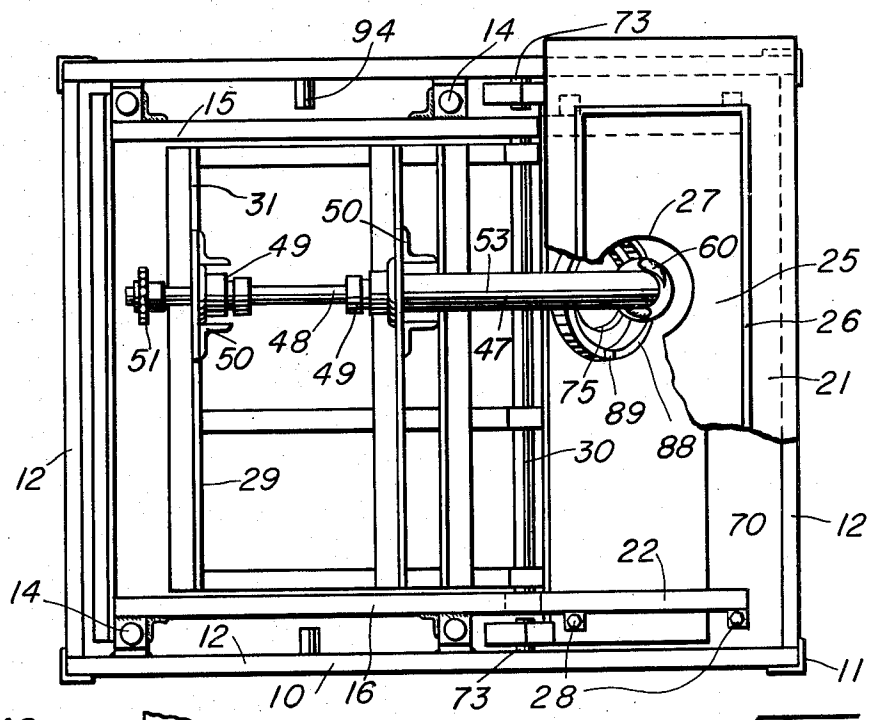


Fig. 3

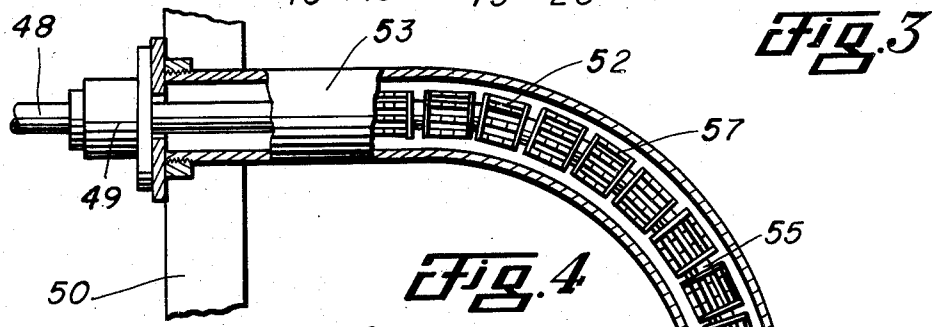


Fig. 4

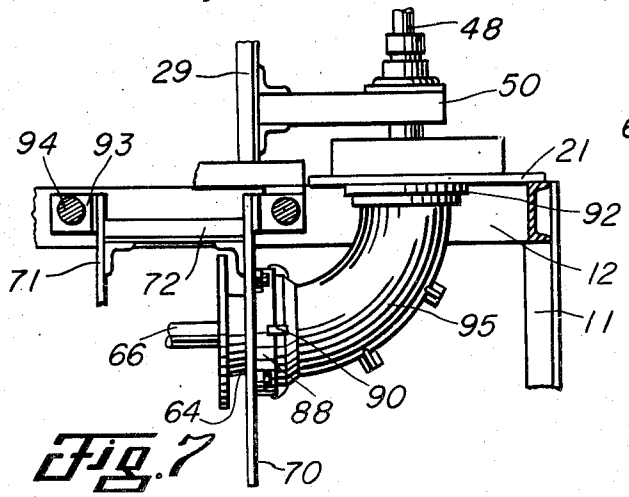


Fig. 7

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UNITED STATES PATENT OFFICE

2,508,293

MACHINE FOR FORMING CONCRETE PIPE BENDS

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Application September 28, 1949, Serial No. 118,297

12 Claims. (Cl. 25—30)

1

This invention relates to new and useful improvements in machines for forming concrete pipe bends.

One object of the invention is to provide an improved machine for forming concrete pipe bends substantially automatically so as to reduce manual operations and increase the rate of production.

Another object of the invention is to provide an improved concrete pipe bend forming machine having an internal forming element constructed and arranged in such manner that the same may be swung in an arc while being rotated whereby a pipe bend of uniform, compact density may be economically and efficaciously produced.

A particular object of the invention is to provide an improved machine, of the character described, having an arcuate, internal forming member pivotally mounted so as to be capable of being swung through an arcuate path for coaction with a complementary form to produce a concrete pipe bend, the internal forming member having a rotatable head for forming the bore of the bend and flexible drive means for imparting rotation to the head throughout its arcuate travel, whereby said bend may be swung on an arc of short radius.

A further object of the invention is to provide an improved machine, of the character described, which includes a rotatable packer head carried by an arcuate member having a flexible drive shaft for imparting rotation to the head, the member being pivotally supported substantially coincidental with the axis of its arc whereby said head is swung through said arc when pivoted, together with means for swinging said member about its pivotal support.

Still another object of the invention is to provide an improved machine, of the character described, which includes a movable support for engaging and confining one end of a pipe bend form, the support being moved away from the form to permit insertion of and removal of said form.

A construction designed to carry out the invention will be hereinafter described together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings, wherein an example of the invention is shown, and wherein:

Fig. 1 is a side elevational view, partly in section, of a concrete pipe bend forming machine, constructed in accordance with the invention, and showing the forming of a 45° bend,

2

Fig. 2 is a transverse, vertical, sectional view of the machine, showing its packer head and table raised preparatory to removing a completed pipe bend,

Fig. 3 is a plan view of the machine with a portion of the table broken away,

Fig. 4 is an enlarged, longitudinal, sectional view of the packer, its flexible drive shaft and mounting,

Fig. 5 is an enlarged, longitudinal, sectional view of the bell packer and its drive shaft,

Fig. 6 is an enlarged, detailed view of a portion of the flexible shaft, and

Fig. 7 is a side elevational view of a portion of the machine, showing the forming of a 90° bend.

In the drawings, the numeral 10 designates an open main frame which is substantially rectangular in plan and elevation and which includes upright corner members or angle bars 11 having their upper and lower ends connected by transverse, marginal channel members 12 and 13. A plurality of upright, cylindrical guide posts or bars 14 are suitably connected to the frame and extend upwardly thereabove, being disposed internally of the channel members 12 and 13 and preferably at the rear portion of said frame. An auxiliary frame or support 15 is slideably mounted upon the posts 14 so as to be vertically reciprocal relative to the main frame 10. As is most clearly shown in Figs. 1 and 3, the auxiliary frame 15 is substantially square in plan and rectangular in elevation, having an upper box frame 16 and a lower box frame 17 connected by upright bars or members 18. For raising the frame 15, a hydraulic ram or cylinder 19 is mounted on the frame 10 and has its plunger 20 connected to the lower box frame 17.

A material receiving member or work table 21 is disposed forwardly of the reciprocal frame 15 and rests upon the upper channel members of the main frame. Suitable longitudinal, angle bars or members 22 are connected to the upright bars 18 so as to underlie the upper box frame 16 and engage beneath the table for lifting the same. Thus, the table 21 is movable with the auxiliary frame relative to the main frame. If desired, guide pins or elements 23 may depend from the forward portion of the table for coacting with suitable keepers 24 carried by the main frame to assist in guiding the vertical movement of said table. An enclosure 25 is provided by upright retaining walls 26 secured to the top of the table and a circular opening 27 is formed in said table in communication with the enclosure. It is noted that the auxiliary frame is re-

ciprocal relative to the table and that the upward movement of said table is controlled by upstanding adjusting screws 28 carried by the angle bars 22 so as to engage the underside of said table.

A support 29 is pivotally connected to the frame 15 and is preferably disposed within and below the upper box frame 16. For pivotally mounting the support 29, a cylindrical bar or shaft 30 extends transversely across the forward end of the box frame 16 immediately behind the table 21 and the forward end of said support is suspended from the shaft so as to be capable of undergoing forward, pivotal movement relative to the auxiliary frame. The support includes a box frame 31 which has its rear end portion supported by a hydraulic cylinder 32 pivotally connected to the lower box frame 17, the frame 31 being pivotally connected to the piston rod 33 of the cylinder. Due to this arrangement, the pivoted support is maintained in a substantially horizontal position when the piston rod 33 is retracted and is movable vertically with the reciprocal or auxiliary frame. Upon ejection of the piston rod, the support is pivoted forwardly or in a clockwise direction relative to the auxiliary frame and is returned to its horizontal position upon retraction of said piston rod.

A hydraulic system for actuating the ram 19 and cylinder 32 has been shown schematically in Fig. 1 and includes a reservoir 34, for oil or other fluid, connected by lines 35, 36 and 37 to the upper and lower ends of said cylinder 32. A pump 38 is connected in the line 35 and a control valve 39 connects said line to the lines 36 and 37, whereby oil or other fluid under pressure may be forced into the ends of the cylinder. The lower portions of the ram and cylinder are connected by a suitable line 40 which has a check valve 41 connected therein. An actuating element or rod 42 is carried by the piston rod 33 for engaging and actuating the check valve 41 when said piston rod is retracted and the support 29 is in its horizontal position (Fig. 2). This actuation of the check valve opens the same so as to permit the flow of fluid from the cylinder 32 to the ram 19, it being noted that the line 40 is connected to said cylinder above the lowermost position of its piston (not shown) so as to permit such flow. When fluid is admitted to the ram, the auxiliary frame 15 and the support 29 is moved upwardly as shown in Fig. 2. Line 43 extends between the reservoir 34 and the control valve 39 for communicating with either the line 36 or 37. The upper portion of the ram 19 communicates directly with the reservoir through a return line 44. A by-pass line 45, having a pressure relief valve 46 connected therein, establishes communication between the reservoir and the line 35 on the pressure side of the pump for relieving excessive pressure.

In order to raise the piston rod, the control valve 39 is turned so as to establish communication between the lines 35 and 36 and between the lines 37 and 43. Thus, fluid is forced into the lower end of the cylinder and from the upper end thereof into the reservoir. Upon turning the valve to connect the line 35 to the line 37 and the line 36 to the line 43, fluid is forced into the upper end of the cylinder and from the lower end thereof into the reservoir so as to retract or lower the piston rod. Continued downward movement of the piston rod causes the actuating rod to engage and open the check valve 41, whereby the fluid is directed to the lower end of the ram so long as the valve remains in or is turned to the above described position. Thus, the auxiliary frame and pivotal support may be raised only when said support is in its horizontal position. Any fluid which might escape into the upper end of the ram is forced back into the reservoir through the line 44. The auxiliary frame and its support are lowered by gravity upon turning of the valve so as to connect the line 37 to the line 43 without connecting the lines 35 and 36. Fluid in the lower end of the ram is forced through the line 40 into the cylinder 32 and through the lines 37 and 43 into the reservoir by the weight of the auxiliary frame.

An internal forming member or assembly 47 is carried by the support and includes a longitudinal shaft 48 mounted above the box frame 31 in spaced, parallel relation. The shaft 48 is preferably journalled in spaced bearings 49 supported in brackets 50 projecting upwardly from the box frame and has a sprocket 51 mounted on its rear free end. Although not shown, the sprocket 51 is adapted to be driven by a suitable motor mounted on the support and connected by an endless chain to said sprocket. A flexible shaft 52, having an arcuate, tubular housing or casing 53, connects the forward end of the shaft to a cylindrical forming mandrel or packer head 54. As is clearly shown in Figs. 4 and 6, the flexible shaft 52 includes a plurality of stub shafts or spindles 55 having a sprocket 56 mounted on each end with the sprockets of adjacent stub shafts connected by encircling roller chains 57. The sprockets 56 have their teeth 58 bevelled at their sides and ends to permit pivotal movement of the stub shafts 55 relative to each other. It is preferable for the shaft housing 53 to have an arc of approximately 90°, whereby the packer head 54 is disposed at a right angle to the shaft 48. The axis of this arc is substantially co-incidental with the pivot axis of the support whereby the internal forming member is swung through said arc upon pivotal movement of said support. As shown by the numeral 59, the stub shaft at the free end of the flexible shaft has a single sprocket and is journalled in the end of the shaft housing with the packer head secured to its free end. Upwardly and outwardly flared or arced wings 60 are carried by the inner end of the packer head which is of conventional construction and which extends through the opening 27 of the table 21.

The packer head is adapted to coact with a suitable form 61 and a bell packer or forming member 62 in the manufacture of concrete pipe bends, such as the one designated by the numeral 63. As shown in Fig. 5, the bell packer 62 is substantially cylindrical having a radial flange 64 formed on its inner end and a bore or socket 65 in its outer end for receiving the packer head. For imparting rotation to the bell packer, a shaft 66 is secured thereto and is adapted to be driven by a sprocket 67 and an endless chain and motor (not shown). A support 69 is provided for the shaft 66 and includes a pair of spaced, parallel plates or members 70 and 71 connected by angle bars or straps 72. The plates are disposed at a forwardly directed inclination beneath the table 21 and the upper plate has its rear portion suspended from pivot pins 73 carried by the channels 12 of the main frame immediately behind said table. Adjustable links 74 are provided for connecting the for-

ward portion of the upper plate to the forward frame members 11.

Axially-alined, circular openings 75 and 76 are formed in the plates and are disposed in vertical alinement with the table opening 27. The shaft 66 extends through the opening 76 of the lower plate being rotatably and slidably confined therein by a pair of collars 77 which overlie opposite sides of said plate. A cylindrical tube or sleeve 78 is journalled in the collars 77 and is keyed to the shaft as shown by the numeral 79 so as to be rotatable therewith. The sprocket 67 is fixed on the rear portion of the sleeve 78 below the plate and axial movement of said sprocket and sleeve is prevented by retaining collars 80 mounted on said sleeve and bearing against the collars 77. A split stop nut 81 is screw-threaded on the shaft rearwardly of the sprocket for adjustably controlling the axial movement of said shaft relative to the sleeve and sprocket as well as the support 69. Axial movement is imparted to the shaft by a lever 82 pivoted to one of the lower channels 13 of the main frame, pivotal links 83 and 84, and a rigid link 85 pivotally attaching the link 84 to the rear portion of the plate 71. The intermediate portion of the link 84 is pivotally connected to the shaft by a gimble ring 86 rotatably confined upon a collar 87 carried by the rear end of said shaft.

For supporting the form 61, the upper plate 70 of the support 69 has an annular, concentric collar or element 88 surrounding its opening 75. Spaced notches 89 are formed in the collar for receiving lugs 90 carried by the lower end of the form. It is noted that the lower end of the form is enlarged or belled outwardly to permit the forming of a bell or collar 91 on one end of the pipe bend 63. Therefore, the collar 88 is of larger diameter than the opening 75 and the end of the form bears against the table between said opening and collar. A similar flanged collar or element 92 is secured to the underside of the table 21 in concentric surrounding relation to the opening 27 for receiving and confining the upper end of the form. The collar 92 has its opening alined with and of the same diameter as the table opening. Manifestly, the form is clamped between the confining elements or collars 88 and 92 upon lowering of the auxiliary frame and its table and may be removed upon raising of said frame and table.

It is noted that the packer head 54 is of a diameter to snugly engage the table opening 27 and that said head extends through said opening and depends below the retaining collar 92 when the support 29 is in a substantially horizontal position. Upon forward pivoting or tilting of the support, the packer head is swung along or through the frame arc upon which the form is swung, whereby said packer head is co-axially spaced from the wall of said form throughout its arcuate travel. Since the ends of the pipe bend 63 must be straight for connection with one another, the initial movement of the packer head is vertical or axially of the upper end of the form. This vertical movement is brought about by lowering the support 29 relative to the main frame. The opposite straight end of the form is made possible by the axial or straight line movement of the shaft 66 and its bell packer 62. It is pointed out that the latter has an internal diameter substantially equal to the diameter of the opening 75 and extends through said opening into the lower end of the form, whereby its

socket 65 receives the lower end of the packer head.

In operation, a form 61 is placed upon the upper plate 70 of the inclined support 69 by engaging its enlarged lower end within the notched collar 88. The auxiliary frame 15, pivotal support 29 and table 21 is raised during the insertion of the form and is lowered to clamp said form in position. Due to the retaining collars 89 and 92, displacement of the form is prevented and proper alinement is assured due to the co-action of the notches 89 and lugs 90. The auxiliary support is formed or tilted in a clockwise direction to move the packer head through the form into engagement with the bell packer 62 as shown in Fig. 1. Cement or concrete of the desired consistency is dumped within the enclosure 25 and fed into the form through the opening 27 with the element in this position. Of course, it is necessary to swing the lever 82 downwardly and lift the bell packer in order to engage the latter with the packer head. Since the packer head and bell packer are constantly rotating, it is manifest that the enlarged collar or bell 91 of the pipe bend 63 is the first portion of said bend to be formed. The remainder of the pipe bend is formed by raising the packer head which is accomplished by counter-clockwise swinging of the support 29. Due to the provision of the wing 60 and the rotation of the packer head, it is manifest that the concrete is poured outwardly and compacted against the form. The straight upper end of the pipe bend is provided by the engagement of the packer head within said bend at the end of its arcuate movement. As has been pointed out, the packer head is not withdrawn from this engagement until the table, support and auxiliary frame are raised as shown in Fig. 2. Upon this disengagement, the form and the pipe bend may be removed for the insertion of another form. It is noted that excess material is removed from the form and its pipe bend by the upward travel of the packer head.

In Fig. 7, the forming of a 90° pipe bend has been illustrated. The bell packer support 69 is swung rearwardly whereby the plates 70 and 71 extend substantially vertical and the bell packer and a shaft 66 is disposed horizontally. Suitable lugs 93 are secured to the rear edge portion of the plate 71 for co-acting with pins 94 in connecting said plate to the upper channel 12 of the main frame. A form 95 having an arc of 90° may then be inserted between the retaining collars 88 and 92 in a manner described hereinbefore. Of course, it would be necessary to lengthen the cylinder 32 and its piston rod 33 in order to swing the support and the packer head through an arc of 90°.

The foregoing description of the invention is explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:

1. A machine for forming concrete pipe bends including, a main frame, an auxiliary frame reciprocally mounted on the main frame, a support pivotally mounted on the auxiliary frame and reciprocal therewith, an internal forming member carried by the support and pivotal therewith, the forming member being arcuate and swung on an arc substantially coincidental with the pivotal mounting of said support, means for

reciprocating said auxiliary frame, means for pivoting said support to swing the forming member about its axis, and means mounted on said main frame to support a pipe bend form in co-acting relation to said forming member whereby the latter may be engaged in and swung through the form.

2. A concrete pipe bend forming machine as set forth in claim 1 including, a bell packer supported by the main frame in co-acting relation to the internal forming member and the pipe bend form.

3. A concrete pipe bend forming machine as set forth in claim 1 including, a bell packer movably mounted on the main frame in co-acting relation to the internal forming member and adapted to be engaged with the pipe bend form.

4. A concrete pipe bend forming machine as set forth in claim 1 including, a bell packer mounted on the main frame and movable axially into one end of the pipe bend form for co-acting with the internal forming member.

5. A machine for forming concrete pipe bends including, a frame, means mounted on the frame to support a pipe bend form, an axially-movable member mounted on said frame and adapted to be moved into one end of the pipe bend form, and an arcuate forming member pivotally supported on said frame so as to be pivotal through the pipe bend form into engagement with the axially-movable member.

6. A machine as set forth in claim 5 wherein the arcuate forming member is reciprocally mounted on the frame so as to be movable axially of the end of the pipe bend form opposite the axially-movable member.

7. A machine as set forth in claim 5 wherein the axially-movable member includes a rotatable bell packer having a socket in its end, the arcuate forming member having a rotatable packer head engageable in the socket.

8. A machine as set forth in claim 5 including means reciprocally mounted on the frame for engaging one end of the pipe bend form and co-acting with the supporting means in clamping the form in a fixed position.

9. A concrete pipe bend forming machine including, a frame, means mounted on the frame to support a pipe bend form, means mounted on said frame and movable axially into one end of the form, means carried by said frame for engagement with the opposite end of the form, whereby the form is confined between the supporting and engaging means, an arcuate member pivotally mounted on said frame so as to be capable of being swung through the form, and a packer head carried by the member for engagement with the axially-movable means, said engaging means and member being reciprocal relative to said frame whereby the packer head and engaging means are movable axially of one end of the form.

10. A concrete pipe bend forming machine including, a frame, means mounted on the frame to support a pipe bend form, a rotatable bell packer mounted on said frame and movable axially into one end of the form, means reciprocally mounted on said frame for engagement with the opposite end of the form, a rotatable packer head movable through the form into engagement with the bell packer, and an arcuate member pivotally supported by said frame and carrying the packer head.

11. A machine as set forth in claim 10 wherein the arcuate member is reciprocal relative to the frame whereby the packer is movable axially of one end of the pipe bend form.

12. A machine as set forth in claim 11 including, means for reciprocating the armuate member, means for pivoting said member, and means rendering the reciprocating means inoperative during actuation of the pivoting means.

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No references cited.