

April 2, 1963

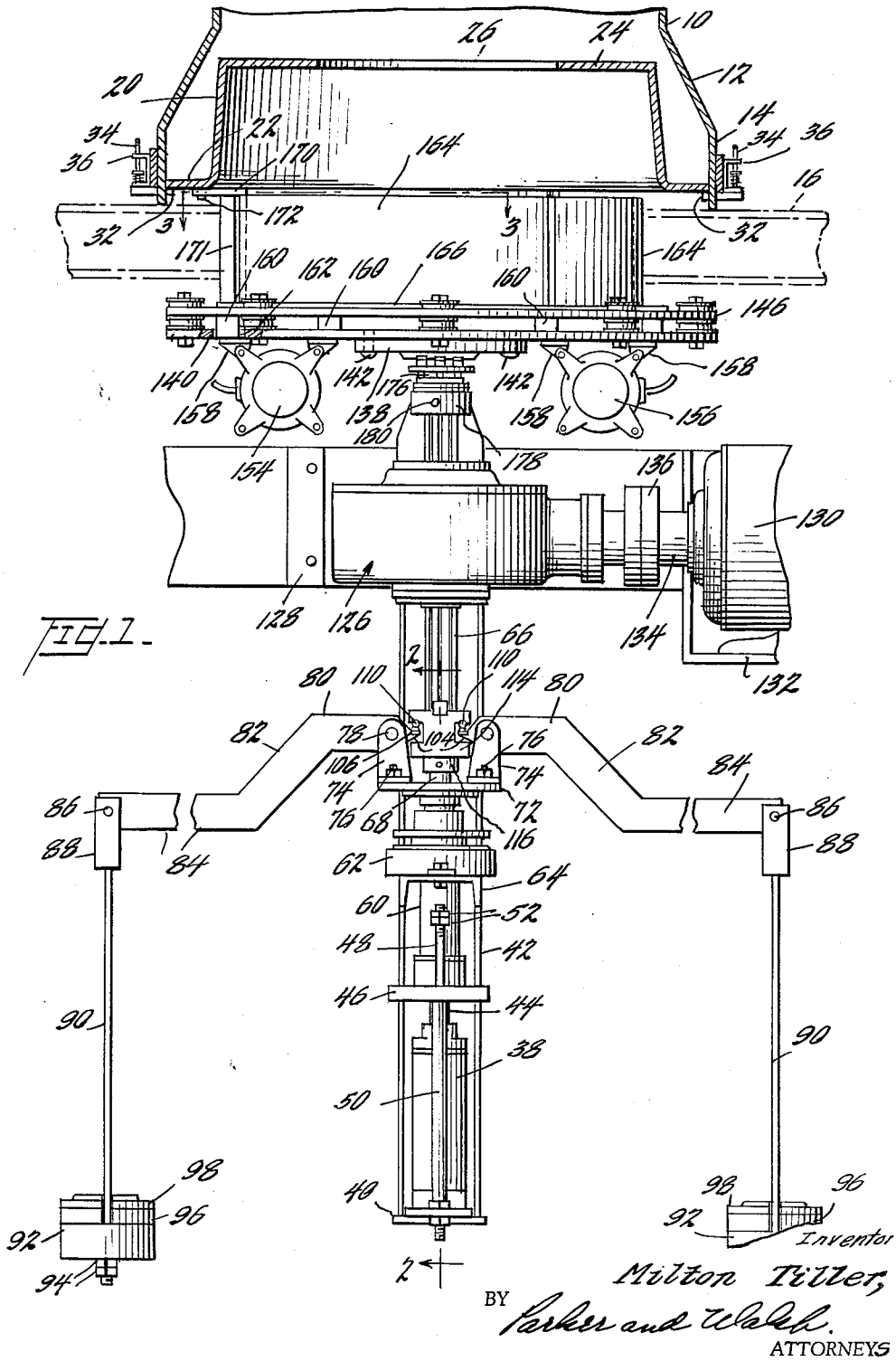
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MACHINE FOR MAKING CONCRETE PIPE

Filed Dec. 19, 1960

3 Sheets-Sheet 1



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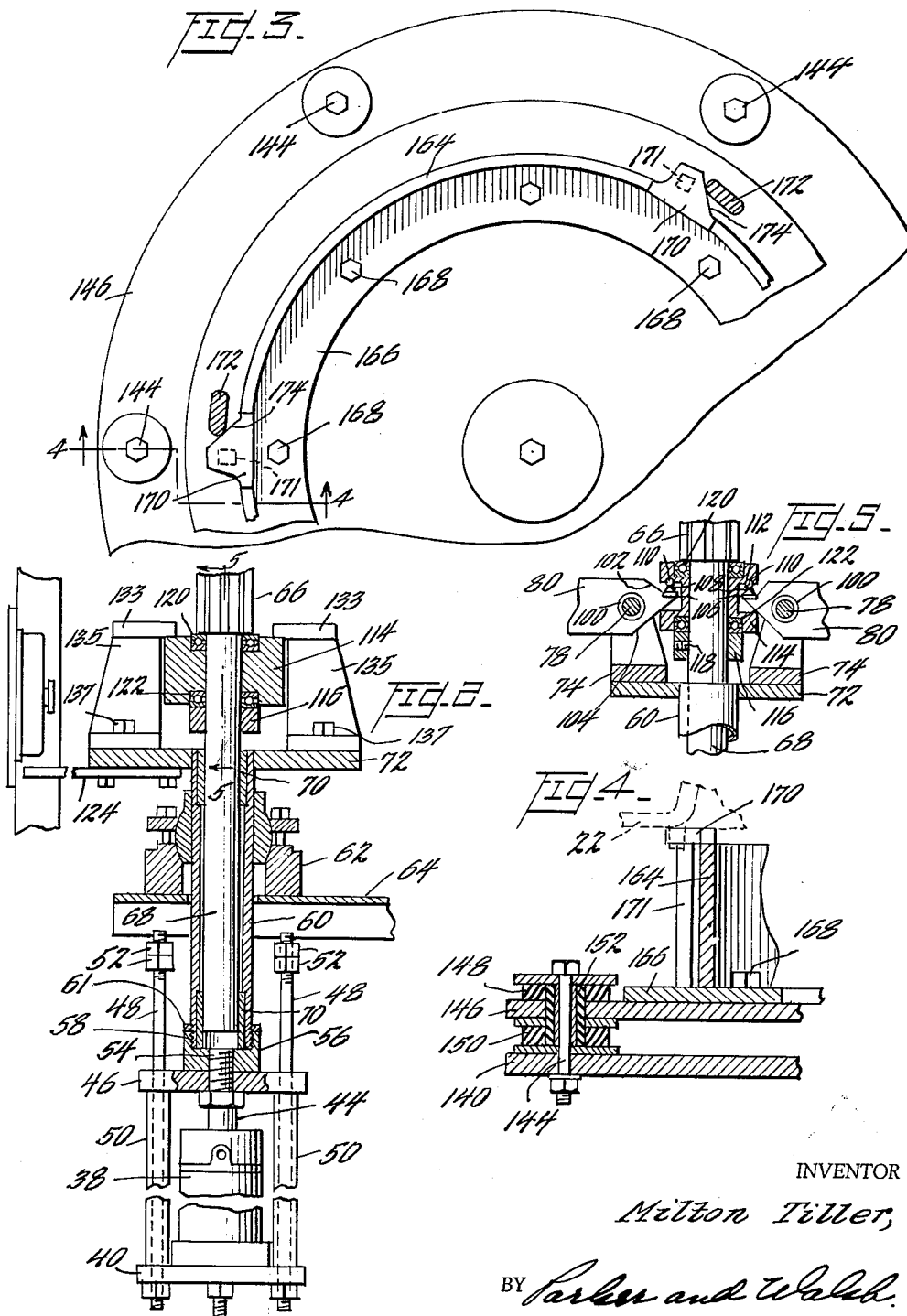
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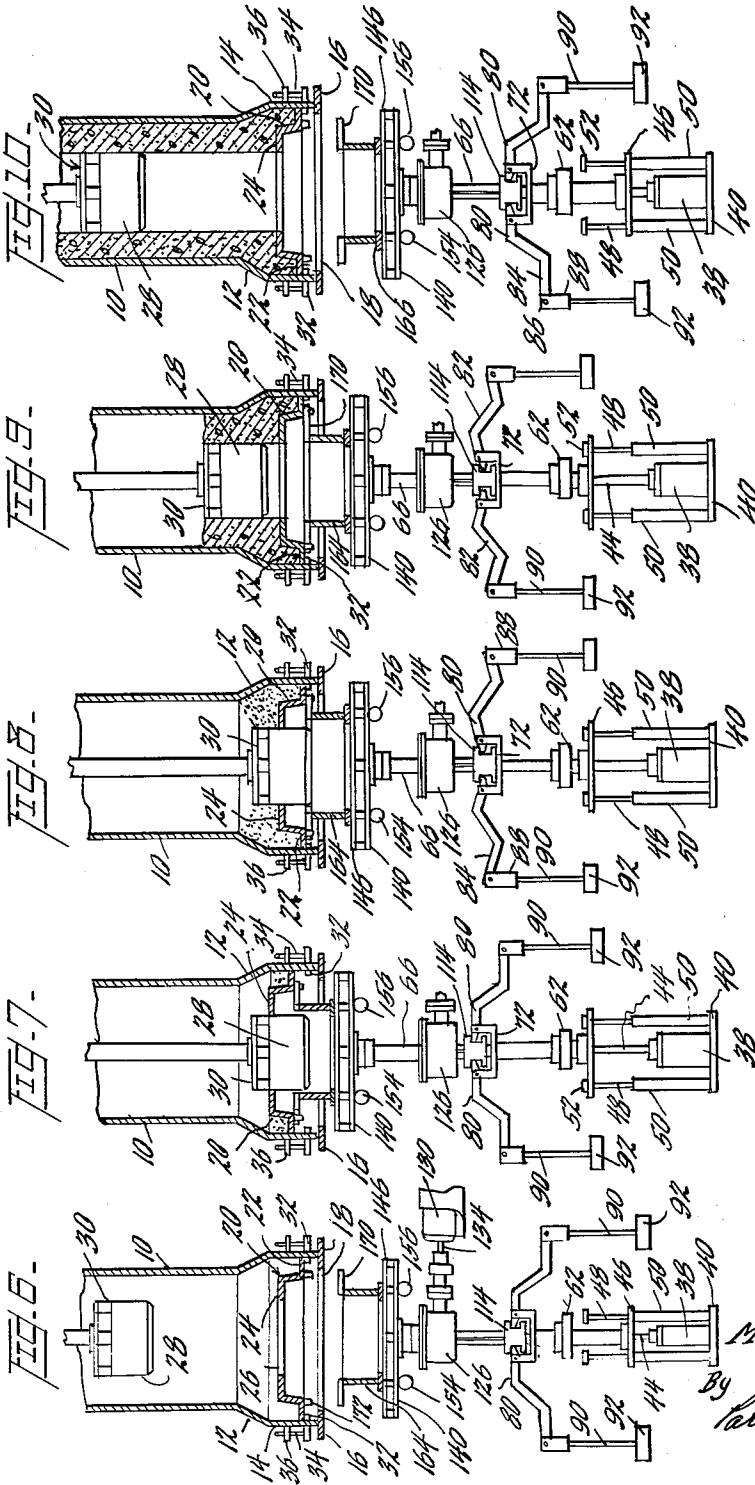
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MACHINE FOR MAKING CONCRETE PIPE

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3 Sheets-Sheet 3



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MACHINE FOR MAKING CONCRETE PIPE
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7 Claims. (Cl. 25—39)

This invention relates to the making of concrete pipe or the like, and machinery therefor, and has particular reference to the making of bell-mouthed pipe with the bell end in the downward position, or grooved-mouthed pipe with the female end in the downward position. Indeed the ideas incorporated herein would have equal force where the spigot end of bell and spigot pipe is made in a downward position or where the tongue end of tongue and groove pipe is made with the tongue end down.

From primitive beginnings, this pipe-making art has kept step with technological progress and consequent demand in such fields as irrigation, sewage and drainage. As a result of this development, a current practice in the art is to manufacture the pipe in a vertically disposed form with a bell-shaped end, a generally frusto-conical platen centered in the bell-shaped end, and a packer head which moves slowly along the axis of the form, while rotating, and while concrete is being poured in, to form the barrel of the pipe section.

Recently, however, the engineers in certain of the pipe-using fields have been concerned with leakage at the joints, as in keeping out ground water or other contaminating fluids, and in containing the fluid being transported against leakage and consequent loss. This has led to demands for precision tolerances in the dimensions of the pipe joints, so that rubber gaskets may be employed rather than the old, ineffective method of trowelling in mortar at the joints. Prime among the factors involved in attaining a precision joint are the use of a pallet which is precisely fabricated, dimensionwise, such as by machining, and a guaranteed attainment of optimum density, that is, close packing, in the bell-mouth. The latter is best and most economically accomplished by forming the pipe in the bell-down position and, for best results, the pallet is left in place in the bell-mouth for the duration of the curing time, or a substantial portion thereof. Since operation in the bell-down position does not permit of inspection of the condition of the bell in time to re-use the material in a faulty pipe, the need for sure methods of compacting is correspondingly great.

It is therefore a general object of the invention to attain favorable and predictable conditions of density or compacting in the bell-mouth of a pipe section. More particularly, it is an object to attain the foregoing by a more efficient method of vibrating the fluid pipe material. Another and related object is to achieve efficient compacting with minimum wear, and consequent longer life in certain elements of the pipe-forming apparatus.

The foregoing and other objects are attained by the present invention, which may be briefly described as comprising a mechanism which is raised to contact and raise the pallet from its normal seat of dwell within the bell-mouth, and to rotate the pallet and subject it to vibrations while so elevated, and the said mechanism including a yielding connection permitting a slight adjustment of its effective length, and a consequent lowering of the pallet to its seat, in response to the weight of a pre-determined amount of material charged into the form in forming the bell-mouth.

For a more detailed description of the invention, reference is made to the following specification, as illustrated in the accompanying drawings, as keyed by several reference numerals, and in which:

FIGURE 1 is a front elevational view of the lifting,

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rotating, and vibrating mechanism, showing the bell portion of a pipe former in vertical section and in superposed relation thereto;

FIGURE 2 is an axial sectional view, taken along the line 2—2 of FIGURE 1;

FIGURE 3 is a fragmentary view of a section of the apparatus, taken along the line 3—3 of FIGURE 1, enlarged, and showing the lug connection for rotating the pallet;

FIGURE 4 is a sectional view taken along the line 4—4 of FIGURE 3, and showing the resilient mounting between the plates of the rotating and vibrating plates;

FIGURE 5 is a sectional view taken along the line 5—5 of FIGURE 2, enlarged, and showing details of the balance block; and

FIGURES 6 through 10 are views similar to FIGURE 1, on reduced scale, showing the sequence of operations, omitting details, and with the lift cylinder mounting turned through 90° for better perception of the movements.

Referring to the drawing by characters of reference, there is shown, in FIGURE 1, a pipe form 10, shown as cylindrical in form, but which may have circular corrugations. The lower, bell end of the form has a diverging, frusto-conical section 12, and at its lower extremity, a cylindrical skirt 14, which rests on a platform 16, which may be a turntable for indexing in production work, and the skirt 14 is spotted in surrounding relation to a circular opening 18 (FIG. 6) in the table. This opening permits access of the lifter to the pallet 20, which is also frusto-conical in form, and has a lower, outer, annular flange 22 having a sliding fit within the skirt 14 of the form, and a planar top 24 with a central, circular opening 26 of a diameter to just pass the cylindrical bottom 28 of the packer head, indicated generally by the numeral 30 (FIG. 6), which forms the barrel of the pipe by rotation and axial translation from the pallet upward through the mix in the form.

In accordance with the invention, the pallet will be lifted upwardly slightly in an initial state of the operation, and in its normal, lowered position it dwells on a series of lugs 32 extending radially inward through skirt 14 of the form. For insertion and removal of the pallets, these lugs are made retractable, being locked in position by a pin 34 carried by a bracket 36.

The lifting mechanism will perhaps be better understood if described in sequence from the lowermost part upward to the region of the pallet. The lifting effort is provided in a hydraulic cylinder 38 mounted on a bracket 40 extending from a channel plate 42 affixed to the over-all structure (not shown) of which turntable 16 is a part. The piston rod 44 carries a cross arm 46 having a pair of bores slidably received on the reduced upper sections 48 of a pair of uprights 50 secured to the base of the cylinder, the shoulder between section 48 and the wider part 50 serving as a lower limit stop on which the piston rod cross arm 46 dwells when idle. A pair of nuts 52 on each of the threaded, upper ends of reduced extensions 48 serve as an adjustable upper limit stop which is of considerable significance as part of the several structural features involved in the invention, although not novel in itself.

Secured to the top of cross arm 46 centrally thereof, as by screws 54 (FIG. 2), is an upwardly open, cup-shaped cylindrical element 56, internally threaded as at 58 to receive the threaded lower end of a tube 60, having a lock nut 61, the latter thus being in effect, a part of the piston rod 44, and the whole may be referred to as a push rod. Tube 60 is given lateral support by a bushing block 62 bolted to a shelf 64 carried by bracket 42. At the top of the tube 60 there is an interruption in the rigid nature of the connections in the push rod system, the separate upper part of the system comprising a splined shaft 66, having a long, reduced, lower end 68, of circular section,

slidably and rotatably mounted in the interior of tube 69, at top and bottom, with bearing sleeves 70. According to the invention, the thrust is communicated from the tube 69 to the shoulder between the splined shaft and its reduced, lower extension, in a by-pass arrangement which is controlled by a yieldable force, whereby the thrust is communicated normally with the telescoping parts extended to a limiting, effective length of the push rod system, but, in response to a predetermined load on the system, the telescoping parts collapse to a limiting, shorter, effective length of the system, the difference in length being about one-quarter of an inch.

For communicating the by-passing thrust, tube 60 has, at its upper end, a horizontal, annular flange 72 (FIG. 1), on the upper face of which a pair of forked brackets 74 are secured by bolts 76, in diametrically opposite positions, and which carry the two weight and lever systems constituting the yieldable force which hold the telescoping push rod system extended. Describing one only of these identical weight systems, the brackets 74 are bored to receive a pin 78, which serves as the fulcrum of the first-class lever system. The outer, longer arm 80 of the lever has a dog leg bend 82, and an outer, horizontal section 84, the latter having a bore near its extremity, receiving a pintle bolt 86, by means of which there is pivotally attached to the lever, the forked, upper end 88 of a rod 90, having a main weight 92 retained by nuts 94 on its threaded, lower end, and which is adapted to receive a series of smaller, radially notched, adjusting weights, such as the two shown, and indicated by the numerals 96 and 98. The lever, adjacent section 80, is bored to receive a bearing sleeve 100 (FIG. 5), which, in turn, is received on the fulcrum pin 78. The short arm of the lever, inwardly of the fulcrum pin has tapering sides 102, 104 with a small plate insert 106 at the vertex carrying a horizontally disposed, thrust-communicating pin 108, of hardened material. In practice, a lever ratio of 1:10 has been found satisfactory.

The by-pass thrust is communicated to the splined shaft 66 by tangential contact of pins 108 with similar pins 110 carried in a recess 112 in a sleeve 114 which abuts the shoulder between the splined shaft and its reduced extension 68, the sleeve being locked in position against the shoulder by means of a collar 116 below the sleeve, which is secured to extension 68 by a set screw 118. The clearance between sleeve 114 and flange 72 represents the play in the telescoping parts. This clearance is also apparent between the bottom of shaft 68 and the floor of the recess in cup 56. Actual contact with the sleeve by the shoulder and the collar is through the outer races of a pair of bearing cages 120, 122, which are provided because the splined shaft is subject to rotation. A radially extending finger 124 (FIG. 2), bolted to the under side of flange 72, contacts the bracket 42 to prevent rotation of sleeve 114 and for other purposes to be hereinafter described.

The splined shaft 66 is slidably received in the center of the output gear of a gear unit indicated generally by the numeral 126, which is secured to a bracket 128 carried by the main framework holding the turntable, the drive to the gear unit being from a motor 130 supported on a platform 132, and feeding through a shaft 134 and coupling 136. A pair of stop blocks 133, carried by standards 135 secured by bolts 137 to sleeve flange 72, extend above the top of sleeve 114 and constitute a stop which prevents sleeve 114 from contacting the gear unit.

The splined shaft 66 carries, at its top, a circular plate 138, on which is mounted the system which lifts, rotates, and vibrates the pallet 20. Thus, there is mounted on top plate 138, a larger circular plate 140, secured to the plate 138, by screws 142 and which may be conveniently referred to as the rotating disc. Connected to disc 140 by a series of bolts 144 (FIG. 4) is an upper disc 146 of the same diameter as disc 140, and may be called the vibrating disc, since, although it rotates with disc 140, its main

function is to provide the vibrations, and this vibration is isolated, to the maximum extent possible, from the rotating plate 140, and the balance of the lifting and rotating mechanism therebelow. This insulation is provided in a pair of rubber washers 148, 150, surrounding each bolt 144 and located above and below the top disc 146, and a rubber sleeve 152 surrounding the bolt shank. The vibrators 154, 156, which are standard, commercial equipment are located on a diametral line, on opposite sides of the center of plates 140, 146, and are bolted to brackets 158, which in turn are bolted to lugs 160, depending from top disc 146 and passing through openings 162 in lower disc 140.

The actual contact for lifting, rotating and vibrating the pallet is provided in a cylindrical standard 164 having a bottom, annular flange 166 secured by bolts 168 to the vibrating disc 146. Extending radially outward from the top edge of standard 164 are three equi-spaced lugs 170, supported by legs 171 dwelling on the flange of the standard, the lugs being adapted to contact the flange 22 of the pallet, to lift it from its seat, and upon rotation of the lifting system being adapted to contact three lugs 172 depending from the said pallet flange, and so communicate rotation to the pallet. Lugs 170 have cam-shaped sides 174 (FIG. 3) for contacting the pallet lugs 172, providing a wedging action which gives a tight grip on the pallet and thus enhances the efficiency of the vibrating process.

The operation of the system will now be described, with reference to the cycle illustrated in FIGURES 6 through 10. In FIGURE 6, the piston of the hydraulic cylinder is in lowered position, with cross plate 46 resting on the shoulders of rods 50. With the entire lift system thus inactivated, the lift standard 164 is below the turntable, and the latter may be indexed to bring another form into the working position, with its pallet flange 22 resting on the retracting lugs 32. Since there is no load on the lift standard, the weights 92 are in lowermost position, and consequently the movable sleeve 114, and all of the parts of the lift system above it, are in the "up" position, that is the extended position of the telescoping parts. In FIGURE 7, the hydraulic cylinder has been actuated, to raise the lift system to its highest point, as determined by nuts 52 on the slide rods 42, or by other suitable limit means. In this position, the pallet is lifted about one-quarter of an inch off its seat. Since there is still insufficient load on the system to overcome the weighted levers, the telescopic lift remains extended, and the levers and weights are in the same position as in FIGURE 6. At this stage the packer head 28 is lowered through the central opening of the pallet, and charging of concrete into the form is commenced. Motor 130 is also started, to slowly rotate the pallet, and the packer head is rotated in the opposite direction. At the same time, the vibrators are energized, with plate 146 communicating the vibrations to the pallet. For energizing the vibrators, collector rings may be conveniently located in the top plate 138, and cooperating brushes in a sleeve 176 mounted on the splined shaft and held in position by a sleeve 178 secured by a pin or set screw 180.

As more and more concrete is charged in, and compacted, for forming the bell-mouth of the pipe, a point is reached where the downward packing force of the packing element acting through the concrete overcomes the weighted levers, and, as shown in FIGURE 8, the standard 164 descends sufficiently to return the pallet to its seat, the levers and weights rise, and close inspection will show that sleeve 114 has descended through the clearance distance between it and the top flange 72 of sleeve 60. This situation indicates satisfactory conditions in the bell-mouth, and may be signalled to the operator, as for instance, by a light actuated by a limit switch contacted by the anti-turn lever 124 of sleeve flange 72. Thereupon, both rotation and vibration of the pallet continue momentarily while lifting of the rotating packer

head commences to form the barrel, as shown in FIGURE 9. Though rotation and vibration cease, the pallet remains in position while the lower portion of the barrel is made. Finally, as shown in FIGURE 10, the hydraulic cylinder is de-activated and the parts return to the position shown in FIGURE 6.

While a certain, preferred embodiment has been shown and described, various modifications will be apparent to those skilled in the art, in the light of this disclosure, and the invention should not, therefore, be deemed as limited, except insofar as may be reasonably inferred from the spirit and scope of the appended claims.

I claim:

1. A device for lifting, rotating and vibrating a pallet in a pipe-forming apparatus comprising a powered main lift mechanism having a ram, said ram comprising separate upper and lower telescoping sections and limit stops defining a degree of axial play between the sections, a splined shaft on said upper section, means slidably receiving said shaft and adapted to rotate the shaft, a circular plate carried by said shaft above said rotating means, a second plate mounted above said first plate for rotation therewith, cushion means spacing said plates, vibrating means carried by the lower of said plates, and means to hold said telescoping parts extended comprising a plurality of levers, each mounted on a fulcrum carried by said lower section, weights carried by the outer arms of said levers, a sleeve rotatably mounted on said upper section, means holding said sleeve against axial movement along said upper section, and contact means on the inner arms of said levers, engaging said sleeve to bias it upwardly under the urging of said weights, said sleeve movable downwardly with said upper section in response to a weight load on said upper section sufficient to overcome the upward force of the weighted levers.

2. A device for lifting, rotating and vibrating a pallet in a pipe-forming apparatus comprising a powered main lift mechanism with an upwardly movable push system, said system comprising separate upper and lower telescoping sections and limit stops defining a degree of axial play between the sections, an upwardly open sleeve on said lower section, a splined shaft on said upper section having a reduced cylindrical lower end rotatably and slidably received in said sleeve, means slidably receiving said splined shaft and adapted to rotate it, a circular plate carried by said splined shaft above said rotating means, a second plate mounted above said first plate for rotation therewith, cushion means spacing said plates, vibrating means carried by the lower of said plates, a standard on said upper plate having wedge shaped lugs for engaging depending lugs on a pallet, and means to hold said telescoping parts extended comprising a plurality of levers, each mounted on a fulcrum carried by said lower section and extending radially outward from said sections, weights carried by the outer arms of said levers, a sleeve rotatably mounted on said upper section, means holding said sleeve against axial movement along said upper section, and contact means on the inner arms of said levers engaging said sleeve to bias it upwardly under the urging of said weights, said sleeve movable downwardly with said upper section in response to a weight load on said

upper section sufficient to overcome the upward force of the weighted levers.

3. A device for lifting, rotating and vibrating a pallet in a pipe forming apparatus comprising a powered main lift mechanism with an upwardly movable push system comprising separate upper and lower telescoping sections and limit stops defining a degree of axial play between the sections, an upwardly open sleeve on said lower section, a splined shaft on said upper section having a reduced cylindrical lower end rotatably and slidably received in said sleeve, means slidably receiving said splined shaft and adapted to rotate it, a circular plate carried by said splined shaft above said rotating means, a second plate mounted above said first plate for rotation therewith, cushion means spacing said plates, vibrating means carried by the lower of said plates, a standard on said upper plate having wedge shaped lugs for engaging depending lugs on a pallet, and yieldable force means holding said telescoping parts extended and responsive to an overcoming force on said upper section to permit contraction of said telescoping parts.

4. A lift device for use with a pipe-forming apparatus comprising axial power lift means having a ram in two separate but interconnected sections with limit stops defining a degree of axial play in said sections, means to rotate the upper of said sections, a vibrator carried by said upper section above the rotating means, means on the top of said upper section associated with said vibrator and adapted to engage a pallet for rotation thereof with said upper section, and yieldable means holding said interconnected sections extended said yieldable means permitting approach of the interconnected sections to the limit stops, upon the application of a predetermined weight to the upper section.

5. A lift device for use with a pipe forming apparatus comprising power means having a ram in two separate but interconnected sections with limit stops defining a degree of axial play in said sections, means to rotate the upper of said sections, a vibrator carried by said upper section above the rotating means, means on the top of said upper section associated with said vibrator and adapted to engage a pallet for rotation thereof with said upper section, and yieldable force means holding said interconnected sections extended in the absence of an overcoming weight applied axially of said upper section.

6. A device as in claim 4, said upper section comprising a splined shaft with a reduced cylindrical lower end, and said lower section comprising a tube slidably and rotatably mounting said reduced end and means to rotate the output end of the ram.

7. A device as in claim 6, said reduced end having a block adjacent said splined shaft, fixed against axial movement, but rotatably and slidably receiving said reduced end, and the inner arms of said levers engaging said block to bias it upwardly.

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