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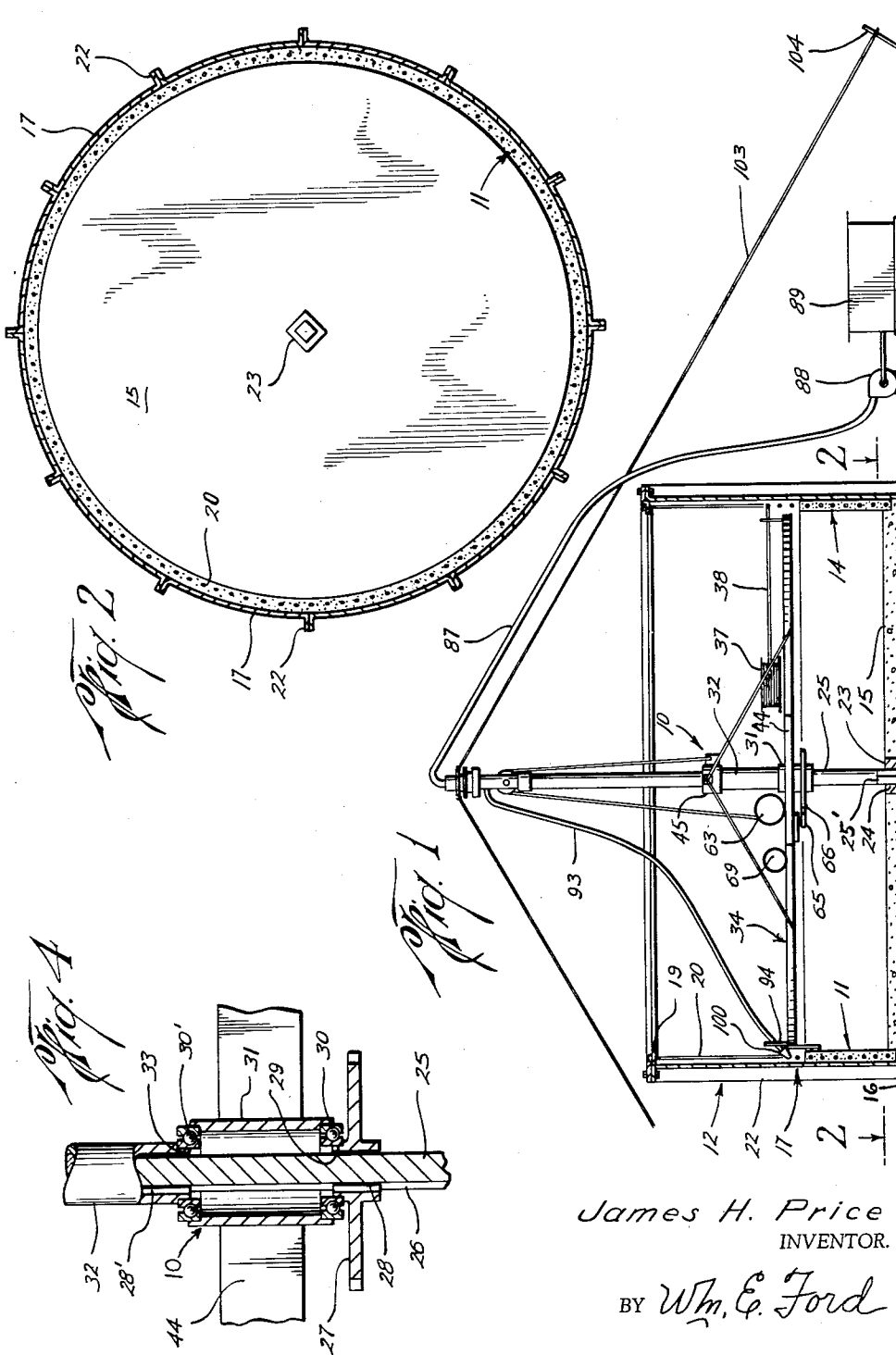
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CYLINDER GENERATING MACHINE AND METHOD OF GENERATION

Filed Sept. 16, 1957

3 Sheets-Sheet 1



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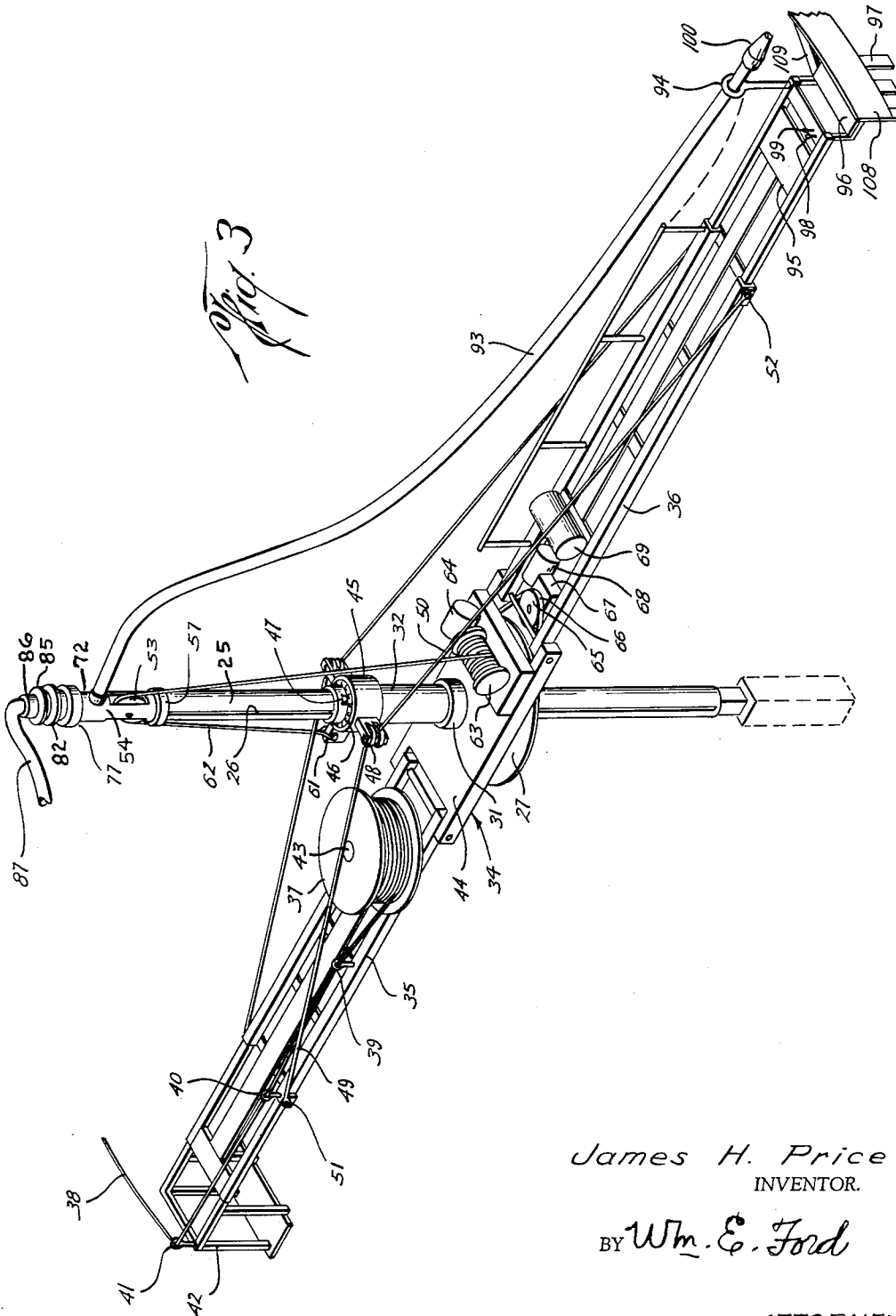
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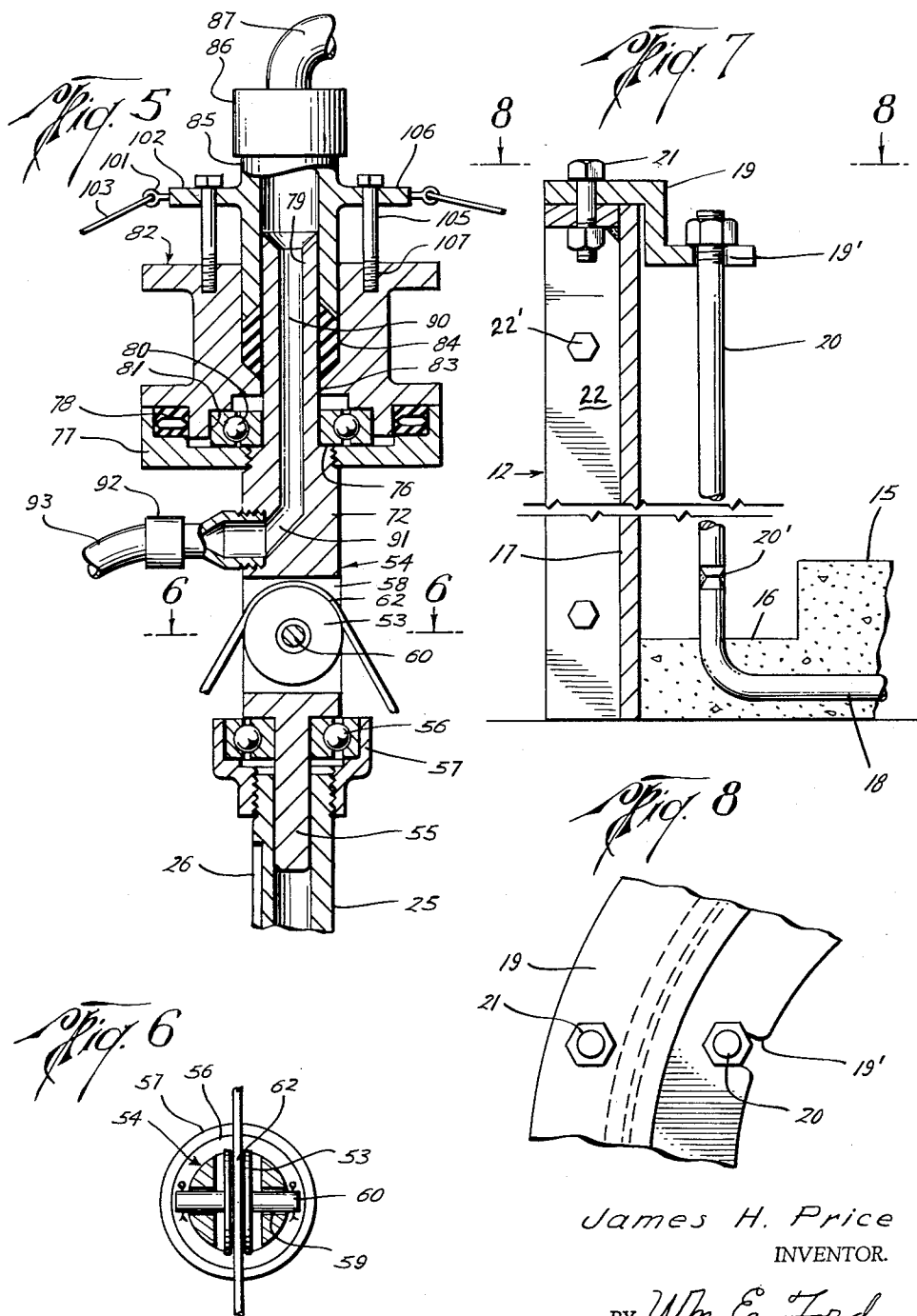
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1

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CYLINDER GENERATING MACHINE AND METHOD OF GENERATION

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6 Claims. (Cl. 25—1)

This invention relates to a machine adapted to be rotated to automatically generate concrete cylinders and the like within a reinforcing frame therefor.

It is a primary object of the invention to provide a machine adapted automatically to generate such a cylinder above a base first poured by conventional means.

It is another object of this invention to provide a machine of this class adapted automatically to generate such a cylinder in a manner to take advantage of a pre-erected reinforcing frame therefor.

It is a further object of this invention to provide a machine adapted automatically to generate such a cylinder while at the same time placing a spiral of reinforcing rod in the generated cylinder.

It is also another object of this invention to provide a machine of this class that is adapted to smooth the inner surface of the generated cylinder.

It is also a further object of this invention to provide a machine of this class adapted to receive concrete from a stationary source and deliver it through a rotatable source.

It is yet another and further object of this invention to provide such a cylinder generating machine which may construct cylinders of reinforced, pressurized gunite, or optionally of conventional concrete.

Other and further objects will be apparent when the specification herein is considered in connection with the drawings in which:

Fig. 1 is an elevational view, part in section, showing a concrete cylinder generating machine embodying the invention in process of generating a concrete cylinder as determined by the forms employed by the invention;

Fig. 2 is a plan view of the cylinder form taken along line 2—2 of Fig. 1;

Fig. 3 is a perspective view of the machine;

Fig. 4 is a sectional elevation through the center of the machine;

Fig. 5 is a sectional elevation through the upper part of the machine;

Fig. 6 is a sectional plan view taken along line 6—6 of Fig. 5;

Fig. 7 is a sectional elevation showing details of form arrangement; and

Fig. 8 is a plan view taken along line 8—8 of Fig. 7.

Referring in detail to the drawings, in which like reference numerals are employed to represent corresponding elements in the various views, a concrete cylinder generating machine 10 is shown generally in Fig. 1 in process of generating a concrete cylinder 11 within the defining limits of a form assembly 12, in a manner to lay a spiral 14 of reinforcing rod or wire within the concrete cylinder 11.

At outset a circular concrete slab 15 has been poured by conventional method and equipment, but in a manner that the upper part thereof is of slightly reduced diameter, thereby providing a shoulder 16 to serve as the annular seating surface for the cylinder 11 to seat thereon, as later generated. The base of the slab 15 thus defines

2

the cylindrical surface against which the lower ends of form segments 17 are brought to bear, such segments subtending selected arcs about the circumference of the base 15, as arcs of 30° as shown in Fig. 2.

As best shown in Figs. 7 and 8, reinforcing rods 18 are provided in the slab 15 having upwardly turned ends which extend upwardly through the shoulder 16, such rods being spaced to arise circumferentially around the slab at predetermined arcuate distances apart. On top of each form segment 17 an arcuate ring 19 is provided of substantially Z-shaped cross-section, and affixed thereto by bolts 21. Slots 19' are provided in the rings 19 with design of spacing to be located above the upstanding ends of the reinforcing rods 18. Then vertical reinforcing rods 20 are placed with heads in the slots 19' and the bottoms thereof welded at 20' to the upstanding ends of the reinforcing rods 18, whereby vertical reinforcement is provided for each segment. Vertically extending flanges 22 are provided on the side edges of each segment 17, so that the adjacent segments 17 may be joined together by vertically spaced apart, conventional connecting bolts and nuts 22' thereby to form an assembly 12 of desired inner diameter, and with proper vertical reinforcement.

When the slab 15 is ready to be poured, an inverted cap or bearing base 23 is provided, having an opening 24 therein of non-circular cross-section, and such base is placed at the center of the slab space and the slab is poured therearound. A post 25 having an end 25' of non-circular cross-section is provided to fit into the opening 24 to serve as the axis of the concrete cylinder generating machine 10 to be hereinbelow described. As shown in Fig. 4, a keyway 26 is provided in the post 25 to extend from the base 26 thereof upwardly to a point near the top of the post. A gear 27 having a key 28 inside its hub is mounted on the post 25 to slide up and down the post as keyed thereto by the key 28 in the keyway 26.

The upper end of the gear hub is turned down at 29 and the inner race of a ball bearing assembly 30 is pressed thereon as shown in Fig. 4. A cylinder 31 having internally recessed ends is provided to serve as the hub of the machine 10 and such cylinder is installed with its lower end pressed upon the outer race of the ball bearing assembly 30. A similar ball bearing assembly 30' has its outer race pressed into the upper end of such cylinder 31 and a sleeve 32 is provided having a turned down lower end 33 which is pressed into the inner race of the ball bearing assembly 30', such sleeve receiving the post 25 through the bore thereof.

As best shown in Fig. 3, the machine 10 includes a bridge 34 which includes a table 44 connected inwardly to the sleeve 31 and extending outwardly therefrom. Arms 35 and 36 are pivotally connected to the outer ends of the table 44 about a horizontally extending axis transverse to a diametrical line through the machine and such arms extend to the limits of the cylinder to be generated. A drum 37 of reinforcing rod or wire 38 is mounted upon the arm 35, the hub or axle 43 of the drum 37 being supported from the arm 35 in a conventional manner to facilitate drum rotation responsive to the unwinding of the wire or rod. A cage 42 at the outer end of the arm 35 supports an eyelet 41 and eyelets 39 and 40 are mounted inwardly thereof on the arm 35. Such eyelets serve to guide the wire 38 as it is unreeled from the drum 37 to be fed out as a spiral as the machine rotates, in a manner to be hereinbelow described.

A lift sleeve 45, as shown in Figs. 1 and 3, and having a roller bearing assembly 46 therein, is mounted on the guide sleeve 32 to bear upwardly against lift lugs 47 on the guide sleeve 32. Pulley brackets 48 are provided on diametrically opposite sides of the lift sleeve 45 and supporting guy ropes 49 and 50 extend therefrom for re-

spective connection at 51 and 52 to the arms 35 and 36 respectively.

At the top of the post 25, as shown in Fig. 5, a swivel 54 having a shaft 55 on the lower end thereof is mounted to rotate in a ball bearing assembly 56 which is pressed into a cup 57 threaded upon the top of the post 25. A milled slot 58 is provided within the swivel 54 with bores 59, as shown in Fig. 6, being provided through the side walls of the slots to receive the axle 60 of a pulley 53 mounted thereon, the pulley being conventionally spaced, and the axle being conventionally and adequately journaled, and located against axial displacement.

A lift lug 61 is provided on the lift sleeve 45 spaced 90° from the pulley brackets 48, and such lift lug has connected thereto a line or rope 62, preferably wire cable, which extends upwardly and into the slot 58 and over the pulley 53 and downwardly therefrom about the drum of a winch 63 which is mounted on the table 44 adjacent the drive cylinder 31. A hydraulic motor 64 is also mounted on the table 44 and connected in conventional manner to rotate the winch 63.

A drive pinion 65 is supported below the table 44, or optionally below the arm 36, as the case may be, for rotation with relation to such table, and a drive belt 66, as a sprocket chain, makes driving connection between the gear 27 and the pinion 65. Below the arm 36, and supported thereby, a reduction gear unit 67 is shown in Fig. 3 positioned to make driving connection to the pinion 65, and adjacent thereto a fluid motor 68 is located beneath the arm 36, or the table 44, as the case may be, to make driving connection to the reduction gear unit 67. Whether the pinion 65, the reduction drive unit 67, or the motor 68, are carried by the table 44 or by the arm 36 is a matter of choice, such elements being relevantly shown in Fig. 3 as in positions of adjacency with relation to each other whereas in installation the mounting means and structural supports will be made in correspondence with conventional arrangements of this type of equipment.

A fluid pump 69 is shown in Fig. 3 as carried by the arm 36 and designates the source of power, which, through conventional hydraulic systems, drives the hydraulic motor 68 and also the hydraulic winch motor 64. However, other sources of power may be employed such as an electric motor or a gasoline motor.

Above its main body 72 the swivel 54 is slightly turned down and threaded at 76 to receive thereon a roller bearing support flange 77 which is recessed at its upper end to carry therein a seal 78, or a roller bearing assembly, as the case may be, such support flange being counterbored inwardly of the roller bearing assembly or seal to provide a clearance space. Above the swivel body 72 the swivel 54 has a reduced diameter upper end 79 to receive thereon the ball bearing assembly 80 which shoulders against the end face of the part 76, such ball bearing assembly being outwardly pressed into a recess 81 provided in the lower end of a guy cap 82. Such guy cap 82 is bored and counterbored inwardly of the ball bearing assembly recess, the counterbore 83 providing the journal, for the upper end 79 of the swivel 54.

The upper end of the guy cap 82 is bored and counter-sunk to provide a stuffing box 84 to receive therein the lower end of a hose connection gland 85, such lower end receiving the swivel end 79 therein and compressing the packing in the stuffing box 84. The upper end of the gland 85 is threaded to receive a conventional hose connection 86 thereon from which a hose 87 extends to a pump 88 mounted outwardly of the form assembly 17 and adjacent a reservoir 89 containing concrete or gunnite (see Fig. 1).

The swivel 54 has an axial bore 90 through the upper end thereof which communicates at its lower end with a diagonally and radially extending bore 91 so that fluid can flow from the stationary hose 87 through the rotating swivel 54, the bore 91 of the swivel 54 being threaded to receive a conventional hose connection 92 to which there

is connected a hose 93 which extends to a support eyelet 94 at the end of the arm 36.

A platform operator's seat or station 95 is provided at the end of the arm 36 so that an operator may stand with his feet on a stand 96 supported at the very end of the arm 36, such stand having scraping blades 97 extending downwardly therefrom for a purpose to be hereinbelow described. The operator at the station 95 works controls 98 and 99 which control the motors 64 and 68 and in this manner he regulates the operation of the winch 63 in correlation with the driving of the pinion 65. As the pinion 65 rotates in mesh with the sprocket chain 66 it drives itself around the stationary gear 27 and drives the bridge 34 therearound. As the bridge rotates, the operator directs the nozzle 100 of the hose 93 to deliver concrete or gunnite adjacent the form assembly 12 and the blades 97 scrape off the excess concrete or gunnite to maintain the inside of the cylinder to be generated at a uniform inner diameter.

As the bridge 34 rotates the winch 63 takes up the cable thereon so that the inner race of the bearing assembly 46 within the lift sleeve 45 lifts upwardly against the lift lugs 47 on the guide sleeve 32 and draws the guide sleeve 32 upwardly therewith, the guide sleeve 32 being keyed into the keyway 26 to prevent rotation, as by a key 28'. This also lifts the bridge 34 by virtue of the connection between the guide sleeve 32 and the drive cylinder 31 as effected by the ball bearing assembly 30'. Also, since the drive cylinder 31 is connected to the gear 27 by means of the ball bearing assembly 30 the gear 27 is also lifted as it maintains keyed contact with the post 25. In this manner lifting can be effected while concrete or gunnite is poured from the nozzle 100 as the bridge 34 rotates. At the same time reinforcing rod or wire 38 is payed out by an operator in the cage 42 at the other end of the bridge 34, such operator standing in the cage 42 and correcting the position of the wire with relation to the vertical reinforcing rods 20.

In order to support the post 25 and the elements assembled thereabove hooks 101 are threaded into the top flange 102 of the guy cap 82 and the upper ends of the guy wires 103 are connected into the hooks 101 while the lower ends thereof are connected to pegs 104 spaced outwardly of the form assembly 12 a sufficient distance to permit the guy wire 103 to clear the top of the form assembly 12.

As the packing 84 wears adjustment can be made by tightening the take-up bolts 105 which pass through holes provided in the gland flange 106 and into tapped holes 107 in the top of the guy cap 82. In this manner there can be no leakage as the construction material in fluid form such as concrete or gunnite is transferred from the stationary hose 87 through the rotating swivel 54 and through the hose 93 extending therefrom to the nozzle 100 at the end of the rotating bridge 34. As the guy cap 82 is subject to exerting both horizontal and vertical components of thrust it may be necessary to provide both the ball bearing assembly 80 and the roller bearing assembly 78 to minimize these thrust effects while at the same time permitting the swivel end 79 to rotate freely within the guy cap 82, otherwise a seal may be provided at 78 instead of a roller bearing assembly so that the ball bearing assembly takes all the thrust, as shown in Fig. 5.

In summarizing the relative rotation of the machine elements, the pinion 65 carried by the bridge 34 connected to the drive cylinder 31, drives itself around the gear 27 and carries with it the bridge 34. As the lift sleeve 45 is connected to the arms 35, 36 of the bridge 34, the lift sleeve must rotate therewith, which it does by virtue of the bearing assembly 46 interposed between it and the guide sleeve 32, the guide sleeve being keyed to the post 25, so that consequently the lift sleeve 45 rotates about the guide sleeve.

The hose 93 which extends to the nozzle 100, passes through the eyelet 94 on the arm 36, so that the hose 93

must rotate with the bridge 34, and the swivel 54 must therefore rotate with the hose 93. As the shaft 55 of the swivel 54 is journaled for rotation in the ball bearing assembly 56 at the top of the post 25, the swivel can rotate with relation to the post. Also, since the upper end 79 of the swivel is journaled in the guy cap 82, and in the bearing assembly 80 therein, the swivel can also rotate in the guy cap 82 which the guy lines 103 hold non-rotatable.

As shown in Fig. 3, a vertically extending circular plate 108 is fixed to the stand 96 and carries the scraping blades 97. Such a plate would be required in the case of pouring conventional concrete, as a certain vertical contact would be required to define the inner diameter of the cylinder being generated until the concrete hardened sufficiently. As shown, the plate 108 is not defined in extent and the bracing therefor is indicated more or less diagrammatically by the brace 109. However, it can be seen that in practice the plate may have to extend for a substantial arc around the inner diameter of the cylinder to be generated, or it may extend all around the cylinder, depending upon the rate at which the concrete hardened. In any event, no problem would be posed as such plate could always be braced from the bridge 34 and guy lines extended thereto from the lift sleeve 45. In these cases where the plate 108 is required, the scraper blades 97, which scrape off the inwardly extending parts of concrete, as the concrete hardens, would have to be lowered with relation to the plate 108 from an upwardly retracted position above the slab 15 at outset to the position shown in Fig. 3 as the generated cylinder is built up to a height permitting the blades 97 to be thus lowered. In this regard no special kind of lowering device is required and the lowering could be done manually or by any conventional means, not shown, as by some spring loaded arrangement which would serve the purpose.

When the material employed to generate the cylinder is gunnite, such as a substance comprised of say seven parts sifted sand and one part cement, the mixture being applied under pressure and in the presence of water, then the plate 108 is not required, but only the scraping blades 97 may be needed. This is due to the fact that the mixture is sprayed onto the form and onto the gunnite parts exteriorly of the nozzle pressures such as 2,000 pounds per square inch being employed. Under such pressure the gunnite adheres to the wall of the form, and thereafter to the gunnite outwardly of that being sprayed on, and a cylinder is generated after the "spray on" method, in the manner that some swimming pools are generated by present manual methods. In the case of employing gunnite with this invention, care has to be taken that there is escape space provided for the gunnite particles that do not adhere when blasted on, and this can be accomplished through the spaces between the blades 97 when the blades are employed without the plate 108. In such case the blades would be carried by the stand 96, at first in upwardly retracted position, and paid out as cylinder generation advances from outset. As described hereinabove, the method of paying out the blades downwardly may be by any conventional method, as by a spring loaded device.

The disclosure shown can be varied in many details. For instance, the eyelets 39, 40, 41 may have bearing assemblies therein to facilitate the paying out of the reinforcing wire or cable 38. Also, the wire drawn 37 may be mechanically rotated to abet the paying out of the rod.

In summary, the invention is not limited to the structural embodiment as disclosed in the drawings and described herein, nor to the precise method steps set forth, but other embodiments and combinations of structures are considered as well as such may fall within the broad spirit of the invention and within the broad scope of interpretation claimed and merited by the appended claims.

What is claimed is:

1. A cylinder generating machine comprising a fixed post, a keyway extending from the bottom upwardly to a point near the top thereof, a gear concentric around said post and keyed to said keyway, a drive cylinder concentric around said post, ball bearing means connecting said gear to mount said drive cylinder for rotation thereon, a guide sleeve concentric around said post and keyed to said keyway, ball bearing means at the upper end of said drive cylinder connecting it to said guide sleeve for rotation therearound, a swivel rotatably mounted on top of said post coaxially therewith, a pulley mounted in said swivel to rotate on a horizontal axis, a guy cap mounted on said swivel in a manner that said swivel may rotate relative thereto, opposed guy wires extending from said guy cap to make supporting connection outwardly of said machine a stuffing box in said guy cap around said swivel, a flow passage down said swivel and out therefrom below said guy cap and above said pulley, a hose connection including a stuffing gland to be installed on top of said guy cap to extend around said swivel in said stuffing box, a hose connected to said hose connection to deliver fluid construction material therethrough, opposed arms connected to said drive cylinder, a lift sleeve around said guide sleeve and making lifting connection therewith, opposed guy wires extending from the top of said lift sleeve for connection to support the outer ends of said arms, a cable connected at one end to said lift sleeve and extending over said pulley, a winch mounted on one of said arms adjacent said drive cylinder, said cable extending from said pulley to said winch and being wound therearound and having its other end connected thereto, a hose extending from the lower end of said swivel flow passage to an end of said arm to deliver said construction material, and said generator generating a cylinder as said hose lays a cylinder of said material in a spiral to harden, said winch raising said lift sleeve and therewith said guide sleeve, said drive cylinder, said arms, and said gear, as said pinion rotation about said gear rotates said arms and said drive cylinder about said gear and said guide sleeve, and said arms draw said lift sleeve to rotate therewith about said guide sleeve.

2. A reinforced hardenable construction material cylinder generating machine comprising a fixed post, a keyway extending from the bottom upwardly to a point near the top thereof, a gear concentric around said post and keyed to said keyway, a drive cylinder concentric around said post, ball bearing means connecting said gear to mount said drive cylinder for rotation thereon, a guide sleeve concentric around said post and keyed to said keyway, ball bearing means at the upper end of said drive cylinder connecting it to said guide sleeve for rotation therearound, a swivel rotatably mounted on top of said post coaxially therewith, a pulley mounted in said swivel to rotate on a horizontal axis, a guy cap mounted on said swivel in a manner that said swivel may rotate relative thereto, opposed guy wires extending from said guy cap to make supporting connection outwardly of said machine a stuffing box in said guy cap around said swivel, a flow passage down said swivel and out therefrom below said guy cap and above said pulley, a hose connection including a stuffing gland to be installed on top of said guy cap to extend around said swivel in said stuffing box, a hose connected to said hose connection to deliver fluid construction material therethrough, opposed arms connected to said drive cylinder, a lift sleeve around said guide sleeve and making lifting connection therewith, opposed guy wires extending from the top of said lift sleeve for connection to support the outer ends of said arms, a cable connected at one end to said lift sleeve and extending over said pulley, a winch mounted on one of said arms adjacent said drive cylinder, said cable extending from said pulley to said winch and being wound therearound and having its other end connected thereto, a hose extending from the lower end of said swivel flow

passage to an end of said arm to deliver said construction material, a drum of flexible reinforcing rod mounted on said other arm and adapted to be paid out in a spiral from the end thereof, and said generator generating a cylinder as said hose lays a cylinder of said material in a spiral to harden, said winch raising said lift sleeve and therewith said guide sleeve, said drive cylinder, said arms, and said gear, as said pinion rotation about said gear rotates said arms and said drive cylinder about said gear and said guide sleeve, and said arms draw said lift sleeve to rotate therewith about said guide sleeve.

3. A machine for generating a cylinder of a hardenable construction material comprising a vertical axle and a bridge rotatable about said axle and vertically slidable with relation thereto and having means adapted to deliver the cylinder forming material at one end thereof and means adapted to lay reinforcement means in the material at the other end thereof, drive means carried by said bridge and cooperative with said axle to rotate said bridge therearound, a swivel mounted on top of said axle and about an axis which is co-axial extension thereof, a pulley carried by said swivel and rotatable about an axis transverse to the pulley axis and perpendicular to the axis of said bridge, a cable extending over said pulley and connected at one end to lift said bridge up said axle, a driven winch carried by said bridge and having the other end of the cable connected to the drum thereof whereby winch rotation winds said cable thereon to lift said bridge as said swivel rotates therewith, a packing gland cap and a cylinder forming material hose connection mounted on said swivel and non-rotatable with relation thereto and having guys extending therefrom to guy said machine from the top thereof and outwardly of the cylinder to be generated, a flow passage from said hose connection through said cap and said swivel, and a second hose connection from said outlet to said one end as the means to deliver the cylinder forming material, whereby as said bridge rotates while it is lifted a spiral of construction material is placed in which a spiral of reinforcement means is deposited with the consequence that a cylinder of reinforced hardenable construction material is generated.

4. A cylinder generating machine comprising a base support, a vertical axle supported thereby and a bridge mounted to rotate on said axle and slidable axially therealong, a swivel mounted coaxially on said axle and mounting a pulley rotatable upon an axis perpendicular to said axle, a cable connected at one end to lift said bridge and extending over said pulley and connected at the other end to a driven winch drum carried by said bridge, a first hose connection non-rotatably mounted on said swivel, a flow passage extending from said hose connection through said swivel to an outlet provided in said swivel, and a second hose connection from said outlet to one end of said bridge, means to force a flowable construction material through said first hose connection, said flow passage, and said second hose connection to deliver a spiral of said material within a cylindrical form with said axle as its center as said bridge rotates, said bridge carrying means to deliver a spiral of reinforcement from the other end thereof to be deposited in said ma-

terial whereby as said bridge is lifted as it rotates a cylinder of reinforced hardenable construction material is generated.

5. A cylinder generating machine comprising a machine support positioned at the base center of the cylinder to be generated, a vertical axle upstanding from said support as the vertical axis of the cylinder defining form, a bridge mounted to rotate within said form upon said axle and slidable axially therealong, a swivel mounted coaxially upon said axle and mounting a pulley rotatable upon an axis perpendicular to said axle, a cable connected at one end to lift said bridge and extending over said pulley and connected at the other end to a driven winch drum carried by said bridge, a first hose connection non-rotatably mounted on said swivel, a flow passage extending from said first hose connection through said swivel to an outlet provided therefrom, a second hose connection extending from said outlet to an end of said bridge and in adjacency to said form, means to force a hardenable, flowable construction material through said first hose connection, said flow passage and said second hose connection, motor means positioned on said bridge to rotate therewith including means adapting said motor means to drive said winch and to rotate said bridge about said axle whereby as said bridge is lifted as it rotates a spiral of said material is delivered from said second hose connection upon said form to generate a cylinder to harden within said form.

6. A cylinder generating machine comprising a machine support positioned at the base center of the cylinder to be generated, a vertical axle upstanding from said support as the vertical axis of the cylinder defining form, a bridge mounted to rotate within said form upon said axle and slidable axially therealong, a swivel mounted coaxially upon said axle, a first conduit non-rotatably mounted on said swivel, a flow passage extending from said first conduit through said swivel to an outlet provided therefrom, a second conduit extending from said outlet to an end of said bridge and in adjacency to said form, means to force a hardenable, flowable construction material through said first conduit, said flow passage, and said second conduit, motor means positioned on said bridge to rotate therewith, and means adapting said motor means to lift said bridge up said axle and to rotate said bridge about said axle whereby as said bridge is lifted as it rotates a spiral of said material is delivered from said second conduit upon said form to generate a cylinder to harden within said form.

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