United States Patent

[11] **3,599,782**

[72] Inventor **Homer G. Whitfield**
Northville, Mich.

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[45] Patented **Aug. 17, 1971**
[73] Assignee **Condeco Automation, Inc.**

[54] **SPIRAL STORAGE FEEDER UNIT**
17 Claims, 27 Drawing Figs.

[52] **U.S. Cl.** **198/219,** 198/136
[51] **Int. Cl.** **B65g 25/04**
[50] **Field of Search** 198/2.9, 136, 108

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Primary Examiner—Gerald M. Forlenza
Assistant Examiner—Frank E. Werner
Attorney—Farley, Forster and Farley

ABSTRACT: The invention pertains to a spiral storage feeder unit primarily intended to receive parts from a prior manufacturing operation and pass them to a subsequent operation. The invention provides for pass through during normal operation; for accumulation to allow the prior operation to continue if a subsequent operation ceases; and for delivery of stored parts if a prior operation ceases so that the subsequent operation may continue. The invention is suitable for multiple and automatic use in a manufacturing production line.

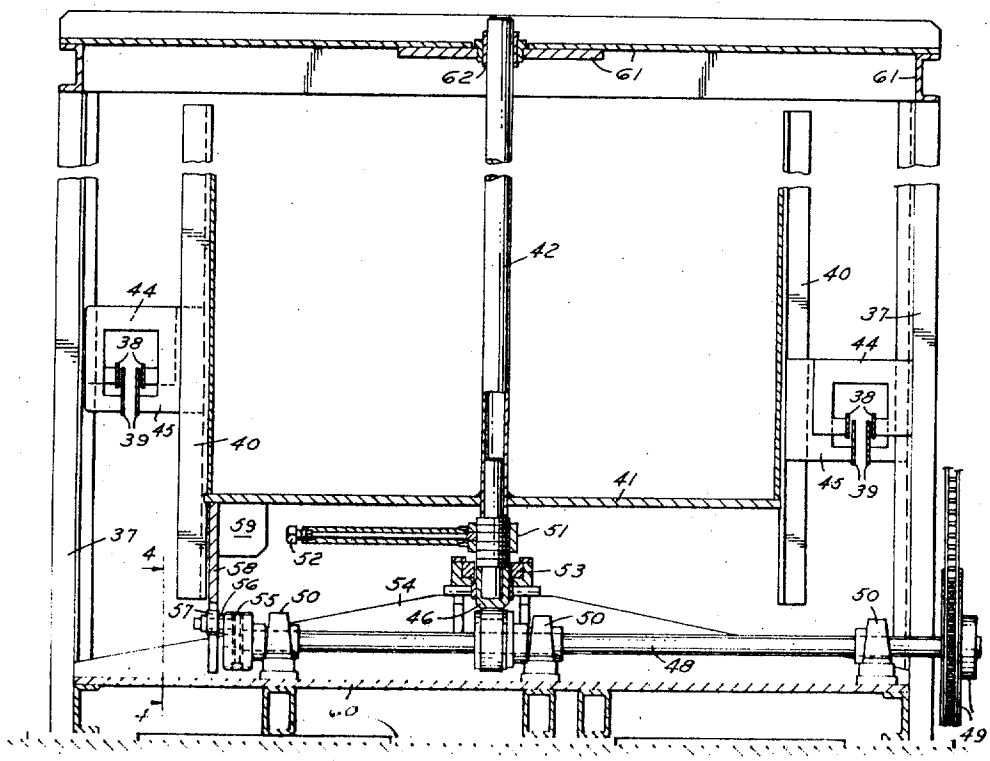

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FIG. 1

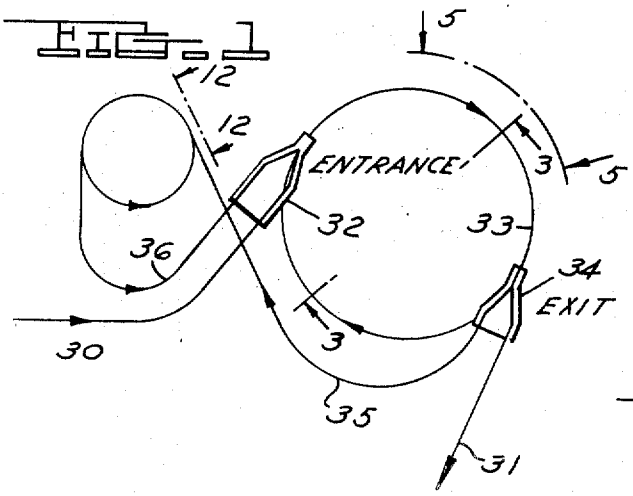
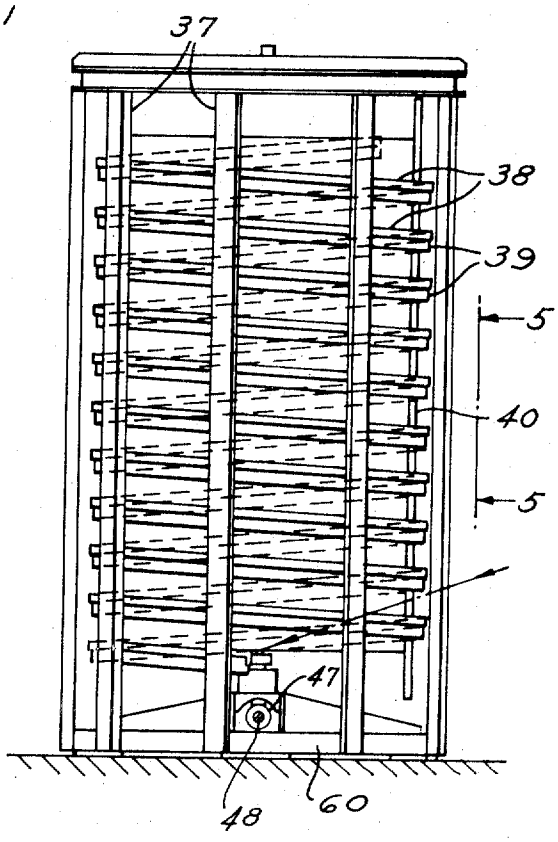


FIG. 2



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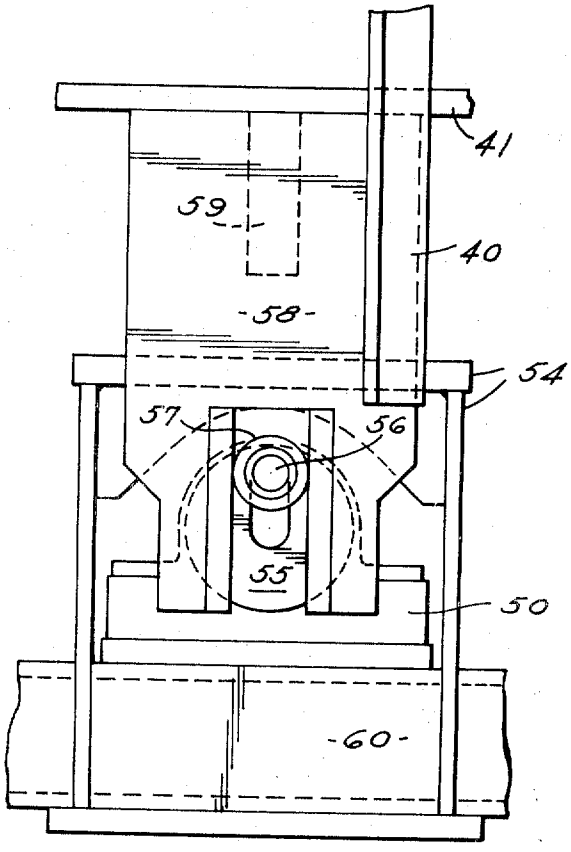

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HOMER G. WHITFIELD
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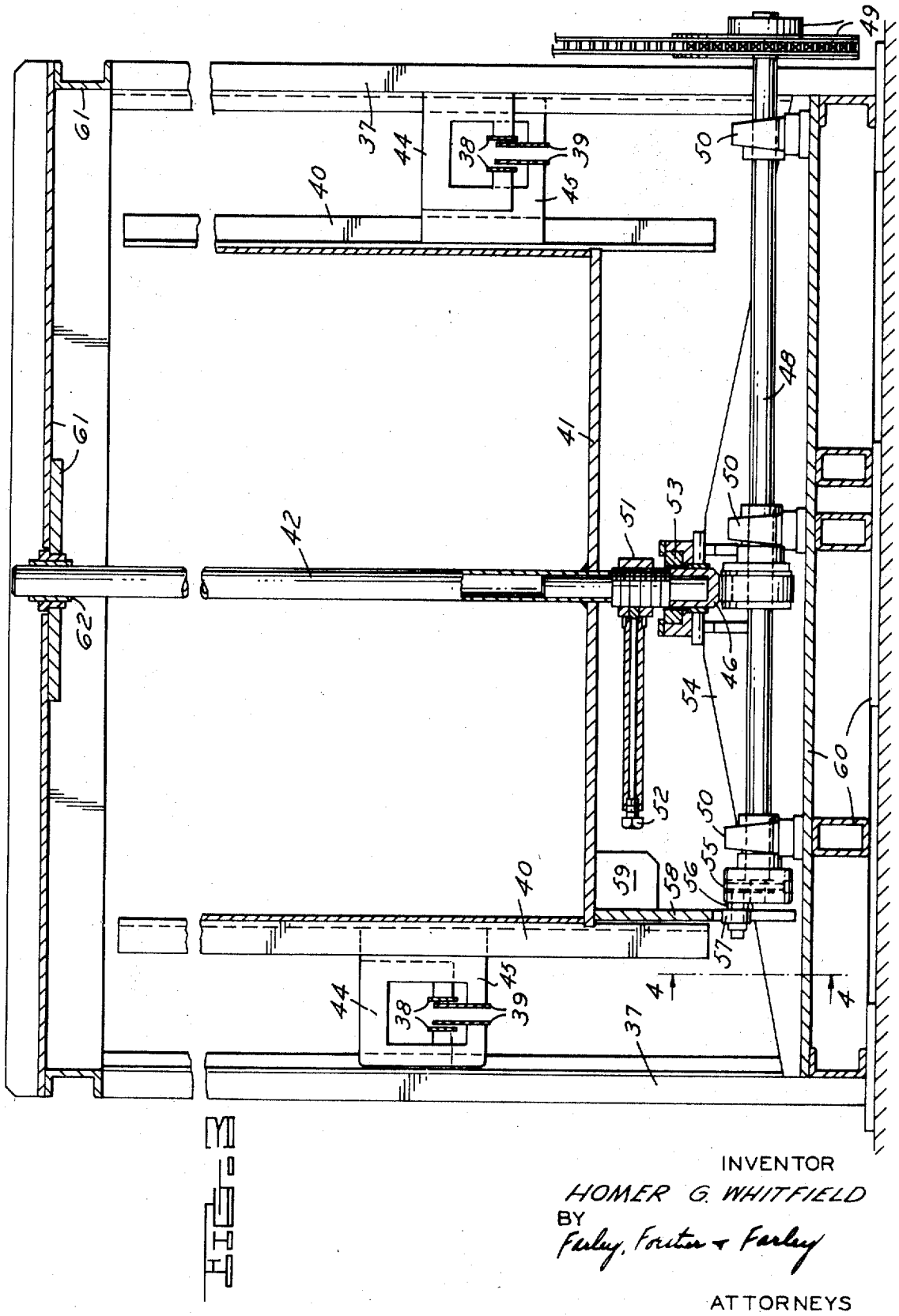

FIG. 1

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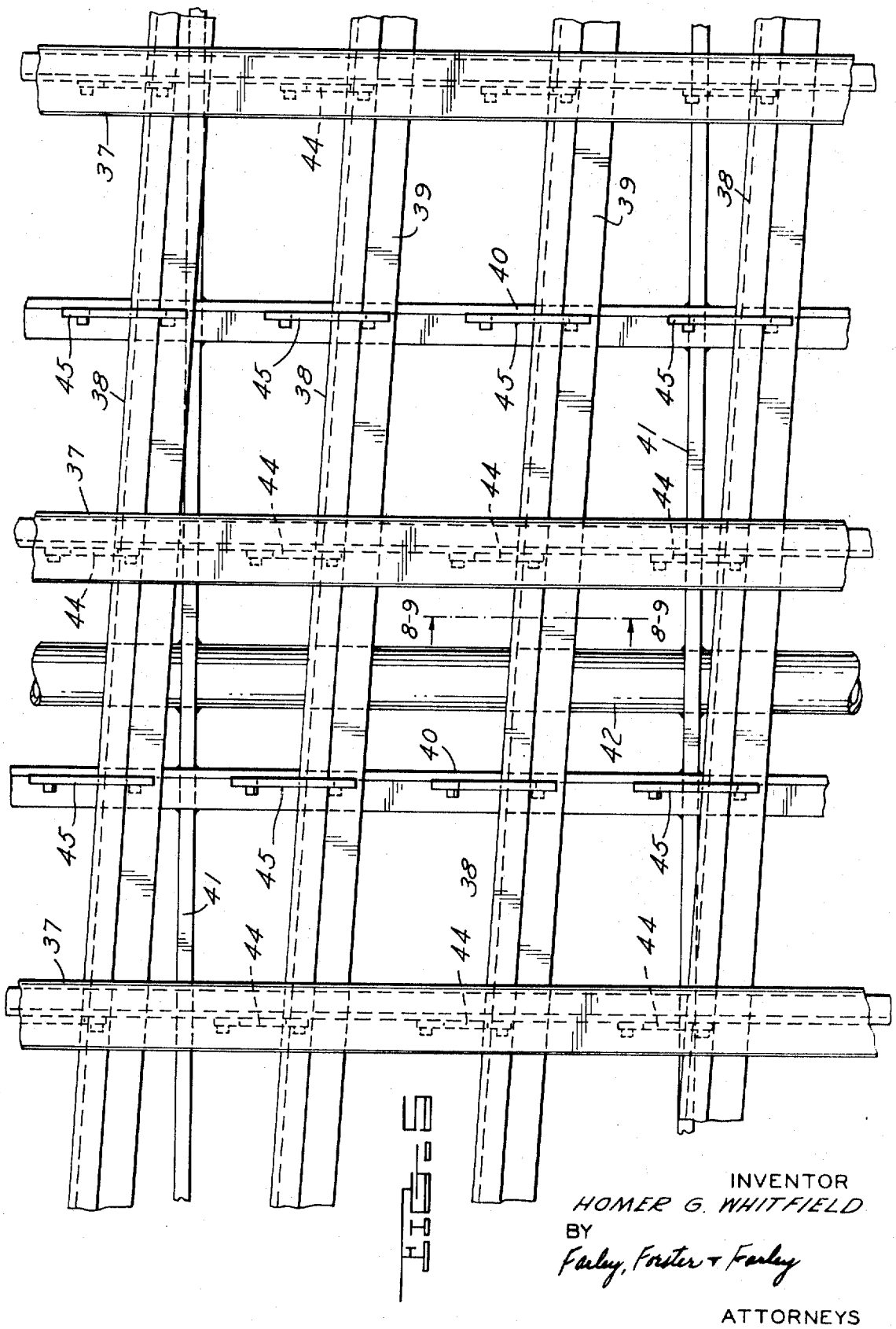

FIG. 5

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HOMER G. WHITFIELD
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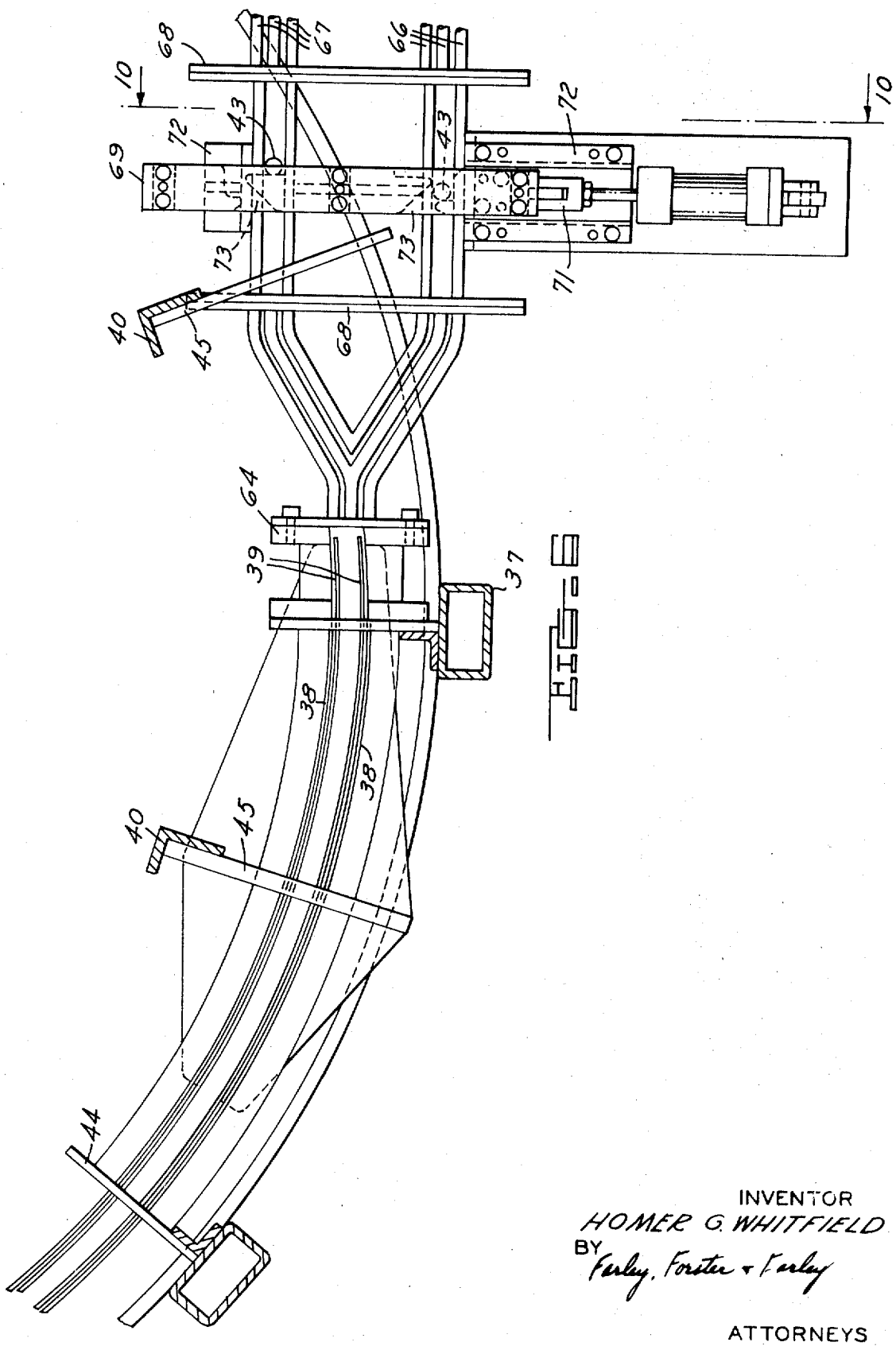

FIG 5

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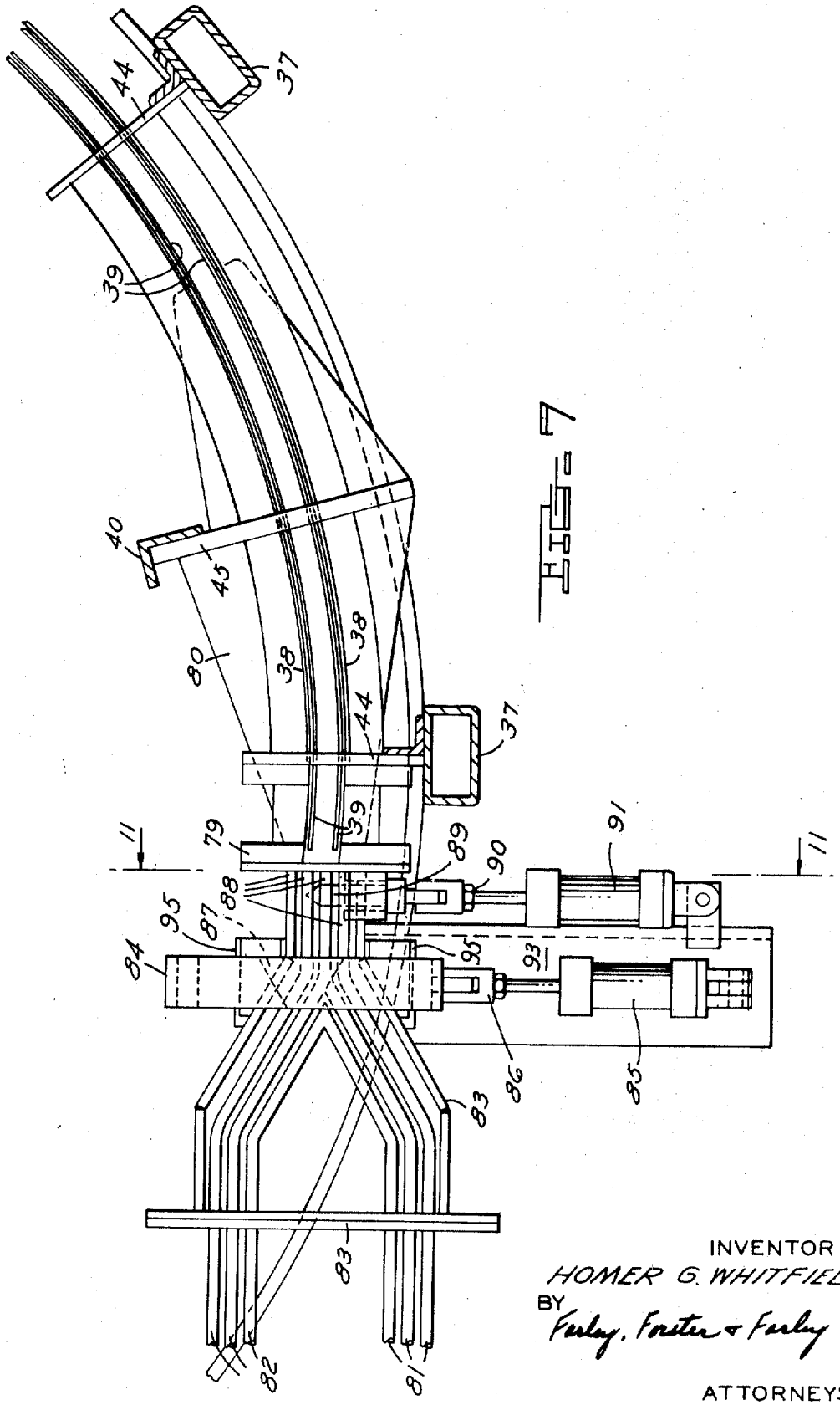

FIG. 7

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HOMER G. WHITFIELD
BY
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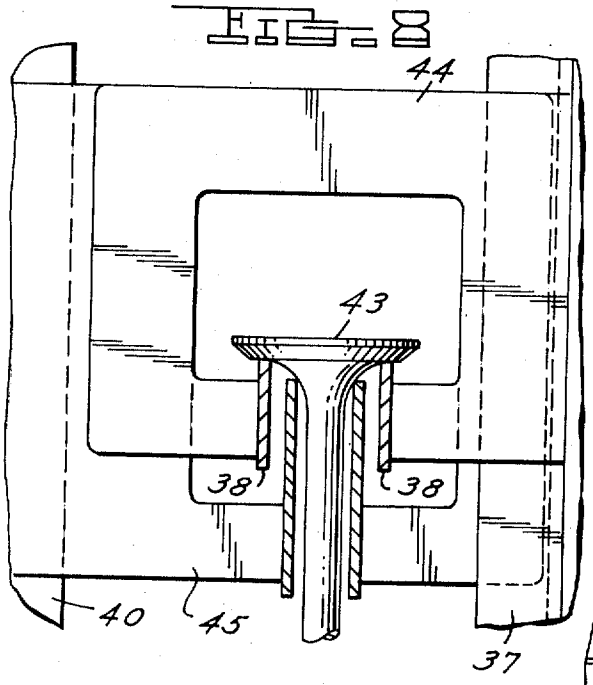
FIG. 8



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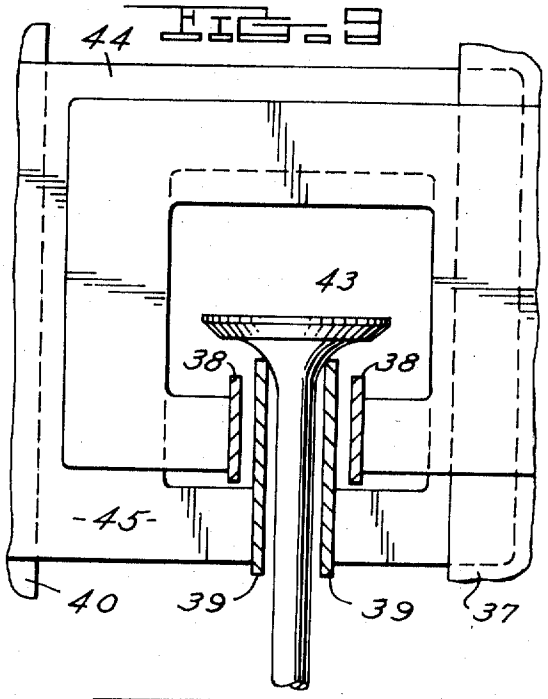

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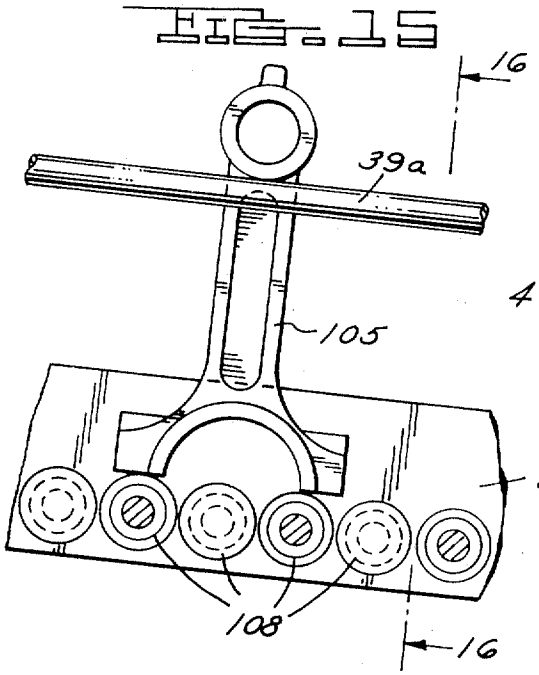

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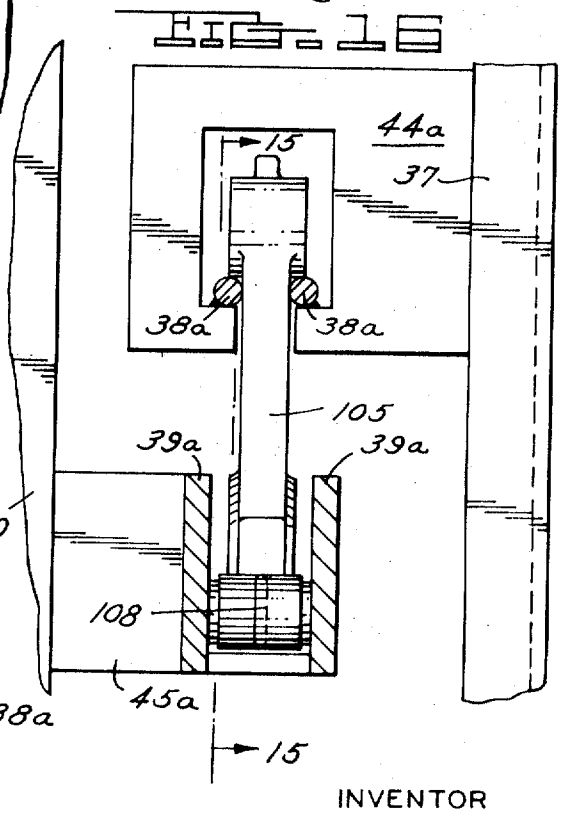

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HOMER G. WHITFIELD
BY
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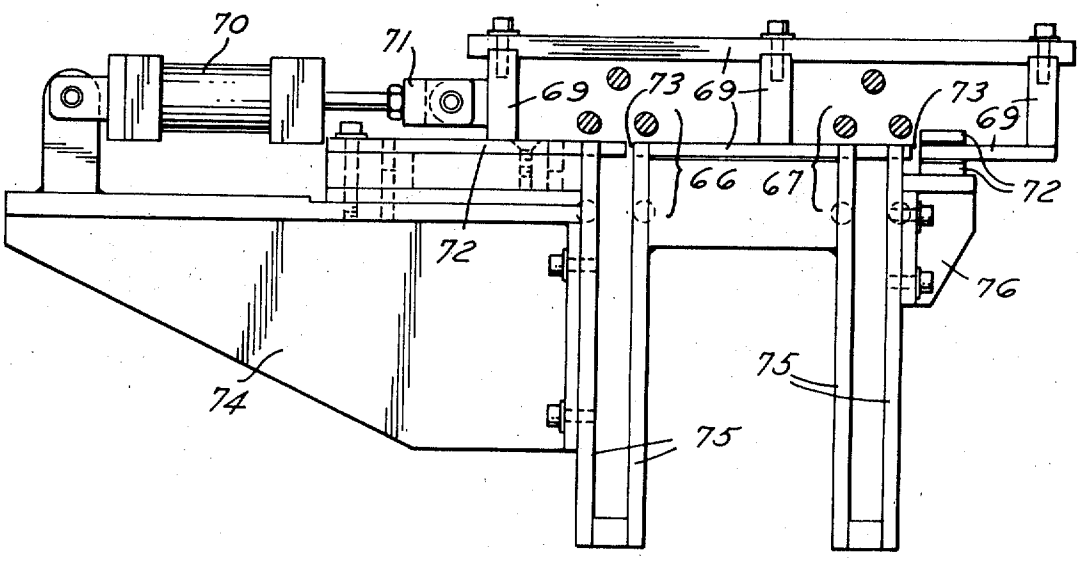
FIG. 10



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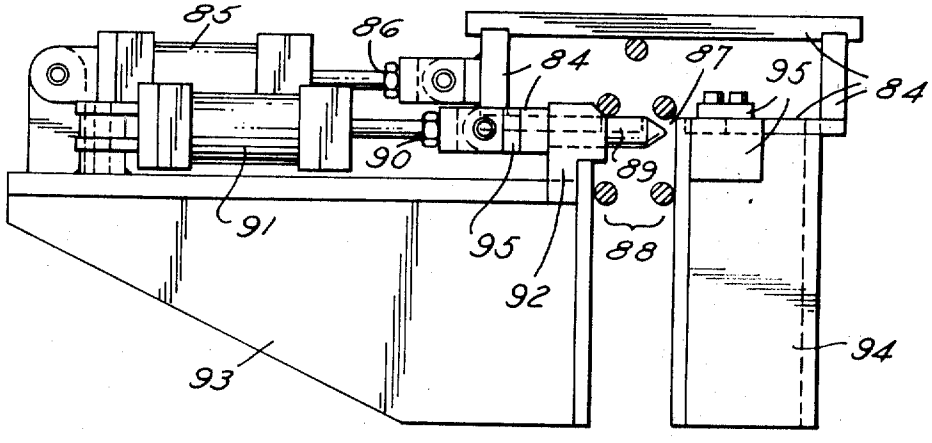

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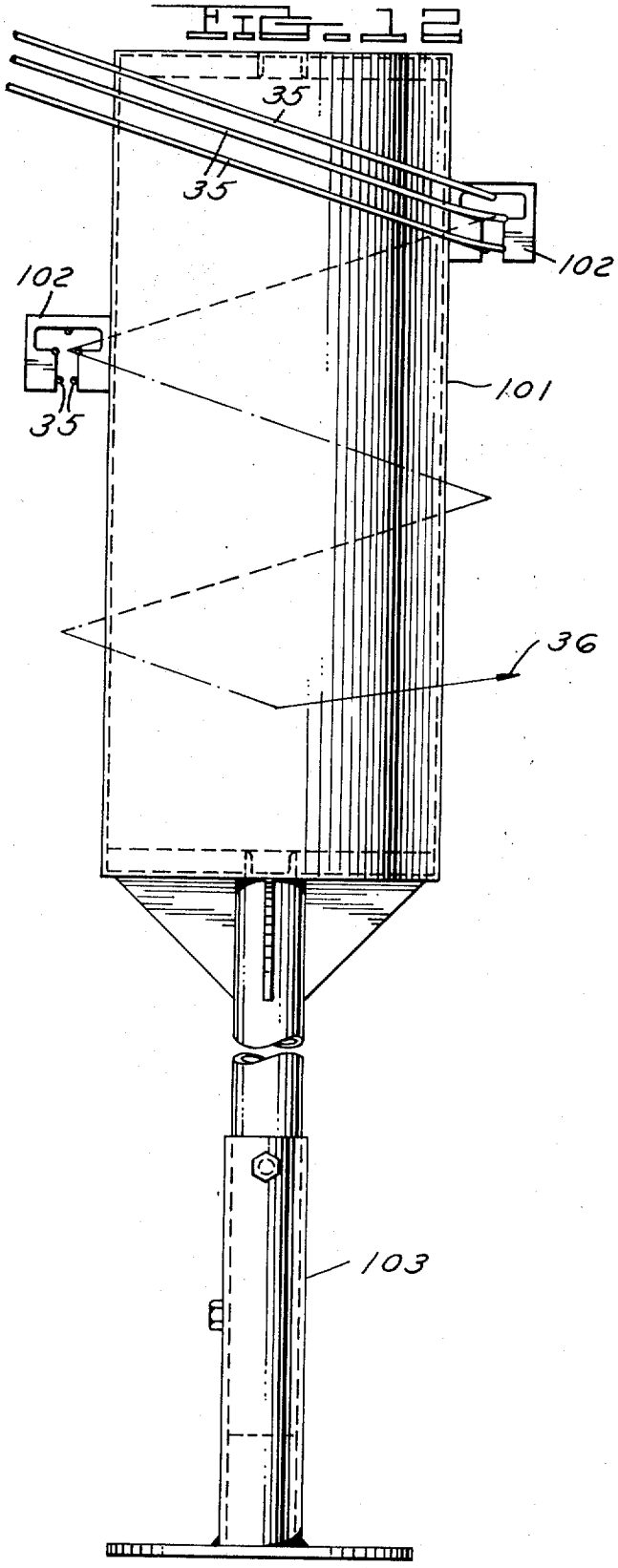
FIG. 12



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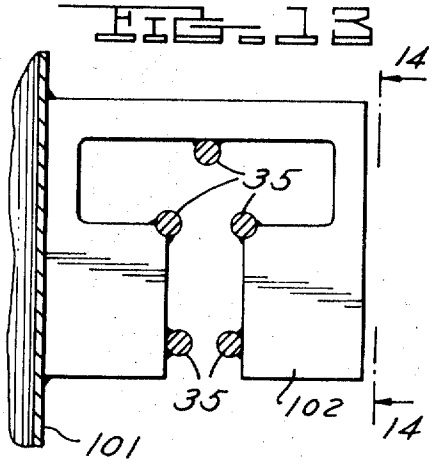

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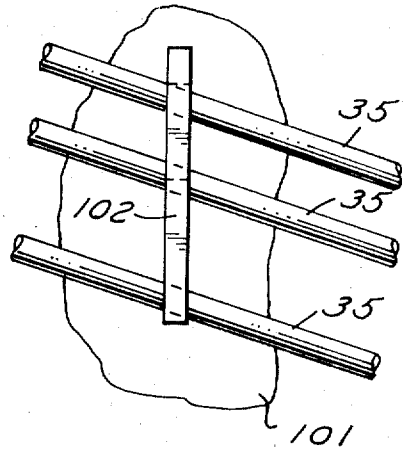

INVENTOR
HOMER G. WHITFIELD
BY Farley, Forster & Farley
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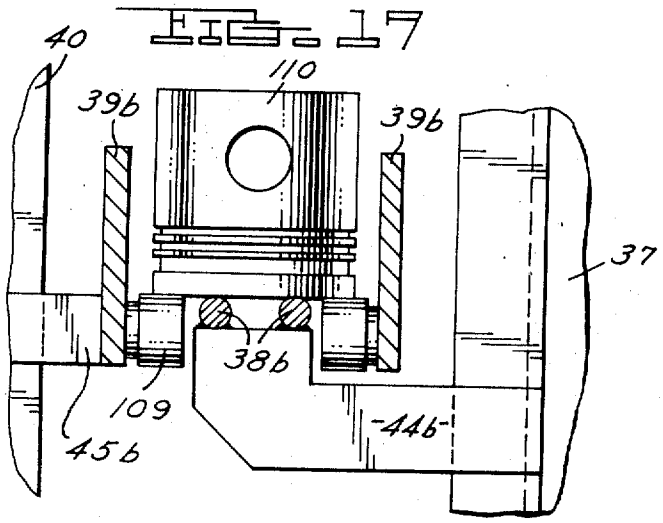
FIG. 17



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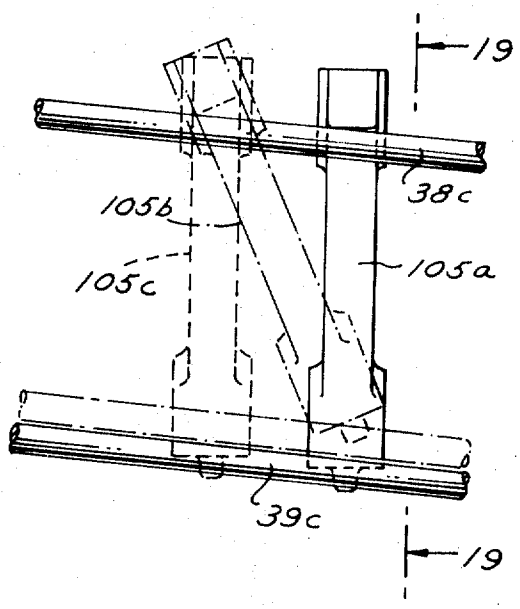

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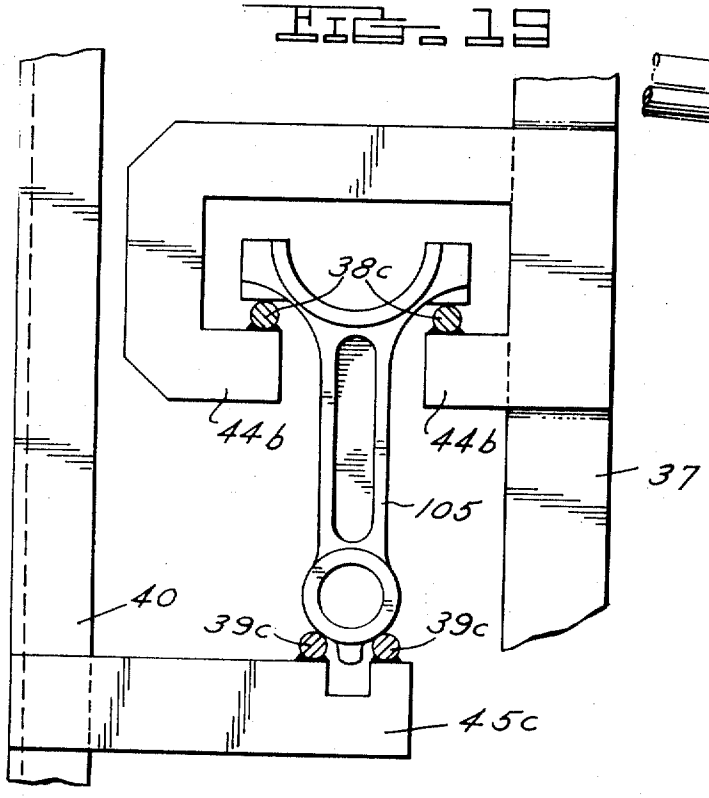

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HOMER G. WHITFIELD
BY
Farley, Forster & Farley

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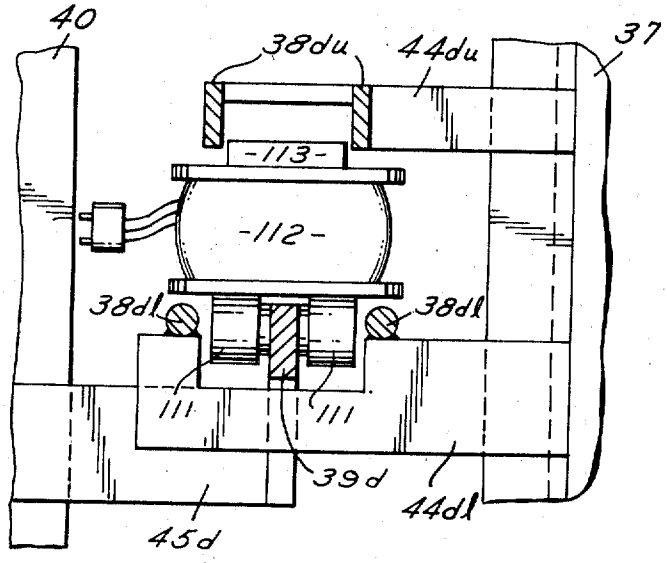
FIG. 20



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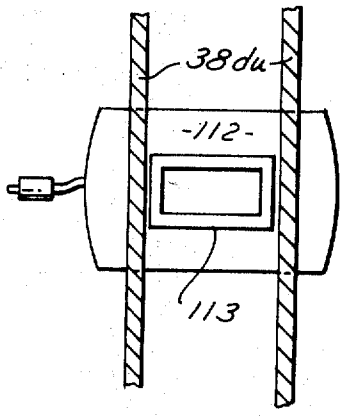

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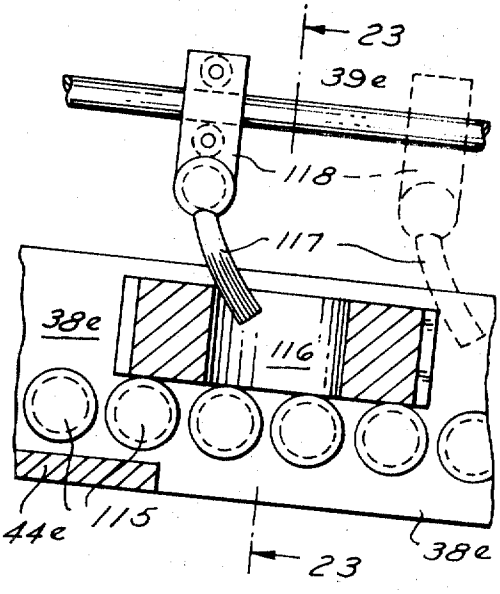

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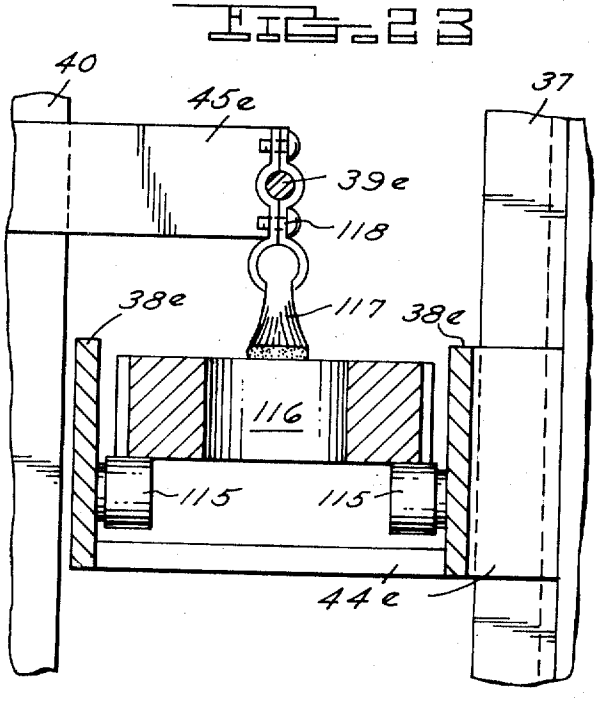

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HOMER G. WHITFIELD
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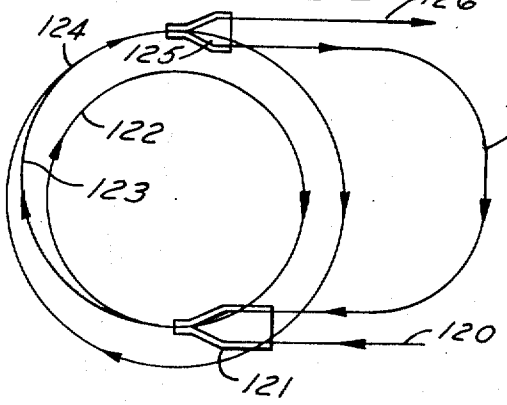
FIG. 24



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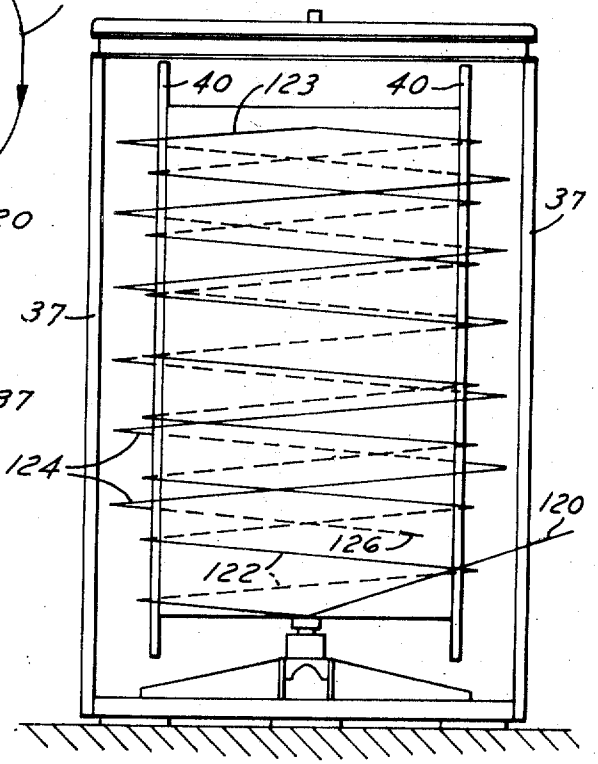

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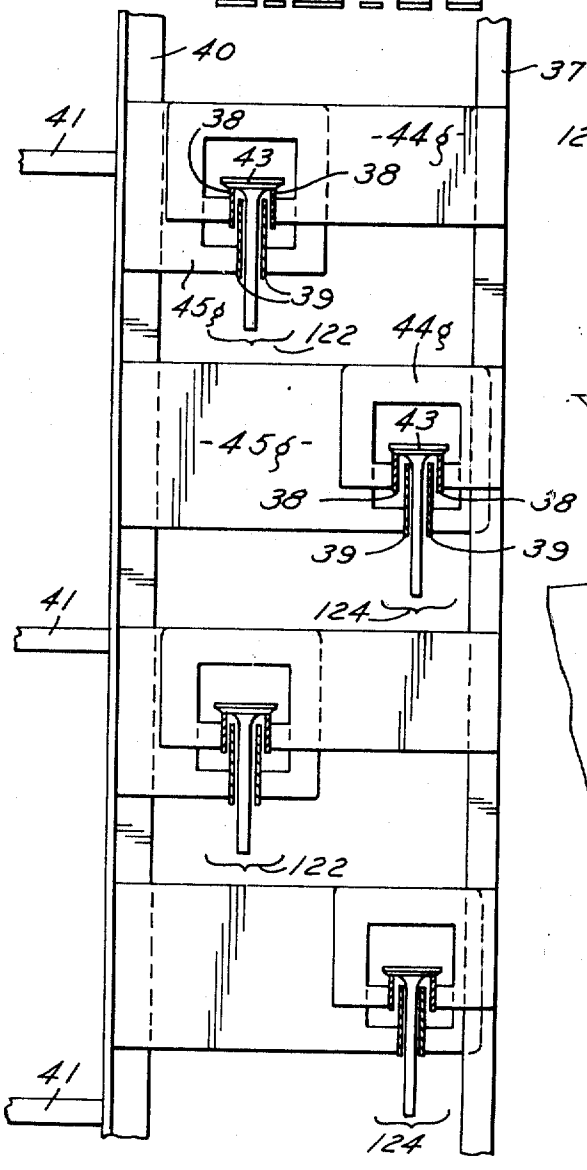

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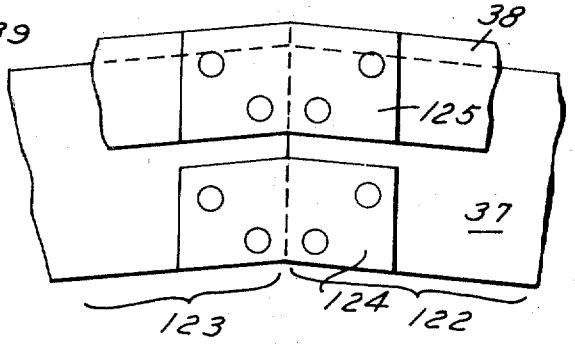

INVENTOR
HOMER G. WHITFIELD
BY Farley, Forster & Farley
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SPIRAL STORAGE FEEDER UNIT

BACKGROUND OF THE INVENTION

Where there is a series of manufacturing operations to be performed on parts it is common practice to place feeding units between the operations to receive parts from the prior operation and feed them to the next operation automatically. For a limited number of applications spiral feeding units have been used for this purpose. Usually the parts exit from one manufacturing operation, are conveyed to the top entrance of the storage unit and spiral downward to an exit leading into the entrance of the next manufacturing operation. Where there is no provision for storage the output rate will be determined by the output rate of the slowest operation and the shutdown of one operation will require the shutdown of all the operations in the series. Where storage is provided the parts may accumulate between operations and insulate a temporary shutdown of one operation from affecting other operations in the series.

Spiral storage units have been employed utilizing brushes moving parts upwardly along the spiral in a unit discharging at the top. Spiral storage units have also been employed utilizing a gravity feed along rollers the acceleration of which controls part flow against excessive speed. In either case only parts meeting certain configuration requirements can be effectively handled and the present unit is directed to increase the latitude of part configurations which can be handled as well as the variety of operating conditions which may be accommodated.

SUMMARY OF THE INVENTION

Stationary and movable spiral tracks are respectively mounted on a stationary frame and movable drum which can be raised, rotated and lowered relative to the stationary track. In a typical case the stationary track may comprise a pair of parallel spaced spring steel strips adapted to retain parts deposited thereon while the movable track may comprise a similar pair of spring steel strips projecting within the stationary strips and adapted to have their upper edges raised and lowered above and below the supporting upper edges of the stationary strips. The drum framework for the movable track is actuated, as by cam means, to raise, advance circumferentially, lower and retract to starting position thereby engaging the parts, raising and advancing them and lowering them onto an advanced position on the spiral stationary track. In order to minimize an inactive storage bank between operations, during normal operations on either side of the storage unit, the incremental rate of travel through the storage unit is preferably fast enough to provide substantial spacing between adjacent parts in the storage unit with provision for consolidating the parts at the exit of the storage unit if the next operation should be shut down or is unable otherwise to receive them; or, as an alternate, for returning an overflow of parts to the entrance of the storage units for consolidation with incoming parts from the previous operation.

DESCRIPTION OF THE DRAWINGS

The foregoing and other aspects of the invention will best be understood from a more detailed description of a preferred embodiment of the invention and certain modifications thereto, with reference to the drawings wherein:

FIG. 1 is a schematic plan view of a typical embodiment showing an entrance, ascending spiral path, an exit with a branch overflow return path leading to the entrance;

FIG. 2 is a side elevation of such storage unit with the outer cover removed to more clearly reveal the spiral track construction;

FIG. 3 is an enlarged broken sectional side elevation taken along the line 3–3 of FIG. 1 showing particularly the drive mechanism for the movable track;

FIG. 4 is a fragmentary side elevation taken along the line 4–4 of FIG. 3 providing an end view of the drive mechanism for effecting circumferential reciprocation;

FIG. 5 is an enlarged fragmentary side elevation taken along the line 5–5 of FIG. 2 showing the detail of the track suspension;

FIG. 6 is an enlarged fragmentary plan view of the entrance shown in FIG. 1;

FIG. 7 is a similar plan view of the exit shown in FIG. 1;

FIG. 8 is a further enlarged fragmentary sectional view of the track taken along the line 8–8 of FIG. 5 showing a production valve part suspended on the stationary track preparatory to engagement by the movable track;

FIG. 9 is a similar view taken along the line 9–9 of FIG. 5 showing the movable track in a raised position;

FIG. 10 is a side elevation taken along the line 10–10 of FIG. 6 showing a gate-operating mechanism for controlling passage through the alternate branches of the entrance;

FIG. 11 is a similar view taken along the line 11–11 of FIG. 7 showing a diverter control mechanism for the exit;

FIG. 12 is a side elevation of the return track taken along the line 12–12 of FIG. 1;

FIG. 13 is an enlarged fragmentary view of a hanger for the return track;

FIG. 14 is a side elevation of the return track taken along the line 14–14 of FIG. 13;

FIG. 15 is a fragmentary side elevation of an alternative track construction adapted to handle engine connecting rods taken along the line 15–15 of FIG. 16;

FIG. 16 is a fragmentary sectional view of such modified track section taken along the line 16–16 of FIG. 15;

FIG. 17 is a fragmentary sectional view of a further modified track section adapted to handle engine pistons;

FIG. 18 is a fragmentary side elevation of a further modified track section adapted to handle engine connecting rods in a different manner;

FIG. 19 is a fragmentary view of FIG. 18 taken along the line 19–19;

FIG. 20 is a fragmentary sectional view of a further modified track section adapted to handle a motor armature;

FIG. 21 is a fragmentary sectional plan view of the upper track shown in FIG. 20.

FIG. 22 is a fragmentary side elevation of a further modified track section wherein parts are advanced through reciprocation of brush elements;

FIG. 23 is a fragmentary sectional view taken along the line 23–23 of FIG. 22;

FIG. 24 is a view similar to FIG. 1 showing a schematic plan view of a modified construction employing a combination of spirally ascending and descending tracks;

FIG. 25 is a side elevation showing somewhat schematically the modified construction of FIG. 24;

FIG. 26 is an enlarged fragmentary sectional view of the combined ascending and descending track construction of FIGS. 24 and 25; and

FIG. 27 is a fragmentary view of the adjoining ends of the ascending and descending portions of the track employed in the modified embodiment of the last three figures.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. 1 a typical embodiment of the present storage feeder unit adapted for handling engine valves between an operation discharging along the lines 30 and a subsequent operation to which parts are fed along the line 31, the unit comprising an entrance track section 32, spirally ascending track section 33, an exit track section 34, an overflow gravity return track 35, terminating in a branch line 36 leading to the entrance track section 32.

With reference to FIG. 2 the storage feeder unit includes a stationary framework having circumferentially spaced upright 37 to which a spiral stationary track 38 is secured as best shown in FIGS. 5, 8 and 9. In FIG. 5 the stationary spiral track

38 is again shown secured to the stationary circumferentially spaced uprights 37. The movable spiral track 39 is shown secured to the movable circumferentially spaced uprights 40. The movable circumferentially spaced uprights 40 are secured to horizontal discs 41. The horizontal discs 41 are secured to a vertical, centrally located, movable shaft 42. In FIGS. 8 and 9 are shown the stationary spiral track 38 and a movable spiral track 39 in a configuration suitable for engine valves 43. The stationary track 38 is supported by hangers 44 secured to the stationary framework 37. The movable track 39 is supported by movable hangers 45 secured to the movable framework 40. In FIG. 8 an engine valve 43 is shown resting upon the stationary spiral track 38 preparatory to engagement by the movable spiral track 39. In FIG. 9 the engine valve 43 is shown resting upon the movable track 39 in the raised position.

The central vertical shaft 42 to which the movable framework 40 and 41 is secured rests upon a cam follower 46 and cam 47 as shown in FIG. 3. The camshaft 48 rests on bearings 50 and is driven by a sprocket and chain 49. A collar 51, adjustable my means of a screw 52, is provided on the cam follower 46 to support the central shaft 42 during a portion of a cam stroke if desired. Thus, the collar may rest upon the circular ring stop 53 during the lowermost dwell portion of the cam rotation adjustably limiting the effective vertical reciprocating stroke. The circular ring stop 53 is held in position by the stationary framework 54. The camshaft 48 also drives the crank 55 and crankpin 56. More particularly in FIG. 4 the crank 55, the crankpin 56, and the crankpin bearing 57 are shown driving the crank follower 58. The follower 58 is secured by means of the bracket 59 to the lowermost disc 41. The bearings 50 are secured to the base of the storage feeder unit 60. Thus, the revolving shaft 48 will cause the movable framework 40 to reciprocatingly revolve about the central shaft 42. The upper end of the central shaft 42 is guided by a bearing 62 in the upper portion of the stationary framework 61.

In FIG. 6 a return track 66 and an entrance track 67 are shown joining together and entering the movable spiral track 39 and the stationary spiral track 38. At the entrance 64, the movable spiral track 39 is supported by a gusset 65. A sequencing gate 69 is moved by an air cylinder 70 through an adjustable yoke 71. A sequencing gate 69 allows parts such as the engine valves 43 to alternately enter the spiral feeder unit through the openings 73 in the lower plate of the sequencing gate 69. The sequencing gate 69 slides back and forth in guides 72 secured to support brackets 74 and 76. In FIG. 10 the support brackets 74 and 76 are secured to parts guides 75. The parts guides 75 are aligned with the return track 66 and the entrance track 67 by means of the frames 68 shown in FIG. 6.

With reference to FIG. 7 the movable spiral track 39 and the stationary spiral track 38 are shown at the exit. The movable spiral track 39 is secured to a gusset 80 and exit gate 79. The guide track 88 divides into an exit track 82 and a return track 81. The framework 83 supports the guide rails 88 in proper alignment with the exit of the spiral storage feeder tracks 38 and 39. A switching gate 84 having a converging opening 87 in the lower member is moved by an air cylinder 85 and an adjustable yoke 86. The switching gate 84 moves back and forth in guides 95 which are mounted on supporting brackets 93 and 94. An exit stop 89 is moved by an air cylinder 91 through an adjustable yoke 90 and guide 92. Thus, as may be seen in FIGS. 7 and 11, the stop 89 will prevent parts from moving onto either track 81 or 82 when the switching gate 84 is to be moved.

In FIG. 12 the return track 35 descends in a spiral through hangers 102 which secure the return track 35 and which in turn are secured to the outside of a cylinder 101. The cylinder 101 is supported upon a pedestal 103. The return track 35 exists from the return cylinder 101 at 36 and reenters one side of the entrance in FIG. 1. FIGS. 13 and 14 show the return track 35 as it passes through a hanger 102.

FIGS. 15 and 16 show an alternate configuration of stationary spiral track 38*a* and movable spiral track 39*a* for the purpose of storing and feeding connecting rods 105. The movable spiral track 39*a* features rollers 108 to allow the accumulation storage of connecting rods 105 at the exit of the storage feeder unit without undue frictional drag and pressure build up. The rollers 108 provide sufficient drag to carry the connecting rod 105 along the ascending spiral when the movable spiral track 39*a* lifts the connecting rod 105 from the stationary spiral track 38*a* and advances. However, when the connecting rods accumulate together each connecting rod 105 moves vertically only and the rollers 108 revalve as the movable spiral track 39*a* advances underneath the connecting rod 105. In FIG. 16 a modified hanger 44*a* for the modified stationary spiral track 38*a* is secured to the stationary upright 37. Similarly, a modified hanger 45*a* for the modified movable spiral track 39*a* is secured to the movable upright 40.

FIG. 17 is a second modification of the movable spiral track 39*b* and the stationary spiral track 38*b* adapted to handle engine pistons 110. As before, a movable spiral track 39*b* is carried by hangers 45*b*, secured to movable uprights 40 and the stationary spiral track 38*b* is carried by hangers 44*b* secured to the stationary upright 37. Here, again, rollers 109 are mounted on the movable spiral track 39*b* to prevent undue frictional drag and pressure build up when accumulation storage occurs.

In FIGS. 18 and 19 a third modification of the spiral tracks 38*c* and 39*c* for connecting rods 105 utilizes only the vertical motion of the movable spiral track 39*c*. The connecting rods 105 are caused to move along the tracks in the manner as follows: When the track 39*c* is most distant relative to the track 38*c*, a connecting rod 105 rests on both tracks with its center of gravity slightly off the vertical in the direction of advancement desired as shown by position 105*a* in FIG. 18. As the movable track 39*c* moves closer to the stationary track 38*c*, the connecting rod 105 is lifted, tilts, and the upper end advances into the position 105*b*. As the movable track 39*c* returns to its most distant position relative to the stationary track 38*c*, the lower end follows as the connecting rod 105 assumes the position 105*c*, Thus, no rotational reciprocating motion is necessary for the movable track 39*c* with this particular configuration. As before, the stationary track holder 44*c* secures the stationary track 38*c* to the stationary upright 37 and the holder 45*c* secures the movable track 39*c* to the movable upright 40.

In FIGS. 20 and 21 the spiral tracks 38 and 39 are further modified to retain proper alignment of a part such as a motor armature 112. In its lowermost position the motor armature 112 rests upon the lower portion of the stationary track 38*dl*. When the movable spiral track 39*d* raises the motor armature 112 the rectangular portion 113 of the motor armature 112 is aligned between the upper portions of a stationary spiral track 38*du*. A movable spiral track 39*d* is provided with rollers 111 for accumulation storage without undue friction and pressure of the motor armatures 112 at the exit of the spiral tracks. The upper and lower stationary spiral track 38*du* and 38*dl* are secured to the stationary uprights 37 with brackets 44*du* and 44*dl* respectively. The movable spiral track 39*d* is secured to the movable upright 40 with the brackets 45*d*.

In FIGS. 22 and 23 the fifth modification of the track configuration incorporates brushes 117 to move the parts 116 along the stationary track 38*e*. The stationary track 38*e* incorporates rollers 115 to allow the parts 116 to both roll freely along the stationary track 38 *e* as the parts 116 are urged along and allow accumulation storage at the exit. As the movable track 39*e* reciprocates vertically and rotationally, the brushes 117 gently move the parts 116 along the rollers 115. The brushes 117 are secured to the movable track 39*e* with the clamp brackets 118. As before, the stationary spiral track 38*e* is secured to the stationary uprights 37 by means of hangers 44*e* and the movable spiral track 39*e* is secured to movable uprights 40 by means of hangers 45*e*.

In the modification of a storage feeder unit shown in FIG. **24** parts enter along the line **120** into the entrance gate **121**. The parts then move up the ascending spiral indicated by the line **122** and at the top move off the ascending spiral along the line **123** to the descending spiral along the line **124**. The parts then move down the descending spiral **124** to the exit **125**. The parts then either exit along the line **126** or are shunted along the return line **127** back to the entrance **121**. In FIG. **25** the inner spiral **122** is shown adjacent to the movable uprights **40** and the outer spiral is shown adjacent to the stationary uprights **37**. More particularly in FIG. **26** the modification of FIG. **24** is shown adapted to engine valves **43**. The ascending spiral tracks **122** are shown adjacent to the movable upright **40** which is secured to the discs **41**. The stationary track **38** is secured to the stationary upright **37** by the hangers **44***f* and the movable track **39** is secured to the movable upright **40** by the hanger **45***f*. Similarly, the descending spiral track adjacent to the stationary upright **37** incorporates the stationary spiral track **38** secured to the stationary upright **37** by means of hangers **44***g* and the movable spiral track **39** is secured to the movable upright **40** by means of hangers **45***g*. In FIG. **27** at the top of the spiral tracks **37** and **38** flat plates **128** and **129** and common fasteners are used to secure the ascending and descending portions of each of the spiral tracks together.

SUMMARY OF OPERATION

The rate of flow of parts through the spiral storage feeder unit is a function of the vertical stroke, the circumferential stroke and the speed of the camshaft **48**. In each cycle the parts are lifted, moved along the incline of the spiral and then set down onto the stationary track. The normal input and output flow rate is determined by the production rate of the manufacturing line. However, to protect either the prior operation or the subsequent operation from the shutdown of the other, the spiral storage feeder unit may be run at double the maximum consumption and input speed thus allowing spaces between the parts for the accumulation storage of parts. Therefore, in the event that the subsequent operation is shut down the prior operation can continue while the subsequent operation is being serviced since parts will be diverted onto the return track at the exit and travel back to the entrance. In the event that the prior operation is shut down, the subsequent operation can continue utilizing parts stored in the spiral storage feeder unit. The overall efficacy of the production line is therefore increased because operations that tend to be slower than other operations can continue while the faster operations are being serviced. The speed control and the gate controls for the exit and entrance gates may be controls well known in the art.

While a preferred embodiment and several modifications have been described it will be understood that numerous other modifications may be resorted to without departing from the scope of the invention as defined in the following claims.

I claim:

1. A parts storage feeder unit comprising a vertically inclined spiral track, a second vertically inclined spiral track adjacent to and concentric with the first spiral track, means to impart reciprocating motion to one of the tracks relative to the other and to advance parts along the tracks, entrance means to accept parts onto the spiral track, an exit means to release parts from the spiral track, eccentric means located centrally of said feeder unit, second eccentric means located substantially radially distant from said central location, and a common drive shaft having both of said eccentric means mounted thereon whereby rotation of said drive shaft will produce a combination of vertical and rotational reciprocating motion.

2. A storage unit as set forth in claim **1** wherein means are included for adjusting the effective stroke of the eccentric means.

3. A storage unit as set forth in claim **1** wherein each spiral track is adapted to engage the part at a different portion of the part.

4. A storage unit as set forth in claim **3** wherein at least one portion of the part that is engaged by one of the spiral tracks is horizontally off the vertical from the center of gravity of the part so that relative vertical movement will produce a horizontal component of motion of the part's center of gravity.

5. A storage unit as set forth in claim **1** wherein the exit means includes a gate to prevent release of parts from the spiral track.

6. A storage unit as set forth in claim **1** incorporating a plurality of rotatable elements mounted on one of the spiral tracks such that the parts can rest upon and move along the rotatable elements parallel to the incline of the spiral tracks.

7. A storage unit as set forth in claim **1** wherein the parts have a specific orientation upon entering into the storage unit, and means are incorporated into the configuration of the spiral tracks to retain the specific orientation.

8. A storage unit as set forth in claim **1** wherein the first spiral track is located on the inside of a cylindrically shaped assembly and the second spiral track is located on the outside of a second cylindrically shaped assembly located inside the first cylindrically shaped assembly and concentric therewith.

9. A storage unit as set forth in claim **1** incorporating means for operating in a pass through mode such that parts are spaced relatively far apart and are released at the exit means at the same rate per unit time as parts are accepted at the entrance means.

10. A storage unit as set forth in claim **1** incorporating a plurality of brush means mounted on one of the spiral tracks such that the parts are moved along the other spiral track by the reciprocating action of the brush means.

11. A parts storage feeder unit comprising a vertically inclined spiral track, a second vertically inclined spiral track adjacent to and concentric with the first spiral track, means to impart reciprocating motion to one of the tracks relative to the other and to advance parts along the tracks, entrance means to accept parts onto the spiral tracks, an exit means to release parts from the spiral tracks, a return track from the exit means to the entrance means, a switch incorporated into the entrance means to accept parts from a return track, and a second switch incorporated into the exit means to divert items onto the return track.

12. A storage unit as set forth in claim **11** wherein the entrance means includes a gate which sequentially permits parts to enter either from the return track or from outside the storage unit.

13. A storage unit as set forth in claim **11** incorporating means for operating in an accumulation mode such that parts are diverted at the exit means onto the return track, back to the entrance means and onto the spiral tracks along with parts being accepted at the entrance means.

14. A storage unit as set forth in claim **11** incorporating means for operating in a delivery mode such that parts are accepted at the entrance means from the return track only when no parts are being delivered from the preceding operation and are released at the exit means.

15. A parts storage feeder unit comprising a vertically inclined spiral track, a second vertically inclined spiral track adjacent to and concentric with the first spiral track, means to impart reciprocating motion to one of the tracks relative to the other and to advance parts along the tracks, entrance means to accept parts onto the spiral tracks, a third vertical spiral track inclined in the opposite direction to the first and second inclined spiral tracks and concentric therewith, a fourth vertically inclined spiral track adjacent to and concentric with the third spiral track, means to impart a reciprocating motion to the fourth spiral track relative to the third spiral track, and an exit means to release parts from the spiral tracks.

16. A storage unit as set forth in claim **15** wherein the same means are used to impart reciprocating motion to the second and fourth spiral track relative to the first and third spiral tracks.

17. A storage unit as set forth in claim **15** wherein the first and third spiral tracks are located on the inside of a cylindrically shaped assembly and the second and fourth spiral tracks are located on the outside of a second cylindrically shaped assembly located inside the first cylindrically shaped assembly and concentric therewith.