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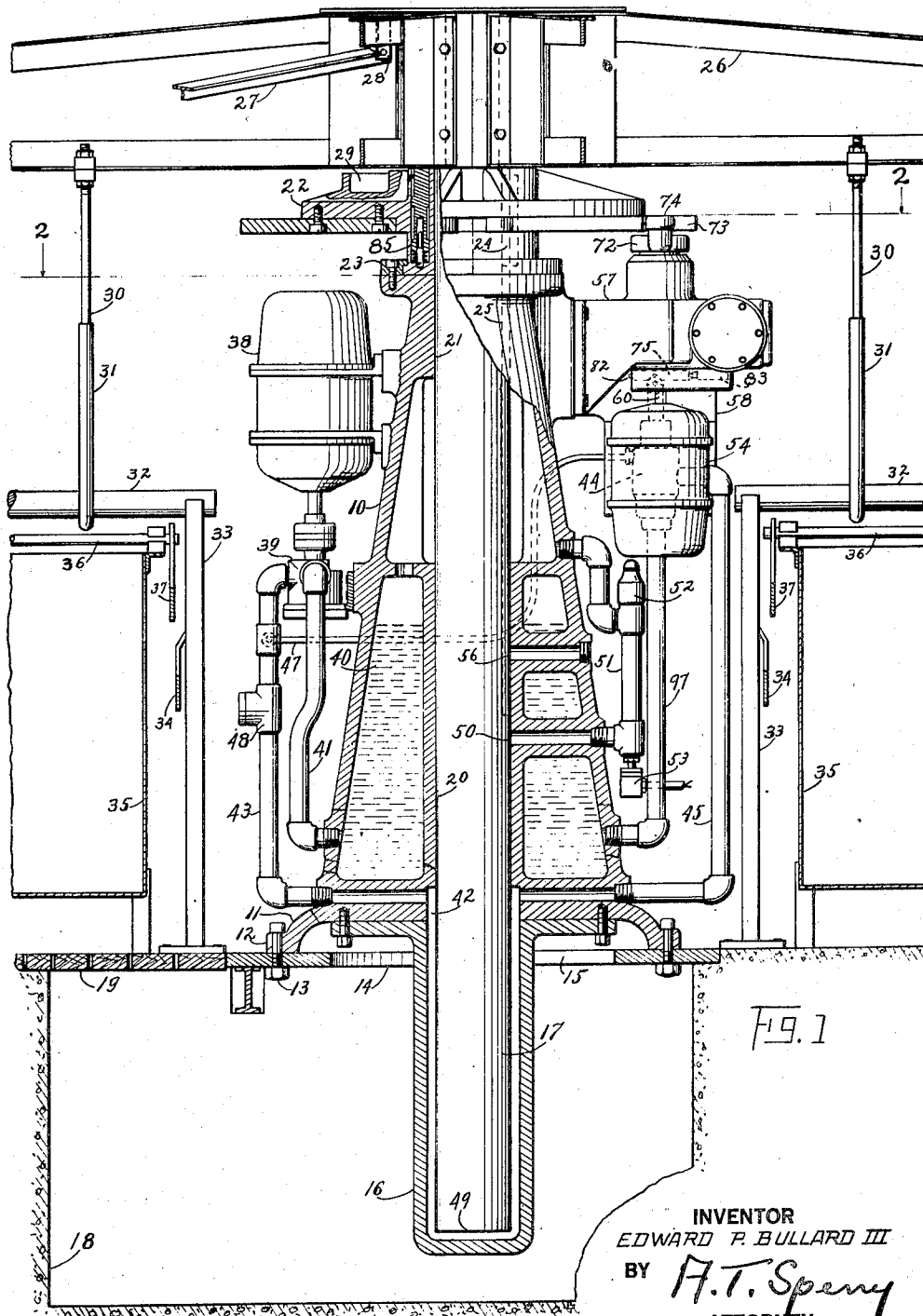
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2,129,463

STATION TYPE TREATMENT MACHINE

Filed Jan. 28, 1937

2 Sheets-Sheet 1



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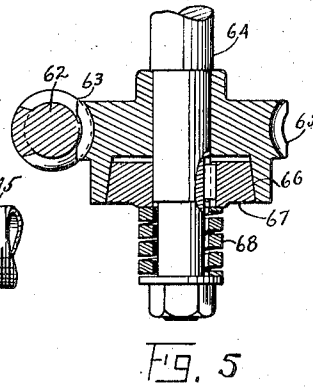
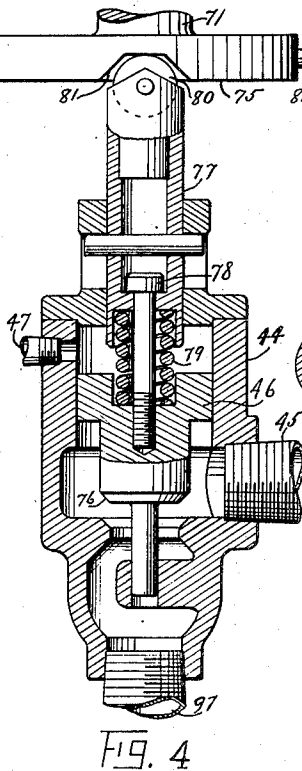
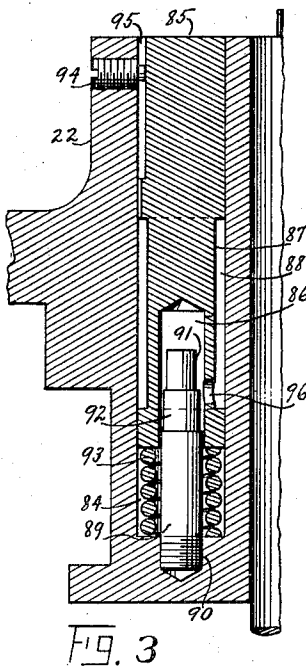
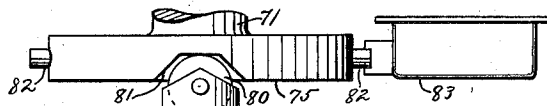
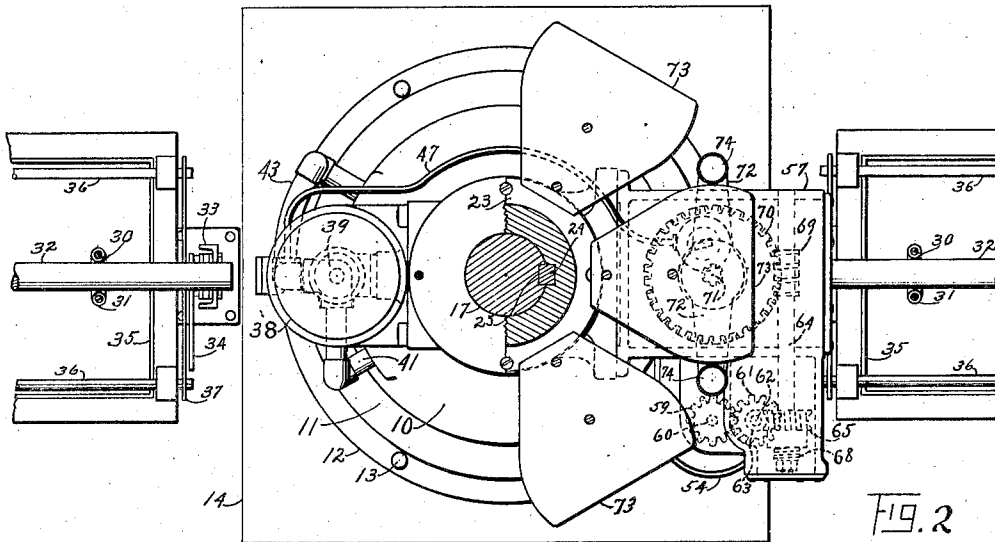
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STATION TYPE TREATMENT MACHINE

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2 Sheets-Sheet 2



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STATION TYPE TREATMENT MACHINE

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18 Claims. (Cl. 214—86)

This invention relates to rotary, power driven, station type treatment machines employing sus-
pending means adapted to be raised, rotated and
lowered to carry material from a loading sta-
tion to successive treatment stations surround-
ing the machine.

Among the objects is to provide a treatment machine combining the advantages of simplicity in structural design with ready accessibility to all the working parts.

Another object of this invention is to provide a novel, simple and improved machine of the type set forth adapted to perform a series of predetermined cycles either automatically or at the will of the operator.

Another object is to provide a treatment machine having a self-contained fluid supply reservoir for maintaining in the machine a fluid supply for performing certain machine functions and avoiding long and cumbersome piping and extraneous equipment.

A still further object is to provide a station type machine with an arrangement to retard the downward movement of the carrier, preventing shock to the machine and material in the tanks, avoiding splashing of injurious acids and wasting of materials.

An important object is to provide a station type machine, incorporated with an indexing movement, to carry material from one station to another with smooth and vibrationless motion which is accomplished by starting the rotation slowly and increasing gradually until maximum rotation is reached and coming slowly to a stop at another station without jar or shock which might tend to throw the material from the racks.

A further important object is to provide, in a machine of the type referred to, a novel, simple and improved indexing mechanism integrally associated with the machine and at all times in connection with the indexible member thus to insure uniformity of operation and to maintain relationship of parts so as to provide for locking of the indexible member by its indexing mechanism.

In that form of the invention disclosed, by way of illustration in this application, there is a central column having a central bore through which a plunger reciprocates. Attached to the plunger, preferably at its upper end, is a carrier which has been shown, for example, as a spider having several arms, depending upon the number of treatments. In the machine disclosed, there are five fluid treatment tanks and a load-

ing station, thus the spider is provided with six arms.

The conical form of the column, while giving rigidity and strength to the machine, readily lends itself to a suitable location for the fluid supply to operate the plunger. In this form of the invention, pressure to operate the central plunger may be supplied by a pump preferably attached to the side of the column. Indexing of the spider is preferably achieved by a separate motor which may also be attached to the column.

Electric control of the motors for automatic cycle and manual operation are not described in detail as it will be apparent that there are many ways in which this can be accomplished, but other novel features of the construction and operation of the station type machine will be described with reference to the accompanying drawings forming part of this application in which:

Figure 1 is a vertical view, partly in section, of a machine embodying the present invention.

Figure 2 is a view taken on line 2—2 of Figure 1.

Figure 3 is an enlarged sectional detail view of the hydraulic shock absorber.

Figure 4 is a sectional detail view of the control valve housing and controlling cam; and

Figure 5 is a sectional detail of a spring operated friction safety clutch incorporated in the gearing.

As has been mentioned, a machine of this type is arranged for a varying number of stations, one of which is a loading station. The more usual arrangement, and the type of machine disclosed in this application, has one loading station and five tanks containing liquids suitable to the process for which the machine may be used.

In the preferred type of machine shown in the drawings, there is a central column 10, of conical form, having an enlarged circular base member 11 provided with a flange 12 bored to receive bolts 13 by which the column is securely held to a rectangular floor plate 14. In the center of the plate 14 is a large circular opening 15, through which a lower section 16 projects, providing a cylinder to receive a plunger 17 in its lower position, as shown in Figure 1. Access to the part of the machine below the plate 14 may be provided by a pit 18 with removable boards 19. The plunger 17 is free to rotate and move vertically in bearings 20 and 21. Resting upon the upper portion of the column is an indexing bracket 22 rotatable within a ring 23.

The bracket 22 is provided with a key 24, coinciding with a keyway 2, in the plunger 17. This arrangement allows the plunger 17 to slide vertically through the bracket 22 and to rotate, with it, in response to the indexing mechanism to be hereinafter described.

Securely fastened to the upper end of the plunger 17 is a spider 26, which may be of any suitable form, to carry material from one station to another. Located in the upper part of the spider 26 is a bar 27 hinged as at 28. When it is desirable to leave the plunger and the spider in its raised position for any length of time, as when the machine may be idle, the lower end of the bar 27 may be placed in a pocket 29 to preclude lowering of the spider.

For supporting the work, there are suspended from the arms of the spider U shaped rods 30, which may be partially covered by insulating material 31, which, in the arrangement shown, support current carrying members 32. When the machine is in the position shown in Figure 1, the members 32 rest upon upright standards 33 and thereby complete electrical connections with bus bars 34; suitable tanks, shown at 35, being provided with electrode rods 36 connected to bus bars 37. The invention is not concerned with the particular type of hangers disclosed, this being but one of many arrangements that may be used to suspend work in the tanks.

Conveniently located upon the side of the column 10 is a motor 38, directly coupled to a pump 39 also secured to the column. The pump 39 draws fluid from a reservoir 40 by means of a pipe 41 and supplies fluid under pressure to a cylinder 42 through a pipe 43. Upon the opposite side of the machine, from the motor 38, is a valve housing 44 shown in detail in Figure 4. Fluid pressure, inaugurated by the pump 38 in the cylinder 42, also provides pressure in a pipe 45 to act upon the lower side of a piston 46 in the valve housing 44. Pressure upon the upper side of the piston is supplied through a small pipe 47 joining the pipe 43 between a check valve 48 and the pump 39. A more detailed description of the valve housing is given with the indexing mechanism to which it belongs.

The plunger 17, rising under fluid pressure supplied by the pump 39, will eventually reach a position in the bearing 20 in which a lower end 49 of the plunger 17 passes an outlet 50 in the column 10. As the diameter of the plunger corresponds closely with the diameter of the bearing 20, no fluid can pass beyond the end 49 of the plunger 17, but must necessarily escape through the outlet 50 and a pipe 51 to return to the supply reservoir 40. The pipe 51 is fitted with a relief valve 52 and a pressure switch 53 which forms part of the electric control of the motor 38 and the indexing motor 54.

The height to which the plunger 17 is required to rise in the bearing 20 depends upon the depth of tanks and type of material to be moved; two outlets in the column at the different heights to which the plunger may be raised being shown at 50 and 56. Obviously other outlets may be provided as required.

Indexing mechanism

One of the important features of this station type machine is the indexing unit attached to the upper part of the column 10. The unit comprises a housing 57 forming a motor support 58 to which the indexing motor 54 is attached. The motor 54 drives a gear 59 by means of a

shaft 60. The gear 59 is in mesh with a companion gear 61, keyed to a shaft 62, upon which a worm 63 is also keyed. Upon one end of a horizontal shaft 64 is located a friction clutch shown in detail in Figure 5. The clutch comprises a worm gear 65, loosely mounted upon the shaft 64, having an extended portion enclosing a tapered recess 66. Fitting within the recess 66 is a frustum 67 having a surface corresponding with the recess 66. The frustum 67 is slidably keyed to the shaft 64 and, urged by a spring 68, forms a friction clutch between the shaft 64 and worm gear 65. This device permits the worm gear 65 to rotate independently of the shaft 64 in case of excessive torque. Also upon the shaft 64 is a worm 69 meshing with a worm gear 70 keyed to an index shaft 71. Securely fastened to the upper end of the index shaft 71 are a pair of indexing arms 72. The indexing bracket 22 is provided with six spaced plates 73 forming Geneva spaces which cooperate with rolls 74 on the ends of the indexing arms 72. Rotation of the indexing arms 72 through 180 degrees will cause the rolls 74 to shift their relative positions and cause the bracket 22, and with it the spider 26, to move one-sixth of a revolution. It will be obvious that this arrangement partakes of the usual Geneva movement phenomenon of providing an indexing movement which starts slowly and increases in speed and then diminishes to a slow speed before stopping.

The valve housing 44 and a cam 75, shown in Figure 4, form a safety device to prevent accidental opening of the valve during indexing. The piston 46, which operates a valve 76, is joined to a stem 77 by a pin 78 and a spring 79 to form a yielding connection. The upper end of the stem 77 is fitted with a roller 80 under partial control of the cam 75. The valve 76 is actuated by the variation in the pressure above the piston 46. To open the valve 76, the roller 80 must coincide with a recess 81 in the cam 75 to allow vertical movement of the stem 77. The cam 75 is attached to the lower end of the index shaft 71 and revolves with it during each indexing cycle. Two recesses 180 degrees apart, one of which is shown at 81, receive the roller 80 and allow the stem 77 to rise only when the indexing arms 72 are in the position shown in Figure 2. Two pins 82, located on the cam 75, control a limit switch 83 to stop both the pump motor 38 and the indexing motor 54 at the end of the indexing period.

Hydraulic shock absorber

At the end of each indexing movement, the plunger 17 and the spider 26 are lowered to place material in the tanks and to bring finished work to the loading and unloading station. The combined weight of the spider 26, plunger 17 and the material carried by the spider tends to produce a rapid downward movement which, if brought to a sudden stop, as when the spider 26 meets the indexing bracket 22, would cause an undesirable shock to the machine and the material in the tanks. In order to effect a cushioning to the downward movement of the spider 26, the combination spring and fluid controlled plunger, shown in detail in Figure 3, is used.

Located in the indexing bracket 22 is a bore 84 having a closely fitting plunger 85. The plunger 85 is provided with a central passage 86 in the lower end, a section 87 of the plunger 85 being of reduced diameter forming a fluid reservoir 88 within the bore 84. A pin 89 is

securely fastened in the bore as at 90. The upper end of the pin 89 has two sections of reduced diameters 91 and 92, each section being of less diameter than the one below it. The lower part of the pin 89 corresponds closely in diameter with the passage 86. The plunger 85 is normally urged upward by a spring 93 until further rise is prevented by a screw 94 in a groove 95.

The operation of the shock absorber is as follows:

It is assumed that the plunger 85 is in the uppermost position and the part of the bore 84, below the plunger 85, is filled with fluid. As the spider 26 approaches the indexing bracket 22 near the completion of its downward movement, it will force the plunger 85 downward against the spring 93 and fluid will be forced into the passage 86 through a duct 96 and into the reservoir 88. Soon after the beginning of the downward movement of the plunger 85, the small diameter 91 of the pin 89 will enter the passage 86 and, partially filling the entrance, will reduce the amount of fluid that can escape into the passage 86 and retard the downward movement of the plunger 85. The larger diameter 92 of the pin 89 similarly reduces still more the flow into the passage 86 and further reducing the downward movement until the full diameter of the pin 89 enters the passage 86 and thereby bringing the plunger 85 and the spider 26 to a stop with no resultant shock to the machine.

The operation of the station type machine is as follows:

Starting the pump motor 38 will produce fluid pressure in the pipes 43, 45 and 47, the latter pressure closing the valve 76 thus building up pressure in the cylinder 42 and raising the plunger 17 with the spider and work holders until the lower end 49 of the plunger passes the outlet 50 which will allow fluid to escape into the pipe 51 and return to the reservoir 40 precluding further rise of the plunger 17. The relief valve 52 in the pipe 51 produces sufficient pressure to cause the switch 53 to start the indexing motor 54 thereby rotating the spider 26 one-sixth of a revolution by means of the indexing arms 72 acting upon indexing plates 73. The indexing arms 72, coming to rest in the position shown in Figure 2, prevent further rotation of the spider 26.

The indexing arms 72 are brought to rest at the desired position by means of the pins 82 on the cam 75 tripping the switch 83 and stopping not only the indexing motor 54 but also the pump motor 38. Stopping the pump motor 38 reduces pressure in the pipe 43 closing a check valve 48 allowing pressure to be retained in the lower part of the pipe 43 from the weight of the plunger 17. While that part of the pipe 43 above the check valve 48, and the branch pipe 47, being relieved of pressure, the piston 46 (Figure 4) rises due to the pressure in pipe 43 being less than the pressure in pipe 45, opening the valve 76 and allowing fluid to escape into the reservoir 40, by way of a pipe 97, returning the plunger 17 to the lower position. The plunger remains in the lower position as long as it is required to load material at the loading station or until the treatment of the material in the tanks is completed when the cycle is repeated automatically by a timing switch (not shown) or may be repeated manually by a push button switch.

From the foregoing description of the preferred embodiment of the invention, it will be apparent that the objects of the invention have

been obtained and that a new and improved station type machine has been produced. While the invention has been illustrated and described with reference to the preferred embodiment thereof, it is not intended to be limited to the particular construction illustrated and described which may be varied within the scope of this invention.

Having set forth the nature of my invention, what I claim is:

1. In a rotary station type machine, a column, a bore in the column, a vertically reciprocable plunger rotatably mounted in the bore, a fluid reservoir in the column, and means for delivering fluid from said reservoir to the bore to raise the plunger in the bore.

2. In a rotary station type machine, a column, a bore in the column, a vertically reciprocable plunger rotatably mounted in the bore, a fluid reservoir in the column, means for delivering fluid from said reservoir to the bore to raise the plunger in the bore and automatic means to rotate said plunger while raised to a predetermined height.

3. In a rotary station type machine, a column, a bore in the column, a vertically reciprocable plunger rotatably mounted in the bore, a fluid reservoir in the column, means for delivering fluid from said reservoir to the bore to raise the plunger in the bore and means to return fluid to said reservoir when said plunger is lowered.

4. In a rotary station type machine, a column, a bore in the column, a vertically reciprocable plunger rotatably mounted in the bore, a fluid reservoir in the column, means for delivering fluid from said reservoir to the bore to raise the plunger in the bore and means for by-passing fluid from said first mentioned means to said reservoir when said plunger reaches a predetermined height.

5. In a rotary station type machine, a column, a bore in the column, a vertically reciprocable plunger rotatably mounted in the bore, a fluid reservoir in the column, means for delivering fluid from said reservoir to the bore to raise the plunger in the bore and means for by-passing fluid from said first mentioned means to said reservoir when said plunger reaches a predetermined height, including a relief valve to build up a low pressure within last mentioned means.

6. In a rotary station type machine, a column, a bore in the column, a vertically reciprocable plunger rotatably mounted in the bore, means to rotate said plunger, a fluid reservoir in the column, means for delivering fluid from said reservoir to the bore to raise the plunger in the bore, means for by-passing fluid from said first mentioned means to said reservoir when said plunger reaches a predetermined height, including a relief valve to build up a low pressure within last mentioned means and a pressure responsive means actuated by said low pressure to inaugurate said rotating means.

7. In a rotary station type machine, a column, a bore in the column, a vertically reciprocable plunger rotatably mounted in the bore, a fluid reservoir in the column, means for delivering fluid from said reservoir to the bore to raise the plunger in the bore and a positively acting mechanical means for retaining said plunger in raised position.

8. In a rotary station type machine, a column, a plunger mounted within the column, fluid pressure means to raise the plunger, means to hold the plunger at a predetermined height, means to

rotate the plunger and means including a switch operable by said fluid pressure means to start said third mentioned means.

9. In a rotary station type machine, a column, a plunger mounted within the column, fluid pressure means to raise the plunger, means to hold the plunger at a predetermined height, means to rotate the plunger, means including a switch operable by said fluid pressure means to start said third mentioned means and a separate switch operable by rotation of said plunger to discontinue its rotation.

10. In a rotary station type machine, a column, a plunger mounted within the column, a carrier attached to the plunger, means to raise the plunger and carrier to a predetermined height, means to hold the plunger and carrier at said predetermined height, means to rotate the plunger and carrier, means including a switch to control the third mentioned means so that said plunger and carrier will be rotated a predetermined number of degrees and means including a switch to interrupt the first mentioned means at the termination of the rotation of the plunger and carrier.

11. In a rotary station type machine, a column, a reciprocating plunger mounted within the column, means to index the plunger and an indexing member, including indexing plates, to rotate the plunger a predetermined number of degrees in response to each actuation of said indexing means.

12. In a rotary station type machine, a column, a reciprocating plunger mounted within the column, means to index the plunger and an indexing member, including indexing plates, to rotate the plunger a predetermined number of degrees in response to each actuation of said indexing means, said plates being stationary with respect to the reciprocation of said plunger.

13. In a rotary station type machine, a column, a plunger mounted within the column, a carrier attached to the plunger, means to raise said plunger and said carrier, means to periodically index said plunger and said carrier, including an indexing member, indexing plates attached thereto, two rolls engaging opposite sides of the plates and means to rotate said rolls to index said plunger and said carrier a predetermined number of degrees.

14. In a rotary station type machine, a column, a plunger mounted within the column, pressure means to raise said plunger, an indexing unit in

combination with a plunger, an indexing shaft for said unit, driving means for said shaft, means for stopping said indexing shaft and controlling said pressure means after rotating the said plunger a predetermined number of degrees.

15. In a machine of the class described, a plunger, means for delivering fluid pressure to raise said plunger, means for holding said plunger at a predetermined height by said pressure and a pressure responsive actuator to allow said plunger to move downward when said means for delivering fluid ceases operation and means for periodically restraining said pressure responsive means.

16. In a machine of the class described, a plunger, means for delivering fluid pressure to raise said plunger, means for holding said plunger at a predetermined height, means for indexing said plunger, a pressure responsive actuator to allow said plunger to move downward and means including a cam for preventing said actuator from responding to variations in said pressure only at predetermined intervals.

17. In a machine of the class described, a shock absorbing mechanism in combination with a column and a carrier, including a bore, a fluid controlled plunger reciprocable vertically in said bore, a central portion of the plunger being of reduced diameter forming a cavity between the walls of the bore and the reduced portion of the plunger and means to permit the escape of fluid from the lower portion of the bore to said cavity upon the downward movement of the plunger.

18. In a machine of the class described, a shock absorbing mechanism in combination with a column and a carrier, including a bore, a fluid controlled plunger reciprocable vertically in said bore, a central portion of the plunger being of reduced diameter forming a cavity between the walls of the bore and the reduced portion of the plunger, means including a passage extending upward in the lower portion of the plunger to permit the escape of fluid from the lower portion of the bore to said cavity and a piston having a head with a plurality of increasing diameters on its upper side axially mounted in said bore so as to enter said passage permitting a graduated reduction in the flow of said fluid through said passage in the plunger by the successive entrance of the increasing diameters on said piston during the downward movement of said plunger.

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