

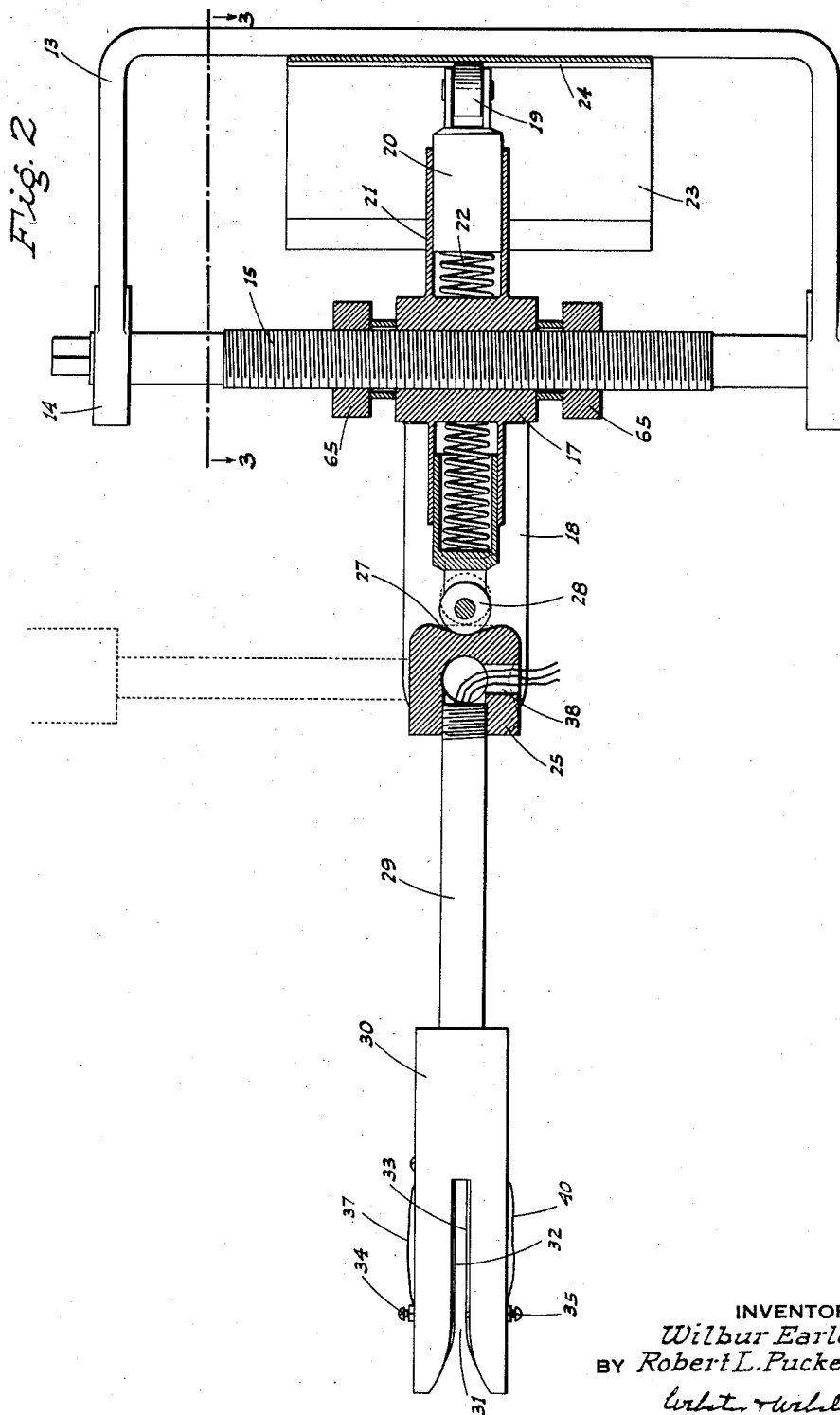
July 29, 1958

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AUTOMATIC LEVELING MECHANISM FOR CONCRETE
SLAB LAYING MACHINES

2,844,882

Filed Oct. 17, 1955

4 Sheets-Sheet 2



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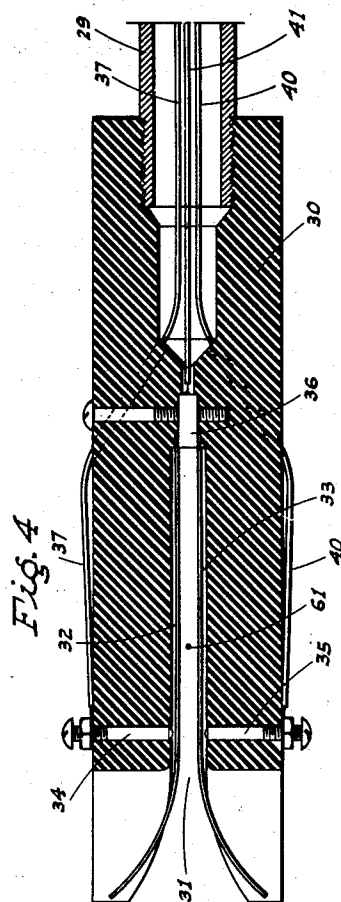
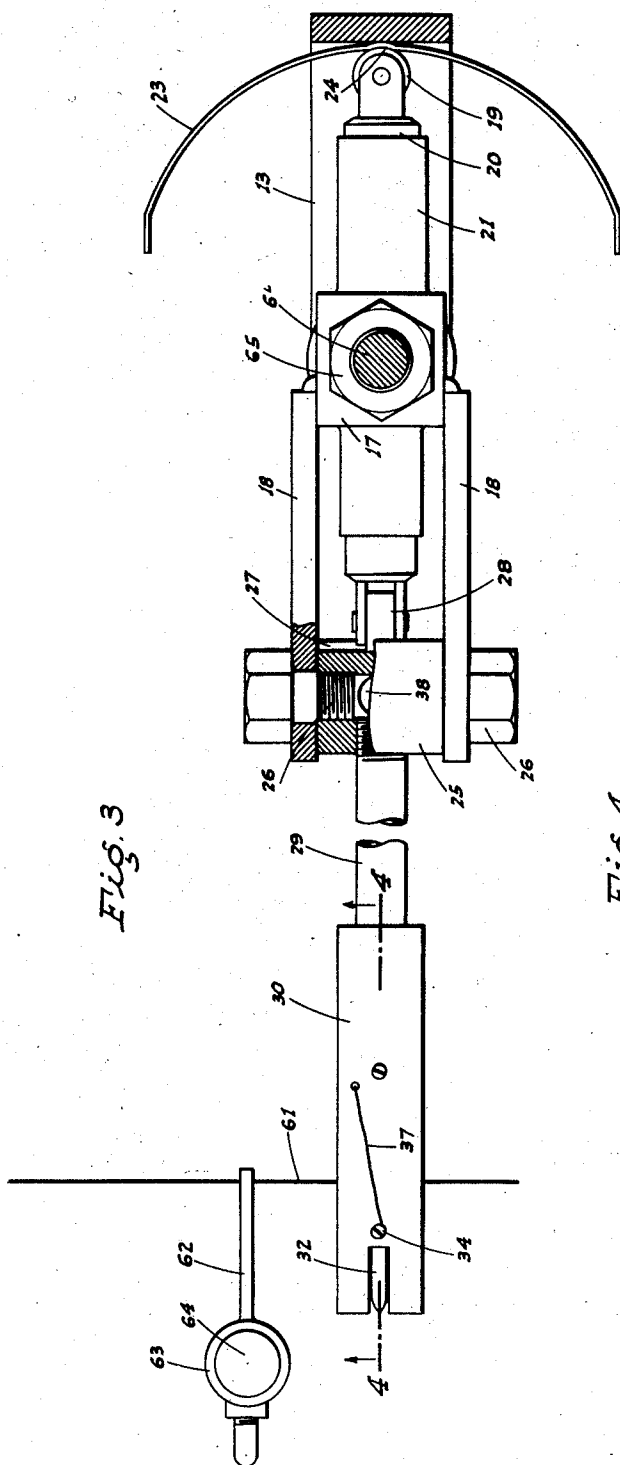
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Fig. 5

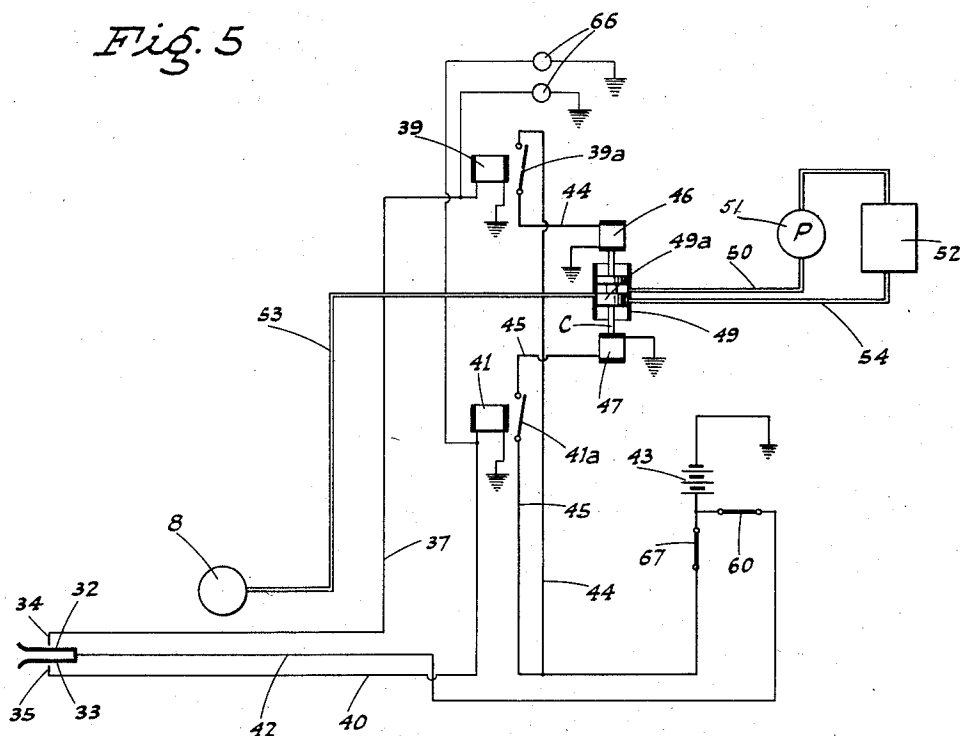
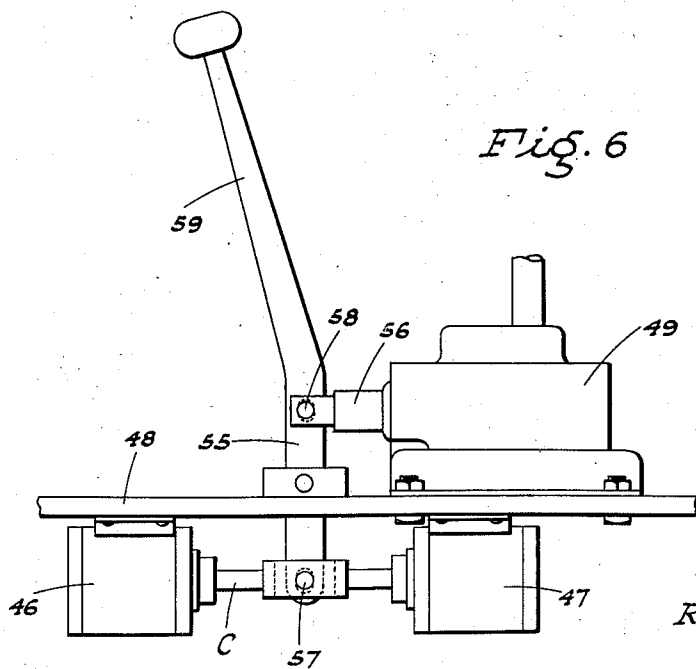


Fig. 6



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AUTOMATIC LEVELING MECHANISM FOR CON-
CRETE SLAB LAYING MACHINES

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Application October 17, 1955, Serial No. 540,808

16 Claims. (Cl. 33—185)

This invention relates to concrete-slab laying machines, such as those used to lay landing strips at airports, lining large irrigation ditches, and other concrete-laying projects of considerable magnitude.

Such machines straddle the area to be covered or lined, and are supported on rails laid to the sides of said area, so that the machine can be advanced to make a continuous pour.

In order to meet specifications as to minimum concrete thickness, and to avoid the loss to the contractor which would be caused by an unnecessarily thick pour, it is essential that the machine shall be controlled, as to its level, so that the concrete as poured shall be maintained at a predetermined thickness, within close limits.

Such control can be maintained roughly by a proper setting of the supporting rails, but it has been found to be impractical to set the rails to the accurate level necessary to provide the desired close control of thickness of the concrete, which must be maintained within relatively small fractions of an inch.

It is therefore the major object of our invention to provide a control means for a slab-laying machine which will automatically maintain the machine, as it advances, at a predetermined and accurately held level, regardless of any variations in the level of the supporting rails of the machine.

Another object of the invention is to arrange the control means so that it may be actuated automatically or manually, as may be desirable or necessary at times.

Still another object of the invention is to provide a practical and reliable automatic leveling mechanism for concrete slab laying machines, and one which will be exceedingly effective for the purpose for which it is designed.

These objects are accomplished by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings:

Fig. 1 is a diagrammatic and foreshortened end outline of a slab laying machine, equipped with our improved level control mechanism.

Fig. 2 is an enlarged side elevation, partly in section, of one of the leveling-control arm units, detached.

Fig. 3 is a top plan view of an arm unit, partly in section, on line 3—3 of Fig. 2, and shown in connection with a grade wire and one of the supporting posts therefor.

Fig. 4 is an enlarged (full size) sectional elevation of the feeler and switch-closing portion of an arm unit; the view being on line 4—4 of Fig. 3.

Fig. 5 is a diagram of the fluid control and electrical system for each ram of the leveling mechanism.

Fig. 6 is a side elevation of one of the fluid control valves showing the electrical and manual control means therefor.

Referring now more particularly to the drawings and

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to the characters of reference marked thereon, the slab laying machine itself may be of any existing form, such as that contemplated by Patent No. 2,549,953, dated April 15, 1951, to L. R. Zimmerman. Such a machine includes an upstanding frame structure 1 of a suitable width to straddle the concrete slab 2 to be poured by the machine, and which slab is confined by side skirts 3 on the frame, and its thickness determined by a smoothing blade 4 rigid with the frame.

The frame structure 1 is rectangular or four-cornered in plan, and at each corner said structure is supported by a unit 5 which includes a wheeled truck 6 riding on a rail 7 laid lengthwise of the intended direction of travel of the machine, which is lengthwise of the slab of concrete to be laid. A single rail on each side of the machine supports both trucks 6 on the corresponding side of said machine.

Each unit 5 includes an upstanding hydraulic jack 8; the cylinder 9 of which is rigidly connected to the frame structure 1 by a bracket 10; while the piston rod 11 of the jack is connected to truck 6.

Admission of fluid under pressure to the top of any jack causes the frame structure 1 to be raised at the corresponding corner, while release of the fluid allows said structure to drop.

The units 5 are preferably of the type shown in said Patent No. 2,549,953, or as shown in Patent No. 2,549,954.

The feeding of the fluid to, or release of the same from, the jacks is automatically and independently controlled; so as to maintain the machine at a predetermined level as it advances, by the following mechanisms:

Depending from each jack 8 laterally out from and clear of the corresponding truck 6 is a bracket 12 on which is secured a U-shaped yoke 13, vertically disposed and opening laterally out. Turnably mounted in bearings 14 at the outer end of the yoke is a screw shaft 15; which is held against axial movement in said bearings. A crank handle 16 is mounted on the upper end of the shaft so that it may be readily rotated by hand.

Threaded on the screw shaft 15 is a hub 17 from which horizontally spaced arms 18 project laterally out, or so as to extend transversely of the direction of movement of the machine. The arms are yieldably maintained in such transverse position by suitable means, such as a vertical-axis roller 19 mounted on a support 20 slidable in a housing 21 projecting from the hub 17 opposite the arms 18.

A spring 22 in the housing 21 presses the support 20 radially of the hub so that the roller 19 frictionally engages a vertically elongated horizontally curved track plate 23 secured on the back of the yoke 13.

The plate is formed with a seat 24 for the roller which releasably holds said roller so that the arms 18 are then in said transverse position. The plate 23 is curved on both sides of the seat so as to be eccentric to the shaft; and is arranged so that the spring 22 is increasingly compressed as the arms 18 swing to one side or the other; and thus tends to return said roller to its normal seated position. The purpose of this feature will be seen later.

Disposed between the arms 18 at their outer end is a hub member 25 turnably supported from the arms by trunnions 26 set horizontally and normally lengthwise of the machine. The back side of the member 25 is formed with a depression 27 in which a spring-pressed roller 28 seats; said roller being supported from the hub 17 and disposed between the arms 18.

A tubular rigid rod-like arm 29 projects laterally out from the member 25; and at its outer end is rigidly connected to an elongated block 30 of dielectric material, and formed with a horizontal elongated slot 31 open to the outer end of said block. Each arm 18; to

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gether with arm 29 and block 30, actually form a single arm unit consisting of inner and outer portions. Upper and lower resilient contact or feeler strips 32 and 33 extend lengthwise of the block within the slot 31 and clear of the upper and lower edges thereof, so as to be exposed in said slot. Strips 32 and 33 are normally clear of but engageable with vertical terminal posts 34 and 35, respectively and which are mounted in block 30. The strips at their inner end are connected to a common mounting block 36 secured in the block 30.

For each jack 8 the following control arrangement is provided as shown in Fig. 5:

A wire 37 extends from post 34 through arm 29 and a passage 38 in hub 25 to a relay 39 on the machine. Another wire 40 leads from post 35 to a relay 41, while a third wire 42 leads from block 36 to a source of electrical energy (such as a battery 43) on the machine. Another wire 44 leads from source 43 to relay 39, while yet another wire 45 leads from said wire 44 to relay 41. The relays 39 and 41 include normally open switches 39a and 41a, respectively, and which are interposed in the wires 44 and 45, respectively. A solenoid 46 is arranged for actuation upon energization of relay 39, while an opposed solenoid 47 is arranged for actuation upon energization of relay 41.

The solenoids are mounted in connection with a supporting base 48 on the machine in axially aligned but spaced relation, and are provided with a movable core unit C common to both solenoids (see Fig. 6).

Mounted on the base 48 in vertically spaced relation to the solenoids is a valve 49. This valve is of conventional piston type, with the axis of the piston 49a parallel to the axis of the solenoids. A pressure pipe 50 leads to the valve 48 from a hydraulic pump 51 which takes from a supply tank 52.

Another pipe 53 leads from the valve to the corresponding jack 8, while a third pipe 54 leads from the valve to tank 52. The valve is of that type which with one position of the piston thereof will place pipes 50 and 53 in communication with each other to feed fluid to the jack; in a second position of the piston the pipe 53 will be blocked off so as to hold the fluid within the jack; while in a third position of the piston, the pipe 53 will be placed in communication with the return pipe 54 so as to relieve the fluid from the jack. The second or central position of the valve piston is in the normal position, when both solenoids are deenergized, and is that shown in Figs. 5 and 6.

To shift the piston of the valve in one direction or the other from said central position upon energization of one solenoid or the other, a lever 55 is pivoted intermediate its ends on base 48 at a point between the axis of the solenoids and that of the valve piston 56. The lever is pivoted, with loose-play in a vertical direction, to the core unit C and to the piston 56, as shown at 57 and 58, respectively.

In order to enable the valve to be manually actuated when desired, the lever 55 above the valve is extended to form a handle 59; the possibility of a concurrent electrical actuation of the valve taking place being prevented by the provision of a hand switch 60 in the power lead 42; which switch, when opened, preventing energizing of the solenoids.

The valve, solenoids, and electric circuits leading thereto are arranged so that when feeler strip 32 contacts post 34 a circuit will be closed and solenoid 46 will be energized to cause the valve piston to be shifted in a direction to feed fluid to the jack 8 so as to raise the frame structure 1. When the strip 33 contacts the post 35 a circuit will be closed to energize solenoid 47, causing the valve piston to be shifted so that fluid will be released from the jack 8, and the frame structure 1 will be lowered.

Such alternate engagement of one contact strip or the other with the corresponding terminal posts is effected

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with any slight vertical deviation of the machine from a predetermined level, as said machine moves along the rails 7, by means of grade wires 61, one on each side of the machine, or for each pair of jacks on said side, and extending lengthwise of the direction of travel of the machine, in mutually parallel alinement in a horizontal plane. Each wire is supported at intervals by brackets 62, each projecting radially from a sleeve 63 slidably adjustable on a post 64 adapted to be driven into the ground.

The posts are set so that the blocks 30 will clear the same as they move along; the wire being taut and being then in the slot 31 intermediate the ends thereof, and between the strips 32 and 33 initially clear of both such strips, as shown in Fig. 4. It will of course be understood that the one wire, on each side of the machine, passes through the slots of the two blocks on the same side of the machine, while separately and independently effecting the actuation of the corresponding circuits and solenoids.

The wires 61 must of course be set at a level within the range of vertical adjustment of the blocks, and to dispose the wire in the proper centralized relation to the strips 32 and 33, it is only necessary to rotate the screw shaft 15 in one direction or the other, which raises or lowers the hub 17 and parts attached thereto, and which include the block 30. Once the proper level of the block 30 has been effected, further rotation of shaft 15 relative to hub 17 is prevented by lock nuts 65 on shaft 15, and which clamp the hub to the shaft.

It will therefore be seen that as the machine moves along, any appreciable drop or lift of the frame structure 1 at any corner will be transferred to the corresponding block 30 to a greater extent. Therefore, with the wires 61 properly taut, such drop or lift will cause the wire to engage one or the other of the contact strips, and force the same into engagement with the corresponding terminal post, closing the circuit and energizing one or the other of the solenoids with the result previously described.

While the posts 64 are set clear of each block 30, the brackets 62 are in the path of movement of said block. The block when coming in contact with the brackets upon advance of the machine therefore swings back, turning about and with the shaft 15 as an axis until the block clears the bracket. The block then returns of itself to its normal laterally projecting position due to the action of the eccentric track plate 23 on the spring-pressed roller 19.

Each jack 8 is controlled in its operation by its own valve and solenoid mechanism, but it will be understood that all of the valves for the four jacks are arranged as a single unit or bank, and one pump supplies fluid to all the valves. Similarly, a single source of electricity supplies energy for all the solenoids of the valves, without affecting their individual operation.

It will be noted that signal lights 66, one for each solenoid, are mounted wired in parallel in connection with the circuits of said solenoids, so that an operator, watching the operations of the machine, may know whether and how the control mechanism is functioning.

In order, however, that the valves 49 may be manually actuated if desired or necessary due to solenoid failure, while still utilizing the signal lights as an indicating means, a hand switch 67 is interposed in wire 44 beyond the connection of wire 42 with the battery 43. Opening this switch will therefore immobilize the solenoids, enabling the valves to be hand-actuated without any drag or resistance from the solenoids. At the same time, the circuits to the various signal lights are arranged so that said circuits will still be closed upon the corresponding contact strips and terminal strips becoming engaged.

If no leveling action is desired, each of the blocks 30, before being engaged with wire 61, is merely swung out of the way, turning on trunnions 26 as an axis; the

flat side of member 25 being then engaged with the spring-pressed roller 28, yieldably preventing any, undesired down-swing of the block 30 and parts attached thereto of themselves.

With the described mechanism, the frame of the slab laying machine is accurately maintained at a predetermined level and the slab thickness closely controlled, even though there may be some vertical deviation in the rails relative to such level.

From the foregoing description it will be readily seen that there has been produced such a device as will substantially fulfill the objects of the invention, as set forth herein.

While this specification sets forth in detail the present and preferred construction of the device, still in practice such deviations from such detail may be resorted to as do not form a departure from the spirit of the invention, as defined by the appended claims.

Having thus described the invention, the following is claimed as new and useful, and upon which Letters Patent are desired:

1. In a concrete slab laying machine which includes a frame structure, ground supported trucks on opposite sides of the frame structure, and vertical jack units connecting the frame structure and the trucks and providing for vertical adjustment of the frame structure relative to the trucks; ground supported grade wires extending along the path of movement of the machine to the sides of the same, and mechanisms on the machine to actuate the jack units independently of each other upon deviation of the frame structure from a predetermined level, said mechanisms each including wire engaging feeler elements.

2. A structure, as in claim 1, in which each mechanism includes normally open circuits, the closing of either of which actuates the corresponding jack unit in one direction or the other, and the feeler elements comprise a pair of horizontal contact strips arranged to straddle the corresponding wire in normally spaced relation thereto, and vertical terminal posts fixed with relation to the strips for engagement thereby and normally spaced therefrom, the posts and strips being interposed in the circuits.

3. In a concrete slab laying machine which includes a frame structure, front and rear ground supported trucks on opposite sides of the frame structure, and vertical jack units connecting the frame structure and the trucks and providing for vertical adjustment of the frame structure relative to the trucks; a ground supported grade wire extending along the path of movement of the machine on each side of the same, and mechanisms on the machine to actuate the jack units independently of each other upon deviation of either side and end of the frame structure from a predetermined level, said mechanisms each including wire engaging feeler elements mounted adjacent the corresponding jack unit.

4. In a concrete slab laying machine which includes a frame structure, ground supported trucks on opposite sides of the frame structure, and vertical jack units connecting the frame structure and the trucks and providing for vertical adjustment of the frame structure relative to the trucks; ground supported grade wires extending along the path of movement of the machine to the sides of the same, means to control the movement of each jack unit including a valve, normally idle electric devices to actuate the valve, circuits for said devices, and normally open switches interposed in the circuits, said switches comprising feeler and contact strips arranged to straddle one of the grade wires in normally spaced relation thereto and transversely thereof.

5. In a concrete slab laying machine which includes a frame structure, ground supported trucks on opposite sides of the frame structure, and vertical jack units connecting the frame structure and the trucks and providing for vertical adjustment of the frame structure relative to the trucks; means to control the movement of each jack unit including a piston valve, normally idle electric devices

to actuate the valve, circuit for said devices, normally open switches interposed in said circuits, and a ground supported element arranged to cooperate with the switches to alternately actuate the same upon undulating movement of the machine as it advances; said electrical devices comprising opposed axially aligned and separated solenoids, a common axially movable core extending therebetween, a lever connected to the core and valve piston, and means pivoting the lever intermediate its ends in a fixed position.

6. A structure, as in claim 5, in which the axes of the core and valve piston are disposed in parallel but spaced-apart relation.

7. A structure, as in claim 5, in which the lever extends beyond one of the pivot means to form a manually operable handle for actuating the valve when the electrical devices are inactive.

8. In a concrete slab laying machine which includes a frame structure, ground supported trucks on opposite sides of the frame structure, and vertical jack units connecting the frame structure and the trucks and providing for vertical adjustment of the frame structure relative to the trucks; ground supported grade wires extending along the path of movement of the machine to the sides of the same, normally idle mechanism on the machine to actuate each jack unit and including normally inactive electrical devices, circuits for said devices, normally open switches in the circuits including vertically spaced flexible feeler and contact strips straddling the grade wire transversely thereof and in normally spaced relation thereto and vertical terminal posts above and below the strips and normally spaced therefrom, a block in which the strips and posts are mounted and formed with a horizontal slot extending lengthwise of the strips and open at its outer end and in which the strips are exposed, and means mounting the block on the machine adjacent the corresponding jack unit.

9. A structure, as in claim 8, in which the mounting means for the block provides for vertical adjustment thereof.

10. A structure, as in claim 8, in which the mounting means for the block is arranged to provide for vertical swinging of the block to a position clear of the wire while normally maintaining said block at a definite level.

11. A structure, as in claim 8, in which the mounting means for the block is arranged to provide for horizontal swinging of the block from a normal transversely projecting position, while yieldably maintaining the block in said position.

12. A structure, as in claim 8, in which the mounting means for the block is arranged to provide for horizontal swinging of the block from a normal transversely projecting position, while yieldably maintaining the block in said position; and independently providing for vertical swinging of the block to a position clear of the wire while normally maintaining said block at a definite level.

13. A structure, as in claim 8, in which the mounting means for the block comprises a support secured on the jack unit and projecting laterally out therefrom, a vertical shaft mounted in the support, an arm unit projecting from and relatively turnable on the shaft and on the outer end of which the block is mounted, and means between the arm unit and support yieldably preventing rotation of the arm unit.

14. A structure, as in claim 13, in which the shaft is threaded, and the arm unit includes a hub screwed on the shaft and movable up and down the same upon rotation of the shaft in opposite directions.

15. A structure, as in claim 8, in which the mounting means for the block comprises a support secured on the jack unit and projecting laterally out therefrom, an arm unit projecting laterally out from the support and on the outer end of which the block is mounted, said arm unit comprising inner and outer portions, means mounting the inner portion on the support, horizontal pivot

means connecting the arm portions, and means yieldably preventing swinging of the outer arm portion about said pivot means.

16. A structure, as in claim 4, with means to operate each valve manually, signal lights, circuit means for said lights included in part with said circuits, so that the lights will be lit when the electric devices are energized, and a normally closed switch for said circuits arranged in connection with said circuit means so that said lights may be energized upon closing of said normally open switches and when the normally closed switch

is opened, but energization of the electric devices by such closing of the normally open switches will be prevented.

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