Nov. 24, 1959 D. L. SAMPSON ET AL 2,914,302

SLIP-FORM JACK

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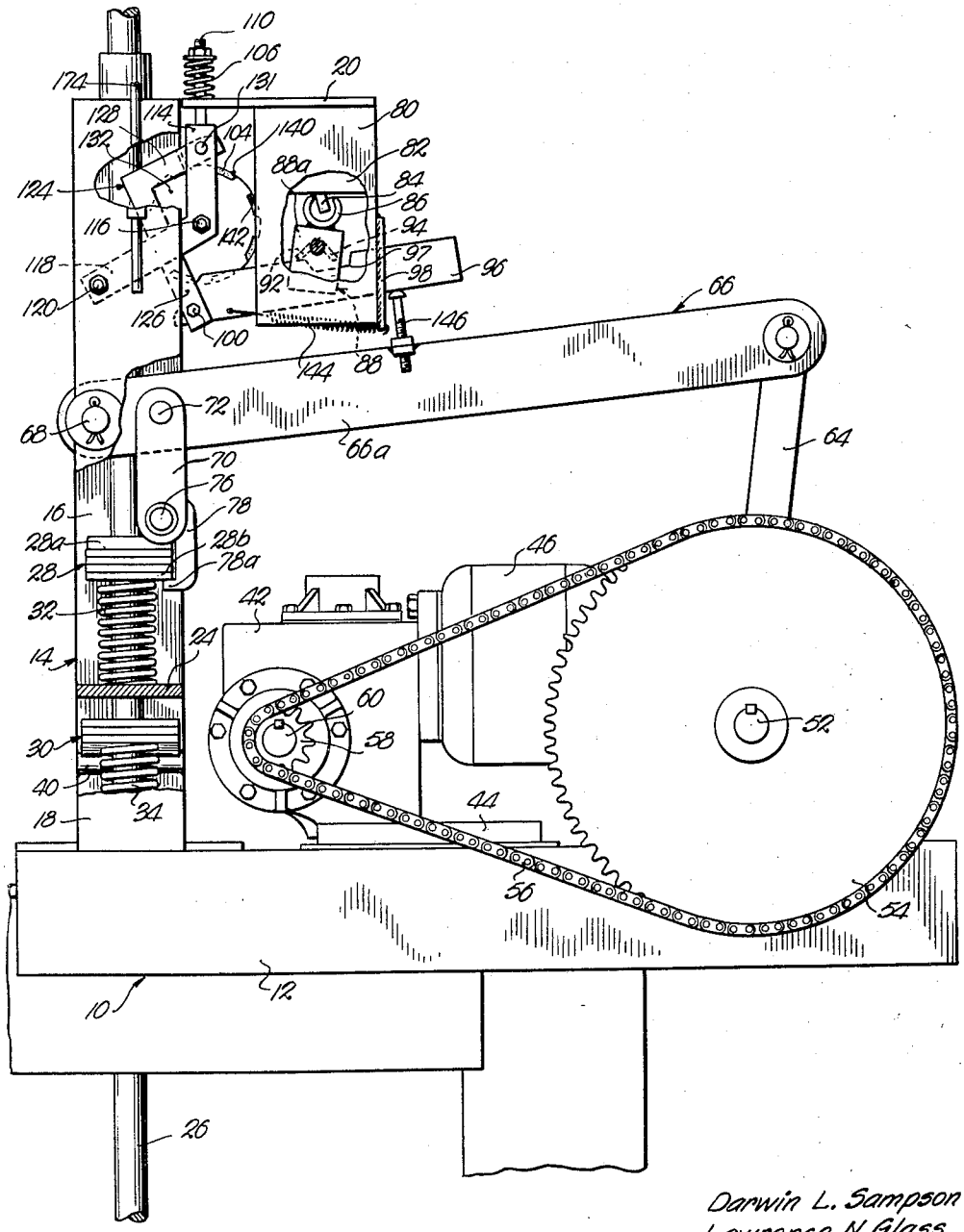



Fig. 1.

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SLIP-FORM JACK

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Fig. 2.

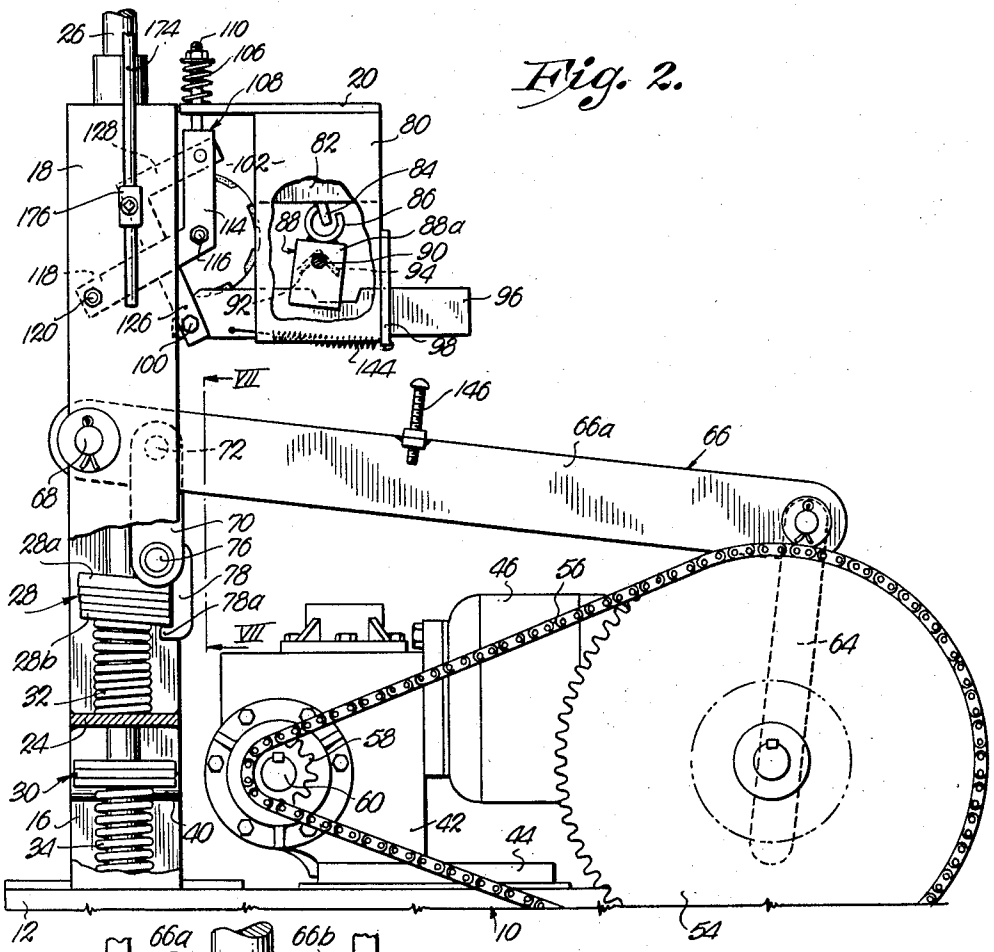
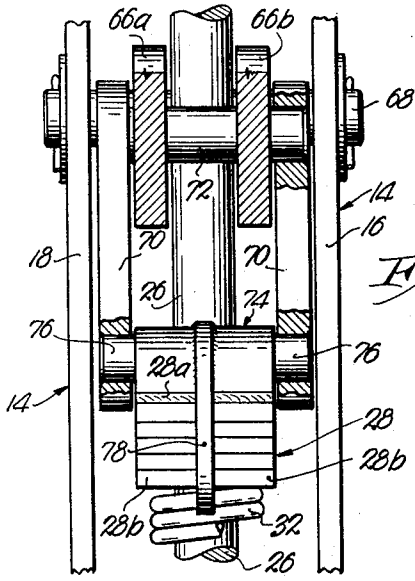



Fig. 7.




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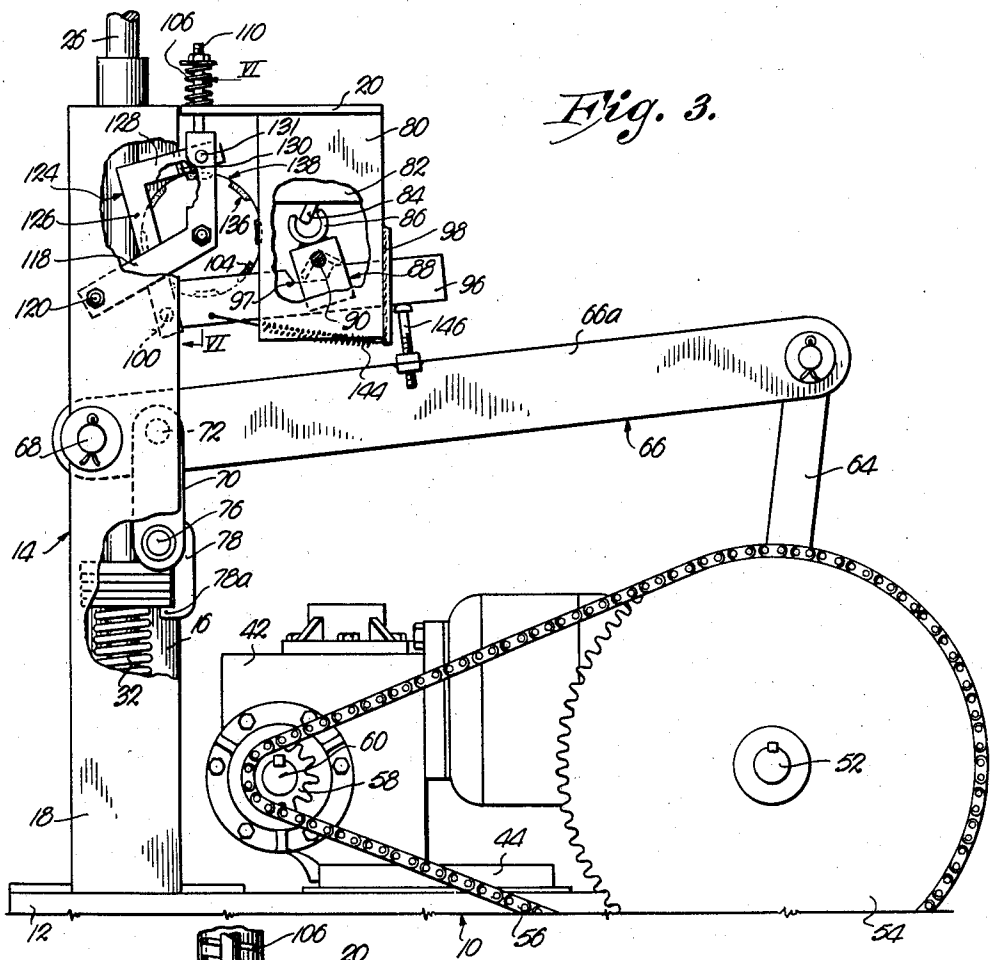



Fig. 3.

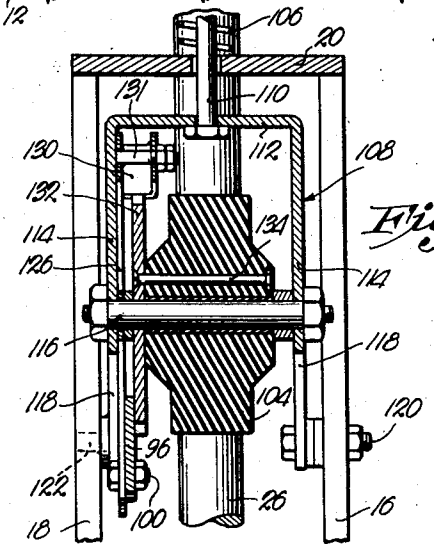



Fig. 6.

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SLIP-FORM JACK

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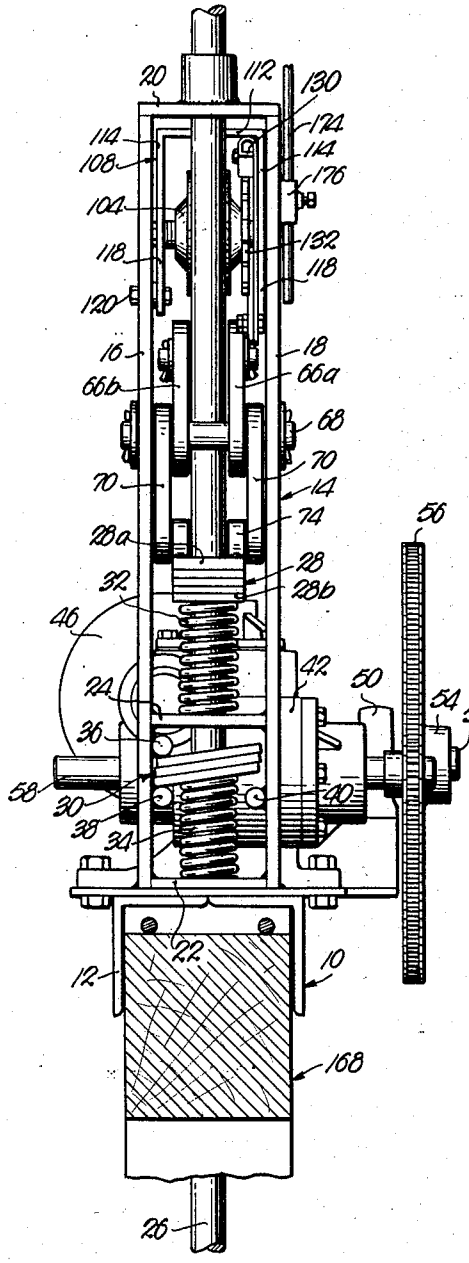



Fig. 4.

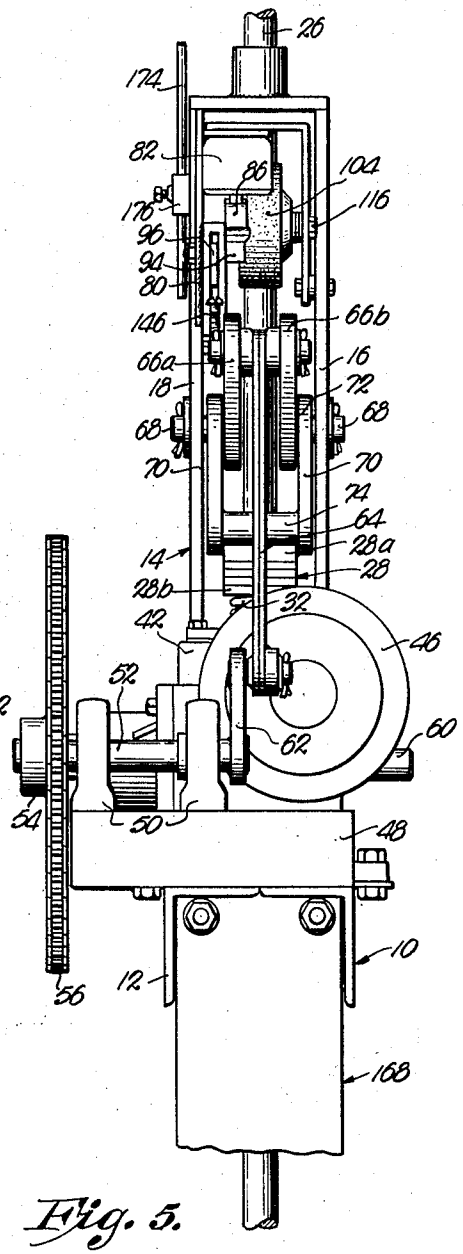



Fig. 5.

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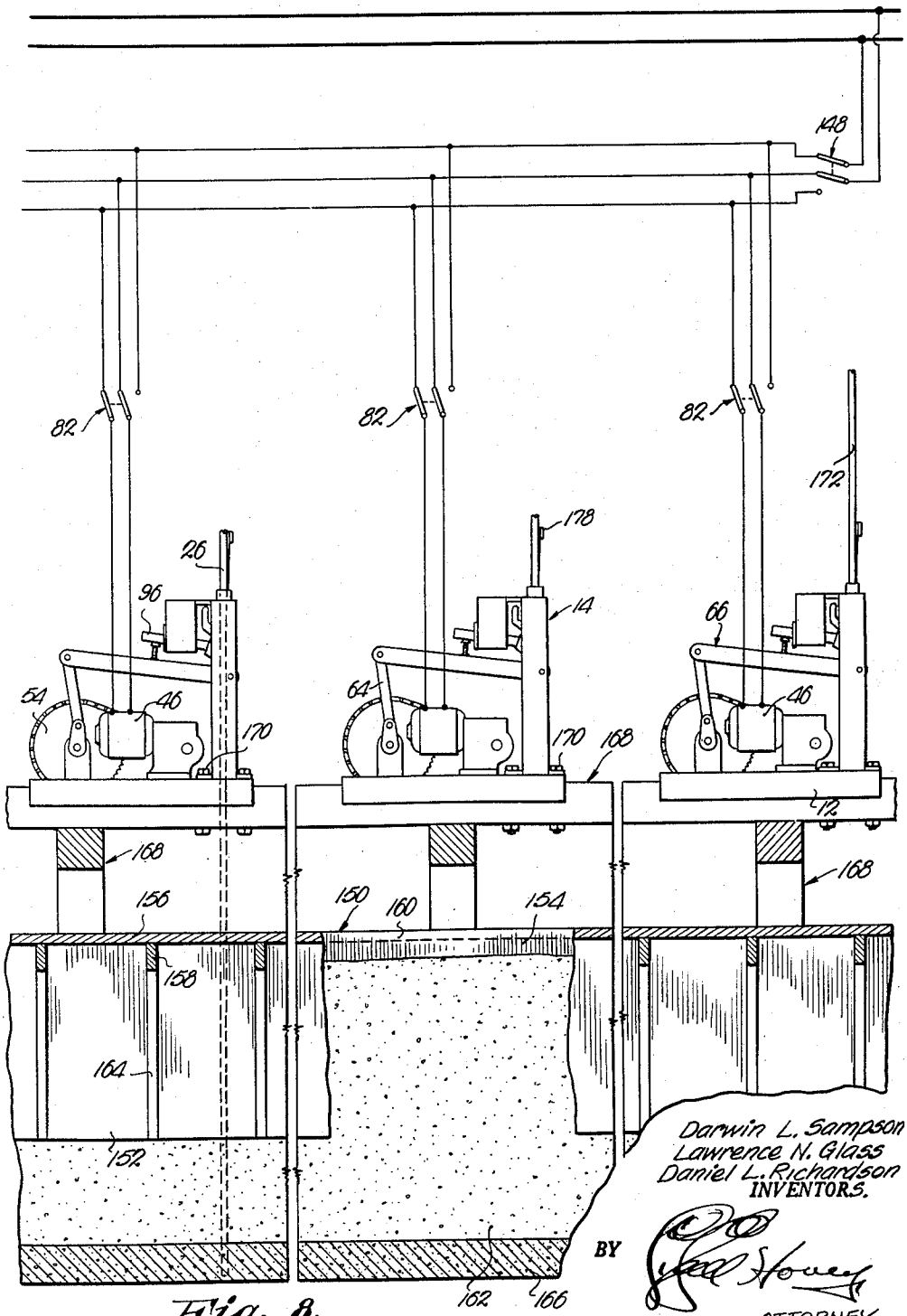



Fig. 8.

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United States Patent Office 2,914,302 Patented Nov. 24, 1959



2,914,302

# SLIP-FORM JACK

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Application May 27, 1957, Serial No. 661,810

6 Claims. (Cl. 254—106)

This invention relates to apparatus for automatically lifting slip forms, permitting the continuous pouring of concrete as the forms are gradually raised the most important object being to provide an improved control through use of a single master switch enabling an entire form or a large section of a form to be easily controlled from a single operating station.

It is an important object of the instant invention to provide a control device for each of a plurality of jacks operable to automatically stop the lifting operation thereof only after the jack has risen a predetermined distance regardless of the length of time required for the jack to rise such distance.

Another important object of the instant invention is to provide a control that is operable to cause each of the jacks to come to rest at the end of its return stroke to the end that none of the jacks stop on the load stroke whereby electrical current requirements are reduced and no overload results when the electric prime movers are initially placed in operation.

Another important object of the instant invention is to provide a lifting jack capable of ascending an upright upon vertical swinging movement of a lifting lever, all operably associated with a series of lifting knives and a plurality of holding knives, each adapted to cant against the upright alternately as the jack is placed in operation.

A further object of the instant invention is the provision of control structure for jacks of the aforementioned character having switch control means that is operated not only by the lifting lever, but by stepping mechanism which is in turn responsive to the rising of the jack on the upright.

Additional objects include many important details of construction to be made clear as the following specification progresses.

In the drawings:

Fig. 1 is a side elevational view partially broken away to reveal details of construction showing a slip-form jack made pursuant to the present invention.

Fig. 2 is a fragmentary view similar to Fig. 1 but showing the lifting lever at the end of its lifting stroke.

Fig. 3 is a fragmentary view similar to Fig. 1 showing the switch control mechanism in another position.

Fig. 4 is an elevational view showing one end of the jack.

Fig. 5 is an elevational view showing the opposite end thereof.

Fig. 6 is an enlarged, fragmentary, detailed, cross-sectional view taken on line VI—VI of Fig. 3.

Fig. 7 is an enlarged, fragmentary, detailed, cross-sectional view taken on line VII—VII of Fig. 2; and

Fig. 8 is an elevational view partially in section showing a plurality of jacks operably associated with a slip form with which the same is designed to be used.

Each of the slip-form jacks illustrated in Fig. 8 of the drawings is made as detailed by Figs. 1 to 7 inclusive and includes a frame broadly designated by the numeral



10, which frame 10 is substantially L-shaped presenting a base 12 and a standard 14.

Standard 14 which is welded or otherwise attached to the uppermost face of downwardly-facing channel-shaped base 12 at one end of the latter, includes a pair of upstanding, spaced-apart plates 16 and 18 interconnected by upper and lower ends 20 and 22 and an intermediate partition 24, the three horizontal elements 20, 22 and 24, as well as the top face of base 12, being perforated to receive an upright or jackrod 26, along which the jack ascends as will hereinafter be made clear.

A plurality of superimposed lifting knives 28 above partition 24, and a similar series of holding knives 30 beneath partition 24, are also perforated to receive the rod 26, but rather loosely mounted thereon for canting against rod 26 for support thereby as illustrated for example in Figs. 2 and 4. Partition 24 supports a spring 32 coiled about rod 26 beneath knives 28 and the lower end 22 of standard 14 supports a spring 34 coiled about rod 26 beneath the knives 30.

Knives 30 are disposed between a pair of spaced, horizontal stops 36 and 38 rigid to the inner face of plate 16 and above a third similar stop 40 rigid to the inner face of plate 18 within substantially the same horizontal plane as the stop 38.

Base 12 carries a gear reducer 42 whose platform 44 is releasably attached to the base 12 and a prime mover such as an electric motor 46 is releasably attached to the gear reducer 42 for operable connection therewith in the usual manner. Another platform 48 rigid to the upper face of base 12 carries bearings 50 for a driven shaft 52 having a sprocket wheel 54 secured thereto. A continuous chain 56 is trained over sprocket wheel 54 and over a pinion 58 on the output shaft 60 of gear reducer 42. A crank 62 rigid to driven shaft 52 is pivotally joined with the lowermost end of a connecting rod 64, the latter of which has its uppermost end pivotally coupled with a lifting lever 66.

As seen in Figs. 4, 5 and 7 of the drawings, the lever 66 comprises a pair of arms 66*a* and 66*b* which straddle the rod 26 between plates 16 and 18 and pivotally join with such plates 16 and 18 of standard 14 by pivot pin 68.

A pair of links 70 (Fig. 7) embracing the lever 66 and depending therefrom between the plates 16 and 18, are pivotally connected to the lever 66 by cross pin 72 and swingably receive at the lowermost ends thereof, a head 74 through the medium of opposed pintles 76 on the latter. Head 74 is rigidly affixed to the uppermost knife 28*a* and is provided with a hook 78 depending therefrom along the knives 28 and thence beneath the lowermost knife 28*b* through a laterally extending ear 78*a* forming a part of the hook 78.

As seen in Figs. 1–3 the uppermost end 20 of the standard 14 extends beyond the plates 16 and 18 and supports a plate 80 depending therefrom and spaced from plate 18. Plate 80 supports an electric toggle switch 82 on the inner face thereof immediately below end 20, switch 82 having its toggle arm 84 depending therefrom and embraced by an upwardly-facing C-shaped actuating element 86. Element 86 is rigid to the uppermost inturned leg of a small L-shaped bracket 88 whose vertical leg 88*a* is pivotally mounted for swinging movement within a vertical plane on the inner face of plate 80 by pin 90. An L-shaped member having a pair of spaced ears 92 and 94 is rigid to the inner face of leg 88*a* adjacent pivot pin 90.

An elongated, longitudinally reciprocable, vertically swingable bar 96 adjacent the inner face and lower end of plate 80 moves within a slotted guide 98 on the plate 80 and has pivotal connection at 100 with stepping mechanism broadly designated by the numeral 102. Bar 96

is provided with a notch 97 in the upper edge thereof and intermediate its ends.

The stepping mechanism 102 detailed in part by Fig. 6, includes a roller 104 of rubber or other resilient material yieldably held in rolling contact with rod 26 by a spring 106. A U-shaped bracket 108 is suspended from the upper end 20 of standard 14 by a bolt 110 that extends through end 20 and through bight 112 of bracket 108, spring 106 being coiled about bolt 110 above end 20. Legs 114 of bracket 108 depend from bight 112 and receive the roller 104 therebetween, axle 116 for roller 104 spanning the distance between and being carried by the legs 114. Arms 118 extending downwardly and inwardly from legs 114 between plates 16 and 18 are pivoted to the latter at 120 and 122 respectively.

An L-shaped member 124 is provided with an upright leg 126 between roller 104 and one of the arms 118, the pivotal connection 100 for bar 96 being at the lowermost end of the leg 126. A laterally extending leg 128 forming a part of the member 124 is rebent upon itself to present a pawl 130 perpendicular thereto and overlying a toothed ratchet wheel 132 disposed between leg 126 and roller 104. A pin 131 pivotally connects the leg 128 with one of the legs 114 of backet 108 adjacent the bight 112, along the inner face of the said one leg 114. The arm 66*a* of lever 66 is provided with an upwardly-extending, adjustable bolt 146 intermediate the ends thereof and disposed to engage the bar 96 as illustrated in Figs. 1, 3 and 5. Wheel 132 is concentric to axle 116 and attached to roller 104 for rotation therewith by suitable fasteners 134.

Ratchet wheel 132 is provided with a series of notches or cam recesses 136 and an alternate series of teeth or cam lobes 138 at its periphery, it being noted that each lobe 138 is provided with an inclined trailing edge 140 tangential to the circular periphery of wheel 132 and leading edges 142 that are radially disposed.

Bar 96 is yieldably biased toward one end of its reciprocable path of travel by a spring 144 connecting the same with guide 98.

As is clear from the wiring diagram illustrated in Fig. 8, all of the motors 46 are deenergized when the switches 82 are in the position shown and until a master 3-way switch 148 is manually thrown.

Fig. 8 also exemplifies a manner of use of a plurality of the jacks, all mounted on their jack-rods for ascent therealong. A slip form 150 includes a pair of spaced-apart, parallel panels 152 and 154 depending from floor 156. Floor 156 is laid on horizontal joists 158 and is provided with a slot 160 through which concrete is poured to form wall 162, forms 152 being suitably reinforced by bracing 164. Rods 26 are supported by concrete floor 166 and manifestly become embedded within the wall 162. Intersecting yokes 168 secured to the slip form 150, mount each jack respectively through the medium of bolts 170 which attach the bases 12 to the yokes 168.

Rods 26 are calibrated in one-foot increments for example as at 172 and a rod 174 adjustably mounted on plate 18 by set collar 176, is provided with a line of sight pointer or the like 178 at its uppermost end.

*Operation*

Initially, after building the slip form 150 and mounting the jacks thereon, the panels 152 and 154 rest directly on the foundation floor 166 and concrete is poured through the slot 160 to commence the wall 162 prior to placing of the jacks into operation to raise the form 150. It is contemplated that the raising operation will be substantially continuous and as concrete is poured to the level of the floor 156, the entire assembly will again be raised, the rate of advance depending of course, upon the time required for sufficient setting of the concrete to render the wall 162 self-supporting.

All of the jacks are placed into operation simultaneously by throwing the master switch 148, thereby energizing all of the motors 46 through their corresponding switches 82.

As seen in Figs. 1 and 4, when the lever 66 is at the upper end of its path of travel, the jack is supported by the holding knives 30 which are in turn supported by the rod 26 because of the fact that the knives 30 are canted into biting engagement with the rod 26. Actually, as seen in Fig. 4, the entire weight of the jack, as well as the underlying structure which it supports, is supported by the stop 36 resting upon the knives 30.

As soon as motor 46 commences to operate, it swings the lever 66 downwardly from the position shown in Fig. 3 to the position illustrated by Fig. 2, through the gear reducer 42, shaft 60, pinion 58, chain 56, sprocket 54, shaft 52, crank 62, and connecting rod 64. As lever 66 commences to swing downwardly, imparting a downward thrust to fulcrum links 70, the knives 28 are canted against the rod 26, against the action of spring 32 as illustrated in Fig. 2. The knives 28 are, therefore, supported by the rod 26 and the fulcrum links 70 are supported by knives 28 as lever 66 descends. Since pivot pin 72 is restrained against downward movement, the pivot pin 68 moves upwardly to raise the entire jack along the rod 26.

During the downward lifting stroke of lever 66, and upward movement of the frame 10, stop 36 releases the holding knives 30 and the latter are supported by stops 38 and 40 in horizontal positions as the spring 34 causes the knives 30 to slide upwardly along the rod 26 together with the frame 10.

During the return stroke of lever 66 from the position shown in Fig. 2 to the position illustrated by Fig. 1, knives 30 reassume the holding position shown in Fig. 4 the moment that the jack is no longer supported by the knives 28. As knives 28 are relieved of the weight thereon through fulcrum links 70, hook 78 will release the knives 28 from the position illustrated in Fig. 2 inasmuch as upward swinging movement of lever 66 imparts an upward movement to the hook 78 through links 70. With lifting knives 28 released, as seen in Figs. 1 and 3, spring 32 will cause the knives 28 to slide upwardly along the rod 26 during movement of the lever 66 to the position shown in Fig. 1.

During downward swinging movement of the lever 66 and the consequent ascent of the jack along rod 26, roller 104 is rotated anticlockwise, viewing Figs. 1 and 2, it being noted also that as bolt 146 leaves the bar 96, the latter swings to the lower end of its path of travel (see Fig. 2).

It is to be noted in Fig. 3 that the pawl 130 is resting on one of the lobes 138. Consequently, as roller 104 and wheel 132 rotate, pawl 130 will fall into the next succeeding recess 136. By the time lever 66 reaches the lower end of its path of travel, pawl 130 will be adjacent the next succeeding inclined edge 140 ready, as seen in Fig. 2, to climb the latter and come to rest on the next lobe 138.

Such movement of pawl 130 into a recess 136, swings the member 124 anticlockwise about pivot 131 to in turn move the bar 96 outwardly.

Consequently, when lever 66 returns to the position shown in Fig. 1, raising the bar 96, the upper edge of the latter will come into engagement with ear 92 to swing the bracket 88 clockwise and shift the ear 94 into the notch 97. Such swinging of the bracket 88 actuates the toggle arm 84 for switch 82 through the C-shaped element 86. Therefore, referring to the wiring diagram of Fig. 8, it is seen that motor 46 is deenergized at the end of the return stroke of lever 66 and that the motor 46 remains deenergized until the operator again throws the master switch 148.

During the next cycle of operation, wheel 132 again rotates anticlockwise as lever 66 descends from the position shown in Fig. 1, and as soon as pawl 130 rises onto the next succeeding lobe 138, bar 96 will be forced

inwardly. Such position of lever **66** will be as shown in Fig. 2 but bar **96** will be as seen in Fig. 3 as far as its linear movement is concerned. Then, when lever **66** again rises to the position shown in Fig. 3, bar **96** will be brought into engagement with finger **94** as finger **92** swings into the notch **97**. This swings the bracket **88** and, therefore, the element **86**, to the position shown in Fig. 3, again actuating the toggle arm **84** and deenergizing the motor **46**. It is to be noted at this juncture that spring **144** yieldably biases the pawl **130** against the periphery of wheel **132** at all times.

It is now apparent that all of the motors **46** continue to operate until such time as their lifting levers **66** have completed their return strokes, regardless of the length of time required by any individual jack to complete its cycle of operation. An operator may visually determine by viewing pointers **178**, whether or not any given jack has completed its cycle and risen to a predetermined point **172**. After all motors **46** have become deenergized, the operator may throw the switch **148** when desired, depending of course, upon the extent of progress of the workmen pouring the cement.

It is to be understood that the showing in Fig. 8 is for illustrative purposes only and that manifestly, a large number of walls, including cross partitions and the like, together with one or more jacks for each wall respectively, may be employed to raise the entire slip form assembly as a unit gradually and progressively, automatically and without interruption or operator attention other than control of the master switch **148** as above described.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In combination with an upright, and a lifting jack provided with a frame, a lever pivotally mounted on the frame for vertical swinging movement, and mechanism for raising the frame on the upright as the lever is swung; a prime mover on the frame operably coupled with the lever for swinging the latter; and structure responsive to swinging of the lever to one end of its path of travel for deenergizing the prime mover, said structure including a control device, an actuator for said device, and stepping means on the frame having parts engaging the upright for controlling the actuator.

2. In combination with an upright, and a lifting jack provided with a frame, a lever pivotally mounted on the frame for vertical swinging movement and mechanism for raising the frame on the upright as the lever is swung, a control assembly including an electric motor on the frame operably coupled with the lever for swinging the latter; switch means for controlling said motor; an actuator for said switch means shiftable alternately to two switch actuating positions and disposed for control by said lever as the latter swings to one end of its path of travel; and stepping means on the frame responsive to rise of the frame on the upright for shifting said actuator.

3. In combination with an upright, and a lifting jack provided with a frame, a lever pivotally mounted on the frame for vertical swinging movement, and mechanism for raising the frame on the upright as the lever is swung, a control assembly including an electric motor on the frame operably coupled with the lever for swinging the latter; switch means for controlling said motor; an actuator for said switch means shiftable alternately to two switch actuating positions and disposed for control by said lever as the latter swings to one end of its path of travel; roller means on the frame engaging said upright for rotation thereby as the frame rises; and means responsive to rotation of said roller means for shifting said actuator.

4. In combination with an upright, and a lifting jack provided with a frame, a lever pivotally mounted on the frame for vertical swinging movement, and mechanism for raising the frame on the upright as the lever is swung, a control assembly including an electric motor on the frame operably coupled with the lever for swinging the latter; switch means for controlling said motor; an actuator for said switch means shiftable alternately to two switch actuating positions and swingable into engagement with the switch means when in either of said positions, said actuator being disposed for engagement by said lever as the latter swings to one end of its path of travel whereby to swing the actuator; roller means on the frame engaging said upright for rotation thereby as the frame rises; and means responsive to rotation of said roller means for shifting said actuator.

5. In combination with an upright, and a lifting jack provided with a frame, a lever pivotally mounted on the frame for vertical swinging movement, and mechanism for raising the frame on the upright as the lever is swung, a control assembly including an electric motor on the frame operably coupled with the lever for swinging the latter; switch means for controlling said motor; an actuator for said switch means shiftable alternately to two switch actuating positions and swingable into engagement with the switch means when in either of said positions, said actuator being disposed for engagement by said lever as the latter swings to one end of its path of travel whereby to swing the actuator; roller means on the frame engaging said upright for rotation thereby as the frame rises; and stepping means responsive to rotation of said roller means for shifting said actuator, and including a toothed ratchet coupled with the roller means for rotation thereby and pawl means pivotally connected with the actuator and operably connected with the ratchet.

6. In combination with an upright, a lifting jack adapted to ascend the upright and comprising a frame; a number of holding knives slidable along the upright, said knives being normally canted against the upright in supporting relationship to the frame; a lever pivotally mounted on the frame for vertical swinging movement; a fulcrum member for said lever; a plurality of lifting knives slidable along the upright and disposed in supporting relationship to the fulcrum member, said lifting knives being adapted to cant against the upright as the lever is swung downwardly to raise the frame, the upright supporting the knives when the latter are canted thereagainst; means for releasing the holding knives from the upright as the frame rises; means for releasing the lifting knives from the upright as the lever is swung upwardly to raise the fulcrum member; a prime mover operably coupled with said lever for swinging the latter; and structure responsive to swinging of said lever to one end of its path of travel for deenergizing the prime mover, said structure including a control device, an actuator for said device, and stepping means on the frame having parts engaging the upright for controlling the actuator, said stepping means including a roller engaging the upright for rotation thereby as the frame rises.

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