May 13, 1952 J. M. JACK ET AL 2,596,854

APPARATUS FOR RAISING AND LEVELING FORMS FOR WALLS OF CONCRETE STRUCTURES

Filed Nov. 7, 1949 4 Sheets-Sheet 1

Fig. 1.

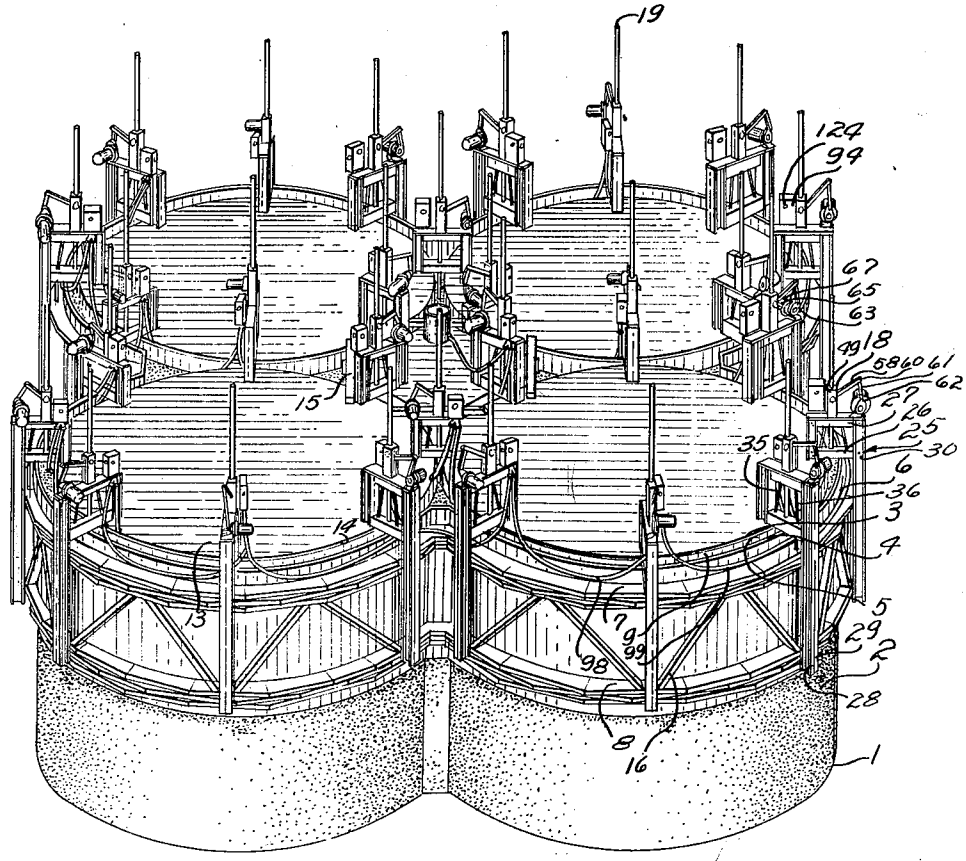


Fig. 8.

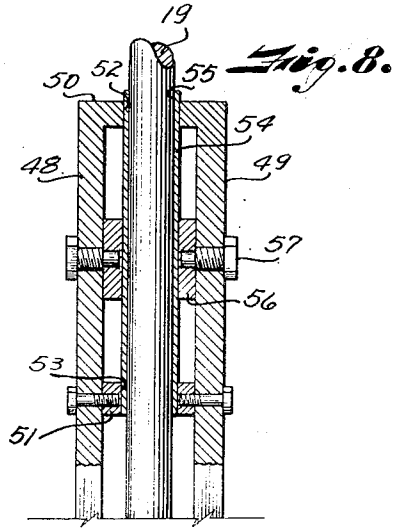
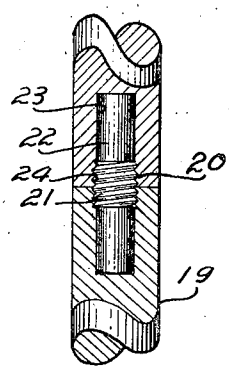


Fig. 9.



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Fig. 2.

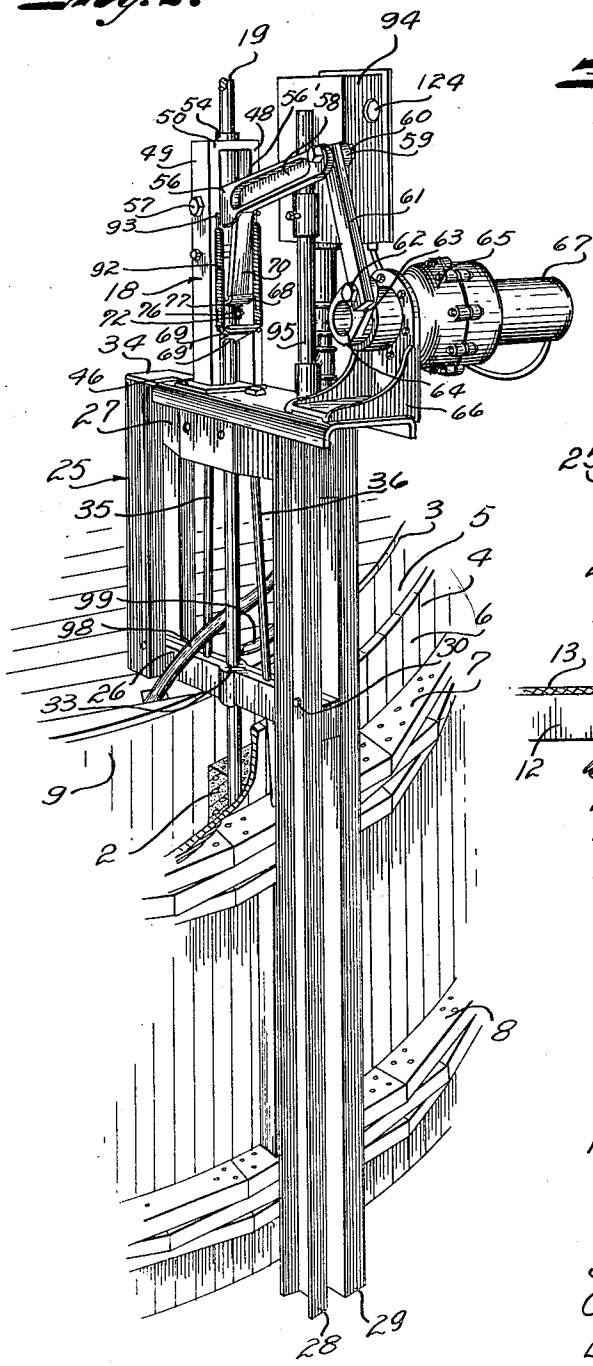
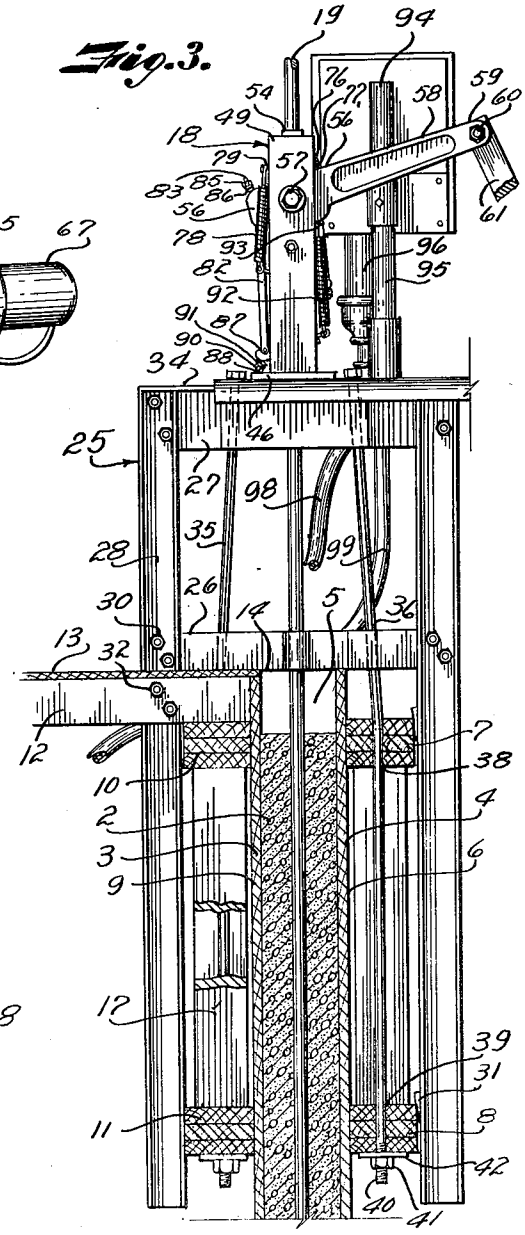


Fig. 3.



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Fig. 4.

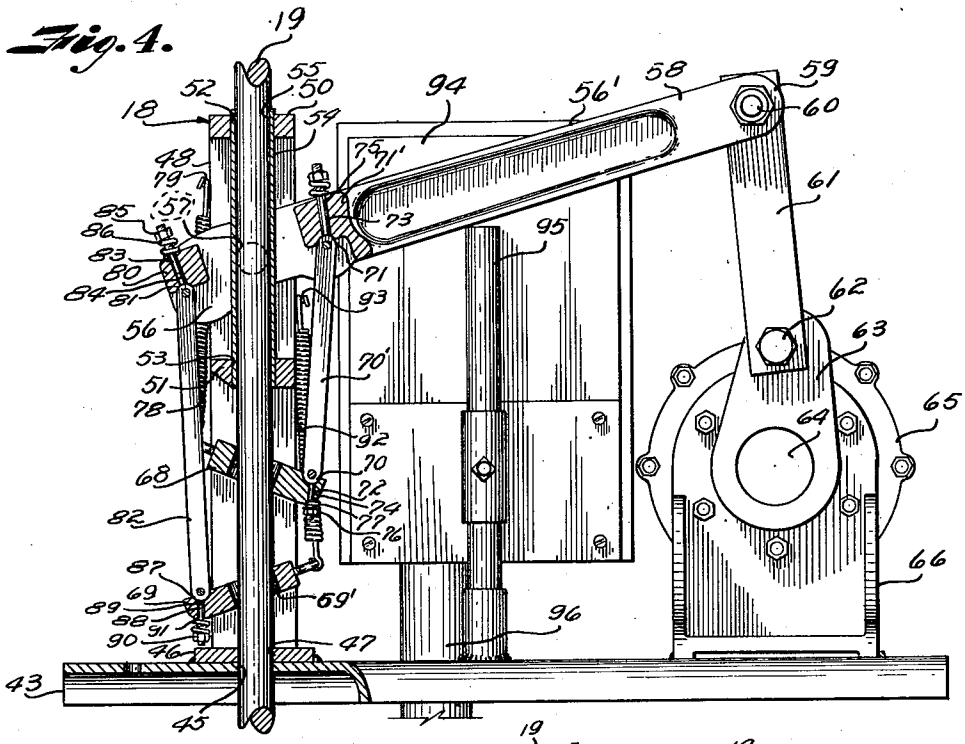


Fig. 6.

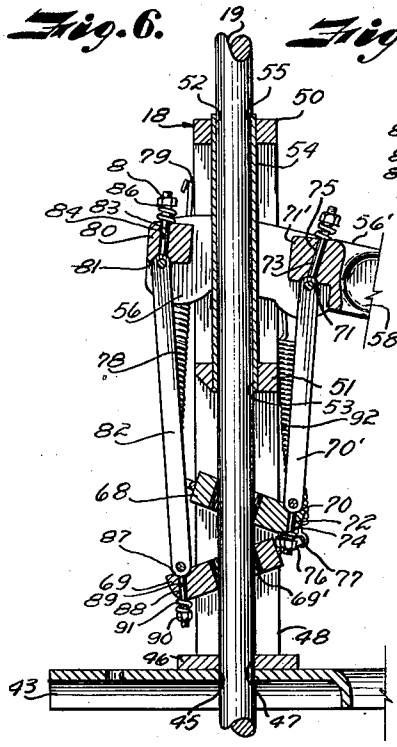


Fig. 5.

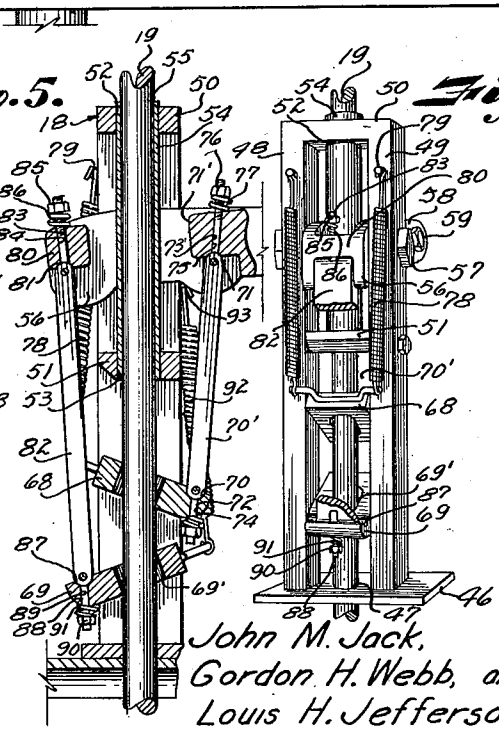


Fig. 7.

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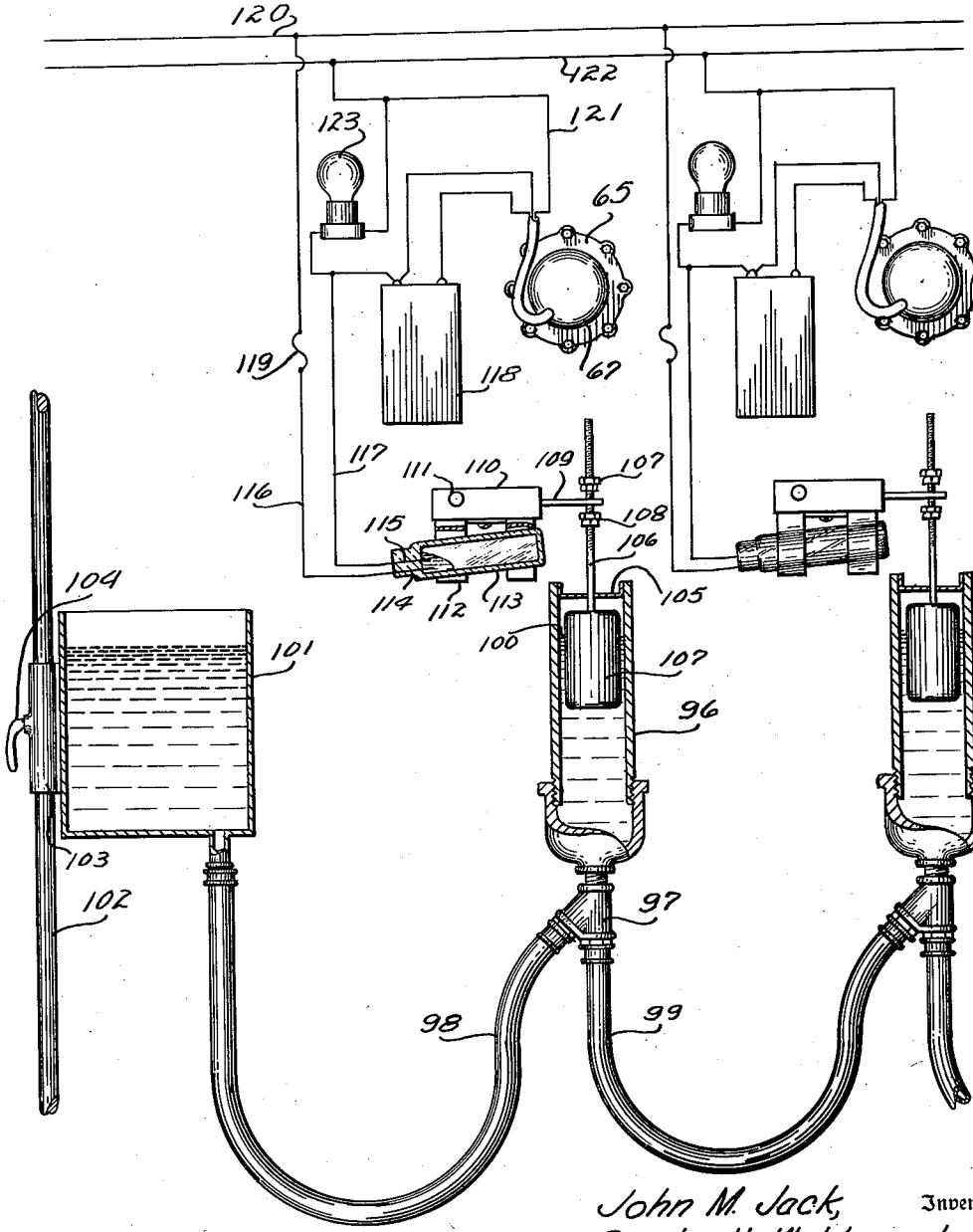
By Fishburn & Mullendore Attorneys

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Filed Nov. 7, 1949 4 Sheets-Sheet 4

Fig. 10.



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Patented May 13, 1952 2,596,854

UNITED STATES PATENT OFFICE

2,596,854

APPARATUS FOR RAISING AND LEVELING FORMS FOR WALLS OF CONCRETE STRUCTURES

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Application November 7, 1949, Serial No. 125,928

4 Claims. (Cl. 25—131)

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This invention relates to apparatus for raising and leveling forms for walls of concrete structures and more particularly to a plurality of motor driven jacks and controls therefor for effecting periods of continuous raising movement of forms suspended from the jacks, said jacks moving up vertical rods or columns which are imbedded in the concrete walls of relatively tall structures such as grain elevators and the like.

Relatively tall concrete structures have been built wherein forms defining the space for the concrete of the walls were shorter than the final height of said walls and said forms raised by means of a plurality of screw jacks or the like, the actual raising operation was effected by one or more men each operating a series of jacks, and all endeavoring to raise the forms simultaneously. In such operations the concrete at the lower part of the form must have set to the point that the form can be moved. The forms must be moved some, at frequent intervals, to prevent the concrete from sticking to the forms. The forms must not be lowered from a position even for a very small amount as such movement of the forms will cause imperfections in the wall surfaces. Obviously manual operation of a large number of screw jacks to raise all portions of a large form requires the services of one or more men to each series of jacks and even then it is practically impossible to obtain uniform raising of the form. Also with the screw jacks for raising the forms an excessive number of men would have to be employed on the structure.

The objects of the present invention are to provide an efficient, economical apparatus for progressively raising a form during construction of concrete walls without stopping pouring of concrete or other work; to provide for uniformly raising a form on a concrete building structure and automatically maintaining the form in level condition under varying weight conditions; to provide a plurality of power operated jacks individually driven and collectively controlled for raising a form on a concrete structure; to provide for suspending the concrete form from the jacks and plumbing the form; to provide a float operated device on each jack and responsive to a collective liquid level device for controlling operation of the respective jacks; to provide a plurality of vertical rods in a concrete structure and jacks having jaws engageable with the rods for moving said jacks up the rods; to provide a rod connector forming a rod joint wherein the outer dimensions are uniform throughout the length of the rods, said joint being capable of withstanding the forces applied thereto by the jack jaws; to provide a pair of jaws and operating members in each jack for effecting raising action by one jaw and then another, one or the other of said jaws always having engagement with the rods and an overlap in the jaw engaging cycle during which both jaws are engaged with the rod whereby the raising action is substantially continuous during the cycle with no possible slip back of the jack on the rods; to provide a motor and gear reducer drive for the jacks to slowly raise the forms whereby there is substantially continuous movement of the forms during pouring and construction of the walls and no sticking of the concrete to the forms; and to provide a jack which is positive in operation, of simple, sturdy construction, and capable of operating under adverse conditions.

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In accomplishing these and other objects of the present invention, we have provided improved details of structure, the preferred forms of which are illustrated in the accompanying drawings, wherein:

Fig. 1 is a perspective view of a concrete structure under construction with a plurality of jacks for supporting and raising a form on the structure as the walls are being poured.

Fig. 2 is a perspective view of one of the jacks and a portion of the form suspended therefrom.

Fig. 3 is a transverse sectional view through the wall form, the jack being shown in side elevation.

Fig. 4 is a longitudinal sectional view through the jack illustrating the position of the jaws in one extremity of the movement of the operating lever.

Fig. 5 is a detail sectional view through a portion of the jack illustrating the position of the jaws when the crank is moved 90° from the position shown in Fig. 4.

Fig. 6 is a sectional view through a portion of the jack, similar to Fig. 5, showing the position of the jaws when the crank is moved 180° from the position shown in Fig. 4.

Fig. 7 is a perspective view of the jack operating members.

Fig. 8 is a vertical sectional view through the jack guide sleeve with the rod extending therethrough.

Fig. 9 is a sectional view through a joint of the rod showing the stud connector therefor.

Fig. 10 is a diagrammatic view of the jack control mechanism.

Referring more in detail to the drawings:

1 designates a concrete structure such as a

grain elevator in the process of construction. The walls 2 of the structure are formed by pouring concrete and the like between inside and outside wall forms 3 and 4 respectively, the inner surfaces of said walls being spaced as at 5 in accordance with the thickness of the wall desired. The height of the forms 3 and 4 is less than the final height of the walls 2 to be built and is preferably approximately the height of the concrete in the wall that will be poured in a four to eight hour period, whereby the form may be raised and the portion of the wall uncovered at the bottom of the forms by the raising will have set four to eight hours. The time required for raising the form a distance corresponding to the height thereof should be varied according to the setting time of the concrete mix used.

The outer forms 4 preferably consist of a vertical wall 6 which extends continuously around the outer surface or perimeter of the walls of the structure to be built. The walls 6 may be formed of wood or other suitable material and secured to the outer surface thereof and substantially coextensive therewith are rib structures 7 and 8 to reinforce said wall 6. The inside form 3 also consists of a vertical wall 9 extending continuously around the inner surface of the wall structure to be built. Where the structure is an elevator or otherwise has a plurality of compartments, the inner forms extend around the inner surface of each of the compartments. The inner form also has spaced ribs 10 and 11 secured thereto to reinforce the wall 9, said ribs 10 and 11 preferably being on the same planes as the ribs 7 and 8 respectively.

Supported on the upper ribs 10 and extending across the inside areas of the building to be constructed are joists 12 which support decking 13, the outer edge 14 of which substantially conforms to the shape and size of the inner surface of the wall to be constructed. Where there are inner chambers not defined by outside walls the forms for the inner chamber are connected to the forms of adjacent chambers by tie members 15 to aid in supporting and maintaining all of the forms of the same level. Both the forms 3 and 4 have suitable reinforcing members or braces 16 extending between the upper and lower ribs and also have vertical studs or spreaders 17 for distributing the stress on the forms.

The forms shown and described are particularly adapted for the building of elevators and the like, but may be varied as desired to meet the requirements of the particular structures to be built, providing the forms are such that they may be raised during the pouring of the concrete walls and that there be decking for movement of workers and material adjacent the top of the forms for facilitating the pouring of concrete and the handling of the equipment.

The forms 3 and 4 and the decking thereon are raised by a plurality of jacks 18 which have operating mechanism engaging columns or rods 19 for effecting movement upwardly thereon. The rods 19 are preferably cylindrical and are arranged substantially centrally between the faces of the forms 3 and 4 whereby the rods extend vertically through the concrete wall being poured, said rods being spaced around the wall at suitable intervals to provide for sufficient jacks to raise and support all portions of the forms. Additional reinforcing rods (not shown) may be arranged as desired in the concrete walls to provide adequate strength thereto.

Elevators and the like are usually of considerable height, therefore it is desirable to have the rods 19 made up in sections for convenience of handling, the joints of said rods being such as to present a smooth, concentric surface thereover and prevent disalignment or shearing of the joints by the pressure of the operating members of the jack as they move thereover. The connection of the rod ends is preferably effected by means of a stud 20 having a relatively short threaded area 21 centrally located on said stud and smooth cylindrical portions 22 extending from the threaded area. Each of the rod ends is provided with sockets 23 for closely engaging the cylindrical portions 22 of the stud, said sockets having threaded portions 24 for threadedly engaging the threaded portion 21 of the studs. Said studs are preferably formed of relatively high tensile steel whereby when applied to the rod ends as shown in Fig. 9 the joint has greater compression and shear strength than the remainder of the rods.

Arranged at each vertical rod 19 extending upwardly between the forms 3 and 4 is a yoke 25 consisting of vertically spaced horizontal members 26 and 27 which extend across the forms 3 and 4, the lower horizontal member 26 preferably resting on the upper edge of the outer wall 6. The ends of the horizontal members 26 and 27 preferably extend between spaced vertical members 28 and 29 and are secured thereto by suitable fastening devices 30 whereby the vertical members extend from the top horizontal member 27 downwardly alongside the forms 3 and 4, and are slightly spaced from the edges of the ribs 7, 8, 10 and 11 whereby suitable wedges 31 may be placed between the ribs and the vertical members from the yoke 25. The inner vertical members also are preferably secured to the joists 12 by means of fastening devices 32.

The lower horizontal member 26 is preferably provided with a central bore 33 adapted to slidably engage the respective rod 19 to form a guide. The upper horizontal member 27 is preferably formed of two members having spaced central portions whereby the rod 19 may extend therebetween and upwardly through a suitable bore in a cap member 34 mounted on said horizontal member 27 and the upper ends of the vertical members 28 and 29.

The forms 3 and 4 are suspended from the upper portion of the yoke by means of rods 35 and 36 which extend between the spaced upper members 27 through apertures 37 in the lower horizontal member 26, aperture 38 in the upper ribs 7 and 10, apertures 39 in the lower ribs 8 and 11 and terminate in threaded ends 40 for threadedly receiving nuts 41. Relatively large washers 42 are preferably arranged between the nuts 41 and the lower rib members 8 and 11 and the nuts threaded to effect engagement with said ribs.

A jack base member 43 is preferably arranged on the upper portion of the yoke whereby the jack is centered relative to the rod 19 and apertures arranged in the base whereby the rods 35 and 36 extend therethrough and heads 44 on said rods engage the base to transmit the load from the form directly to the jack base from the lower ribs 8 and 11, the studding or spreaders 17 also transmitting the load from the tension of the rods 35 and 36 to the upper ribs 7 and 10 on the forms 3 and 4.

Each of the jacks 18 is substantially identical

in structure with all of the operating structure thereof supported on the respective base members 43 as illustrated in Fig. 4. The base 43 has an aperture 45 through which the rods 19 extend. Secured to the base is a lower block 46 having an aperture 47 adapted to slidably engage the rod 19 to form a lower guide. Mounted on and extending upwardly from the lower block 46 on opposite sides of the rod 19 are side plates 48 and 49 connected at their upper ends by a top block 50. Intermediate the top and lower blocks is a center guide block 51. Secured in openings 52 and 53 in the top and center blocks respectively is a sleeve 54 having a bore 55 which is adapted to slidably engage the rod 19 to form a guide therefor. Extending between the guide sleeve and the side blocks are spaced end members 56 of an operating lever 56', said ends being pivotally mounted on trunnions 57 secured to and extending inwardly from the side plates intermediate the top and center blocks whereby said lever may be rocked about a horizontal axis extending through the trunnions and substantially through the vertical center of the rod 19, the lever having an arm 58 preferably extending over the base member and terminating in an end 59 pivotally connected at 60 to one end of a connecting rod 61, the opposite end of said connecting rod being pivotally connected as at 62 to a crank 63 mounted on a shaft 64 extending from a gear speed reduction unit 65 suitably mounted on a bracket 66 carried by the base 43 in spaced relation to the rod 19.

Power is supplied for operating the jack by means of a suitable motor 67 drivingly connected to the speed reducer unit 65 and operating from a suitable source of electric current as later described, said motor and gear reduction unit preferably being such as to drive the shaft 64 at a very slow speed, in actual practice it has been found desirable that the shaft rotate at a speed of one revolution in four to six minutes.

Arranged between the lower block 46 and the center block 51 are vertically spaced upper and lower jaws or dogs 68 and 69 having oval-shaped apertures 69' sleeved over the rod 19. Adjacent the end of the jaw 68, on the motor side of the rod 19, is a transverse groove 70 to seat the end of a push arm 70', the opposite end of which seats in a transverse groove 71 of a block 71' extending between the spaced end members 56 of the lever 56'. In order to resiliently urge the ends of the push arm in the respective seats, said ends are pivotally connected to bolts 72 and 73 which extend through apertures 74 and 75 in the jaw 65 and block 71' respectively, the ends of said bolts being threaded to receive nuts 76 with compression springs 77 located between the nuts and the jaw and block. The end of the jaw 68 on the opposite side of the rod 19 to the push arm 70' is suitably connected to tension springs 78, the other ends of said springs being suitably connected as at 79 to the side plates 48 and 49 adjacent the top block whereby tension of the springs 78 urges the end of the jaw upwardly, pivoting said jaw on the lower end of the push arm 69 whereby the edges of the oval aperture in said jaw engage the rod 19.

The ends of the lever end members 56 are connected by a block 80, the lower surface of which is provided with a seat 81 for seating one end of a push arm 82, said end being pivotally connected to a bolt 83 which extends through an aperture 84 in the block 80, the end of said bolt being threaded to receive a nut 85 and a compression

spring 86 is arranged between the nut and the block to resiliently urge the end of the push arm into the seat on the block 80. The opposite end of the push arm 82 seats in a transverse groove 87 in one end of the jaw 66, said end of the push arm being pivotally connected to a bolt 88 which extends through an aperture 89 in the jaw, the end of said bolt being threaded to receive a nut 90 and a spring 91 being interposed between the nut and the jaw whereby said spring resiliently urges the end of the push arm into seating engagement with the jaw. The end of the jaw 66 on the opposite side of the rod 19 is suitably connected to the ends of tension springs 92, the other ends of said springs being connected as at 93 to the side plates 48 and 49 whereby the tension of the springs urges the end of the jaw upwardly, pivoting same on the lower end of the push arm 82 whereby the edges of the oval aperture 69' of said jaw engages the rod 19. The size of the oval apertures 67 relative to the rod 19, the length of the push arm 70' and 82, and the spacing of the seats for the ends of said arms from the rod 19 are such that when the lever 56' is positioned as shown in Fig. 4, the edges of the apertures 69' of both jaws are engaged with the rods 19, the jaw 68 having just taken a firm bite on the rod and the jaw 69 being ready to release the bite on the rod. Further rotation of the crank 63 by the motor 67 in effect firmly holds the jaw 68 in engagement with the rod whereby the push arm 70' seated in the groove of said jaw fulcrums thereon and the lever 56' fulcrums on the upper end of said push arm and downward movement of the lever 56' raises the trunnions 57, side plates 48 and 49 and base 43 upwardly relative to the rod 19. This raising movement also lifts the yoke 25 and the forms 3 and 4, the jaw 69 sliding upwardly on the rod 19. After 90° of rotation of the crank, as shown in Fig. 5, the jaw 68 is still engaged by the rod and the jaw 69 sliding upwardly thereon. After the crank arm has moved approximately 170° from the position shown in Fig. 4, the jaw 69 begins to bite into the rod 19. On 180° movement of the crank from the position shown in Fig. 4, as shown in Fig. 6, the jaw 69 has taken a bite into the rod 19 and the jaw 68 is beginning to start to release said rod, both of said jaws being engaged at the particular position shown in Fig. 6. Upon approximately ten more degrees of movement of the crank, the jaw 68 will release the rod and the upward movement of the lever 56', in effect, fulcrums said lever on the upper end of the push arm 82 which in turn fulcrums on the jaw 69, which is firmly engaged with the rod 19, whereby the trunnions are moved upwardly relative to the rod, lifting the yoke and forms. This overlapping of the engagement of the jaws prevents any downward slipping of the jacks and effects substantially continuous upward movement of the forms, the tension and compression springs allowing the apparatus to give and prevent binding thereof during the time both jaws are engaged and aiding in releasing said jaws when the pressure from the lever 56' is removed from the respective push arms engaging same.

Each of the jacks is provided with a control box 94 containing suitable electric apparatus for controlling the operation of the motor 67. The control box 94 is adjustably mounted for vertical adjustment on a support 95 carried by the base 43. It is desirable to lift all of the form for the entire structure at the same time, and also to keep the form level. Therefore, fixed in the

lower portion of the control box, and depending therefrom, is a tubular float chamber 96, the lower end of said chamber being connected to a Y-fitting 97, whereby hose members 98 and 99 may be connected to the Y-fitting to effect a series connection of all of the float chambers for the jacks, whereby the level of liquid 100 in said float chambers will vary with the level of liquid in a liquid control receptacle 101. In order to support the liquid control receptacle 101 independently of movement of the forms and jacks, a column or rod 102, which is similar to the rods 19, is arranged in and extends upwardly from the concrete wall and the receptacle provided with a sleeve 103 on the side wall thereof, said sleeve being slidably mounted on the rod 102, a suitable fastening device 104 being provided for securing the receptacle to the rod 102. With this arrangement, the fastening device is released and the receptacle 101 raised as desired whereby the liquid will flow through the hose connections 98 to the next Y-fitting 97, raising the level of liquid in the respective float chamber 96 and also flow through the hose 99 to the next adjacent float chamber 96 to raise the level of liquid therein. The upper end of the float chamber is preferably provided with a closure 105 having an aperture through which a rod 106 extends whereby the closure serves as a guide to center a float 107 in the float chamber for movement vertically therein in response to change in level of the liquid. The rod 106 is threaded and provided with spaced nuts 107 and 108 forming stops adapted to engage an arm 109 extending outwardly from a frame 110 pivotally mounted in the switch box as at 111, and having clips 112 for mounting a mercury switch 113 whereby upward movement of the float engages the stop 108 with the arm 109 to tilt the mercury switch whereby the mercury closes contacts 114 and 115 to close the circuit between lines 116 and 117, the line 117 leading through a capacitor 118 to the motor 67. The line 116 is provided with a fuse 119 and is connected to a line 120 leading to a source of electric current. The ground from the motor is connected by a line 121 to a line 122 which is the return line to the source of electric current.

Connected to the line 117 and line 121, and parallel with the motor 67, is a light 123 which is visible through an aperture 124 or a transparent member in the control box to indicate when the motor is operating. When the motor is operating the jack to effect raising of the forms, the liquid level recedes in the float chamber 96 until the stop 117 engages the arm 109 to tilt the mercury switch to move the mercury away from the contacts 114 and 115 to break the circuit to the motor and stop operation of the jack.

In operating an apparatus constructed as described in the construction of a concrete building a suitable base for the building structure is arranged and the first sections of the rods 19 imbedded in said base to extend vertically therefrom centrally of the walls to be poured. The forms 3 and 4 are then arranged to define the space for the lower portion of the walls with the joist 12 and decking 13 arranged as illustrated. The yokes 25 are then placed on the form and the jacks on the yokes with the jaws 68 and 69 engaged with the respective rods 19. The wedges 31 are then applied to plumb the yoke whereby the upward pull of the jacks on the rods 19 will move the forms vertically. The receptacle 101 is secured to the rod 102 whereby the level of liquid therein is such that the level of liquid in each of the float chambers 96 is adjacent to the floats 107. Each of the control boxes 94 is then adjusted on the supports 95 whereby any change in the level of the liquid in the receptacle 101 or movement of said receptacle effects operation of the mercury switch 113. This adjustment may be made before the original pouring of the lower portion of the wall of the structure or may be done simultaneously therewith. Concrete is then poured between the forms 3 and 4 until the height of the forms is substantially filled with concrete, this pouring operation continuing around the entire wall of the structure at such a rate that four to eight hours elapse from the time the pouring is started until the forms are substantially filled.

After the forms are substantially filled with concrete the receptacle 101 is raised on the rod 102, whereby the level of liquid in the float chambers 96 is raised, moving the floats 107 of the respective jacks upwardly to effect operation of the respective switches 113 and energization of the motors of the jacks to rotate the crankshafts 64 to oscillate the levers 56 and operate the jaws 68 and 69 to effect upward movement of the jacks on the rods 19, the jacks continuing in operation until the level of liquid in the float chambers 96 recedes therein and the floats lower to tilt the switches 113 to interrupt the electrical circuit to the motor 67 and stop operation of the jacks.

It is preferable that the receptacle 101 be raised on the rod 102 for a distance of approximately one inch or more and then when the jacks cease operation to again lift the receptacle whereby the forms are moved upwardly at least once in each ten minute period to prevent sticking of the concrete to the forms. This is true even though no concrete might be poured during that period, however, except under such circumstances the receptacle may be raised to effect operation of the jacks as desired to raise the forms according to the concrete that is poured. In actual operation when the receptacle is raised on the rod 102 the liquid flows through the hose 98 to the first float chamber 96 starting operation of the respective jack, and then flows to the next float receptacle to start the operation of that jack and so on around the entire structure. The time elapsing between the starting of the first jack and the last jack on the structure is very short so as not to materially affect the level of the forms 3 and 4, but this arrangement does have a material advantage in that the motors 67 are started individually whereby the starting load on the source of electric current is reduced since at no time will all of the motors start simultaneously. Also if there is any variation in the lift effected by the respective jacks in one revolution of the crankshafts 64, the jack having the lesser lift will merely operate slightly longer than the other jacks to bring the forms into level condition, but by raising the receptacle 101 short distances each time there will be no perceptible out-of-level condition in the forms, even though there is considerable more load in one portion of the decking than in another due to more men or equipment moving thereover during the building construction.

It is believed obvious that we have provided a jack structure which will provide a substantially continuous lift for forms suspended therefrom with accurate control of the lifting of the forms to maintain same level and eliminate sticking of the concrete to the forms whereby a

building having relatively high, uniform walls may be poured efficiently and continually until completed.

What we claim and desire to secure by Letters Patent is:

1. In a jack for progressively raising concrete forms during pouring and setting of concrete therein, a frame adapted to be secured to the walls of the form, a column supported in the concrete in said form and extending upwardly through the upper portion of the frame, a lever extending rearwardly from the column and having spaced arms straddling said column, means pivotally mounting the arms on the frame adjacent the upper portion thereof for oscillation about a horizontal axis extending substantially through the vertical center of the column, vertically spaced upper and lower jaws sleeved on the column below the lever arms and adapted to grip said column in response to tilting of said jaws, a push arm spaced rearwardly of the column and having ends seating on the lever and upper jaw, a push arm spaced forwardly of the column and having ends seating on the lever and lower jaw, means resiliently urging the push arm ends into seating engagement with the lever and jaws, springs having ends connected to the frame and other ends connected to the forward end of the upper jaw and rearward end of the lower jaw for resiliently urging the forward end of the upper jaw and rearward end of the lower jaw upwardly to tilt said jaws about the ends of the respective push arms engaged therewith and into tilted engagement with the column, a crank, a motor and speed reducer connected thereto for rotating the crank, and means connecting the crank with the lever remotely from the column whereby rotation of the crank slowly oscillates the lever and effects further tilting of the jaws and intermittent gripping of the column thereby for slowly and substantially continuously moving the frame vertically relative to the column during the cycle of oscillation of the lever, said lever, push arms and means resiliently urging the jaws into tilted engagement with the column cooperating to effect related gripping engagement of the column by the jaws and maintain at least one jaw in gripping engagement with the column at all times to act as a fulcrum for the lever, said fulcrum being in a vertical plane spaced from the pivotal mounting of the lever on the frame whereby oscillatory movement of the lever effects vertical movement of the frame.

2. In a jack for progressively raising concrete forms during pouring and setting of concrete therein, a frame adapted to be secured to the walls of the form, a rod supported in the concrete in said form and extending upwardly through the upper portion of the frame, a tubular guide mounted in the upper portion of the frame and adapted to sleeve over the rod, a lever extending rearwardly from the guide tube and having spaced arms straddling same, means pivotally mounting the arms of the lever adjacent the upper portion of the frame for oscillation of the lever about a horizontal axis extending substantially through the vertical center of the rod, vertically spaced upper and lower jaws having oval apertures sleeved on the rod below the lever arms and adapted to grip said rod in response to tilting of said jaws, a push arm spaced rearwardly from the rod and having ends seating on the lever and upper jaw, a push arm spaced forwardly of the rod and having ends seating on the lever and lower jaw, means resiliently urging the push arm ends into seating engagement with the lever and jaws, the lever engaging portions of the push arms having greater spacing from the rod than the jaw engaging portions, springs having ends connected to the frame and other ends connected to the forward end of the upper jaw and rearward end of the lower jaw for resiliently urging the forward end of the upper jaw and rearward end of the lower jaw upwardly to tilt said jaws about the ends of the respective push arms engaged therewith and into tilted engagement with the rod, a crank, a motor and speed reducer connected thereto for rotating the crank, and means connecting the crank with the lever remotely of the rod whereby rotation of the crank slowly oscillates the lever and effects tilting of the jaws and intermittent gripping of the rod thereby for slowly and substantially continuously moving the frame vertically relative to the rod during the cycle of oscillation of the lever, the spacing of the push arms from the rod and the size of the oval apertures in the jaws relative to the rod effecting a simultaneous gripping of the rod by both jaws during two intervals of each rotation of the crank to eliminate any downward movement of the frame and form relative to the rod, said lever, push arms and means resiliently urging the jaws into tilted engagement with the rod cooperating to maintain at least one of the jaws in gripping engagement with the rod at all times to act as a fulcrum for the lever, said fulcrum being in a vertical plane spaced from the pivotal mounting of the lever on the frame whereby oscillation of the lever effects vertical movement of the frame and form.

3. In combination, a concrete form, a plurality of frames spaced along the form and adapted to be secured to the walls of the form, a plurality of spaced columns supported in the concrete in said form and extending upwardly therefrom, each of said frames having one of said columns extending through the upper portion thereof, a jack on each of the frames, said jacks each having a pair of jaws sleeved on the column and adapted to grip said column in response to tilting of said jaws, operating mechanism on each of the frames for tilting the jaws of the respective jacks and maintain at least one jaw on each jack in gripping engagement with the respective column at all times to effect slow substantially continuous upward movement of the respective frames relative to the column, a liquid receptacle mounted on a column and adapted for independent vertical movement relative thereto, a float actuated control on each frame for controlling operation of the respective jack operating mechanisms, and a liquid supply pipe common to all of said float actuated controls and communicating with the liquid receptacle for flow of liquid to said float actuated controls, all of said float actuated controls being level whereby raising of the liquid receptacle raises the liquid level in each of said float actuated controls effecting simultaneous operation of the respective jack operating mechanisms for substantial equal vertical movement of all of the frames and form portions relative to the columns, said float actuated controls stopping operation of the jack operating mechanisms when the vertical movement of the respective frame corresponds to the amount the liquid receptacle was raised, each of said controls operating independently of the others whereby the respective jack operating mechanism stops only when that portion of the form is level regardless of the respective speed of vertical move-

ment thereof relative to the other frames and portions of the form.

4. In combination, a concrete form, a plurality of frames spaced along the form and adapted to be secured to the walls of the form, a plurality of spaced columns supported in the concrete in said forms and extending upwardly therefrom, each of said frames having one of said columns extending through the upper portion thereof, levers pivotally mounted on each of the frames adjacent the upper portion thereof for oscillation about the horizontal axes extending substantially through the vertical center of the respective columns, said levers extending rearwardly from the respective columns, vertically spaced upper and lower jaws sleeved on the respective columns below the respective lever arms and adapted to grip said columns in response to tilting of the jaws, push arms spaced rearwardly from the respective columns and having ends seating on the lever and one of the respective jaws, push arms spaced forwardly of the respective columns and having ends seating on the respective levers and other jaws, means resiliently urging the push arm ends into seating engagement with the lever and jaws, means on the frames for resiliently urging the jaws upwardly to tilt same about the ends of the respective push arms engaged therewith and into tilted engagement with the respective column, a motor and speed reducer adjacent each of the frames, cranks driven by said speed reducer, means connecting the respective cranks with the respective levers remotely of the respective columns whereby rotation of the cranks oscillates the levers and effects further tilting of the jaws and intermittent gripping of the columns thereby for slowly and substantially continuously moving the frames vertically relative to the columns during the cycle of oscillation of the levers, a liquid receptacle on one of the columns and adapted for independent vertical movement thereon, float chambers on each of the frames, means connecting the liquid receptacle with each of the float chambers for flow of liquid thereto, a switch for each of the motors for controlling supply of electric current thereto for operating said motors, floats in the respective float chambers and responsive to the level of the liquid therein for actuating the respective switches, and means for adjustably mounting the float chambers on the respective frames whereby all of the floats are on the same level and raising of the liquid receptacle will raise the level of liquid in the float chamber to operate the respective switches to energize the motors for simultaneous movement of the frames vertically relative to the columns, the vertical movement of the frames causing a receding of the level of liquid in the respective float chambers whereby the respective switches are independently actuated to stop the respective motors and the vertical movement of the frames when said vertical movement of each of said frames corresponds to the amount the liquid receptacle was raised.

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