March 23, 1954

W. F. FREDRICKSON

JACK FOR RAISING FORMS AND FLOORING IN ERECTION OF CONCRETE BUILDINGS

2,673,067

Filed May 7, 1951

4 Sheets-Sheet 1

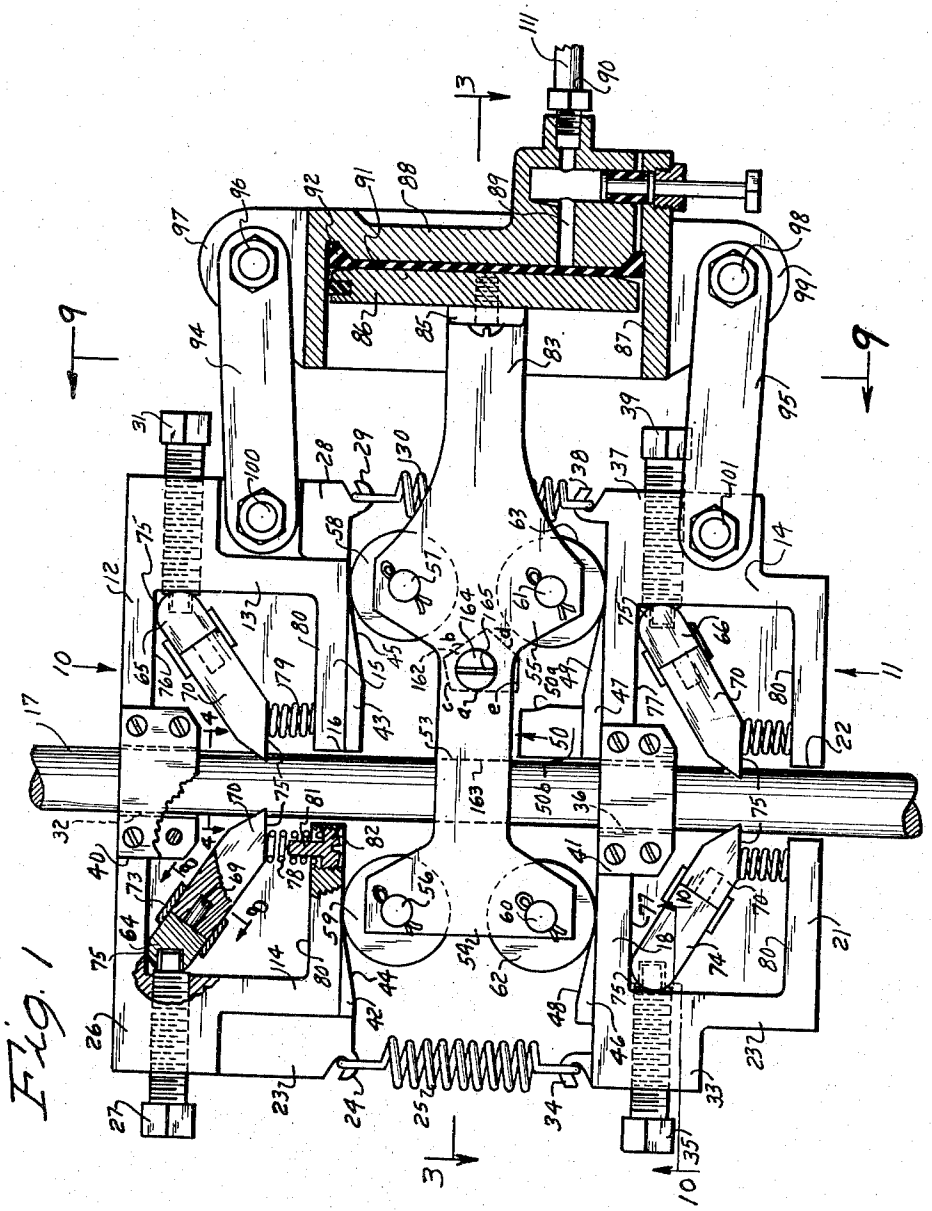


Fig. 1

INVENTOR
WALLACE F. FREDRICKSON
BY Whiteley and Caine
ATTORNEYS

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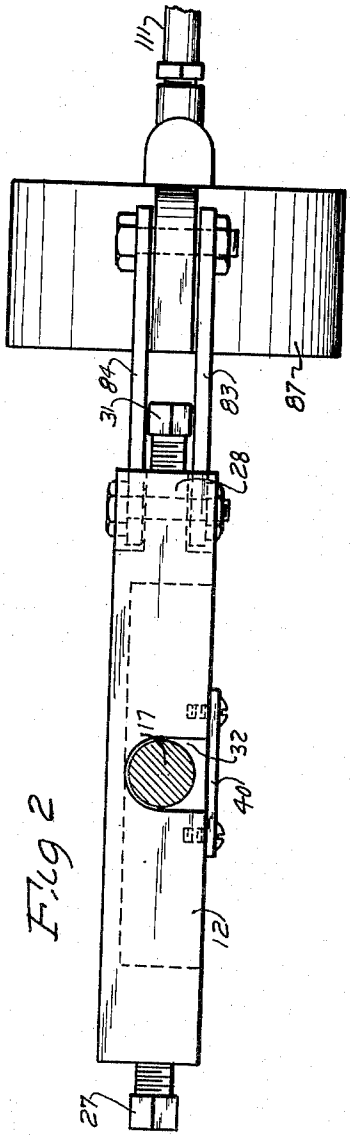


Fig 2

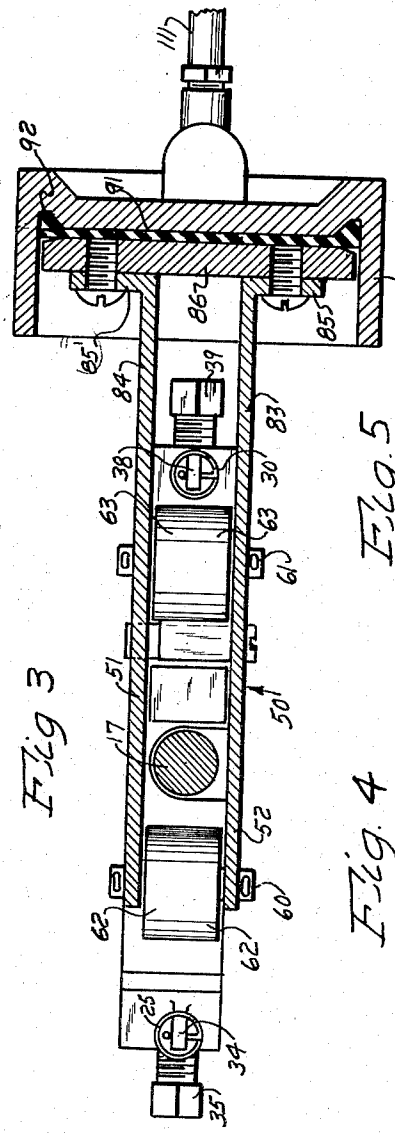


Fig 3

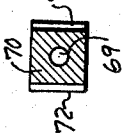


Fig. 5

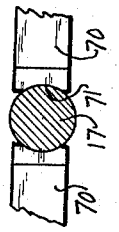


Fig. 4

INVENTOR
WALLACE F. FREDRICKSON
BY Whiteley and Caine
ATTORNEYS

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W. F. FREDRICKSON

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Fig. 6

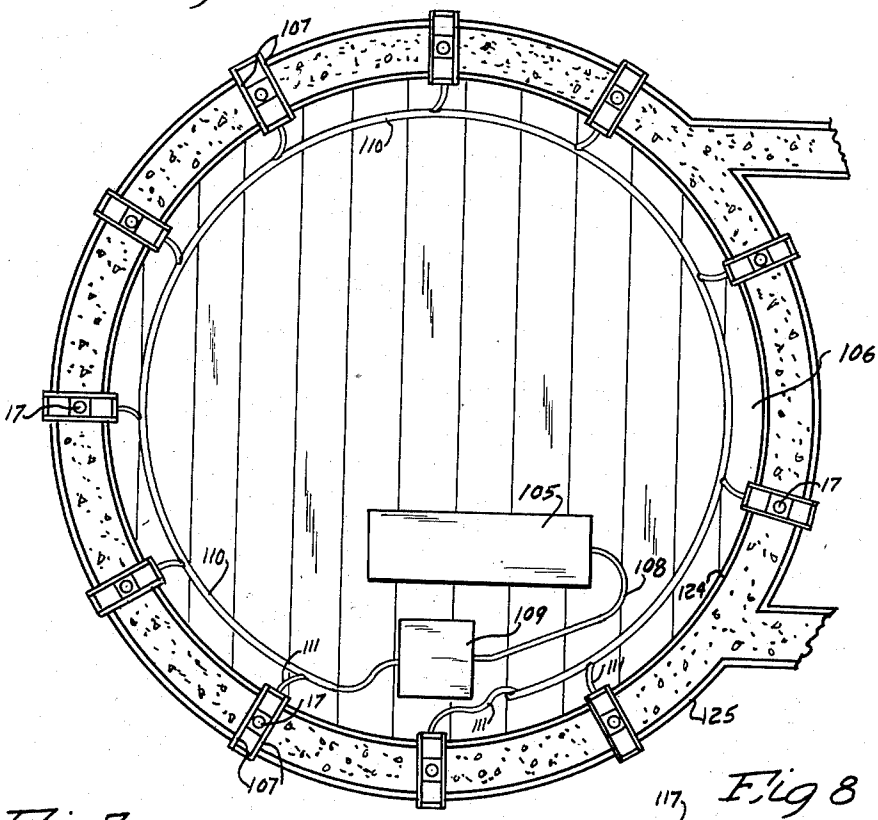


Fig 7

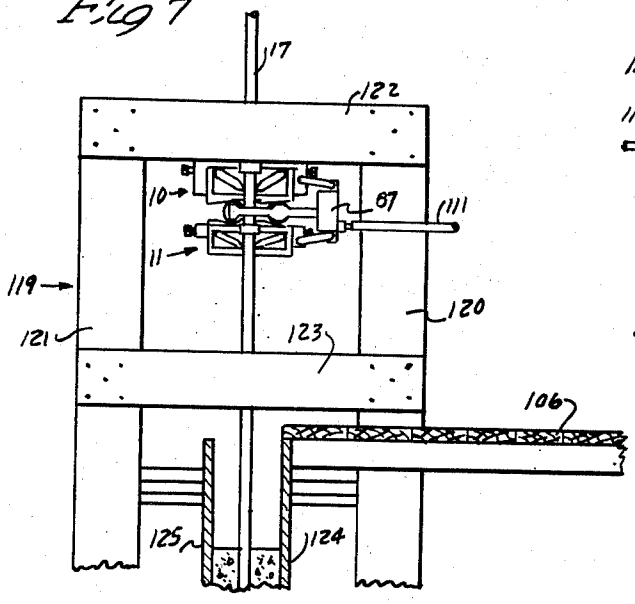
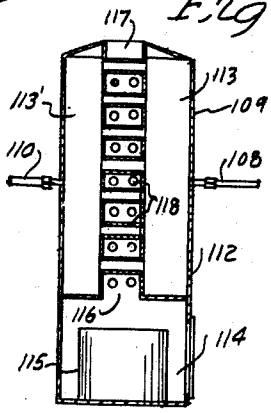


Fig 8



INVENTOR
WALLACE F. FREDRICKSON
By Whiteley and Caine
ATTORNEYS

March 23, 1954

W. F. FREDRICKSON

JACK FOR RAISING FORMS AND FLOORING IN ERECTION OF CONCRETE BUILDINGS

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Filed May 7, 1951

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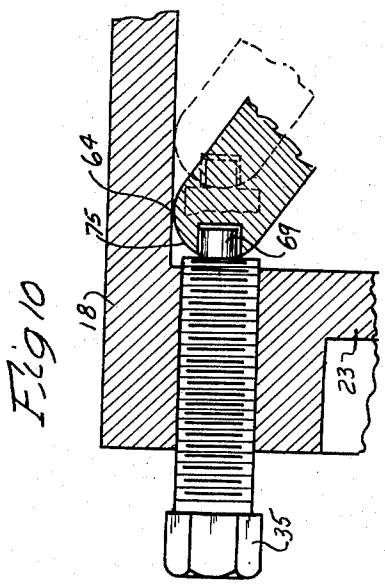


Fig. 10

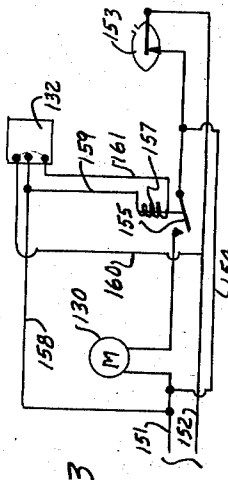


Fig. 13

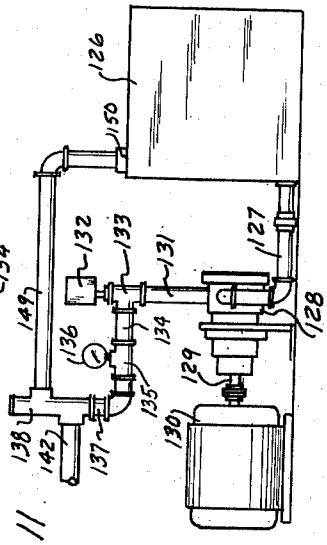


Fig. 11

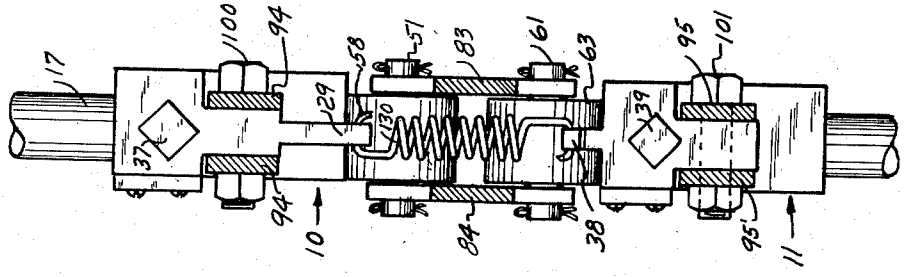


Fig. 9

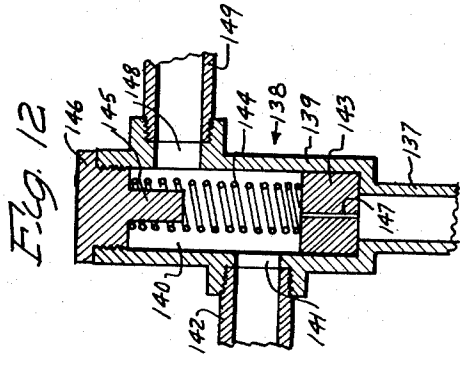


Fig. 12

INVENTOR
WALLACE F. FREDRICKSON
BY Whittlesey and Caine
ATTORNEYS

Patented Mar. 23, 1954

2,673,067

UNITED STATES PATENT OFFICE

2,673,067

JACK FOR RAISING FORMS AND FLOORING IN ERECTION OF CONCRETE BUILDINGS

Wallace F. Fredrickson, Minneapolis, Minn., assignor, by mesne assignments, to Minot Builders Supply Co., Inc., a corporation of Minnesota

Application May 7, 1951, Serial No. 224,910

10 Claims. (Cl. 254—106)

1

My invention relates to a jack for raising forms and flooring in connection with the erection of concrete buildings such as concrete elevators, wherein a jack rod anchored in the concrete cooperates in connection with two sets of sharp edged dogs engageable with their sharp edges with the wall of the jack rod, in combination with means movable at right angles to the jack rod which may be operated pneumatically, hydraulically or electrically for moving the jack and the attached flooring and forms upwardly a given amount at each impulse imparted to it, said movement being effected by the engagement of rollers with sloping surfaces to gradually impart the lifting operation.

Heretofore it has been proposed to have a pneumatic lifting device formed with an annular chamber surrounding the jack rod and movable vertically along the jack rod which is connected to the frame supporting the flooring and pouring forms. Pneumatic pressure is applied directly to separate parts of the lifting device together with two sets of dogs, one of which holds the frame to the jack rod against downward movement and permits upward movement, the other of which permits downward movement of the lifting member and prevents downward movement of the entire structure.

The sets of dogs have been fixed in various ways with a frame carrying the parts of the lifting member and in practice have had their sharp edges held against the jack rod by tension spring means which have pulled the dogs into contact with the jack rod.

The prior arrangement, particularly as to the contact of the dogs with the jack rods, has been very inefficient and has had a frequent result of breaking or dulling the rod engaging sharpened edges of the dogs. A return to relatively initial position of the parts of the lifting device has been effected in some instances by gravity and in other instances by tension spring members, and this has not been very effective for the purpose desired.

I have discovered an entirely new arrangement of parts of a jack rod comprising upper and lower members wholly independent one from the other, each of which is adapted to be moved vertically along the jack rod, the actual upper lifting member being moved vertically by power means applied thereto, and the lower member being moved upwardly by tension springs which have been distended during the raising of the upper lifting member.

The force which is applied to the lifting member for effecting lifting action operates at right angles to the jack rod. It comprises a slide positioned between the lower part of the upper lifting member and the upper part of the lower lifting member, which slide has two parallel parts between which are journaled for free rolling an upper set and a lower set of rollers, each set of two rollers, which contact upwardly sloping cam members on the upper face of the lower lifting member, which cooperate with the lower set of rollers and thrust the upper lifting member and the parts connected therewith upwardly by cooperation of the rollers on the slide members, and which comprise a similar set of downwardly sloping cam members on the bottom face of the upper lifting member, which permits the springs holding the two lifting members in general parallel relation to pull the lower lifting member into its initial position relative to the upper lifting member.

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The force is applied to the slide member from a pneumatically or hydraulically operated pressure member directly at right angles to the vertical extent of the jack rod, or by electric motors operating in the same way by controlled electric current to operate such motors.

The force-applying member is held by outwardly diverging links on the frame positioned between the lower face of the upper lifting member and the upper face of the lower lifting member to hold the force-exerting part of the force-applying member or the electric motor operation thereof so as to thrust directly in a line at right angles to the vertical extent of the jack rod.

It is a principal object of my invention, therefore, to provide two lifting members which have the jack rod extending vertically between them and which are entirely independent of each other, except that the lower lifting member is suspended through powerful springs from the upper lifting member.

It is a further object of my invention to provide a slide between the two lifting members having an upper set and a lower set of rollers contacting cam guideways turned in opposite directions on the lower face of the upper lifting member and on the upper face of the lower lifting member respectively.

It is a further object of my invention to provide upper and lower sets of dogs which are relatively short and each of which comprises two parts, a base part with semi-cylindrical head which may be and is in effect freely pivoted to an adjustable holder having a pin in its head engaging in a socket in the cylindrical head of

the pin, and having a second member which has an outer curved sharp edge for engagement with the jack rod, said second member being removably held in rigid alignment upon the end of and by the head part of the dog. Each of said dogs is engaged by a compression spring held for adjustment upon a screw pin extending through the bottom face of the respective lifting members, each of said compression springs extending parallel with the jack rod and having engagement with a lower face of the dog close to the jack rod for direct thrust vertically upon the respective dogs to hold the sharp edges of the respective dogs in engagement with opposite sides of the jack rod, either to lock the lifting member against vertical movements relative to the dog or to permit said vertical movement.

It is a further object of my invention to provide the slide member with a laterally extended end portion adapted to contact and be secured to a movable member forming in effect a thrust piston of the force-applying member.

It is a further object of my invention to provide a thrust-applying member which comprises a cylindrical chamber and a piston member closure therein, and which is freely supported by connection with the arm of the slide and by two sets of links outwardly diverging from each other, one set secured to the upper lifting member and the other set to the lower lifting member.

It is a further object of my invention in one form thereof to provide a source of compressed air having connection with the cylindrical chamber of the thrust-applying member together with means for controlling the adjustment and escape of said compressed air operated either by the hand of an operator or by automatic means for that purpose.

It is a further object of my invention in another form thereof to apply hydraulic pressure within the cylindrical chamber in the thrust-applying member, such for example, as any suitable oil, together with means either operated by hand or automatically for releasing said oil to apply pressure at proper times and for thereafter effecting return of the oil to initial position through the force exerted by the springs suspending the lower lifting member from the upper lifting member.

It is a further object of my invention to provide valve means subject to the pressure from the pump which will automatically when the pump goes into action open pressure oil to the jack feed line and close pressure oil to the return line, together with means for restoring the valve member when the pump is stopped.

It is a further object of my invention to form the slide member, which extends at substantially right angles to the vertical extent of the jack rod, of side plates spaced apart and straddling the jack rod with two sets of cam-engaging rollers journaled in oppositely extending extensions of said plates and with stop means carried between the plates and engageable with the jack rod at the end of any forward thrust movement of the slide.

The full objects and advantages of my invention will appear in connection with the specification hereinafter set out, and the novel features by which the advantageous and useful results are obtained will be particularly pointed out in the claims.

In the drawings illustrating an application of my invention in some of its forms:

Fig. 1 is an enlarged side elevation view partly in section of my novel jack arrangement.

Fig. 2 is a top plan view with the jack rod in section of what is shown in Fig. 1.

Fig. 3 is a sectional plan view taken on line 3—3 of Fig. 1.

Fig. 4 is a sectional plan view taken on line 4—4 of Fig. 1, showing the manner of the sharpened edge of the dogs engaging the jack rod.

Fig. 5 is a sectional view taken on line 8—8 of Fig. 1.

Fig. 6 shows the position of a set of jacks and jack frames on a part of a concrete building being erected.

Fig. 7 shows the frame supporting the flooring and the concrete forms and the arrangement of my jack in reference to said frame.

Fig. 8 illustrates a body of compressed air adapted to be heated before delivery to the feed lines and jacks, together with a showing of the heating means for effecting such heating.

Fig. 9 is a sectional elevation view taken on line 9—9 of Fig. 1.

Fig. 10 is a sectional view taken substantially on line 10—10 of Fig. 1 showing the arrangement for attachment of the dogs.

Fig. 11 is an elevation view of the parts making up the oil pumping mechanism.

Fig. 12 is a sectional view through the flow control valve of the oil delivering mechanism.

Fig. 13 is a wiring diagram showing the manner in which the motor for forcing the oil is automatically electrically operated.

My jack comprises a top lifting member, designated generally as 10, and a bottom lifting member designated generally as 11. These members are substantially identical in construction and comprise the following parts:

A top plate 12 for the upper lifting member 10, end plates 13 and 14, and a bottom plate 15 which it cut away, as indicated at 16, to receive the jack rod 17 which is embedded in the concrete as it is poured and extends vertically therefrom in a well-known way. The top plate 12 of upper member 10 also is cut away at 32, as shown in Fig. 2 and in dotted lines in Fig. 1.

Similarly the lifting member 11 is provided with a top wall 18 and end walls 19 and 20, and a bottom wall 21, cut away at 22 to receive the jack rod 17. In lifting member 11 top wall 18 also is cut away.

At the front end of lifting member 10 is a flange 23 having thereon a hook 24 to which is connected a strong tension spring 25. The flange 23 has an enlarged portion 26 which has threaded therein a bolt 27 for a purpose later to be given.

Extending outwardly from the side of plate 13 of top member 10 is a flange 28 having thereon a hook 29 to which is connected a spring 30. The flange 28 is made thick enough to receive the threaded bolt 31 for a purpose later to be pointed out.

Similarly the end plate 20 has extending outwardly therefrom a short flange or lug 33 provided with a hook 34 to which the other end of spring 25 is attached. Also threaded in lug 33 is a bolt 35 for a purpose later to be given. The top wall 18 of lifting member 11 is cut away, as indicated at 36 in Fig. 3 and in dotted lines in Fig. 1.

To end wall 19 of lower lifting member 11 is secured a flange 37 which is provided with a

hook 38 to which the lower end of spring 30 is attached. Also in flange 37 there is threaded a bolt 39 for a purpose later to be given.

Secured by screws to an enlargement 40 of upper bar 12 of the lifting member 10 is a keeper plate 40', as shown in Figs. 1 and 2, which plate spans the opening 32 for receiving the jack rod 17. Similarly secured by screws to an enlargement of upper plate 18 of lower lifting member 11 is a keeper plate 41', as shown in Fig. 1.

On the lower plate 15 of the upper lifting member 10 are a pair of flanges 42 and 43 formed on opposite sides and in common axial plane of the jack rod 17. The flange 42 is formed with a sloping cam surface 44, and the flange 43 is formed with a corresponding sloping cam surface 45. These cam surfaces 44 and 45 are formed to be exactly parallel.

Similarly on the upper bar 18 of lower lifting member 11 are formed flanges 46 and 47 respectively on opposite sides and along a common axial plane of jack rod 17.

On flange 46 is formed a sloping cam surface 48, and on flange 47 is formed a similar sloping cam surface 49. Cam surfaces 48 and 49 are parallel and are positioned so their extremities fall in common vertical planes with cam surfaces 44 and 45 respectively, but cam surfaces 44 and 45 slope downwardly while cam surfaces 48 and 49 slope upwardly.

In the space between lifting members 10 and 11 is located a slide member indicated generally by the reference numeral 50, and shown in side elevation in Fig. 1 and in sectional plan view in Fig. 3. The slide member comprises two bars 51 and 52 spaced apart, as shown in Fig. 3. Each of the bars, as shown in Fig. 1, comprises a central part 53 with an expanded front head 54 and a corresponding expanded rear head 55.

Shafts 56 and 57 are journaled in the upper parts of heads 54 and 55 and have thereon rollers 58 and 59, which rollers are held by contraction of springs 25 and 30 in contact with cam surfaces 44 and 45. In the lower parts of the heads 54 and 55 are journaled shafts 60 and 61 upon which are mounted rollers 62 and 63, as shown in Fig. 1.

From the above it will be apparent that the slide member 50 floats between lifting members 10 and 11 and is held with the respective sets of rollers in contact with the beginnings of the cam faces by the springs 25 and 30. If, therefore, the slide is moved from its initial position, as shown in Fig. 1, to the left, the contact of the sets of rollers upon the cam surfaces 44 and 45 and 48 and 49 separate the two lifting members 10 and 11 and correspondingly extend the tension springs 25 and 30.

If, then, means are provided to permit movement only of the upper lifting member 10, that member will be lifted and take with it the connected flooring and forms, lifting them to the same extent that the upper lifting member 10 is moved upwardly.

At the same time the springs 25 and 30 will be extended and when the slide 50 is moved back to initial position, if the upper lifting member is held stationary the springs 25 and 30 will bring the lower lifting member 11 into the position of Fig. 1. This operation may be repeated as desired with the result of progressively lifting flooring and forms contacted by the upper lifting member 10.

It is, of course, necessary to anchor the lower lifting member to the jack rod while the upper lifting member is moved upwardly, also to anchor the upper lifting member to the jack rod

when the springs restore the lower lifting member to initial position. This has been done in various ways, in some instances by the use of sharp edged dogs engageable with their sharp edge at angles with the jack rod and so held as to be capable of sliding movements on the jack rod when the upper lifting member is moved upwardly and conversely when the springs move the lower lifting member upwardly.

I have provided herein a radically new arrangement of dogs and particularly the manner of holding them and producing the necessary pressure of the sharp edge against the jack rod. As well shown in Fig. 1, in the first place I arrange two diametrically opposed dogs for each lifting member which engages the jack rod with their sharpened edges in a horizontal plane on each side of the jack rod.

In the second place I make the dogs in two parts, a head part which is not subject to wear, and a bit part which is removably secured to the head part and engages with its sharp edge the side of the jack rod, and because it is subject to wear it must be frequently sharpened.

A third feature comprises holding the head member of the dogs by means which permit adjustment to take care of grinding the bit parts of the dogs made necessary by wear or use.

These dogs are all similar, as shown in Fig. 1. In general the head parts 64, 65, 66 and 74 will be exactly alike, each being provided with a socket 67 into which extends a pin 68 fastened on the end of screws 27, 31, 39 and 35; however, head 74 is depicted substantially longer than heads 64, 65 and 66 for a purpose which will be subsequently explained.

Secured by means of a pin 69 projecting from the centers of the heads 64, 65, 66 and 74 is a chisel or bit member 70 which has a curved, sharpened edge 71 adapted to engage and bite into the substance of rod 17, there being for each lifting member 10 and 11 two of said bit members 70 in directly opposed relation, as shown in Fig. 1.

Plates 72 and 73 are secured to opposite sides of head members 64, 65, 66 and 74 and receive between them the side walls of bit member 70 and hold such members against turning on the pins 69.

As shown in Fig. 5, the bit members 70 and the heads 64, 65, 66 and 74 are square in cross section. As shown in the lower left hand corner of Fig. 1, heads 74 may be used which are very substantially longer than the heads 64, 65 and 66, which, of course, makes bit members 70 correspondingly shorter.

These longer heads, which may be of varying lengths, are provided for substitution for shorter head parts so that the bit parts which are necessarily formed of special and more expensive steel may be continuously used until too short for further use. Also any of the head parts such as 64, 65 and 66, or 74, or like longer head parts, are adjustable through operation of screw bolts 27, 31, 35 and 39.

The rounded end of the heads 75, as clearly shown in Fig. 1, takes against the inside wall 76 of top rail 12 of upper lifting member 10, or the corresponding edge 77 of top rail 18 of the lower lifting member 11. The screw bolts 27, 31 and 35, and 39 may be individually operated to move the dog members forwardly along these edges as the bit members are worn away at their sharpened edges from use.

The angle which the combined dogs may have to the edges 76 of the upper lifting member 10,

and 77 of the lower lifting member 11, is important and is maintained the same in all positions of adjustment of the dogs. This is accomplished in the following manner.

The bit members 70 have a wedge-shaped end, as shown in Fig. 1, and a curved biting edge 71, as shown in Fig. 4. The lower surface 78 of these wedge-shaped ends is contacted by a compression or thrust spring 79, which is supported in each case upon screw members 81 extending through the upper surface 80 of the respective lower plates 15 of upper lifting member 10, and 21 of lower lifting member 11. The thrust of spring 79 is directly upon faces 76 of bit member 70 and that thrust is always such that when the curved edge 71 of the bit member 70 contacts a wall of the jack rod 17, as shown in Fig. 4, faces 78 and 80 will be parallel.

It will be noted that springs 79 have their thrust operating along lines parallel with the adjacent curved surface of the jack rod and close to the biting edge 71 of the bit members 70. The screw members 81 are threaded into a socket 82 and extend within the springs 79. By screwing these screw members 81 upwardly not only will the pressure of the spring 79 upon faces 79 of the wedge-shaped portion of the bit member 70 be regulated, but also the angle of the dogs to lower faces 76 of upper plate 12 of upper lifting member 10, and lower faces 77 of upper plate 18 of lower lifting member 11 will remain constant, to hold all faces 78 of the bit members 70 and faces 80 of the plates in parallel relation.

As shown in Fig. 1, the slide member 50 has each of its parts 51 and 52, and particularly its rear head 55 provided with rearwardly extending arms 83 and 84, respectively, as shown in Figs. 1 and 3. Each of the arms 83 and 84 is provided with a lip member 85 which is secured to a piston member 86 operative within a cylinder 87.

The cylinder 87 is closed by a back wall 88 through which extends an opening 89 having connection with a pressure air hose 90 when the jack is operated pneumatically by compressed air. A rubber sealing member 91 is secured to the inner face of cylinder 86 and is provided with an annular flange 92.

When, therefore, compressed air for pneumatic operation, or pressure oil for hydraulic operation, goes into the space back of the sealing member 91, the operation of the piston is effected without possibility of wastage of compressed air or pressure oil, since the pressure forces the flange 92 firmly against the inner wall of the cylinder.

The cylinder 87 and connected parts are supported by the bars 83 and 84 through the piston member 86.

A pair of upper links 94 and lower links 95 are provided, the upper links 94 being pivotally connected by bolt 96 with ear 97 extending outwardly from cylinder 87, and lower links 95 being pivoted upon bolt 98 extending through ear 99. The links 94 in turn are secured at their front ends to bolt 100 extending through flange member 28 heretofore described, and links 95 are pivotally secured by bolt 101 extending through flange member 37. The links 94 and 95 are shown outwardly diverging.

It will be seen that when compressed air or oil under pressure is introduced into chamber back of piston 86 the force of that operation will be transmitted to the slide 50 made up of the plates 51 and 52, and will move the slide and the rollers on it in contact with the respective sets of upper cam surfaces 44 and 45, and lower cam surfaces 48 and 49, with the result that the lifting members 10 and 11 must be pushed apart. And since the lower dogs 70 biting into the jack rod 17 will prevent any downward movement of lower lifting member 11 the effect will be to lift the upper lifting member 10 with all the parts connected to it and distend the tension springs 25 and 30.

When, therefore, the pressure in chamber is released the springs 25 and 30 will draw up the lower lifting member 11, since the dogs 70 of the upper lifting member 10 will hold that against downward movement and the effect of this upward movement will be to cause the cam surfaces 44, 45 and 48, 49 acting upon rollers 58 and 59 and lower rollers 61 and 62 to transmit the force of distended springs 25 and 30, to restore the parts to initial position, as indicated in Fig. 1.

As shown in Fig. 7, a frame designated generally as 119 comprises a pair of vertical frame members 120 and 121 to both sides of which are bolted transverse spaced members 122 and 123. To this frame structure, the floor 105 and the form portions 124 and 125 are secured. The double sets of transverse frame members 122 and 123 are spaced apart sufficiently to receive the jack rod 17 to which is secured the upper lifting member 11 and cylinder 87 of the jacks. The transverse frame members 122 rest upon the upper lifting member 11 and as the jack is raised in the manner hereinbefore described the frame member 119 and the parts connected therewith will be elevated along the jack rod 17.

Where air is employed to operate the jacks it will be compressed in a tank 105 Fig. 6, mounted on the floor 106 which is connected with frame members 119 resting on the jacks about the jack rods 17. In the practice of my invention the air will go from the tank 105 through a pipe 108 to an air heater 109 from which it goes through a feed line 110 through branch lines 111 to the several jack cylinders 87 back of the rubber sealing member 91, as shown in Fig. 1.

The heater 109 Fig. 8, may be conveniently formed with an outer casing 112 which comprises upper air chambers 113 and 113' and a lower heat chamber 114. Hot gasses will pass from heat generator 115 through central passageway 116 to discharge at top 117. The air from pipe 108 must pass from chamber 113 to chamber 113' through a system of heated heat exchangers indicated generally at 118. The air delivered to the jack cylinders 87 will, therefore, be heated to desired temperatures to prevent freezing of any water which may accumulate in the jack cylinders in case the apparatus is being used in freezing weather.

All of the springs 25 and 30 for all of the jacks which have been operated will then apply their force to pull up the lower jack member 11 which through operation of rollers 58—59 and 62—63 will cause the slide 50 carrying said rollers to move back to the complete closing position shown in Fig. 1, and then force is directly applied to the oil in the chamber back of the diaphragm 91. This will result in literally forcing the oil that had been in the chambers to operate the jacks for the lifting operation back from the jacks and through the pipes 111 into the main lead pipe 142, and since the chamber 140 is then fully open, this will result in pushing the oil through opening 141, chamber 140, opening 148 and pipe 149 back into the tank.

As shown in the wiring diagram of Fig. 13, line

wires 151 and 152 feed current into the system. While the closing of the circuit may be made by hand, the preferred form is to use a timing switch indicated generally at 153.

The timing switch normally breaks the circuit at 153. The switch 155 is controlled by a solenoid 157. When switch 153 is closed current will go from line wire 151 through branch wires 158 and 159 to one side of the solenoid and from branch wire 160 through pressure switch 132 and branch wire 161 will go to the other side of the solenoid which will energize it and cause it to close motor switch 155. This is true because the pressure switch normally closes the circuit through it from branch wire 160 to branch wire 161.

When, however, the pressure switch is operated to be open, the circuit to the solenoid is open and the motor circuit correspondingly opens, terminating operation of the motor This stops the pump. The spring 144 restores the valve piston 143 to initial position and the oil is forced back into the tank 126 as above described.

The jacks may also be operated hydraulically. The means for controlling the delivery of oil are shown in Figs. 11, 12 and 13. Fig. 11 shows the general assembly, comprising an oil tank 126 for receiving and containing the oil used in the system, which preferably will be a combined oil that will be free-flowing even in very cold weather. From the tank 126 at its bottom leads a pipe 127 which enters the chamber of a rotary pump 128 at a point near its top. The pump is in line with the shaft 129 of a motor 130 which may be an electric motor or a gas engine as desired.

From the pump 128 leads a pipe 131 which will be of the same diameter as the inlet pipe 127 and which is connected at it stop with a pressure switch 132. From a T 133 from pipe 131 a pipe 134 leads through a T 135 which connect with a pressure gage 136 and from there the oil goes through a vertical pipe 137 into a valve member 138 which is shown in detail in Fig. 12 and which will now be described.

The valve member 138 has a cylindrical wall 139 and an inner cylindrical chamber 140 which opens toward its bottom through an opening 141 connected with the main oil delivery pipe 142, which in turn connects all the pressure pipes 111 leading to the several jack cylinders 87.

A valve piston 143 is slidably mounted within the cylinder chamber 140, and is normally held in its lowered position by a strong compression spring 144, which spring is held for action vertically by surrounding a pin 145 extending centrally from a closure plug 146, which closes the upper end of chamber 140. A small leak opening 147 will permit flow of oil from the pumping line back into chamber 140 when the spring 144 restores the piston 143 to initial position, as shown in Fig. 12. Through an opening 148 from chamber 140 return oil will flow through pipe 149 into the top of tank 126 at 150.

When, through electrical means hereinafter described, the motor 130 is started, pressure oil immediately forces the piston 143 up in chamber 140 to uncover opening 141 and block passage of oil to opening 148. That is the delivery position of the valve. The oil will then feed through the main feed line 142 and branch lines 111 into the various cylinders 87 causing all of the jacks simultaneously to push up the frame member 119 and connected parts the small increment of distance provided in the system, which, in practice, is usually three-sixteenths of an inch. The pressure switch 132 will then cut off flow of electricity and result in opening the motor switch to stop the motor.

As shown in Fig. 1 there is an adjustable stop designated generally by the numeral 162 which is provided with five faces to effect five different lengths of stop of the slide 50. These faces are designated respectively *a*, *b*, *c*, *d* and *e*.

As shown, face *a* is parallel with the outer wall of the jack rod 17 which will permit the longest or maximum stroke of the slide 50. Faces *b*, *c*, *d* and *e* in that order call for successive shorter strokes of which the stroke stopped by face *e* is the shortest. These faces are adapted to engage the wall of the jack rod 17, as indicated in dotted lines at 163 which, of course, will limit the length of that stroke. The sloping faces 44, 45 for the lower wall of the upper member, and 48 and 49 for the upper wall of the lower member, are long enough to accommodate the throw for the above indicated five distances.

The adjustable stop 162 is held by a button member 164 extending through the slide 50. In the button member 164 is a transverse slot 165 adapted to receive a screwdriver to turn the member 162 to whatever position the work in hand calls for.

The longest throw of the slide 50 will also be stopped by the roller 63 engaging a depression 50*a* in the upright bar 50*b*.

The advantages of my invention will be apparent from the above description, both in connection with the means of applying the force to the lifting members at right angles to their direction of movement and the extent of the jack rod, and also for the fact that it is practicable with this construction to use extremely fluid oil together with the practical arrangement of the dogs shown, giving a far more effective application of force from the pump to the lifting means than has heretofore been accomplished.

Furthermore the use of oil makes possible operating the lifting jacks in heavy freezing weather, which is not true where air is used since always there will be some condensation of water in the jack cylinders which will freeze the pistons and render the entire apparatus inoperative.

I claim:

1. A jack for elevating forms in connection with the pouring of concrete structures and operative in connection with a jack rod held and imbedded in the concrete, two independent lifting members surrounding and movable along said jack rod, the lower face of one member and the upper face of the other member formed with respective sets of parallel sloping cam surfaces, and a slide between the members having rollers on opposite sides thereof engageable with said faces, and springs connecting the members to hold the rollers in contact with the faces.

2. In combination with a jack rod, a jack comprising a first member encompassing the jack rod and having spaced top and bottom surfaces, a second member encompasing the jack rod beneath the first member and having spaced top and bottom surfaces, the exterior of the bottom surface of the first member and the exterior surface of the top of the second member each formed with a sloping cam surface, a laterally movable driven member positioned between said members and engaging the respective cam surfaces for vertically moving one of said members relative to the other on the jack rod, tension springs extending between said members and

forming a follow-up connection between the second member and the first member, and a set of engaging dogs carried by each of said members beneath the top surface of said members, the dogs of the second member acting to hold said member in rigid relationship with the rod when the first member is moved and the set of dogs carried by the first member acting to hold said member rigid with respect to the rod when the springs move the second member relative to the first member.

3. In a jack of the class described in claim 2 in which each dog consists of a base portion adjustably secured to the respective member and a removable bit secured to said base portion at one end and having a sharpened rod engaging edge at its other end.

4. A device for elevating forms in connection with the pouring of concrete structures cooperating with a jack rod embedded in the concrete, comprising two independent lifting members movable along the jack rod, sloping cam surfaces formed on each of said lifting members, a laterally movable driven member positioned between said lifting members and engaging the respective cam surfaces for vertically moving one of said members relative to the other on the jack rod, and a pair of two part dogs connected with each lifting member, each dog having biting edges on one part arranged to engage the jack rod on opposite sides thereof.

5. In combination with a jack rod, a jack comprising a first member which encompasses the jack rod and has spaced top and bottom surfaces, a sloping cam surface which is formed exterior to the bottom surface of said first member, a second member which encompasses the jack rod beneath the first member and has spaced top and bottom surfaces, a second sloping cam surface which is formed exterior to the top surface of said second member, a laterally movable driven member positioned between said first and second members and engaging the respective cam surfaces for vertically moving one of said members relative to the other on the jack rod, a pair of two part rod engaging dogs carried at an angle with said jack rod by each of said members between their top and bottom surfaces, adjustable means carried by both said first and second members for maintaining said two part dogs at a constant angle with the jack rod though the length of said dogs is variable, and tension springs extending between said first and second members and forming a follow-up connection between the second member and the first member.

6. A device for elevating forms in connection with the pouring of concrete structure and cooperating with a jack rod embedded in the concrete, comprising a first and a second hollow lifting member movable along said jack rod and positioned one above the other, a sloping cam surface formed on the bottom side of said first lifting member, a second sloping cam surface formed on the top side of said second lifting member, a laterally movable driven member positioned between said lifting members and engaging their respective cam surfaces for vertically moving one of said members relative to the other on the jack rod, tension springs extending between said lifting members and forming a follow-up connection between the second member and the first member, a pair of two part dogs contained within the hollow portion of each of said lifting members and forming an angle with the jack rod, each dog consisting of one part having a cylindrical head with a socket formed in its outer extremity and the other part formed with a front biting edge to engage the jack rod, horizontally adjustable abutments carried by both lifting members and engageable in each of said sockets to move the dog horizontally to take up wear on the biting edge of the second part of each of said dogs, and adjustable spring means carried by both lifting members and cooperating with said adjustable abutments for maintaining the biting edge of the second part of each of said dogs at a constant angle with the jack rod, the pair of dogs carried by the second lifting member acting to hold said member in rigid relationship with the rod when the first member is moved and the pair of dogs carried by the first lifting member acting to hold said member rigid with respect to the rod when the springs move the second member.

7. A jack for supporting and raising a lifting frame on a jack rod, comprising a first movable member encompassing the jack rod and provided with a lower surface, a second movable member encompassing the jack rod beneath the first member and provided with an upper surface, a set of rod engaging bits carried by each of said members and acting to hold the respective member on the jack rod during relative movement of the other member, means connecting said members and forming a resilient follow-up connection for moving the second member relative to the first member, a driven member positioned between the first and second members and adapted for intermittent lateral movement between the lower surface of the first member and the upper surface of the second member and provided with two oppositely disposed surfaces which extend in opposition to the lower surface of the upper member and the upper surface of the lower member to thereby provide four opposing surfaces between the three members, at least two inclined planes formed on two of said four surfaces, and at least two roller members carried on the remaining two surfaces which cooperate with the inclined planes on the opposing surfaces to provide relative movement between the first and second members when the driven member is moved in one direction between said members.

8. A jack for supporting and raising a form on a jack rod embodying a pair of relatively movable members encompassing the jack rod and spaced with relation to each other on the jack rod, means operating in the space between said members for intermittently moving one member relative to the other member, means connecting said members and forming a resilient follow-up connection for moving the other of said members between intermittent operations of said last named means, of rod engaging means for supporting at least one of said members on the jack rod during movement of the other member comprising a supporting head having an outer end and an inner end and whose axis extends at an angle with respect to the jack rod, a first adjusting means supported by said lifting member and journalled to the outer end of the head at one side of its axis to move the head relative to the jack rod while permitting the head to maintain a constant angle with respect to the jack rod, a bit having an outer end bevelled on its opposite sides to a sharpened end edge for engaging the jack rod and an inner end conforming to the inner end of the head, means detachably connecting the inner end of

the bit to the inner end of the head, and a second adjusting means carrier by said lifting member and engaging one of the bevelled end portions of the bit for holding the sharpened end edge of the bit in engagement with the jack rod.

9. In a jack for supporting and raising a form on a jack rod, embodying a lifting member movable along said jack rod, in combination with said member of rod engaging means comprising a supporting head having an outer end and an inner end and whose axis extends at an angle with respect to the jack rod, a first adjusting means supported by the lifting member and journalled to the outer end of the head at one side of its axis to move the head relative to the jack rod while permitting the head to maintain a constant angle with respect to the jack rod, a bit having an outer end bevelled on its opposite sides to a sharpened end edge for engaging the jack rod and an inner end conforming to the inner end of the head, means detachably connecting the inner end of the bit to the inner end of the head, and a second adjusting means carried by said lifting member and engaging one of the bevelled end portions of the bit for holding the sharpened end edge of the bit in engagement with the jack rod.

10. In a jack for supporting and raising a form on a jack rod, embodying a lifting member movable along said jack rod, in combination with said member of rod engaging means consisting of a supporting head having an outer end and an inner end whose axis extends at an angle with respect to the jack rod, said head having a socket formed in its outer end on one side of the axis, an adjusting screw supported by said lifting member in a

plane transverse to the jack rod and journalled at one end in the socket of said head, a bit having an outer end bevelled on two opposite sides to a sharpened end edge for engaging the jack rod and an inner end conforming to the inner end of the head, means detachably connecting the inner end of the bit to the inner end of the head whereby the head and bit are movable relative to the jack rod while held at a constant angle with respect to the jack rod, a spring carried by said lifting member in a plane parallel with the jack rod and engaging one of the bevelled end portions of the bit adjacent the jack rod, and an adjusting screw carried by said lifting member and operatively connected to said spring for adjusting the tension on the outer end of the bit to maintain the sharpened end edge in contact with the jack rod.

WALLACE F. FREDRICKSON.

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