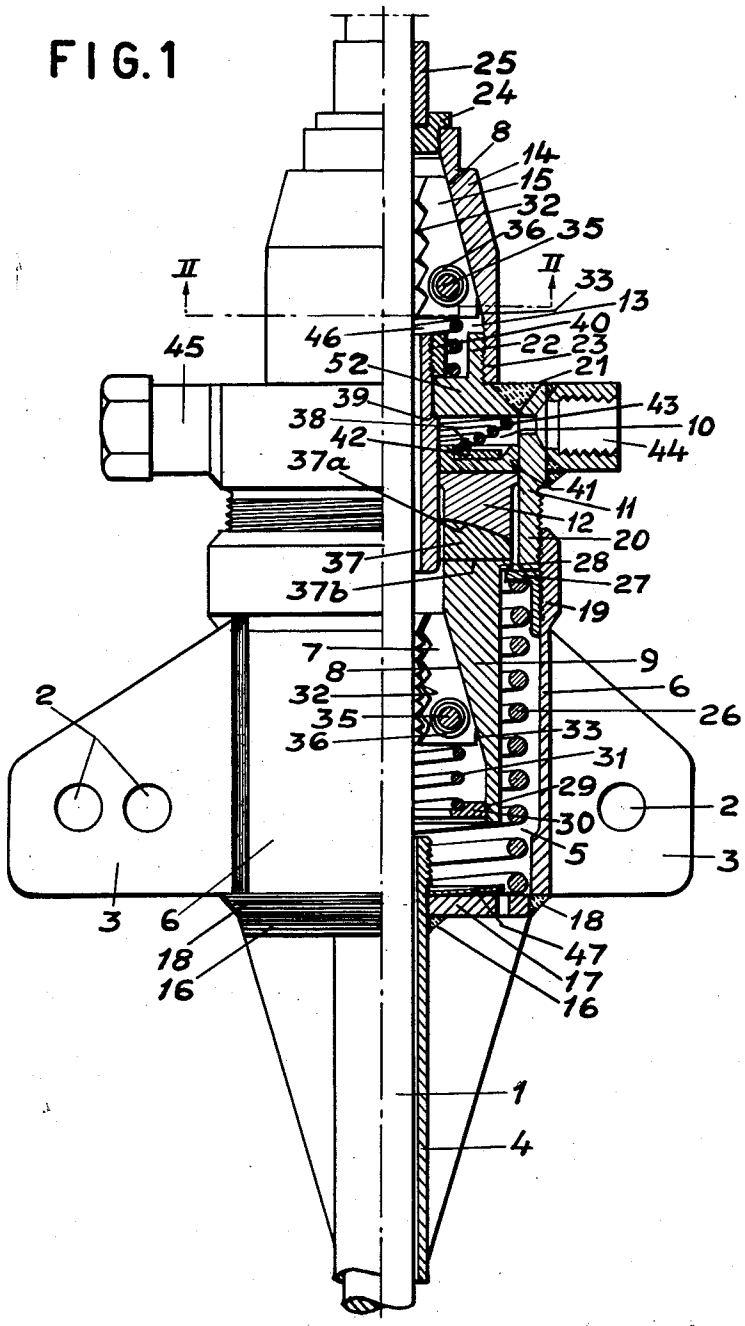
July 24, 1956 E. J. VON HEIDENSTAM ET AL 2,756,019

HYDRAULIC OR PNEUMATIC FORM LIFTER

Filed April 22, 1953 3 Sheets-Sheet 1

FIG. 1



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FIG. 2

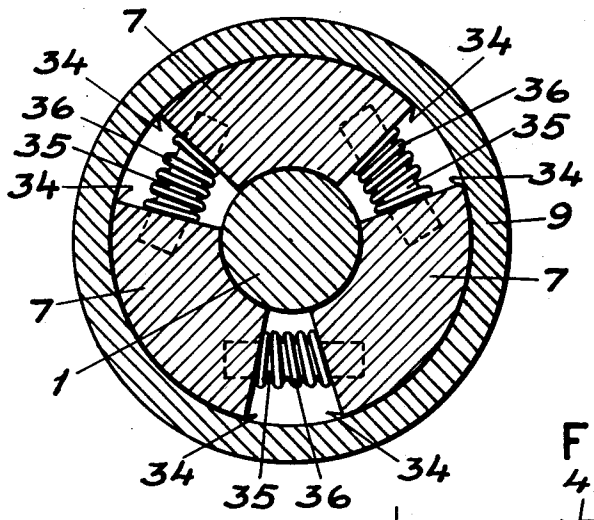


FIG. 8

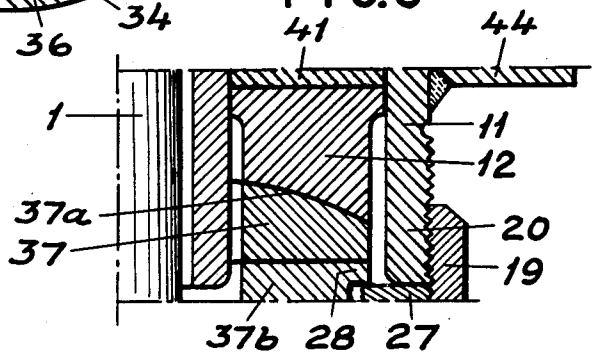
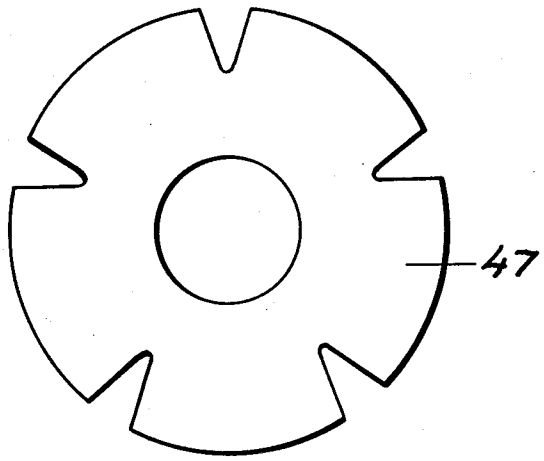


FIG. 3



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FIG. 4

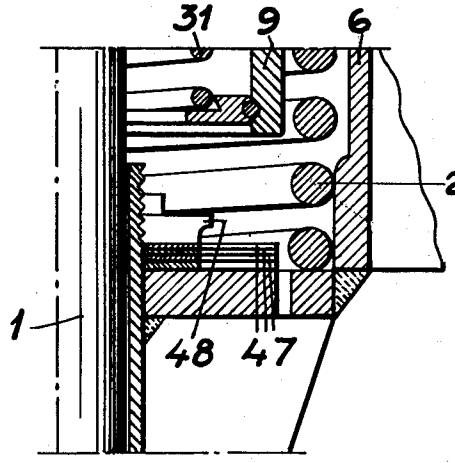


FIG. 5

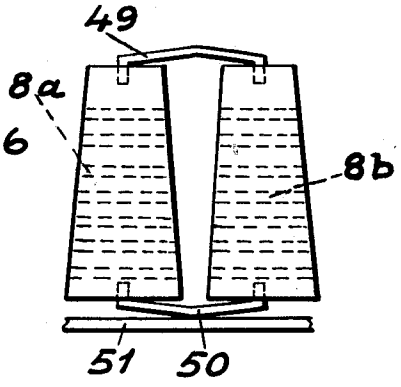


FIG. 6

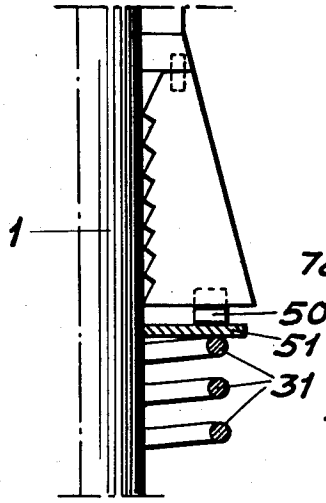
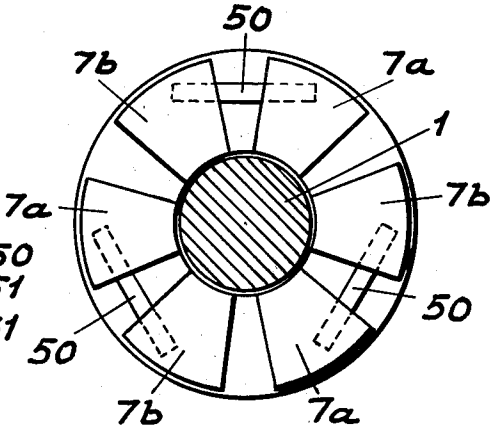


FIG. 7



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United States Patent Office 2,756,019 Patented July 24, 1956

2,756,019

HYDRAULIC OR PNEUMATIC FORM LIFTER

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Application April 22, 1953, Serial No. 350,411

Claims priority, application Sweden October 23, 1947

8 Claims. (Cl. 254—105)

This application is a continuation-in-part of our application Serial No. 56,024, filed October 22, 1948.

This invention relates to hydraulic or pneumatic lifters for lifting slidable forms upwardly along a stationary, vertical member, such as a reinforcing iron bar for a concrete wall.

For practical and economical reasons it is desirable as much as possible to reduce the cross-section of the reinforcing irons, on which the form lifters are to climb upwards and which are to be cast in the concrete structure, for instance, a silo or the like. Such a reduction of the cross-section will render the reinforcing iron relatively weak with regard to the load they must carry and therefore it is necessary to adapt the structure of the form lifters to the altered conditions under which they must work, in order to operate satisfactorily.

For constructional reasons and also owing to the fact that flaws, etc. are scaled off from the reinforcing iron during the climbing operation, it is necessary to have more or less play within the form lifter with respect to the reinforcing iron, which involves that the loaded reinforcing iron will be deflected within the form lifter. This deflection occurs especially during those moments of the climbing operation when the lower set of wedge claws is not in pawling engagement with the reinforcing iron, that is during that moment when said set of wedge claws is moving upwards, therefore incapable of stiffening the reinforcing iron. Consequently, if the reinforcing iron is deflected from the center line of the form lifter just as one of the sets of claws by its guiding mechanism is about to be caused to engage said iron in the case of for instance three claws in the set, but one or possibly two claws will come into grip with the reinforcing iron, whereas the engagement of the third claw is delayed during that interval required for straightening the bent or deflected reinforcing iron. Since not all the claws are then engaging the reinforcing iron, the claws may slip with the result that the form lifter slides downward some distance until all the claws have had time to engage the iron and secure the form lifter in position thereon. Such a sliding or slipping movement does not take place uniformly from time to time and is not the same for different form lifters and therefore, for example, when moulding silos of concrete by means of a round sliding mould, the mould cannot be uniformly lifted around its periphery but it may assume an oblique position at the peril of the concrete structure being deformed, or of the sliding of the mould taking place thereafter obliquely instead of vertically.

The invention will now be more fully explained with reference to the drawings which illustrate a preferred embodiment.

Fig. 1 shows partly in elevation and partly in half-section a form lifter according to the invention.

Fig. 2 is a horizontal section on the line II—II in Fig. 1.

Fig. 3 shows a detail (spring-washer).

Fig. 4 shows an alternative embodiment of a detail in Fig. 1.

Figs. 5–6 are elevations of an alternative embodiment of a set of wedge-claws.

Fig. 7 is a plan view of the device according to Figs. 5–6.

Fig. 8 shows a detail of Fig. 1 on a larger scale.

In the drawing the reinforcing iron 1 is disposed vertically in a concrete wall (not shown) in course of erection. The reinforcing iron is clasped by a form or mould lifter provided at its lower part with one or more cross-plates 3 pierced by holes 2 and possibly placed in different planes. This plate 3 is adapted to be connected with depending bearing members to be fixed to the plate by bolts inserted in the holes 2 and with a yoke (whch preferably may resist moments of force at its top) for lifting a sliding mould or form. For the purpose of stiffening the reinforcing iron its base part is formed with a stiffening pipe 4 the opening of which is approximately the size of the reinforcing iron.

The housing of the lifter located above may be generally considered as divided into two chambers, viz. a lower one 5 encased by a cylindrical wall 6 and housing a lower set 7 of wedge-shaped claws and a cylinder or claw-head 9 provided with an internal conical mantle-surface 8 cooperating with the set 7 of wedge-claws, and further an intermediate chamber 10, defined by a cylindrical sleeve 11 and containing an annular piston 12 fitting therein and finally a top chamber 13 defined by an internally conical sleeve or claw-head 14, in which an upper set 15 of claws is located and with the conical wall of which said set of claws is adapted to cooperate. The stiffening pipe 4 is welded at 16 to a circular plate 17, forming the bottom of the chamber 5 and to the outer periphery of which the cylinder 6 is fixed by a welded seam 18. Further, the top part of the cylinder 6 is provided with a threaded portion 19 in which a corresponding threaded portion 20 of the cylindrical sleeve 11 is engaged. The cylindrical sleeve 11 is covered at its top by an annular lid 52, which, by means of a welded seam 21, is fixed to the cylindrical sleeve 11. Projecting upwardly from said lid 52 is an annular externally threaded flange 22 on to which the clawhead 14 by means of a corresponding threaded part 23 is engaged. Disposed on the top of the claw-head 14 is a guide-ring 24 and a sealing rubber-ring 25.

Resting on the base plate 17 is a relatively coarse helical spring 26, supporting a flanged ring 27, which by the spring 26 is normally urged against the lower annular edge of the cylindrical sleeve 11. The claw head 9 rests on the flanged ring 27 through the intermediary of an annular flange 28. There must be a sufficient play in the lateral direction so that the flange 28 can slide laterally (radially) on the flange of the ring 27. This allows the claw-head 9 to move laterally in relation to the piston 12 and consequently also in relation to the upper claw-head 14. An annular groove is formed internally in the lower part of the claw-head 9, in which groove a split-ring 29 is retained by spring action. Said split-ring 29 in its turn forms a seat for a ring 30, on which a spring 31, carrying the lower set 7 of wedge-claws rests.

In Fig. 1 two wedge-claws units 7 and 15 are shown in elevation, and it may be seen that they are provided with saw-shaped engaging surfaces 32 cooperating with the reinforcing iron 1 and a tapered surface 33 cooperating with the tapered surface of the claw-heads 9 and 14 respectively. The grouping of the claw units about the reinforcing iron is more clearly disclosed in Fig. 2. Said figure shows three claw units engaging the reinforcing iron 1 and it may be pointed out that the surface of each unit 7 abutting the tapered wall of the claw-head 9 makes a sector-shaped part of the mantle surface of the frustum of a cone. However, in order to restrict the wedge-action between the tapered wall and the mantle surface of the wedge claw so as to prevent it from wedg-

ing excessively, as a result of too large a common frictional surface, the dimensions of the units are chosen in such a way that the engaging takes place along a common generatrix, the surfaces on both sides thereof being spaced apart by gaps designated 34. The wedge-claw units are further kept assembled by bearing pins 35 on to which springs 36 are threaded. Said springs on the one hand serve to join the units, and on the other hand to urge them uniformly outwardly out of its engagement with the reinforcing iron, if the claw 9 is lifted in relation to the set of wedgejaws permitting them to expand.

A loose ring 37 rests on the claw head 9, and its upper surface 37*a* is shaped as a part of a spherical surface on which the piston 12 rests with a corresponding spherical surface. The lower surface 37*b* of the ring, however, is plane. This does not exclude the contrary case, viz. the lower surface of the ring being spheric and engaging a corresponding spherical surface at the wedge-claw and the surface of the piston and the ring engaging each other being plane.

It is to be observed that the external diameter of the ring 37 is substantially smaller than the internal diameter of the cylindrical sleeve 11, so that there is a sufficient ridial distance between said ring and said sleeve. This renders it possible for the piston 12 to slide laterally in relation to the claw-head 9. In other words, the claw-heads 14 and 9 may thus slide laterally in relation to each other, also due to a sliding motion at the surface 37*b*.

As aforesaid the piston 12 with its outer periphery fits the inner periphery of the cylindrical sleeve 11, whereas its inner periphery fits a pipe 38 disposed centrally in the lifter, said pipe being fixed to the lid 52 by means of a stepped portion 39 and a screw nut 40. Thus the pipe 38, lid 52 and the cylindrical sleeve 11 form the cylinder space 10 for the piston 12. Resting on the piston 12 is further a ring-packing 41 and a metal ring or the like 42 supporting the packing as well as a tapered helical spring 43 reacting between the lid 52 and said ring 42. Two inlet conduits 44 and 45 for the supply of oil or another pressure medium to the cylinder space open in said space above the piston. One of said inlets may be used for the connection of an auxiliary pump-unit, if for example, there has been a burst in some conduit.

Resting on the lid 52 is further a helical spring 46 carrying the upper set of wedge-claws 15. This set of wedge-claws is arranged in the same way as the lower set of wedge-claws and that which has been said above as to the latter is applicable for the main part also for the upper set 15.

In brief the form lifter operates as follows:

Normally, that is, as long as there is no pressure in the conduits 44 and/or 45, the total weight of the moulds, yoke and the entire mould or form lifter is carried directly by the tapered wall of the claw-head 14, said wall thus pressing the wedge-claws 15 into engagement with the reinforcing iron 1. The moulds and the lifter are thereby supported on their level. Thus, the upper claws normally carry the load. However, when the pressure is applied in the conduits 44 (and 45), which may be brought about by manually or automatically supplying the pressure medium, said pressure will act upon the piston 12 and consequently by way of the lower, tapered, cylindrical wall 9 directly upon the lower wedge-claws 7, causing them to clasp the reinforcing iron 1. Consequently the pressure, after the lower wedge-claws have taken a hold on the reinforcing iron 1, will urge the cylinder 11 upwards. The upper cone 14 is included in said upward movement and thus the upper wedge-claws 15 will loose their grip of the reinforcing iron, and accompany the cylinder 11 upward lifting the yoke and the moulds. When the cylinder 11 has been urged a sufficient distance upward, the pressure in the operating cylinder is caused to drop either by shutting off the conduits 44 and 45 or by escape of the pressure medium from said cylinder 10. The cylinder 11 thereby will be somewhat lowered so that the upper cone 14 will press the upper wedge-claws 15 into engagement with the reinforcing iron 1. Said claws thus will get a fast grip of the iron and will now carry the yoke and the moulds. When the pressure of the medium has dropped, the spring 26 will urge the piston 12 upwardly, the lower cone 9 releasing the lower edge-claws 7 and the piston being lifted. Subsequently the procedure may be repeated with suitable intervals, in order that the form lifter through alternating grips by the upper and the lowed wedge-claws respectively will climb up the iron 1 influenced by supply and discharge of pressure medium. At each time pressure medium is supplied the load is moved a distance equal to the stroke of the piston minus the downward slip, which may be made very small.

Since, it is necessary within the lifter to count on a greater or less degree of play, it is obvious that the loaded reinforcing iron 1 may be bent within the lifter proper and this is all the more the case since the pipe 38 between the upper and lower wedge-claws must have a sufficient width for releasing possible flaws or flakes etc. which may flake off the surface of the iron, and as the lower wedge-claws 7, due to their ability of moving in vertical direction, do not afford a rigid guide for the reinforcing iron. If, in the lower wedge-claw position, there is caused a deflection from the central line of the form lifter, the result will be that one or more of the units of the set of the wedge-claws, after the piston has been returned in position, will not engage the claw-head but will be disconnected. When subsequently the oil-pressure is supplied, a rigid grip of the reinforcing iron cannot be obtained before all the three (at least three) wedge-claws are engaging the claw-head. A certain slip will then take place during this moment of centering, which at different times will result in unequal lifting. According to the invention the cone 9 is spaced from the piston 12, since said parts engage and within certain confines may be able to slide freely relatively to each other along a plane being at right angles to the axis of the form lifter, that is along the surface 37*b*, as mentioned above. A possible small obliquity, which may be desirable with regard to the deformation of the reinforcing iron in the lower position of the claws, will be obtained by the presence of ball-and-socket joint at 37*a* between the working piston 12 and the lower wedge-claw head 9. It is thus evident that the upper gripping member 14 is movable laterally in relation to the lower gripping member 9 in two ways, viz. an angular rocking motion by ball-and-socket action and a lateral parallel displacement (translation or translatory motion).

Consequently, according to the invention, the piston 12 is provided with a lower spherical surface, with which it rests at 37*a* on the ring 37 provided with a corresponding surface, said ring being in its turn carried by the member 9, as apparent from Fig. 1, at the plane surface 37*a*. In addition, the flange 28 is capable of sliding laterally on the member 27.

Thus, by the fact that one set of gripping members or wedge-claws (the lower), which contrary to the other (upper) has to carry the load of the moulds etc., as well as those frictional forces, which must be overcome during the sliding moment of the mould, is automatically centered to the possible deflection of the reinforcing iron in the position in front of the set of wedge-claws, an immediate engagement will be obtained (without any loss of time and return slide respectively), when the oil pressure is applied on the working piston. Therefore this involves reduced strains and deformations of the reinforcing iron and a more exact lifting distance for each pressure impulse.

Provided no double-acting piston system or possibly two pistons are used, one of which engaging the lower wedge-claw head 9 and causing it to be detached from the wedge-claws upon lifting, that is to overcome the frictional pawling, a disengagement effected by mechanical means must be resorted to. This may be achieved, though in an insufficient way, with knocking on the iron 1 by a

tool or the like. Vibrations thus originated will be transmitted through the iron and transferred through the wedge-claws 7 to the head 9, putting it in vibration so that it will be detached from the wedge-claws and lifted, allowing the set of claws to expand and to loose its grip of the reinforcing iron 1. Such a manual action upon the lower claw system is as a matter of fact inconvenient. According to the invention automatic vibrating devices may be instead employed.

According to the invention another mechanical device may be employed, which will automatically detach the claws and the respective claw-head from each other. Such a mechanical device in accordance with Fig. 1 is, in its most simple form, a spring-washer 47 disposed centrally on the base plate 17. Said washer has a diameter approximately equal to the outer diameter of the claw-head located above, and is, to a certain extent, bent upwards along its periphery for the purpose of being springy. Consequently, when the form lifter, while resting on the lower set of claws, by applying pressure in the conduit 44 is pressed upwardly, and the base plate 17 and the washer 47 placed thereon are lifted, so that the spring-washer by being set is depressed by the claw-head 9. When the oil-pressure at a later moment is lowered, the upper set of claws 15 will grip the reinforcing iron securing the lifter thereto. At the upward movement of the lifter, moreover, there will always be caused certain vibrations, which will be transferred to the lower claw-head 9, which under influence of said vibrations, the tension in the spring-washer 47 and in the spring 26 will be detached from the set of claws 7 and lifted, permitting said claws to expand and to be lifted by the spring 31.

In several cases it may be required that the spring-washer shall provide a considerable resistance in axial direction and additionally have a sufficiently great measure of deformation in the axial direction of the form lifter. For that reason, according to the invention, the washer 47 may be substituted by a number of assembled washers 47 of the form shown in Fig. 3. Fig. 4 shows a partial section in the vicinity of the base plate 17 with three spring-washers assembled and secured by a screw-nut 48 engaged on a threaded part of the stiffening pipe 4. Such a spring device is considerably more resistant against deformation than merely a washer having the same springy force.

Although, according to the invention, the number of wedge-claws in each set may be chosen arbitrarily, it will generally be most convenient to choose a number of three or a multiple thereof and to dispose the claws at equal distance apart about the central line of the form lifter. In the embodiment shown in Fig. 1 there has been provided three units in each set. For form lifters which are adapted to climb on relatively weak reinforcing irons it will prove, upon deflection of the reinforcing iron within the form lifter and at the adaptation of the set of claws thereto by lateral translatory movement, and possibly by a ball-and-socket action, that the different units of claws, in spite of their possibility of moving independently about the pins 35, and due to the relatively large angle over which the saw-shaped surface ranges considered in a horizontal view, the units in engagement, will be too stiff. In order in this connection to obtain a better result, each of the three large units, according to the invention, may be separated into two or more smaller ones. However, it may be most convenient if the less units are still in such a way joined in sets, that such a set, comprising for instance two small units, will be primarily acted upon by a common vertical force for its lifting, said force automatically and uniformly being distributed to each unit.

According to one embodiment of the invention, shown in Fig. 7, each claw-unit in the embodiment shown in Fig. 1 is thus divided into two ones, so that six units have been obtained. According to Figs. 5 and 7 said units are joined in couples at their base and top by means of leaf springs 49 and 50 respectively so that each couple in reality still forms a claw-unit, though the units shown and designated 7*a* and 7*b* since the spring 50 is supported from a washer 51 placed on the spring 31, are permitted to move independently, which to a great extent eliminates the stiffness of the aforesaid considerably larger claw-unit and furthermore renders possible the ductile adaption of the wedge-claw to the deflected part of the reinforcing iron.

If for some reason the moulding should not be continued, the mould and the concrete located therein must not be left in continuous contact with each other, since then there will be a risk of the mould being stuck fast. In order to avoid this the upper claw-head 14 may be loosened so that the claws 15 will no longer engage the reinforcing iron 1. By applying a pressure in the conduit 44 the form lifter is then lifted and consequently the mould supported by the lower claws 7. Upon eliminating pressure in the conduit 44 it will be lowered again, because climbing may no longer be possible due to the fact that the upper claws are put out of action. Thus if the mould with certain intervals is lifted in this way, the above-mentioned sticking of the form to the concrete structure may consequently be avoided.

It should be mentioned that the ring 37 may be rigidly secured to or made integral with the piston 12. Then there will be no rocking motion (by ball-and-socket action) between the upper gripping member 14 and the lower gripping member 9, but only a translatory lateral displacement. This will be sufficient in many cases.

On the other hand the ring 37 may be rigidly secured to or made integral with the member 9. In this case there will be rocking motion, but no translatory displacement between the upper and lower gripping (clamping) members.

As gripping or clamping members wedge-claws have been shown as an example. Other well-known types of such members may, however, be used, such as balls.

Having now described our invention, what we claim as new and desire to secure by Letters Patent is:

1. A fluid-operated form lifter for sliding forms for moulding concrete walls having vertically disposed reinforcing members, comprising in combination, a frame for connection to a form to be lifted, an upper gripping member and a lower gripping member arranged vertically below said upper gripping member operatively connected to said frame, said gripping members being mounted for movement relatively to each other as well as relatively to said vertical reinforcing member, a universal joint between said upper and lower gripping members providing for relative movement between said upper and lower gripping members so as to adjust to deflections in different directions and degrees of said vertical reinforcing member under the load of the sliding form, and a fluid-operated motor arranged between said upper and lower gripping members for moving said upper gripping member upwardly and then drawing said lower gripping member upwardly for causing the form lifter to climb the reinforcing member and lift a form connected thereto.

2. A fluid-operated lifter for sliding moulds for concrete walls having vertically disposed reinforcing members, comprising in combination, a frame for connection with a mould to be lifted, upper and lower clamping members arranged vertically one above the other and operatively connected to said frame and being mounted for movement relatively to each other as well as relatively to said vertical reinforcing member, a pair of universal joint members operatively mounted between said upper and lower clamping members and having transversely arranged sliding plane surfaces engaging each other providing for relative tilting movement between said clamping members so as to adjust to deflections in different directions and degrees of said vertical reinforcing member under the load of said sliding mould, and a fluid-operated motor arranged between said clamping members for moving the upper clamping members up-

wardly and for pressing it to clamp said vertical reinforcing member at a higher level and for then drawing the lower clamping member upwardly and for pressing it to clamp said vertical reinforcing member so that the mould lifter climbs the vertical reinforcing member and lifts the sliding mould connected thereto.

3. A fluid-operated lifter for sliding forms for moulding concrete walls reinforced by vertical iron rods, comprising, in combination, a frame for connection to a form to be lifted, at least two sets of gripping members, a head for each set of gripping members having inclined surfaces arranged to engage the corresponding sets of gripping members for forcing said gripping members to engage with said rod and for disengaging them therefrom, said sets of gripping members being arranged vertically one above the other and movable in relation to each other and to said rod, a fluid-operated motor arranged between the sets of gripping members, a portion of said motor and a cooperating element forming a ball-and-socket joint between said sets of gripping members and also forming a plane transverse sliding joint between said sets of gripping members, said fluid-operated motor alternately lifting said sets of gripping members upwardly along the rod and engaging them therewith and disengaging them therefrom to cause said lifter to climb the rod and to lift the form.

4. A fluid-operated form lifter for sliding forms for moulding concrete walls having a vertically disposed reinforcing members comprising in combination a frame for connection to a form to be lifted, two sets of wedge-shaped claws having cam faces, two claw heads having inclined cam faces arranged to engage the cam faces of claws of the respective claw sets, said sets of claws being arranged vertically one above the other and capable of moving relatively to each other as well as relative to said vertical reinforcing member, a fluid-operated motor arranged between the sets of claws, a portion of said motor and a cooperating element forming a ball-and-socket joint between said sets of wedge-claws, so that said wedge-shaped claws are able to adapt themselves to different deflections of the said vertical member under the load of the sliding moulds, for moving the upper set of claws upwardly and then drawing the lower set of claws upwardly for causing the form lifter to climb the reinforcing member and lift a form connected thereto.

5. A fluid-operated lifter for sliding forms for moulding concrete walls having vertically disposed reinforcing rods comprising in combination, a frame for connection to a form to be lifted, at least two sets of wedge-shaped claws having cam faces, a claw head for each set of claws having inclined cam faces or arranged to engage the cam faces of the corresponding sets of claws for forcing said claws to engage said rod and for disengaging them therefrom, said sets of claws being arranged vertically one above the other and movable in relation to each other and to said rod, a fluid-operated motor arranged between the sets of claws, a portion of said motor and a cooperating element forming a ball and socket joint between said claw-heads, said fluid motor lifting an upper set of claws and its claw head upwardly for engaging the rod at a higher point and for then drawing a lower set of claws and its claw head upwardly, so that the form lifter climbs the rod and lifts a form connected thereto.

6. A fluid-operated lifter for sliding forms for moulding concrete walls reinforced by vertical iron rods, comprising in combination, a frame for connection to a form to be lifted, at least two sets of wedge-shaped claws, having cam faces, a claw head for each set of claws having inclined cam faces arranged to engage the cam faces of the corresponding sets of claws for forcing said claws to engage with a reinforcing rod and for disengaging them therefrom, said sets of claws being arranged vertically one above the other and movable in relation to each other and to said rod, a fluid-operated motor arranged between the sets of claws, a portion of said motor and a cooperating element forming a ball-and-socket joint between said sets of claws, a vertical pipe rigidly secured to said lifter and narrowly enclosing said rod, said fluid actuated motor alternately moving said sets of claws upwardly to cause the lifter to climb up said rod and lift the form.

7. A fluid-operated lifter for sliding forms for moulding concrete walls reinforced by vertical iron rods comprising in combination, a frame for connection to a form to be lifted, at least two sets of wedge-shaped claws having cam faces, a claw head for each set of claws having inclined cam faces arranged to engage the cam faces of the corresponding sets of claws for forcing said claws to engage with said rod and for disengaging them therefrom, said sets of claws being arranged vertically one above the other and movable in relation to each other and to said rod, a fluid-operated motor ararnged between the sets of claws, a portion of said motor and a cooperating element forming a ball-and-socket joint between said sets of claws, said fluid-operated motor alternately lifting said sets of claws upwardly along the rod to cause said lifter to clamb the rod and to lift the form.

8. A fluid-operated lifter for sliding forms for moulding concrete walls reinforced by vertical iron rods, comprising in combination, a frame having means for connecting it with a form to be lifted, at least two sets of wedge-shaped claws having inclined cam faces, a claw head for each set of claws having inclined cam faces arranged to engage the cam faces of the claws of their corresponding sets for forcing said claws to engage said rod and for disengaging them therefrom, said sets of claws being arranged vertically one above the other and movable in relation to each other and to said rod, a fluid-operated motor arranged between the sets of claws, a portion of said motor and a cooperating element forming a ball-and-socket-connection between said piston and one of said claw-heads.

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