

May 13, 1952

C. F. BALL
JACK MECHANISM

2,596,462

Filed Nov. 21, 1947

3 Sheets-Sheet 1

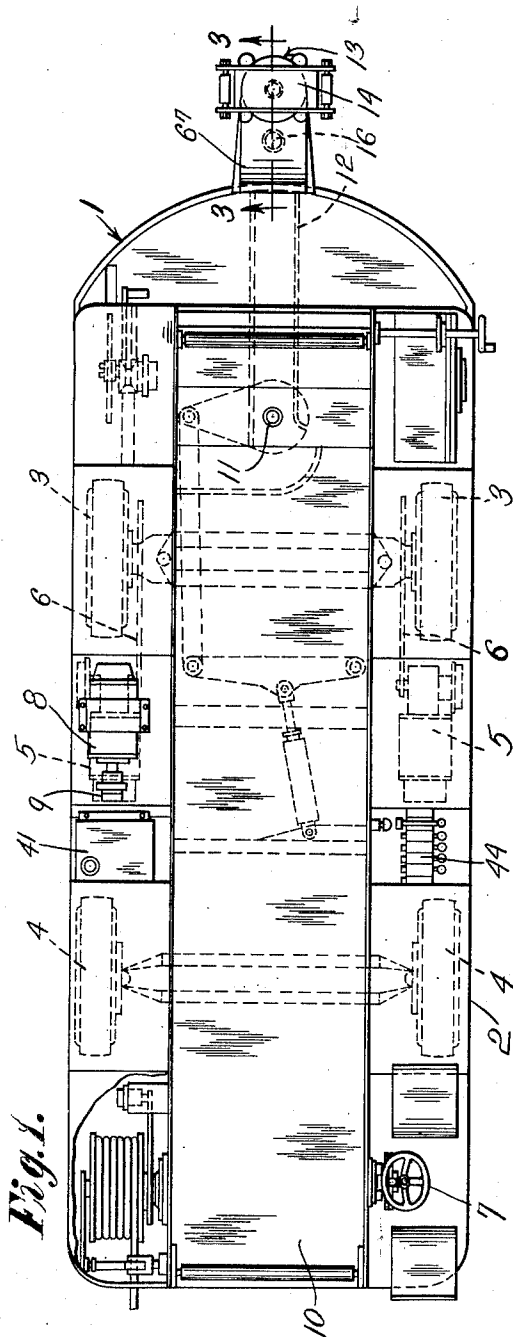
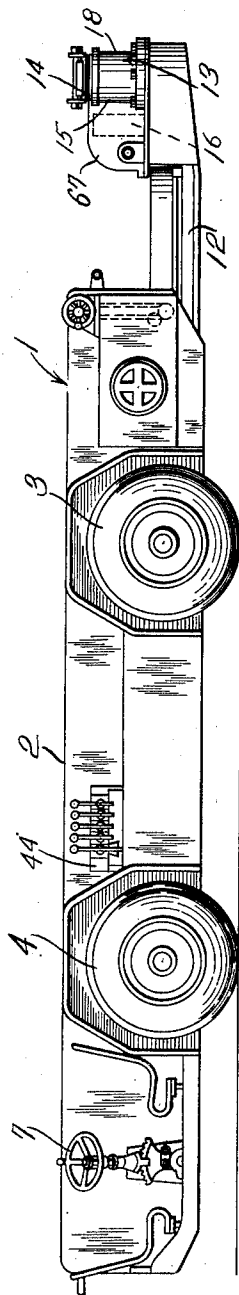


Fig. 2.



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Fig. 3.

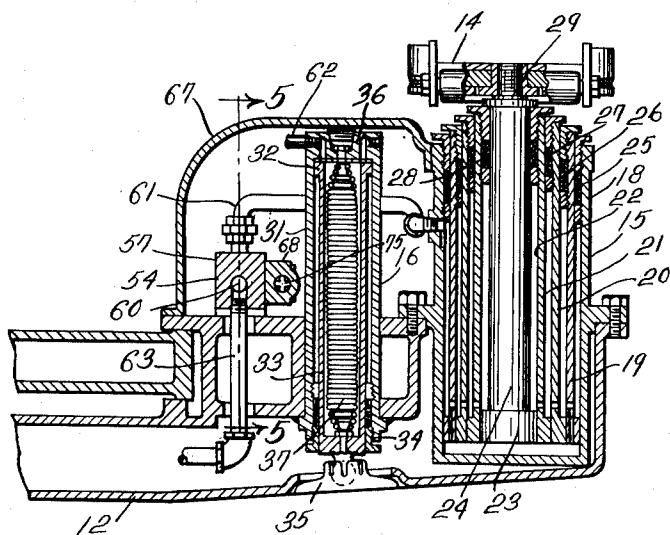
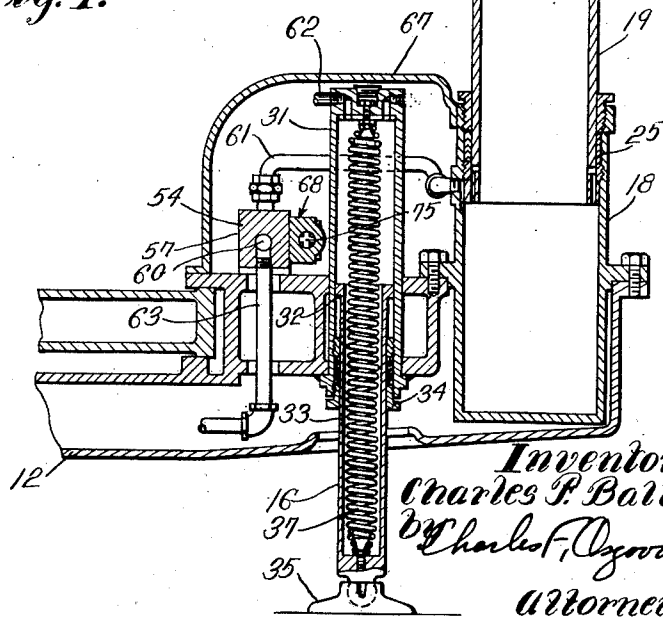


Fig. 4.



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UNITED STATES PATENT OFFICE

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JACK MECHANISM

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This invention relates to jack mechanisms and more particularly to an improved elevating and floor jack mechanism especially designed for use in a timber setting machine for elevating mine timbering elements up against a mine or tunnel roof and for holding the timbering elements in position during setting thereof.

In an earlier form of timber setting machine, there is provided a fluid operated elevating jack for raising a mine timbering element against the roof and a fluid operated floor jack for providing a stable bottom support for the elevating jack during the setting of the timbering element. These jacks were provided with independent control valves. In such machines, in the event that upon raising of the timbering element it was found that a small bodily movement of the elevating jack was necessary to get the timber into just the right place, if there had been an extension of the floor jack, it was frequently necessary to release the fluid from the floor jack and effect its retraction in order for the bodily adjustment to be made. Thus the operator, with the independent controls of the two jacks, if he extended the floor jack and then found the timbering element was not going to move to the desired position, frequently had to retract the floor jack. Again, if the bottom jack be supplied with fluid first, it may move down a little too far and lift the front end of the truck off the bottom, this being not an improbability because the instant when the jack engages the bottom cannot be observed. Further, if the operator raised the timbering element without the supply of fluid to the floor jack, he needed to be on his guard to open the fluid supply to the floor jack at just the right moment, and if the lifting jack is set without setting the floor jack tilting of the whole apparatus and the imposition of serious strains, transverse to the jack axis, on the lifting jack are likely to occur. The present invention contemplates an improvement over the earlier machine in the provision of an auxiliary automatic control in conjunction with the fluid supply system for the elevating jack such that direct operator control of but one manually operable valve is necessary for the proper extension of both jacks, a bypass valve responsive to pressure conditions existing in the elevating jack being provided for controlling the flow of fluid to the floor jack, so that when the timbering element reaches the roof and movement of the elevating jack is resisted enough to cause the building up of a predetermined pressure in the elevating jack, fluid will automatically be supplied to the floor jack. In the preferred embodiment of the invention, the feature of possible independent control of the floor jack is retained, though it may be employed only occasionally. With my invention, after the elevat-

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ing jack has operated to raise the timbering element against the roof, the floor jack is always automatically operated to provide a proper bottom support for the elevating jack without any operation, by the operator, of a separate control valve, and at the same time, the operation of the floor jack is delayed in the normal operation of the machine until after any bodily repositionings of the elevating jack have been effected and until the support of the floor jack needs to be supplied.

An object of the present invention is to provide an improved jack mechanism. Another object is to provide an improved elevating and floor jack mechanism including an elevating jack and a floor engaging jack and improved means for effecting operation of the jacks in a predetermined manner. A further object is to provide improved fluid operated elevating and floor jacks and improved control valve mechanism whereby only when the elevating jack is extended and its movement is resisted in a predetermined manner, the floor jack is automatically operated to provide a stable bottom support for the elevating jack. Yet another object is to provide an improved control valve mechanism for the elevating floor jacks whereby when the elevating jack is resisted by the work and the pressure of the fluid therein has built up a predetermined amount, the valve mechanism is automatically operated to supply pressure fluid to the floor jack to extend the latter into engagement with the floor. These and other objects and advantages of the invention will, however, hereinafter more fully appear.

In the accompanying drawings there is shown for purposes of illustration one form which the invention may assume in practice.

In these drawings:

Fig. 1 is a top plan view of a timber setting machine in which an illustrative form of the improved jack mechanism is embodied.

Fig. 2 is a side elevational view of the timber setting machine shown in Fig. 1, with the elevating and floor jacks in collapsed position.

Fig. 3 is an enlarged vertical sectional view taken substantially on line 3—3 of Fig. 1, illustrating details of the jack mechanism.

Fig. 4 is a sectional view similar to Fig. 3, showing the elevating and floor jacks in operative extended position.

Fig. 5 is an enlarged vertical sectional view taken on line 5—5 of Fig. 3, showing the control valve mechanism.

Fig. 6 is a horizontal sectional view taken on line 6—6 of Fig. 5, showing the manual control valves and the automatic bypass valve.

Fig. 7 is a diagrammatic view showing the hydraulic fluid system.

In this illustrative construction, as shown in

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the drawings, the improved jack mechanism is embodied in a timber setting machine generally designated 1, which may be similar to that disclosed in a copending application to L. G. Felderman and A. S. Knoizen, Serial No. 746,832, filed May 8, 1947. Evidently, the improved jack mechanism may be embodied in machines of other types and may be employed for purposes other than timber setting.

The timber setting machine may assume various forms but is herein of the rubber-tired, wheel mounted type, and comprises a body 2 mounted on rear traction wheels 3, 3 and front steering wheels 4, 4. The traction wheels 3 are driven by suitable motors 5 through suitable transmission connections 6. The steering wheels are swiveled on the machine body in a conventional manner to turn horizontally, and are provided with suitable fluid operated steering gear controlled by a hand wheel 7 located in a recess providing the operator's station at one side of the front end of the machine body. A motor 8 drives a pump 9 to be later referred to. Extending centrally lengthwise of the machine body is a load carrying compartment 10 adapted to receive a load of mine timbering elements, such as cross timbers and props. Mounted on the machine body beneath the compartment to swing horizontally about a vertical axis at 11 is a horizontal arm 12 carrying, at its outer extremity, the improved jack mechanism, herein generally designated 13, which supports a horizontal timber receiving support or saddle 14. A timber may be moved lengthwise from the compartment 10 onto the saddle 14, and when the saddle is elevated slightly by the jack mechanism to position the mine timber above the top of the machine body, the timber may be turned with the saddle into a position crosswise of the machine body in the manner fully disclosed in the application above referred to. The jack mechanism may then be operated, in the manner also fully disclosed in the above mentioned application, to bring the mine timber up against the mine or tunnel roof and to hold it there during setting of the uprights or props.

The jack mechanism 13 may assume various forms but herein includes a telescopic elevating jack 15 and an extensible floor jack 16, both jacks being mounted on the horizontal arm 12. The elevating jack comprises a vertical fluid cylinder 18 suitably rigidly secured to the horizontal arm 12 and containing a series of cylinder and piston sections 19, 20 and 21 arranged in telescopic relation and each having a piston portion and a tubular piston rod portion. Reciprocable in the bore 22 of the inner section 21 is a piston 23 having a piston rod 24. The outer cylinder 18 and the sections 19, 20 and 21 carry suitable packings 25, 26, 27 and 28 sealingly engaging the several piston rod peripheries to prevent fluid leakage. The means for supplying fluid to and exhausting fluid from these cylinders will later be fully described. The inner upwardly extending piston rod is secured at 29 to and supports the saddle 14. The floor jack 16 includes a vertical cylinder 31 rigidly secured to the arm 12 at the inner side of the elevating jack, and contained in this cylinder is a reciprocable piston 32 having a piston rod 33 projecting downwardly through the lower packed head 34 of the cylinder. Secured to the lower end of the piston rod is a footpiece 35 engageable with the floor. Arranged within the piston rod and cylinder and attached to

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the upper cylinder head 36 is a coil spring 37 for retracting the piston, thereby to raise the footpiece from the floor. Evidently, the floor engaging jack may be arranged coaxially with the elevating jack, if desired; and also other types of elevating and floor engaging jacks may replace those disclosed, for example, power operated reversible screw jacks—such as, but without limit thereto, such jacks operated by hydraulic motors.

Now referring to the hydraulic fluid system shown diagrammatically in Fig. 7, it will be noted that the pump 9, driven by the motor 8, has its intake or suction side connected by a conduit 40 to a tank or reservoir 41, mounted on the machine body and herein containing a liquid, preferably a light lubricating oil. The pump discharge is connected by a conduit 42 to the supply passage of a valve box 43 of a conventional valve mechanism 44 which is mounted at one side of the machine body. The discharge passage of the valve box is connected by a conduit 45 back to the tank. The valve box is herein preferably made up in several sections, and the sections 46 and 47 have bores containing conventional slide valves 48 and 49 respectively of the balanced spool type and respectively having suitable operating handles. A valve box section 50 contains a conventional relief valve 51 which is set to open when a maximum predetermined pressure, say 800#, is attained in the fluid system. The bores of the valve box sections 46 and 47 are respectively connected by conduits 52 and 53 which pass through the arm 12 and which lead to a hand valve device 54 mounted on the arm 12 at the inner side of the floor jack 16, as shown. The conduits 52 and 53 respectively have check valves 55 and 56 which permit fluid flow toward the valve device 54 but prevent reverse flow. The valve device 54 may assume various forms but is herein similar to the hand valve device fully described in the copending application above referred to, and herein comprises a horizontal casing 57 having end chambers 58 and 59 connected by a transverse passage 60. A conduit 61 connects the end chamber 58 to the lower end of the fluid cylinder 18 of the elevating jack 15, and a conduit 62 connects the other end chamber 59 to the upper end of the fluid cylinder 31 of the floor engaging jack 16. A return conduit 63, also passing through the arm 12, connects the transverse passage 60 with the suction conduit 40 of the pump. Hand operated valves 64 and 65, herein of the end seating type, independently control the communication of the passage 60 with the end chambers 58 and 59 respectively. A suitable housing 67, mounted on the arm 12, encloses the fluid cylinder 31 and the valve device 54 and is provided with suitable side openings to permit access to the handles of the hand valves 64 and 65. When the hand valves 64 and 65 are closed, pressure fluid may flow under the control of the slide valves 48 and 49 through conduits 52 and 53, through the end chambers 58 and 59 of the valve device 54, and thence through conduits 61 and 62 to the elevating and floor jacks 15 and 16. When the slide valves 48 and 49 are returned to central position, the check valves 55 and 56 automatically prevent reverse fluid flow from the elevating and floor jacks, and when the valves 64 and 65 are open, the elevating and floor jack cylinders are connected to the suction side of the pump through passage 60 and conduits 63 and 40, thereby to effect rapid retraction or collapse of the jacks. Thus, the valve device 54 may serve to vent the

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jack cylinders and the valves 64 and 65 are normally closed during operation of the jacks. Extension of the jacks is controlled by the slide valves 48 and 49, and the automatic check valves 55 and 56 serve, by precluding reverse flow, to lock the jacks in extended position when the valves 48 and 49 are returned to neutral position. Evidently, the valve device 54 may be constructed to vent the jack cylinders in other known manners, as for example, directly back to the liquid reservoir.

In accordance with this invention, associated with the hand valve device 54, is an improved delayed action, bypass valve device generally designated 68, which, in a novel manner, is adapted to delay flow of pressure fluid to the floor jack 16 until the elevating jack 15 is extended to bring the mine timber up against the roof, and its upward movement is resisted. This bypass valve device comprises a casing 69 attached to one side of the valve casing 57 and has passages 70 and 71 communicating with passages 72 and 73 in the valve casing 57. Passages 72 and 73 respectively communicate with the end chambers 58 and 59. A port 74 connects the passage 70 with the passage 71, and flow through this port is controlled by an end seating valve 75 normally held closed by a coil spring 76. The valve 75 is set to open when a predetermined pressure, say 100#, is attained in the elevating jack. When the hand valves 64 and 65 are closed, as shown in Figs. 5 and 6, the slide valve 49 may be operated to supply pressure fluid through conduit 53 to the end chamber 58 and through conduit 61 to the elevating jack 15 to effect extension thereof, thereby to bring a timbering element supported by the saddle 14 up against the roof; and when extension of the elevating jack is resisted by the roof, the pressure of the fluid therein builds up further, thereby building up the pressure in conduit 61 and chamber 58, passage 72 and passage 70, causing the valve 75 to be unseated against the action of the spring so that fluid may flow through port 74 to passage 71 and thence through passage 73, end chamber 59 and conduit 62 to the upper end of the floor jack cylinder 31, thereby moving the piston 32 downwardly to bring the footpiece 35 firmly in engagement with the floor. When the mine timber is firmly held in position against the roof, with the elevating jack exerting its maximum pressure, the valve 49 may be moved to central position and the automatic check valve 55 at that time traps the fluid in the jack cylinders firmly to hold the jacks in position during setting of the mine timber. When the timber is properly set, the hand valves 64 and 65 are opened so that fluid may flow from the jack cylinders, through end chamber 58, transverse passage 60, conduit 63 to the suction side of the pump, thereby to effect collapse of the jacks. It is accordingly evident that, by the provision of the delayed action, bypass valve, only when the elevating jack is extended under the control of the slide valve 49 and its movement is resisted a predetermined amount, is the floor jack operated. If desired, however, the elevating and floor jacks may be independently operated under the control of the hand valves 64 and 65 and the slide valves 48 and 49, in the manner fully disclosed in the above mentioned depending application. However, in this instance, the slide valve 48 and its associated connections may be omitted, with the slide valve 49 controlling both jacks.

As a result of this invention, an improved jack mechanism is provided having improved automatic control means whereby the jack mecha-

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nism may be operated in a predetermined manner. By the provision of the improved automatic, delayed action, bypass valve means, the floor jack is extended only after the elevating jack has been extended in a predetermined manner so that a mine timbering element may be properly positioned before the floor jack is operated. Whenever the elevating jack is operated to bring a mine timbering element up against the roof under the control of the single slide valve, and further extension of the elevating jack is resisted by the roof, the bypass valve is automatically operated by the built-up pressure in the elevating jack to effect extension of the floor jack wholly without manual intervention. By always operating the floor jack automatically when the elevating jack is moved into a predetermined extended position, an extremely stable bottom support is provided for the elevating jack so that the mine timbering elements may be firmly held against the roof during setting thereof. These and other advantages of the invention will, however, be clearly apparent to those skilled in the art.

While there is in this application specifically described one form which the invention may assume in practice, it will be understood that this form of the same is shown for purposes of illustration and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. In a jack mechanism, the combination comprising a pair of cooperating, relatively movable, power operated, extensible roof and floor jacks, power operated means for operating said jacks respectively, means for supplying power medium to said operating means of said roof jack to extend the latter, and means operatively connected to said operating means for said jacks for effecting supply of power medium thereto and including control means automatically responsive to a predetermined load applied to said roof jack upon resistance thereof by the roof for effecting delayed supply of power medium to said floor jack to extend the latter into engagement with the floor only after the roof jack is resisted by the roof.

2. In a jack mechanism, the combination comprising a pair of cooperating, relatively movable, extensible, fluid operated roof and floor jacks, fluid operating means for said jacks respectively, means for supplying operating fluid to said operating means for said roof jack, and means including fluid operated control valve means subjected to the pressure of the fluid in said operating means for said roof jack and automatically responsive to predetermined pressure conditions in said operating means for said roof jack for automatically effecting delayed supply of operating fluid to said operating means for said floor jack to extend the latter into engagement with the floor only when said roof jack assumes a predetermined load.

3. In a jack mechanism, the combination comprising a pair of cooperating, relatively movable, fluid operated, roof and floor jacks, fluid operating means for said jacks respectively, means for supplying pressure fluid to said operating means for said roof jack to move the latter upwardly toward the roof, and means operatively connected to said jacks for supplying fluid to said operating means and including an automatic by-

pass valve subjected to the pressure of the fluid in said operating means for said roof jack and automatically responsive to predetermined pressure conditions in said operating means for said roof jack for effecting delayed supply pressure fluid to said operating means for said floor jack to move the latter into engagement with the floor only when said roof jack is resisted by the roof.

4. In a jack mechanism, the combination comprising a power operated elevating jack for elevating a load, a relatively movable power operated floor engaging jack providing a bottom support for said elevating jack, power operating means for said jacks respectively, and means for supplying power to said jack operating means, first to said operating means for said elevating jack and only thereafter to said operating means for said floor engaging jack and including control means for automatically effecting supply of power medium to said operating means for said floor engaging jack only when said elevating jack is resisted a predetermined amount by the work.

5. In a jack mechanism, the combination comprising a fluid operated elevating jack, a relatively movable, fluid operated, floor engaging jack providing a bottom support for said elevating jack, fluid operating means for said jacks respectively, means for supplying pressure fluid to said operating means for said elevating jack to operate the latter, and means including valve means subjected to the pressure of the fluid in said operating means for said elevating jack and automatically responsive to predetermined pressure conditions in said operating means for said elevating jack and effective only when said elevating jack is resisted a predetermined amount by the work for effecting pressure fluid supply to said operating means for said floor engaging jack, whereby said floor engaging jack is operated only after said elevating jack assumes a predetermined load.

6. In a jack mechanism, the combination comprising a support, a pair of cooperating fluid operated, oppositely acting, roof and floor jacks carried by said support, fluid operating means for said jacks respectively, a source of pressure fluid, supply means for conducting pressure fluid from said supply source to said operating means for said roof jack, and supply means including a delayed action by-pass valve subjected to the pressure of the fluid in said operating means for said roof jack and automatically responsive to a predetermined pressure in said first mentioned supply means for automatically effecting pressure fluid supply to said operating means for said floor jack, whereby said floor jack is operated only after said roof jack assumes a predetermined load to prevent inadvertent lifting of said support.

7. In combination, a power operated elevating mechanism adapted to lift a load, a relatively movable, power operated, extensible support providing a bottom brace for said elevating mechanism when the work load thereon assumes a predetermined degree, power operating means for said elevating mechanism and said extensible support respectively, means for effecting operation of said operating means for said elevating mechanism to effect lifting of a load, and means automatically effective only when said elevating mechanism attains a predetermined

condition as the result of predetermined resistance to load movement for effecting operation of said operating means for said adjustable support to move the latter into position to brace said elevating mechanism only after said latter mechanism assumes a predetermined operating load.

8. In combination, a power operated elevating mechanism, a relatively movable, power operated, extensible support for said elevating mechanism, power operating means for said elevating mechanism and said extensible support respectively, and means including a control element automatically responsive to load conditions on said operating means of said elevating mechanism for effecting operation of said operating means for said elevating mechanism and said extensible support, first one and then the other, always in a definite sequence.

9. In combination, a power operated elevating mechanism, a relatively movable, power operated, extensible support movable downwardly into engagement with a supporting surface for supporting said elevating mechanism, power operating means for said elevating mechanism and said extensible support respectively, means for first effecting operation of said operating means for said elevating mechanism to elevate the latter, and means automatically effective only when movement of said elevating mechanism is resisted a predetermined amount by the work for effecting operation of said operating means for said extensible support, whereby lowering of said support is prevented until said elevating mechanism meets a predetermined resistance to upward movement.

10. In combination, a fluid operated elevating mechanism, a relatively movable, fluid operated, extensible support for said elevating mechanism, fluid operating means for said elevating mechanism and said extensible support respectively, and control means for first effecting a supply of pressure fluid to said operating means for said elevating mechanism to elevate the latter and thereafter effecting a supply of pressure fluid to said operating means for said extensible support to extend the latter, said control means including a fluid actuated valve subjected to the pressure of the fluid in said operating means for said elevating mechanism and automatically responsive to pressure conditions in said operating means for said elevating mechanism for controlling fluid supply to said operating means for said extensible support, whereby said support is extended only after said elevating mechanism meets a predetermined resistance to movement.

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