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LIFTING DEVICE

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Fig.1

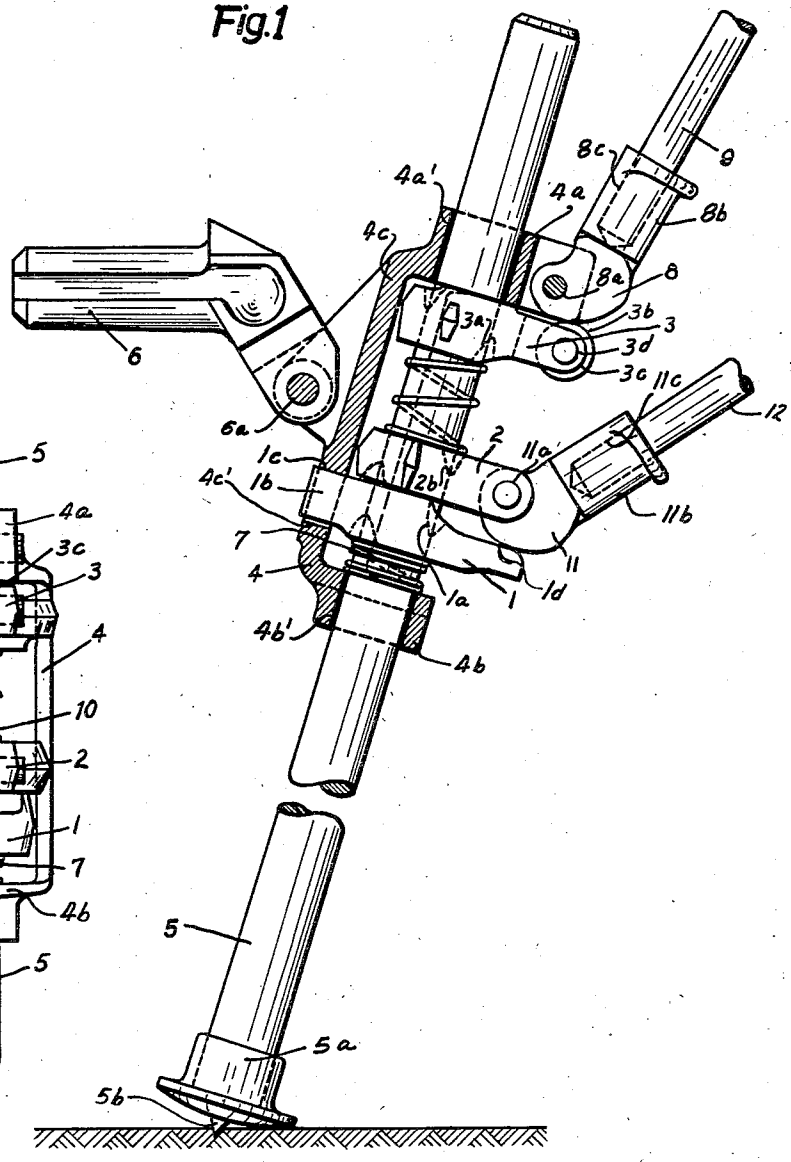
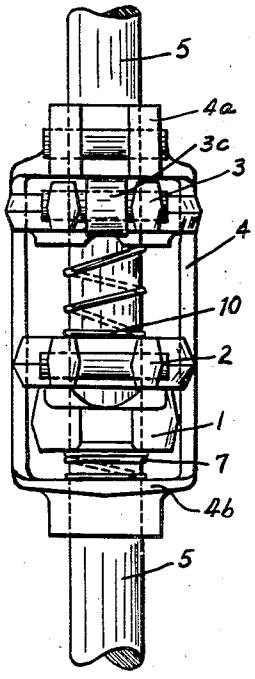


Fig.2



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LIFTING DEVICE

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8 Claims. (Cl. 254—107)

The present invention relates to a lifting device or jack.

More particularly, the present invention relates to a lifting device or jack by means of which a load may be raised or lowered in a step-wise manner.

There exist lifting devices capable of raising and lowering loads in a step-wise manner wherein the arrangement of the parts is such that a lever is continuously moved to and fro or oscillated so as to bring about step-wise raising or lowering. It has been found, however, that in existing lifting devices there exists danger that the load acts in such a manner as to overcome the normal step-wise operation of the device so that during raising and more frequently during lowering the load will fall in one uninterrupted movement. This is undesirable, not only from the point of view of safety, but also inasmuch as rapid and unchecked descent of the load may very easily damage the same.

It is therefore an object of the present invention to provide a lifting device or jack which overcomes the above disadvantages.

It is another object of the present invention to provide a lifting device or jack by means of which a load may be raised and lowered in a step-wise manner.

It is yet another object of the present invention to provide a lifting device or jack which under all circumstances prevents rapid and uncontrolled descent of the load supported by the lifting device.

The objects of the present invention also include the provision of a lifting device which is sturdy, which comprises a minimum number of parts, which may be built at very low cost, and which will give long periods of trouble free service.

With the above objects in view, the present invention mainly resides in a jack which includes an elongated shaft and a work member mounted on the shaft for sliding movement relative thereto in opposite directions. A first clamping member is arranged on the shaft and is movable relative thereto between an unclamping position wherein the first clamping member is freely slidable relative to the shaft and a clamping position wherein the first clamping member wedgingly engages the shaft in such a manner that sliding movement of the first clamping member in one direction is prevented. The first clamping member cooperates with the work member in such a manner that when a force in the one direction is exerted on the work member, the same engages the first clamping member and tends to move the same in the one direction but also moves the same into and tends to maintain the same in its clamping position. A second clamping member is also arranged on the shaft and is movable relative thereto between an unclamping position wherein the second clamping member is freely slidable relative to the shaft and a clamping position wherein the second clamping member wedgingly engages the shaft in such a manner that sliding movement of the clamping member in the opposite direction is prevented. The second clamping member has a tendency

normally to occupy its unclamping position. First moving means are adapted to be interposed between the first and second clamping members for first moving the second clamping member into its clamping position and for thereafter moving the first clamping member into its unclamping position against the effect of a force acting on the work member in the one direction and consequently acting on the first clamping member to move the same into and to maintain the same in its clamping position. Thus, the force is permitted to move the work member and the first clamping member relative to the shaft in the one direction a distance which is just short of sufficient to move the first clamping member out of engagement with the first moving means whereupon the first clamping member is again moved into and maintained in its clamping position by the force acting on the work member in the one direction, thereby preventing further movement of the work member relative to the shaft in the one direction.

A third clamping member is also arranged on the shaft and is movable relative thereto between an unclamping position wherein the third clamping member is freely slidable relative to the shaft and a clamping position wherein the third clamping member wedgingly engages the shaft in such a manner that sliding movement of the third clamping member in the one direction is prevented. The third clamping member has a tendency normally to occupy its unclamping position. Second moving means are adapted to be interposed between the third clamping member and the work member for first moving the third clamping member into its clamping position and for thereafter moving the work member relative to the shaft in the opposite direction against the effect of a force acting on the work member in the one direction.

This application is a continuation-in-part application of my copending application Serial No. 255,406, filed November 8, 1951, now Patent No. 2,731,842.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

Fig. 1 is a side elevational view, partly in section, of a preferred embodiment of the present invention; and

Fig. 2 is a front elevational view of the embodiment illustrated in Fig. 1.

Referring now to the drawing, there is shown a preferred embodiment of a lifting device or jack according to the present invention. The jack includes a substantially vertical elongated shaft 5 which has a base portion 5*a* adapted to rest on the ground. If desired, a point 5*b* may be provided which is adapted to penetrate the surface upon which the jack rests so as to prevent sliding of the base portion 5*a*.

A bifurcated support member 4 is mounted on the shaft for upward and downward sliding movement relative thereto. The support member 4 has a pair of spaced substantially horizontal upper and lower prongs 4*a* and 4*b* which are respectively formed with apertures 4*a'* and 4*b'* therethrough. The apertures are aligned with each other and surround the shaft 5 in such a manner that the support member 4 is freely slidable relative to the shaft in opposite directions. The support member 4 additionally has a substantially vertical portion 4*c* which joins the upper and lower prongs 4*a* and 4*b*. The portion 4*c* is formed with a recess or opening 4*c'* which constitutes a receiving means the purpose of which will be described below.

A support element 6 is connected to the support mem-

ber 4 and may be pivoted thereon as shown at 6a. The element 6 may be inserted into a receiving sleeve or the like which forms part of the load to be raised and lowered by the jack.

The jack further includes first, second and third clamping members 1, 2 and 3 which are arranged between the prongs 4a and 4b as is clearly shown in the drawing. The clamping member 1 is formed with an aperture 1a therethrough which surrounds the shaft 5 and which is so shaped that the clamping member 1 is movable relative to the shaft between an unclamping position wherein the clamping member 1 is freely slidable relative to the shaft and a clamping position wherein the clamping member 1 wedgingly engages the shaft in such a manner that downward sliding movement of the clamping member 1 is prevented. The clamping member 1 is formed with a projecting portion 1b which is adapted to be received by the receiving means 4c' in such a manner that the support member 4 is supported by the clamping member 1 at 1c. A coil spring 7 is interposed between and abuts against the lower prong 4b and the clamping member 1 for urging the latter upwardly.

It will be seen that the clamping member 1 cooperates with the support member 4 in such a manner that when a downward force is exerted on the support member, as, for example, when the jack supports a load, the support member 4 engages the clamping member 1 and tends to move the same downwardly. Additionally, the support member moves the clamping member 1 into and tends to maintain the same in its clamping position.

The clamping member 2 is formed with an aperture 2b therethrough and is arranged above the clamping member 1 and between the latter and the upper prong 4a. The aperture 2b surrounds the shaft 5 and is so shaped that the clamping member 2 is movable relative to the shaft between an unclamping position wherein the clamping member 2 is freely slidable relative to the shaft and a clamping position wherein the clamping member 2 wedgingly engages the shaft in such a manner that upward sliding movement of the clamping member 2 is prevented. The clamping member 2 has a tendency normally to occupy its unclamping position, but a coil spring 10 may be interposed between and abutting against the clamping members 2 and 3 for constantly urging the former into its unclamping position. The effect of the coil spring 10 upon the clamping member 3 will be discussed below.

The third clamping member 3 is formed with an aperture 3a therethrough and is arranged below the upper prong 4a and between the latter and the clamping member 2. The aperture 3a surrounds the shaft 5 and is shaped so that the clamping member 3 is movable relative to the shaft between an unclamping position wherein the clamping member is freely slidable relative to the shaft and a clamping position wherein the clamping member 3 wedgingly engages the shaft in such a manner that downward sliding movement of the clamping member 3 is prevented. The clamping member 3 may have a tendency normally to occupy its unclamping position, but may be constantly urged thereinto by the coil spring 10 which is interposed between the clamping members 2 and 3.

It will be seen from the above that when the jack is supporting a load (not shown) which exerts a downward force on the support member 4, the clamping members will occupy the following rest positions which are shown in Fig. 1: The clamping member 1 will, under the influence of the downward force acting on the support member 4 and transmitted to the clamping member 1 at 1c, occupy its clamping position wherein the clamping member 1 is wedged against downward movement and is consequently able to support the support member 4, whereas the clamping members 2 and 3 occupy their respective unclamping positions.

Suitable moving means are provided for raising and lowering the support member 4, in a step-wise manner, from the rest position shown in Fig. 1.

The moving means for lowering the support member 4 are constituted by a double-armed lever or cam 11 which is pivotally mounted on the clamping member 2 at 11a and which is adapted to engage a cam surface 1d which is formed on the clamping member 1. When the cam 11 is pivoted in a clockwise direction, it is interposed between the clamping members 1 and 2. The arrangement of the parts is such that the clamping member 2 is first moved into its clamping position against the action of the spring 10 so that the clamping member 2 is wedged against upward movement. With upward movement of the clamping member 2 being prevented, the clamping member 1 is thereupon moved out of its clamping position into its unclamping position against the effect of the downward force acting on the support member 4 and consequently acting on the clamping member 1 to maintain the same in its clamping position. Inasmuch as the clamping member 1 is now no longer wedged against downward movement, the downward force acting on the support member 4 is permitted to move the support member 4 as well as the clamping member 1 downwardly relative to the shaft 5. It will be understood, however, that once this downward force has moved the clamping member 1 downwardly a distance which is just short of sufficient to move the clamping member 1 out of engagement with the cam 11, the downward force acting on the support member 4 will once again move the clamping member 1 into and maintain it in its clamping position, thereby preventing further downward movement of the support member 4 relative to the shaft 5. This will be readily understood when it is kept in mind that the cam 11 or other moving means interposed between the clamping members 1 and 2 is relied on to maintain the clamping member 1 in its unclamping position during downward movement of the support member 4 and the clamping member 1. But for the action of the cam 11, the clamping member 1 is maintained in its unclamping position by the downward force acting on the support member 4. In practice, therefore, once the cam has been pivoted in a clock-wise direction, the downward movement of the support member 4 and the clamping member 1 will cease while there is still some physical contact between the cam 11 and the cam surface 1d of the clamping member 1.

In order to continue the downward movement of the support member 4, the cam 11 is pivoted in a counter-clockwise direction out of engagement with the cam surface 1d. The clamping member 2 is thereupon free to return to its unclamping position and will move downwardly under the influence of its own weight and/or the influence of the spring 10 into abutting relationship with the clamping member 1 so that the parts will once again assume the position illustrated in Fig. 1. The cam 11 may thereupon again be pivoted in a clock-wise direction so as to move the clamping member 2 into its clamping position and the clamping member 1 into its unclamping position so that the above described cycle will be repeated.

It will be seen that the clamping member 3 which is normally in its unclamping position is free to move downwardly during the step-wise lowering of the support member 4.

If desired, the cam 11 may be formed with a sleeve portion 11b having a recess 11c which is adapted to receive therewithin the free end of a lever 12. The lever may be removably received within the recess 11c.

Additional moving means are provided for step-wise raising of the support member 4. These moving means may include a two-armed lever or cam 8 which is pivotally mounted on the upper prong 4a as indicated at 8a. The cam 8 is adapted to engage a cam surface 3b which may be constituted by the outer peripheral surface of a roller 3c which is rotatably mounted on the

clamping member 3 at 3*d*. When the cam 8 is pivoted in a clock-wise direction, it is interposed between the prong 4*a* and the clamping member 3 for first moving the latter into its clamping position against the action of the spring 10. Downward movement of the clamping member 3 is thus prevented so that during continued clock-wise rotation of the cam 8 the support member 4 is moved upwardly relative to the shaft 5 against the effect of the downward force acting on the support member. Inasmuch as the clamping members 1 and 2 are free to move upwardly, they will be so moved by the spring 7 which is interposed between the lower prong 4*b* and the clamping member 1. Thus, the clamping member 1 will at all times be maintained in engagement with the support member 4 at 1*c*, so that after the support member 4 has been raised a certain distance and the cam 8 is thereafter pivoted in a counterclock-wise direction, downward movement of the support member 4 will be prevented by the clamping member 1 which, as described above, is maintained in its clamping position by the effect of the downward force acting on the load. Thus, while in practice at least some physical contact is normally maintained between the cam 8 and the surface 3*b* of the roller 3*c* during counterclock-wise rotation of the cam 8, when the latter ceases to apply a substantial downward force on the roller 3*c*, the clamping member 3 will be moved upwardly into abutting engagement with the upper prong 4*a* and also into its unclamping position by the spring 10. The parts therefore, will once again assume the rest position illustrated in Fig. 1, and the above described elevating cycle may be repeated.

The cam 8 may be formed with a sleeve 8*b* having a recess 8*c* adapted to receive therewithin the free end of a lever 9. In practice, only one of the cams 8 and 11 will be actuated at any one time, so that the levers 9 and 12 may be constituted by the same element.

It will be seen from the above that when the jack supports a load, the same may be raised or lowered in a stepwise manner depending upon which of the moving means is actuated. Moreover, the arrangement of the parts is such that irrespective of whether the load is being raised or lowered, the same cannot undergo a continuous or other than step-wise descent.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of lifting devices differing from the types described above.

While the invention has been illustrated and described as embodied in a lifting device or jack for raising and lowering a load in a step-wise manner, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A jack comprising, in combination, an elongated shaft; a work member mounted on said shaft for sliding movement relative thereto in opposite directions; a first clamping member on said shaft and movable relative thereto between an unclamping position wherein said first clamping member is freely slidable relative to said shaft and a clamping position wherein said first clamping member wedgingly engages said shaft in such a manner that sliding movement of said first clamping member in one direction is prevented, said first clamping member cooperating with said work member in such a manner that when a force in said one direction is exerted on said work member, the same engages said first clamping member and tends to move the same in said one direction but also moves the same into and tends to maintain the same in its clamping position; a second clamping member on said shaft and movable relative thereto between an unclamping position wherein said second clamping member is freely slidable relative to said shaft and a clamping position wherein said second clamping member wedgingly engages said shaft in such a manner that sliding movement of said second clamping member in the opposite direction is prevented, said second clamping member having a tendency normally to occupy its unclamping position; first moving means adapted to be interposed between said first and second clamping members for first moving said second clamping member into its clamping position and for thereafter moving said first clamping member into its unclamping position against the effect of a force acting on said work member in said one direction and consequently acting on said first clamping member to move the same into and to maintain the same in its clamping position, thereby permitting the force to move said work member and said first clamping member relative to said shaft in said one direction a distance which is just short of sufficient to move said first clamping member out of engagement with said first moving means whereupon said first clamping member is again moved into and maintained in its clamping position by the force acting on said work member in said one direction, thereby preventing further movement of said work member relative to said shaft in said one direction; a third clamping member on said shaft and movable relative thereto between an unclamping position wherein said third clamping member is freely slidable relative to said shaft and a clamping position wherein said third clamping member wedgingly engages said shaft in such a manner that sliding movement of said third clamping member in said one direction is prevented, said third clamping member having a tendency normally to occupy its unclamping position; and second moving means adapted to be interposed between said third clamping member and said work member for first moving said third clamping member into its clamping position and for thereafter moving said work member relative to said shaft in said opposite direction against the effect of a force acting on said work member in said one direction.

2. A jack comprising, in combination, a substantially vertical elongated shaft; a support member mounted on said shaft for upward and downward sliding movement relative thereto; a first clamping member on said shaft and movable relative thereto between an unclamping position wherein said first clamping member is freely slidable relative to said shaft and a clamping position wherein said first clamping member wedgingly engages said shaft in such a manner that downward sliding movement of said first clamping member is prevented, said first clamping member cooperating with said support member in such a manner that when a downward force is exerted on said support member, the same engages said first clamping member and tends to move the same downwardly but also moves the same into and tends to maintain the same in its clamping position; a second clamping member on said shaft and movable relative thereto between an unclamping position wherein said second clamping member is freely slidable relative to said shaft and a clamping position wherein said second clamping member wedgingly engages said shaft in such a manner that upward sliding movement of said second clamping member is prevented, said second clamping member having a tendency normally to occupy its unclamping position; first moving means adapted to be interposed between said first and second clamping members for first moving said second clamping member into its clamping position and for thereafter

moving said first clamping member into its unclamping position against the effect of a downward force acting on said support member and consequently acting on said first clamping member to move the same into and to maintain the same in its clamping position, thereby permitting the downward force to move said support member and said first clamping member downwardly relative to said shaft a distance which is just short of sufficient to move said first clamping member out of engagement with said first moving means whereupon said first clamping member is again moved into and maintained in its clamping position by the downward force acting on said support member, thereby preventing further downward movement of said support member relative to said shaft; a third clamping member on said shaft and movable relative thereto between an unclamping position wherein said third clamping member is freely slidable relative to said shaft and a clamping position wherein said third clamping member wedgingly engages said shaft in such a manner that downward sliding movement of said third clamping member is prevented, said third clamping member having a tendency normally to occupy its unclamping position; and second moving means adapted to be interposed between said third clamping member and said support member for first moving said third clamping member into its clamping position and for thereafter moving said support member upwardly relative to said shaft against the effect of a downward force acting on said support member.

3. A jack comprising, in combination, a substantially vertical elongated shaft; a forked support member having a pair of spaced substantially horizontal upper and lower prongs each of which is formed with an aperture therethrough, said apertures being aligned with each other and surrounding said shaft in such a manner that said support member is slidable upwardly and downwardly relative to said shaft; a first clamping member formed with an aperture therethrough and arranged between said prongs, said last-mentioned aperture surrounding said shaft and being so shaped that said first clamping member is movable relative to said shaft between an unclamping position wherein said first clamping member is freely slidable relative to said shaft and a clamping position wherein said first clamping member wedgingly engages said shaft in such a manner that downward sliding movement of said first clamping member is prevented, said first clamping member cooperating with said support member in such a manner that when a downward force is exerted on said support member, the same engages said first clamping member and tends to move the same downwardly but also moves the same into and tends to maintain the same in its clamping position; a second clamping member formed with an aperture therethrough and arranged between said first clamping member and said upper prong, said last-mentioned aperture surrounding said shaft and being so shaped that said second clamping member is movable relative to said shaft between an unclamping position wherein said second clamping member is freely slidable relative to said shaft and a clamping position wherein said second clamping member wedgingly engages said shaft in such a manner that upward sliding movement of said second clamping member is prevented, said second clamping member having a tendency normally to occupy its unclamping position; first moving means adapted to be interposed between said first and second clamping members for first moving said second clamping member into its clamping position and for thereafter moving said first clamping member into its unclamping position against the effect of a downward force acting on said support member and consequently acting on said first clamping member to move the same into and to maintain the same in its clamping position, thereby permitting the downward force to move said support member and said first clamping member downwardly relative to said shaft a distance which is just short of sufficient to move said first clamping member out of engagement with said first moving means whereupon said first clamping member is again moved into and maintained in its clamping position by the downward force acting on said support member, thereby preventing further downward movement of said support member relative to said shaft; a third clamping member formed with an aperture therethrough and arranged between said second clamping member and said upper prong, said last-mentioned aperture surrounding said shaft and being so shaped that said third clamping member is movable relative to said shaft between an unclamping position wherein said third clamping member is freely slidable relative to said shaft and a clamping position wherein said third clamping member wedgingly engages said shaft in such a manner that downward sliding movement of said third clamping member is prevented, said third clamping member having a tendency normally to occupy its unclamping position; and second moving means adapted to be interposed between said third clamping member and said support member for first moving said third clamping member into its clamping position and for thereafter moving said support member upwardly relative to said shaft against the effect of a downward force acting on said support member.

4. A jack, comprising, in combination, a substantially vertical elongated shaft; a forked support member having a pair of spaced substantially horizontal upper and lower prongs each of which is formed with an aperture therethrough, said apertures being aligned with each other and surrounding said shaft in such a manner that said support member is slidable upwardly and downwardly relative to said shaft; a first clamping member formed with an aperture therethrough and arranged between said prongs, said last-mentioned aperture surrounding said shaft and being so shaped that said first clamping member is movable relative to said shaft between an unclamping position wherein said first clamping member is freely slidable relative to said shaft and a clamping position wherein said first clamping member wedgingly engages said shaft in such a manner that downward sliding movement of said first clamping member is prevented, said first clamping member cooperating with said support member in such a manner that when a downward force is exerted on said support member, the same engages said first clamping member and tends to move the same downwardly but also moves the same into and tends to maintain the same in its clamping position; a second clamping member formed with an aperture therethrough and arranged between said first clamping member and said upper prong, said last-mentioned aperture surrounding said shaft and being so shaped that said second clamping member is movable relative to said shaft between an unclamping position wherein said second clamping member is freely slidable relative to said shaft and a clamping position wherein said second clamping member wedgingly engages said shaft in such a manner that upward sliding movement of said second clamping member is prevented; a third clamping member formed with an aperture therethrough and arranged between said second clamping member and said upper prong, said last-mentioned aperture surrounding said shaft and being so shaped that said third clamping member is movable relative to said shaft between an unclamping position wherein said third clamping member is freely slidable relative to said shaft and a clamping position wherein said third clamping member wedgingly engages said shaft in such a manner that downward sliding movement of said third clamping member is prevented, said third clamping member having a tendency normally to occupy its unclamping position; spring means for constantly urging said second and third clamping members into their respective unclamping positions; first moving means adapted to be interposed between said first and second clamping members for first moving said second clamping member into its clamping position against the action of said spring means

and for thereafter moving said first clamping member into its unclamping position against the effect of a downward force acting on said support member and consequently acting on said first clamping member to move the same into and to maintain the same in its clamping position, thereby permitting the downward force to move said support member and said first clamping member downwardly relative to said shaft a distance which is just short of sufficient to move said first clamping member out of engagement with said first moving means whereupon said first clamping member is again moved into and maintained in its clamping position by the downward force acting on said support member, thereby preventing further downward movement of said support member relative to said shaft; and second moving means adapted to be interposed between said third clamping member and said support member for first moving said third clamping member into its clamping position against the action of said spring means and for thereafter moving said support member upwardly relative to said shaft against the effect of a downward force acting on said support member.

5. A jack as defined in claim 4 wherein said spring means are interposed between and abut against said second and third clamping members.

6. A jack as defined in claim 4, and additional spring means interposed between and abutting against said lower prong and said first clamping member for urging the latter into and maintaining the same in cooperation with said support member during upward movement thereof during actuation of said second moving means.

7. The combination defined in claim 6 wherein said first moving means are first camming means including a first cam mounted on said second clamping member for pivotal movement relative thereto and a first cam surface on said first clamping member and adapted to be engaged by said first cam, and wherein said second moving means are second camming means including a second cam mounted on said upper prong of said support member for pivotal movement relative thereto and a second cam surface on said third clamping member and adapted to be engaged by said second cam.

8. The combination defined in claim 6 wherein said support member has a substantially vertical portion joining said upper and lower prongs and formed with receiving means, and wherein said first clamping member is formed with projecting means adapted to be received by said receiving means in such a manner that said support member is supported by said first clamping member.

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