April 23, 1957 C. CARROLL 2,789,791

HOIST AND SAFETY MECHANISM THEREFOR

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FIG. 1

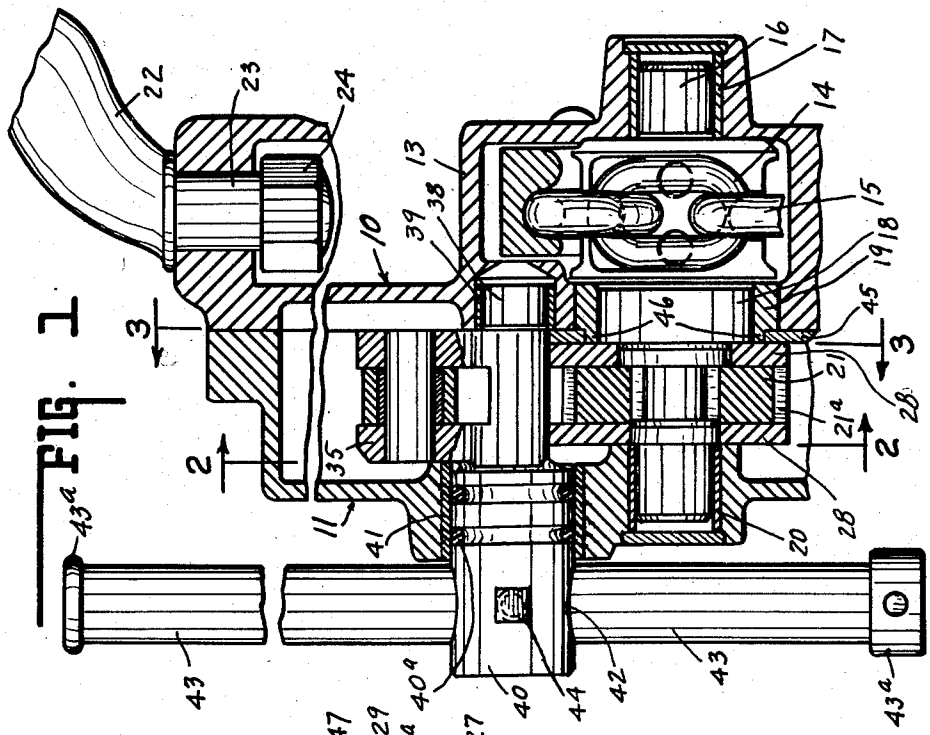
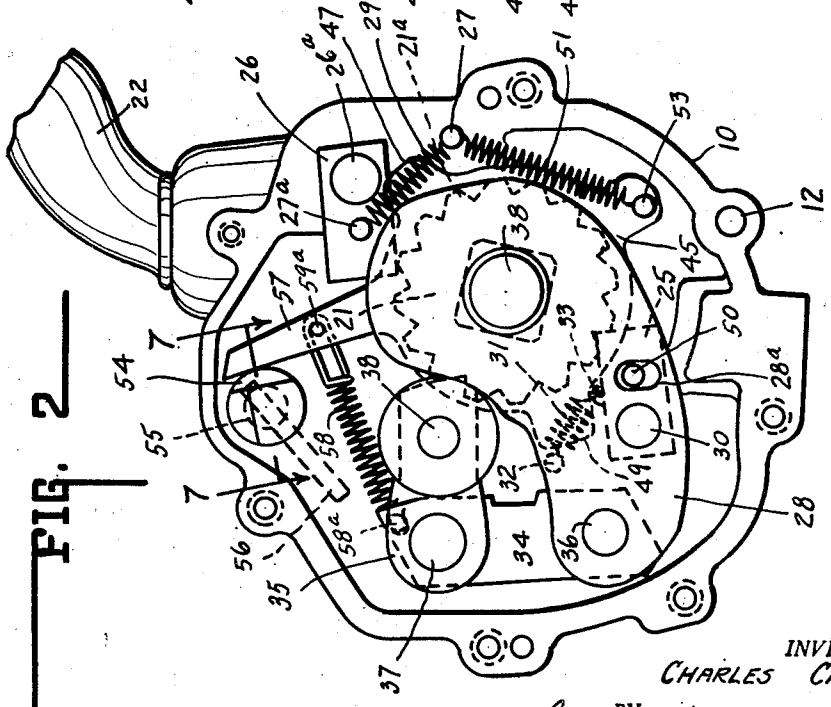


FIG. 2



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FIG. 3

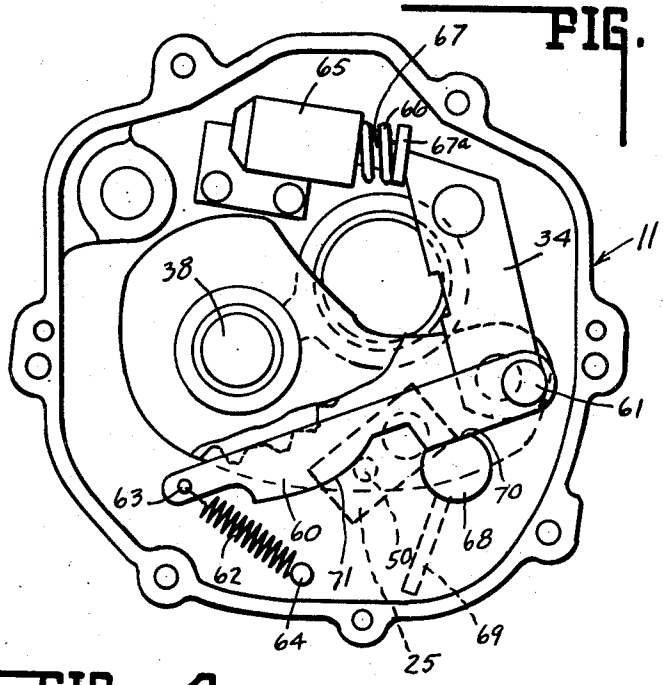
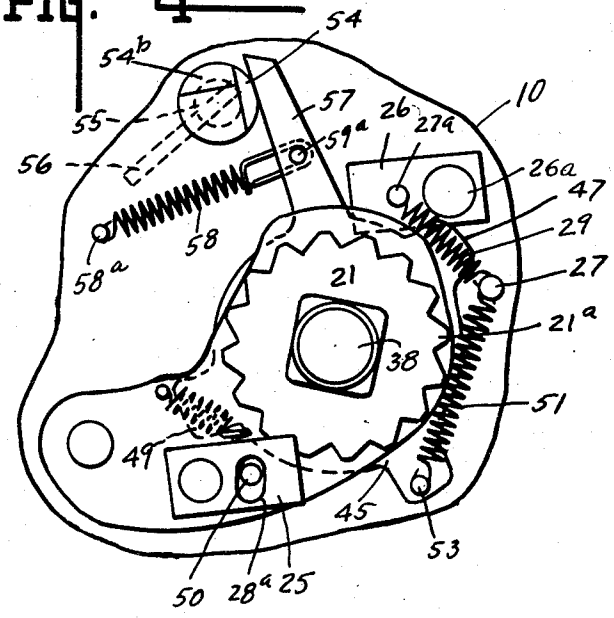


FIG. 4



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HOIST AND SAFETY MECHANISM THEREFOR

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FIG. 5

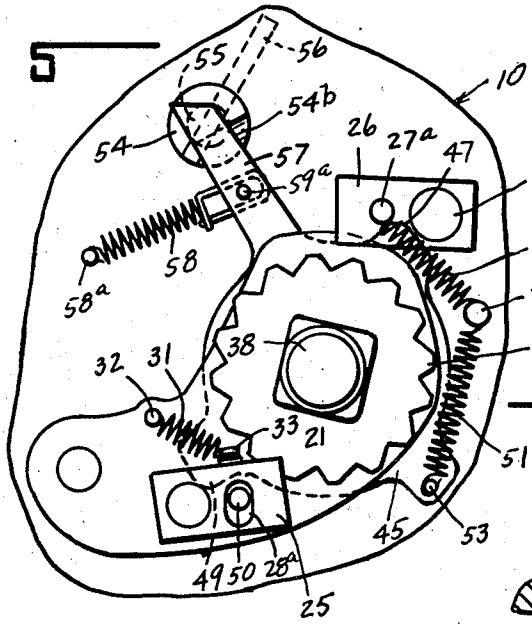


FIG. 7

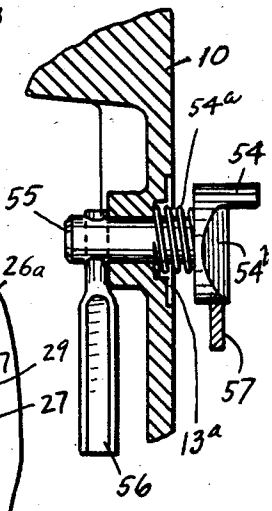
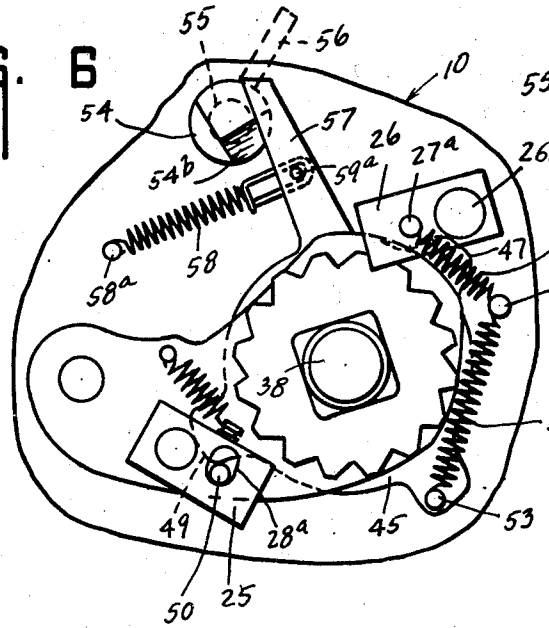


FIG. 6



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HOIST AND SAFETY MECHANISM THEREFOR

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Application December 27, 1955, Serial No. 555,340

7 Claims. (Cl. 254—167)

The present invention relates to improvements in hoisting apparatus, and more specifically to lever-operated chain hoists of the type disclosed in the United States Letters Patent No. 2,670,176 to Frederick W. Coffing, granted February 23, 1954.

The apparatus disclosed in the said patent comprises a lever-operated chain hoist, wherein the hoisting mechanism may be readily and easily adjusted to load-raising condition, to load-lowering condition, or to free-running condition when it is the desire of the operator to establish these conditions. It is characteristic of this type of hoisting mechanism that the operating lever is pulled downwardly to effect load-raising. To effect load-lowering, the operating lever is permitted to move upwardly relatively slowly under the control of the operator. The lever must be controlled during its upper movement because the load tends to move the lever in that direction. If the lever is inadvertently released at its lowermost position, it will travel through its operational arc at excessive speed, thereby becoming a safety hazard to the operator. Such excessive speed of movement of the operating lever may also prevent operation of the ratchet mechanism which normally limits the angular travel of the load chain sheave during a single upward stroke of the lever. When the ratchet mechanism fails to operate the load can drop, creating a further hazard to the operator.

Accordingly, it is the principal object of this invention to provide safety mechanism cooperating with the operating lever and the ratchet mechanism for locking the ratchet mechanism when the lever travels at excessive speed during a lowering cycle of operation of the lever.

In accordance with this invention, there is provided a lever-operated chain hoist including a chain sheave, ratchet mechanism for controlling the rotation of said sheave, means for controlling said ratchet mechanism to effect load-lifting, load-lowering, or free-running rotation of said sheave, an operating lever coupled to said mechanism for operating it, and means effective in response to uncontrolled upward movement of said operating lever for locking said ratchet to prevent free-running rotation thereof in the lowering direction.

For the purpose of disclosing my invention I have illustrated an embodiment thereof in the accompanying drawings in which:

Fig. 1 is a transverse sectional view of a hoist embodying my invention;

Fig. 2 is a longitudinal sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a longitudinal sectional view taken on the line 3—3 of Fig. 1, certain of its parts being shown in dotted lines for the purpose of clarity;

Fig. 4 is a fragmentary view showing parts of the hoist in load-raising position;

Fig. 5 is the same as Fig. 4, showing parts in load-lowering position with the holding pawl freed;

Fig. 6 is the same as Fig. 5 showing the parts in load-lowering position with the load pawl released; and

Fig. 7 is a partial cross-section taken on line 7—7 of Fig. 2 with parts omitted.

In the embodiment illustrated I provide a housing 10 having a front plate closing member 11 secured in place by suitable holding screws 12, shown in Fig. 2. The housing is provided with an offset portion 13, which provides a housing for the load chain sheave 14, over which is adapted to ride the link chain 15. This chain feeds through suitable openings in the bottom of the offset 13. The chain sheave 14 is mounted on a shaft 16, one end of which is mounted in a bearing 17 in the housing 10. On the opposite side of the sheave 14 the shaft 16 is provided with an enlarged portion 18 operating in a bearing 19 supported in a dividing wall of the housing 10. The shaft 16 is extended in reduced diameter, and the opposite end thereof extends into a bearing 20 in the cover plate 11. Mounted on the shaft extension is a ratchet wheel 21 which is keyed on the shaft 16 and, therefore, is rotatable with the sheave 14.

The housing is provided at its top with a swivel hook 22, the end 23 (see Fig. 1) of which extends through the housing to be engaged by a holding nut 24 for maintaining the hook against vertical displacement.

The ratchet wheel 21 is operated and controlled respectively by load pawl 25 (see Fig. 2) and a holding pawl 26. The holding pawl is mounted on a stud 26*a* extending between the side walls of the housing. The end of the pawl is adapted to engage the teeth 21*a* of the ratchet wheel 21. This holding pawl is biased in an engaging direction by coiled spring 29 attached at one end to the pin 27 and at the other end to pin 27*a* in pawl 26.

The load pawl 25 is disposed between and carried by a pair of arms 28 swingably mounted upon the shaft 16 and disposed on opposite sides of the ratchet wheel 21. The pawl is pivoted upon a stud 30 fixed between the arms 28 and has its free end biased in a tooth-engaging direction by coiled spring 31. One end of this spring is secured to a pin 32 on the inner face of one of the arms 28, and its opposite end is connected to a pin 33 on the inner edge of the pawl.

The free ends of the arms 28 are connected by a link 34 with an oscillating lever arm 35. To this end, one end of the link 34 is pivotally connected by a pin 36 extending between the free ends of the arms 28, and the opposite end extends between bifurcated ends of the lever arm 35 and is pivotally connected to the lever arm 35 by a pin 37. This lever arm 35 is a part of an oscillating shaft 38 (see Figs. 1 and 2) having one end journaled at 39 in a side wall of the housing, and the other end enlarged as at 40 and extending through a bearing 41 in the cover plate 11 (see Fig. 1). The outer end of this enlarged portion 40 has a lever arm receiving opening 42 through which may be passed an operating lever arm 43, and which is adjustably slidable through the opening so that the lever length of the same may be adjusted or the direction of lever operation may be changed by sliding the lever from one extremity to the other. Retainers 43*a* are to avoid passing lever 43 entirely out of lever arm receiving opening 42. The lever arm 43 is maintained in its adjusted position through the medium of a set screw 44.

For preventing free rotation of the enlarged shaft portion 40, there are provided friction rings 40*a* mounted in suitable peripheral grooves as shown in Fig. 1. Rings 40*a* may be made of rubber or other friction-creating material.

For controlling the various positions of the holding pawl 26 and the load pawl 25, I provide a reversing ring 45 (shown in Figs. 1 and 2), which is rotatably mounted on an extension 46 of the bearing for the shaft portion 18. This reversing ring is provided with an operating cam 47 (see Fig. 2) for operating and controlling the

position of the holding pawl 26. The holding pawl 26 is provided with a pin 27*a* which projects into the path of cam 47 to be engaged by said cam when the reversing ring 45 is moved to a predetermined position by spring 51.

A cam 49 oppositely disposed relative to the cam 47 (see Fig. 2) on the reversing ring 45 is adapted to control the position of the load pawl 25. This cam is adapted to engage a pin 50 on the load pawl 25 which extends through a slot 28*a* in one of the arms 28 and into the path of the cam 49 to be engaged thereby when the reversing ring is moved to predetermined position by spring 51.

The reversing ring 45 is biased in a direction to cause the cam 47 to engage the pin 27*a* by a coiled spring 51, one end of which is anchored to stud 27 secured in the casing, and the other end of which is connected to a lug 53 on the reversing ring 45. This spring biases the reversing ring 45 in a counterclockwise direction, looking at Fig. 2. The reversing ring 45 is moved in a clockwise direction through the medium of a cam member 54 which is rotatably mounted on a shaft 55 provided with an operating handle 56 which is exterior of the casing. The cam member 54 is adapted when rotated counterclockwise by the handle 56 to engage an arm 57 on the reversing ring and rotate the reversing ring clockwise thereby insuring the disengagement of the cam members 47 and 49 from their respective pawls.

It will be observed that by oscillating the hand lever 43 and shaft 38, the operating lever arm 35 will be oscillated, and in turn will oscillate the load pawl carrying arms 28 through the link 34. Said arms will thereby be caused to oscillate the load pawl about the axis of the sheave 14 relative to the teeth 21*a* of the ratchet wheel 21.

For raising the load, as shown in Fig. 4, the reversing ring 45 has been rotated clockwise by the engagement of the cam 54 with the arm 57 to move the cam member 47 and the cam member 49 out of position to engage the holding pawl 26 or the load pawl 25. Thereupon, these respective pawls are adapted to ratchet on the teeth 21*a* of the ratchet wheel 21. Under these circumstances the holding pawl 26 will be in engagement with the teeth of the ratchet wheel thereby holding the same against clockwise rotation under the influence of a load carried by the load end of the chain 15. If now the handle lever 43 be raised or moved clockwise to the hoist, this will rotate the lever 35 in a clockwise direction and through the link 34 the arms 28 will be raised, thus causing the pawl 25 to ride the teeth 21*a*. As soon, however, as the direction of movement of the hand lever 43 is reversed, the arms 28 will be lowered in a counterclockwise direction with the pawl 25 biting into the teeth 21*a* of the ratchet 21 thereby rotating the ratchet and with it the chain sheave elevating the load. During this movement the holding pawl will ratchet over the teeth being, however, in a condition to lock into the teeth as soon as the load is released by releasing the downward pressure on the handle 43. By repeated oscillations of the handle 43 the load will be raised.

If, however, it is desired to lower the load, the handle 56 is moved to the position illustrated in Fig. 5, reversing the position of cam 54 relative to the arm 57, and the coiled spring 51 will bias the reversing ring in a counterclockwise direction, or in a direction to cause the cam member 47 to engage the pin 27*a* freeing pawl 26 of ratchet wheel 21. With the parts positioned as illustrated in Fig. 5, the load pawl 25 has taken the load, being in engagement with one of the teeth 21*a* of the ratchet wheel 21 and the reversing ring 45 has been biased to the position illustrated in said figures. With the parts in this position, by elevating the handle 43, ratchet 21 rotates clockwise to lower the load. The pawl carrying arms 28 move upwardly, the pawl 26 being free of the ratchet wheel 21. Arms 28 eventually move pin 50 into engagement with the cam member 49, thereby to move reversing ring 45 in a clockwise direction disengaging cam 47 from pin 27*a* in cam 26 thus permitting spring 29 to cause cam 26 to approach engagement with teeth 21*a*. Simultaneously, pin 50 rides up the surface of cam 49 lifting pawl 25 away from the ratchet wheel 21. Pawl 26 assumes the load but permits a few degrees of rotation of the ratchet wheel 21 in a clockwise direction. During this few degrees of rotation, pawl 25 is lifted free of the outer edges of the ratchet teeth and one tooth passes under and beyond pawl 25, and the parts are positioned as shown in Fig. 6. At this point lever 34 will have engaged the bumper pin 67 and the movement of lever 43 must be reversed. Slight downward movement of operating lever 43 rotates arms 28 sufficiently for pin 50 to ride downwardly over the surface of cam 49 thereby to cause the pawl 25 to engage the next tooth of ratchet 21. The pin 50 in load pawl 25 continues to ride downwardly on cam 49, and spring 51 moves reversing ring 45 in a counterclockwise direction to cause the cam 47 to lift the pin 27*a* on holding pawl 26, as shown in Fig. 5. Further downward movement of lever 43 will effect a corresponding downward movement of the arms 28 causing pawl 25 to take the load off the holding pawl 26 by this reverse movement. The holding pawl will be moved out of tooth engagement by the cam member 47 engaging pin 27*a*. Upon again raising lever 43, the pawl 25 in engagement with the teeth 21*a*, the load may be lowered thereby, the lowering action being controlled by the lever 43 and pawl 25. Accordingly, by continued operation of the lever 43 in ratchet style, the load may be controlledly lowered step-by-step.

During use of the hoisting mechanism to lower the load, it can happen that the operator may release the operating lever at the lower extremity at its operational arc. When this happens, lever 43 flies upwardly at relatively high speed because the load tends to rotate ratchet wheel 21 in a clockwise direction. In order to insure that the ratchet will not be free to rotate in a clockwise direction when the operating handle is so released, the cam 54 is provided with a coil spring 54*a* mounted on shaft 55 between cam 54 and the portion 13*a* of housing 10. During normal operation, the cam 54 is retained in a depressed position with its upper surface below the arm 57 of reversing ring 45. Thus, the cam 54 may be rotated to its load-raising position, as shown in Fig. 4, or to the load-lowering position, as shown in Fig. 5, as described previously.

In order to provide such normal operation, the front plate closing member 11 has mounted thereon a block 65 bored to receive a relatively heavy coil spring 66 and a bumper pin 67 nested therein. The head 67*a* of bumper pin 67 engages the free end of spring 66 and is positioned in the way of the upper end of link 34. This normally limits the travel of operating lever 43 to its normal operating arc particularly when the operator is grasping the lever 43 and controls the upward movement thereof.

When operating lever 43 is released prematurely during a lowering operation it will fly upwardly at relatively high speed because the load causes ratchet 21 to rotate in a clockwise direction and pawl 25 is in engagement therewith. Lever 34 impacts pin 67 with sufficient force to depress pin 67 and permit a longer arc of operation of lever 34. In turn, pin 50 engages cam 49 throwing the reversing ring 45 to an extreme clockwise position where the arm 57 swings to its load-raising position beyond the periphery of cam 54. Spring 54*a* then forces cam 54 outwardly into the plane of arm 57 and prevents its return motion in a counterclockwise direction. As described before, reversing ring 45 permits holding pawl 26 and load-pawl 25 to engage the teeth or ratchet wheel 21. With the pawls in these positions, the ratchet wheel is locked and the load cannot move downwardly.

In order to release the reversing ring 45 from this position, cam 54 is provided with an additional cam surface 54*b* which slopes upwardly and extends below the plane of the arm 57 on reversing ring 45. By throwing

the lever 56 in a counterclockwise direction (Fig. 6), cam 54 is turned to bring the cam surface 54*b* beneath the lever arm 57, permitting it to rotate in a counterclockwise direction under the influence of springs 51 and 58. This returns the mechanism to the previous load-lowering position. Spring 58 is provided with an elongated loop 59 engaging pin 59*a* in lever 57, the opposite end of spring 58 being anchored by pin 58*a* secured to casing 10. Spring 58 is tensioned only when lever 57 engages the periphery of cam 54 and serves to provide the force on lever 57 which forces arm 54 backwardly against spring 54*a*. It will be noted that the provision of the spring 54*a* and the bumper pin 67 prevents unintentional release of the load, thereby substantially increasing the safety of operation.

For permitting the ratchet wheel 21 to rotate freely and thereby permit free chaining of the hoist with no load thereon, I provided a throw-out means operable from the exterior of the casing to throw out the load pawl 25, as shown in Fig. 3. This throw-out means comprises a lever 60 pivotally mounted on the pin 61 fixed to the front plate-closing member 11, as shown in Fig. 3. For operating lever 60 there is provided a spring 62, one end of which is attached to the free end of lever 60 at 63 and the other end of which is attached to a stud 64 mounted in the closing member 11. Spring 62 biases lever 60 into engagement with the side of cam 68 rotatably mounted in closing member 11 and provided with an external-operating handle 69. Cam 68 includes a flat surface 70, the purpose of which is to permit lever 60 to move under the influence of spring 62 into the way of the pin 50 which projects upwardly beyond the upper surface of pawl 25. With the operating lever 69 in the position shown in Fig. 3, lever 60 will have moved to such a position that its cam surface 71 will engage pin 50 to hold pawl 25 free of the ratchet teeth.

Thus, for free chaining operation with no load on the hoist and with lever 43 in any position, but with handle 56 in load-lowering position, the handle 69 may be swung in counterclockwise direction. This rotates cam 68 into position to engage surface 70 with lever 60, whereby spring 62 moves lever 60 in a counterclockwise direction. This action will lift pawl 25 free of engagement with ratchet teeth 21*a*. Thus, with the holding pawl maintained in disengaged position by the cam 47 and the load pawl 25 maintained in disengaged position by the cam surface 71 of lever 60, the load chain is free to move in either direction.

I claim:

1. A chain hoist comprising a casing, a shaft mounted in said casing, a chain sheave and ratchet wheel fixed to said shaft, an operating lever and cooperating lever system mounted on said casing and shaft in operative relation thereto, a load pawl coupling said system to said ratchet wheel during movement of said lever in one direction, said load pawl including a control pin, a holding pawl pivoted to said casing to engage said ratchet wheel during movement of said lever in the opposite direction and including a control pin, a reversing ring mounted on said shaft and including a first cam operatively associated with the load pawl control pin and a second cam operatively associated with said holding pawl control pin, spring means biasing said reversing ring and said cams in a direction normally to disengage said pawls from said ratchet wheel, a rotatable and reciprocable control cam operatively associated with said reversing ring and manually rotatable into a first position for rotating said reversing ring and said cams out of engagement with the control pins of said pawls, whereby said lever is operative to lift a load, said cam also being rotatable into a position for permitting said spring means to move said reversing ring into a position where its cams may alternately engage the control pins of said pawls to permit lowering action of said lever, compressible stop means

operatively associated with said lever system for normally preventing said load pawl pin from rotating said reversing ring into load lifting position, and spring means operatively associated with said control cam for reciprocating it into the way of said reversing ring, when said stop means is compressed, to hold said reversing ring in the load lifting position.

2. A chain hoist comprising a casing, a shaft mounted in said casing, a chain sheave and ratchet wheel fixed to said shaft, an operating lever and cooperating lever system mounted on said casing and shaft in operative relation thereto, a load pawl coupling said system to said ratchet wheel during movement of said lever in one direction, a holding pawl pivoted to said casing to engage said ratchet wheel during movement of said lever in the opposite direction, a reversing ring mounted on said shaft and including a first cam operatively associated with the load pawl and a second cam operatively associated with said holding pawl, means for moving said reversing ring and said cams in a direction normally to disengage said pawls from said ratchet wheel, a rotatable and reciprocable control cam operatively associated with said reversing ring and manually rotatable into a first position for rotating said reversing ring and said cams out of engagement with said pawls, whereby said lever is operative to lift a load, said cam also being rotatable into a position for permitting said reversing ring to move into a position where its cams may alternately engage said pawls to permit lowering action of said lever, stop means operatively associated with said lever system for normally preventing said load pawl from rotating said reversing ring into load lifting position, and means operatively associated with said control cam for reciprocating it into the way of said reversing ring when said stop means is compressed to hold said reversing ring in the load lifting position.

3. A chain hoist comprising a casing, a shaft mounted in said casing, a chain sheave and ratchet wheel fixed to said shaft, an operating lever and cooperating lever system mounted on said casing and shaft in operative relation thereto, a load pawl coupling said system to said ratchet wheel during movement of said lever in one direction, a holding pawl pivoted to said casing to engage said ratchet wheel during movement of said lever in the opposite direction, a reversing ring mounted on said shaft and operatively associated with the load pawl and said holding pawl, means for moving said reversing ring in a direction normally to disengage said pawls from said ratchet wheel, a rotatable and reciprocable control cam operatively associated with said reversing ring and manually movable into a first position for moving said reversing ring and freeing said pawls, whereby said lever is operative to lift a load, said cam also being movable into a position for permitting said reversing ring to move into a position where it controls said pawls to permit lowering action of said lever, and means operatively associated with said control cam for reciprocating it into the way of said reversing ring to hold said reversing ring in the load lifting position.

4. A chain hoist comprising a casing, a shaft mounted in said casing, a chain sheave and ratchet wheel fixed to said shaft, an operating lever and cooperating lever system mounted on said casing and shaft in operative relation thereto, a load pawl coupling said system to said ratchet wheel during movement of said lever in one direction, a holding pawl pivoted to said casing to engage said ratchet wheel during movement of said lever in the opposite direction, cam means operatively associated with the load pawl and said holding pawl, spring means biasing said cam means in a direction normally to disengage said pawls from said ratchet wheel, a rotatable and reciprocable control cam operatively associated with said cam means and manually movable into a first position for releasing said pawls, whereby said lever is operative to lift a load, said control cam also being movable into a position for permitting said spring means to move said cam means into

a position where it may alternately control said pawls to permit lowering action of said lever, compressible stop means operatively associated with said lever system for normally preventing movement of said cam means into load lifting position, and means operatively associated with said control cam for reciprocating it into the way of said cam means when said stop means is compressed to hold said cam means in the load lifting position.

5. A chain hoist comprising a casing, a shaft mounted in said casing, a chain sheave and ratchet wheel fixed to said shaft, an operating lever and cooperating lever system mounted on said casing and shaft in operative relation thereto, a load pawl coupling said system to said ratchet wheel during movement of said lever in one direction, a holding pawl pivoted to said casing to engage said ratchet wheel during movement of said lever in the opposite direction, cam means operatively associated with the load pawl and said holding pawl, a control cam operatively associated with said cam means and manually movable into a first position for releasing said pawls, whereby said lever is operative to lift a load, said control cam also being movable into a position for controlling said pawls to permit lowering action of said lever, stop means operatively associated with said lever system for normally preventing said cam means from moving into load lifting position during lowering action of said lever system, and means operatively associated with said control cam for moving it to control of said cam means when said stop means is operated to hold said cam means in the load lifting position.

6. A chain hoist comprising a casing, a shaft mounted in said casing, a chain sheave and ratchet wheel fixed to said shaft, an operating lever and cooperating lever system mounted on said casing and shaft in operative relation thereto, a load pawl coupling said system to said ratchet wheel during movement of said lever in one direction, a holding pawl pivoted to said casing to engage said ratchet wheel during movement of said lever in the opposite direction, cam means operatively associated

with the load pawl and said holding pawl and manually movable into a first position for releasing said pawls, whereby said lever is operative to lift a load and movable into a second position for controlling said pawls to permit lowering action of said lever, and means operatively associated with said cam means and said lever system to hold said cam means in the load lifting position in response to abnormal movement of said operating lever during lowering action of said operating lever.

7. A chain hoist comprising a casing, a shaft mounted in said casing, a chain sheave and ratchet wheel fixed to said shaft, an operating lever and cooperating lever system mounted on said casing and shaft in operative relation thereto, a load pawl coupling said system to said ratchet wheel during movement of said lever in one direction, a holding pawl pivoted to said casing to engage said ratchet wheel during movement of said lever in the opposite direction, cam means operatively associated with the load pawl and said holding pawl and manually movable into a first position for releasing said pawls, whereby said lever is operative to lift a load, said cam means also being movable into a position for controlling said pawls to permit lowering action of said lever, stop means operatively associated with said lever system for normally preventing said cam means from moving into load lifting position during lowering action of said lever system and means operatively associated with said cam means for moving it into the load lifting position when said stop means is operated by abnormal movement of lever system during load lowering action.

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