

June 30, 1964

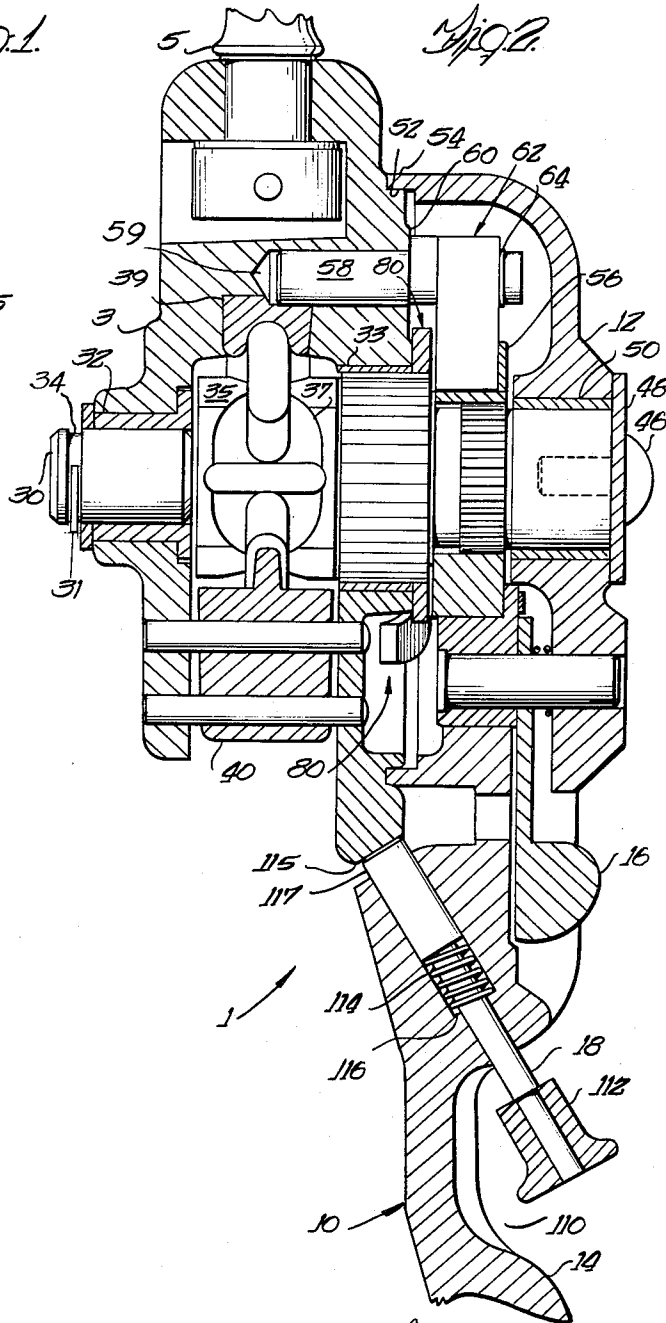
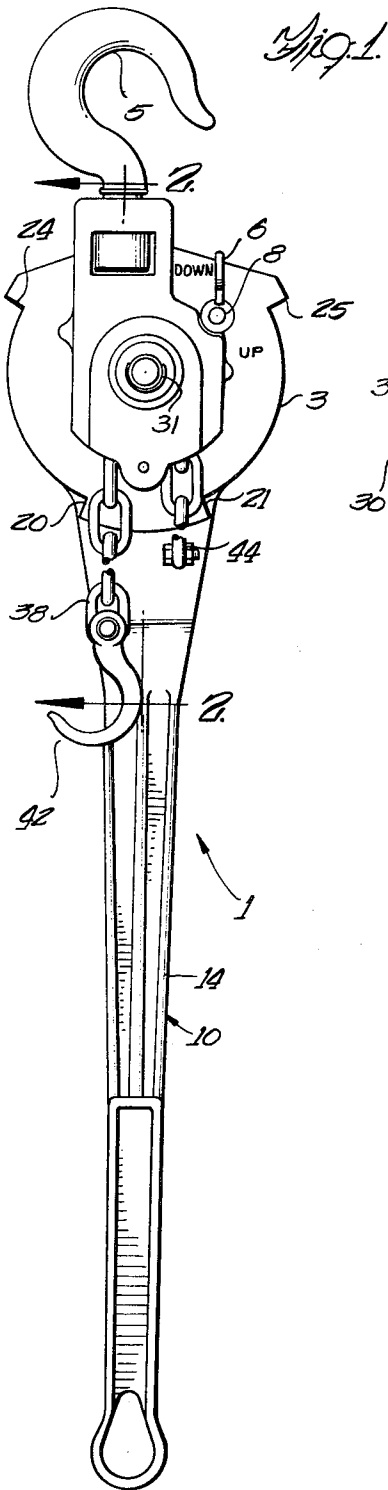
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3,139,268

RATCHET LEVER HOIST

Filed May 2, 1960

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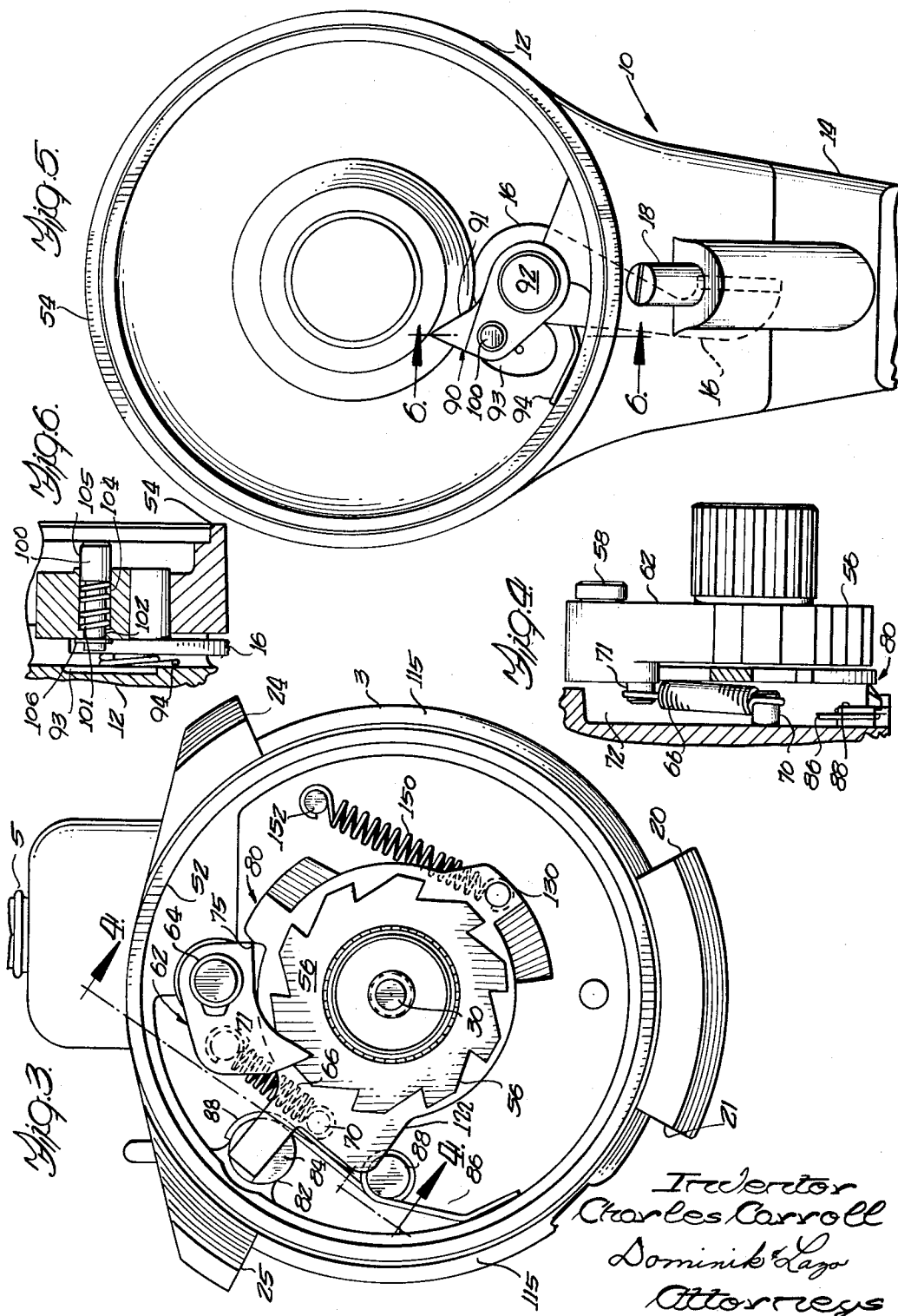
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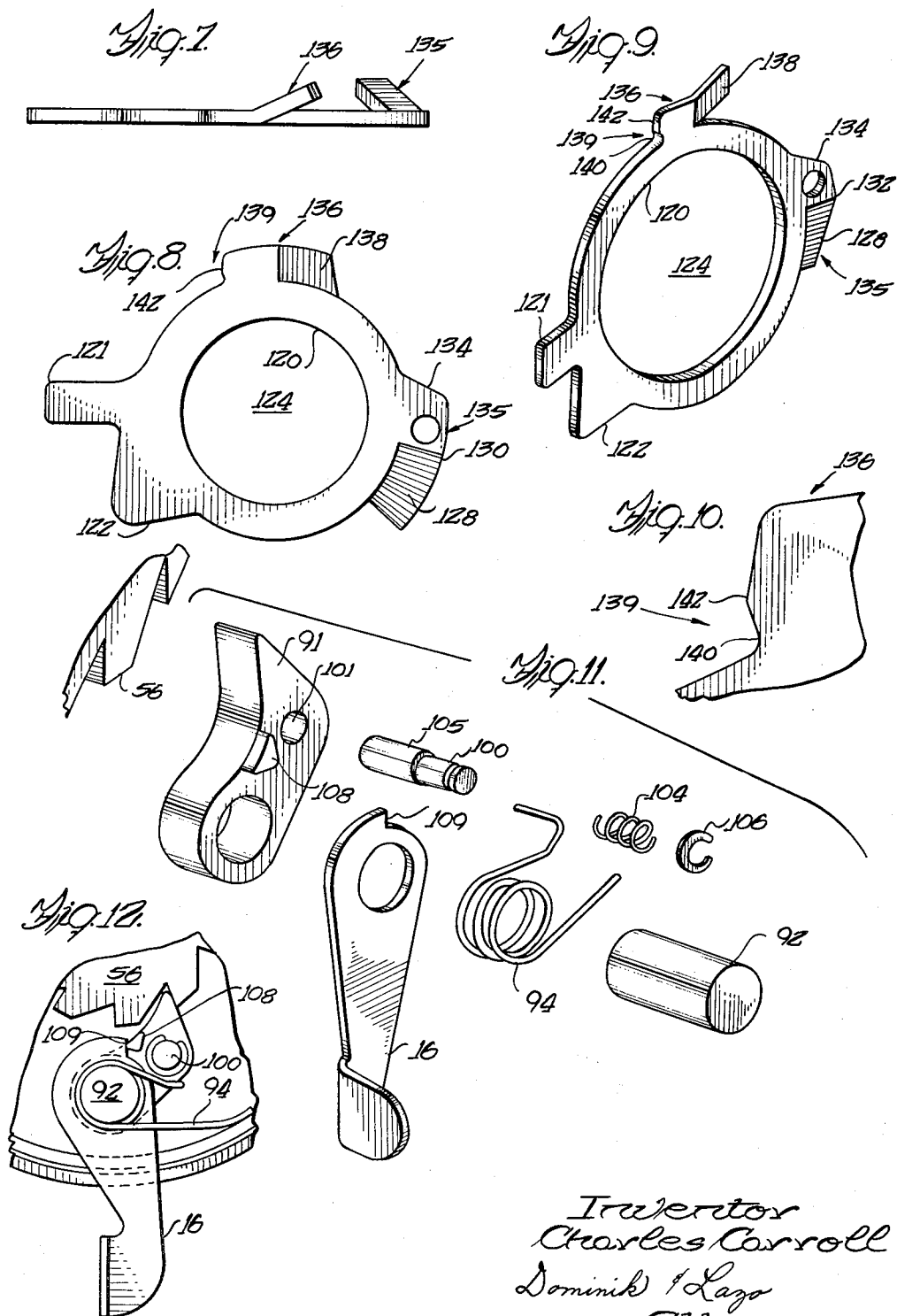
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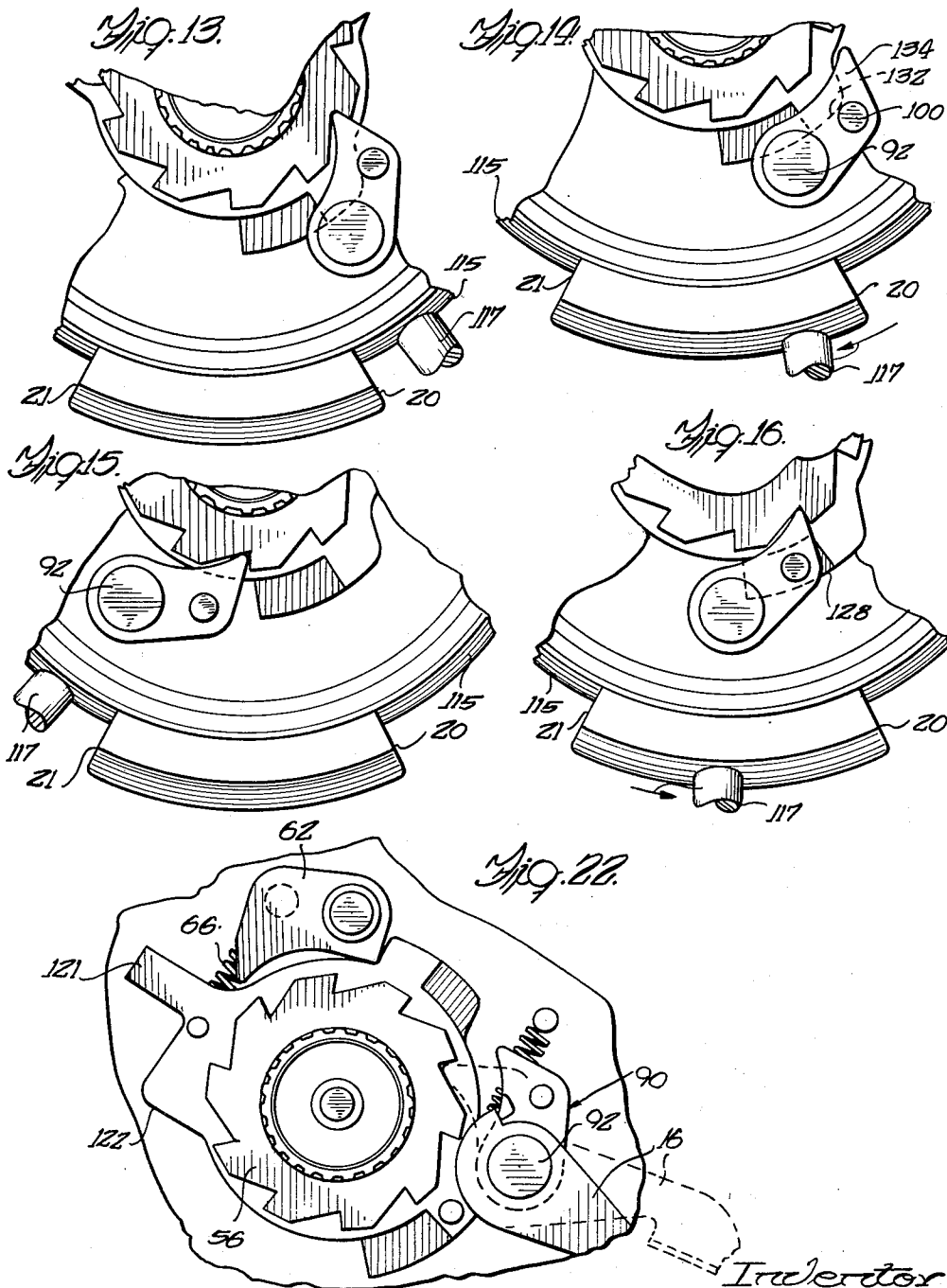
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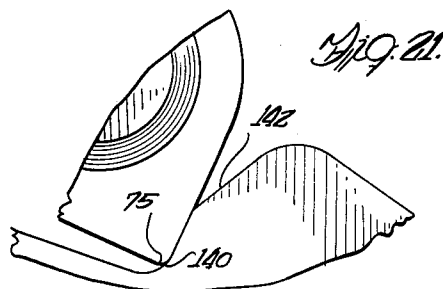
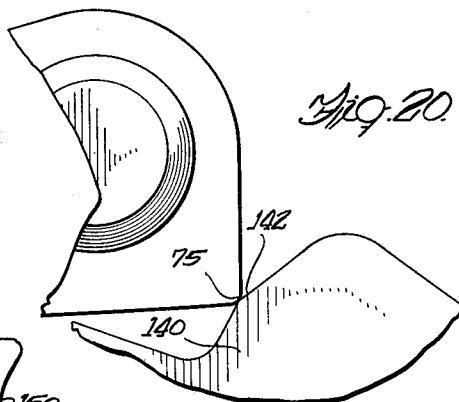
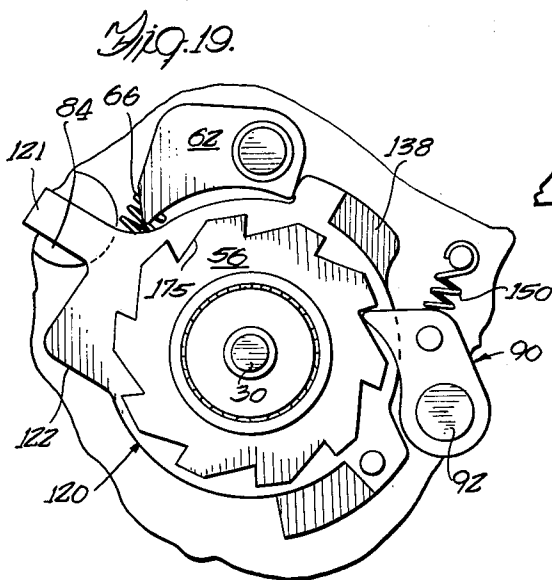
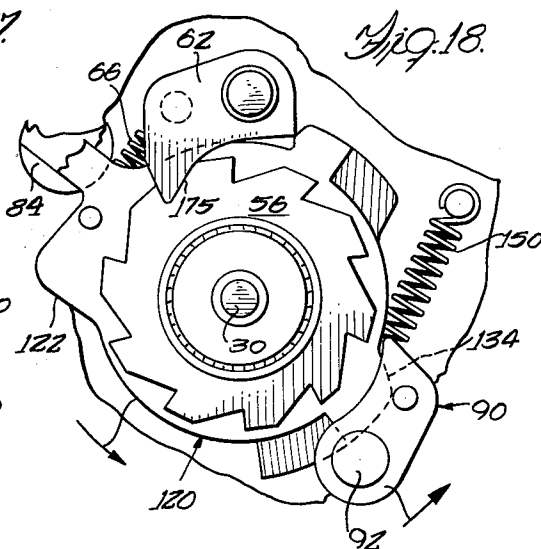
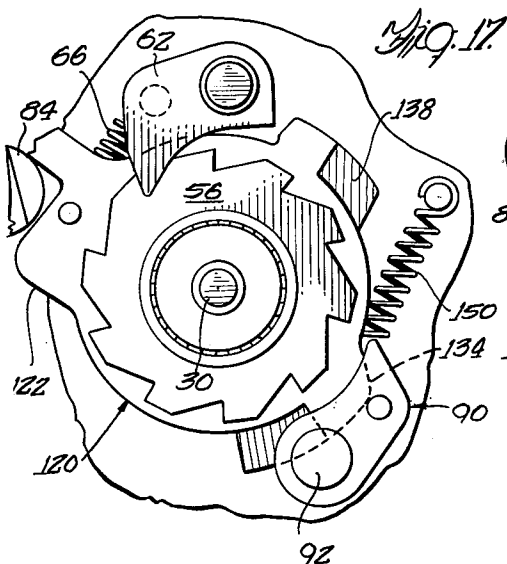
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3,139,268

RATCHET LEVER HOIST

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9 Claims. (Cl. 254-167)

This invention relates to a ratchet lever hoist with positive control over the load under an entire range of normal operating conditions.

While ratchet lever hoists which contain ratchet and pawl mechanisms for stepwise movement of loads in a preselected direction are well known, such hoists are subject to free-chaining when lowering a load and the load is suddenly removed from the hoist, as by coming in contact with a horizontal surface or other supporting means. This is ordinarily attributable to design characteristics which do not maintain a plurality of load arresting means in engagement or engaging position with the load during certain portions of the cycle of operations. In cases where the load is not properly seated on the surface, the immediate loss of restraint by free-chaining presents a safety hazard inasmuch as the load may fall to the floor and injure the operator as well as damaging the load being lowered. It is also characteristic of such devices that should the operator lose control of the lever or handle by which the load is moved stepwise to a preselected position, and particularly when lowering the load, uncontrolled jacking occurs through cycling of the handle up and down (pumping). As explained below, this is ordinarily attributable to requiring only a small arc of motion to disengage a pawl from the ratchet. Both of these characteristics of accidental free-chaining and pumping are undesirable but unfortunately almost universal characteristics of today's commercially acceptable ratchet lever hoists.

It is an object of this invention to provide a ratchet lever hoist having new and useful safety features which provide positive control of the load under an entire range of normal operating conditions. It is also an object of the invention to provide a ratchet lever hoist having a novel construction that prevents free-chaining under either load or no load conditions unless the operator manipulates certain of the apparatus to permit free-chaining. It is another object of the invention to include a ratchet lever hoist having a novel construction that prevents accidental free-chaining. It is also within the objects of the invention to provide a ratchet and pawl hoist that provides a separate and distinct control means for selectively disengaging all of the pawls within the hoist to permit free-chaining.

One specific embodiment of the invention contemplates a construction having within a housing a load chain or the like supported on a load sheave which is coaxially mounted on the same shaft with, and spaced from, a ratchet. A handle that is coaxially rotatable relative to the sheave and the ratchet carries a pawl to engage the ratchet to lift loads and to lower loads, as the case may be. A load pawl is pivotally supported from the housing to engage the ratchet wheel.

A novel reverse ring having cam surfaces to cause a novel sequential action of the two pawls during lowering is rotatably mounted on the shaft adjacent the ratchet. Control means are provided for selectively rotating the reverse ring to a first load raising location or to a second load lowering location. The cams on the reverse ring

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are so disposed that, in the second location, the pawls are alternately in draft, i.e., supporting the load, and also provide a certain overlap wherein both pawls are in a draft position but not necessarily in draft. This overlap during lowering obtains a positive safety feature preventing free-chaining, inasmuch as at least one, if not both, of the pawls is (are) in position to restrain the ratchet from movement. The reverse ring includes means to provide a snap action of the load pawl into and out of draft position. When a reverse ring according to this invention is disposed in a ratchet lever hoist, it provides a positive means for timing the sequential movements of the two pawls in lowering operations.

Another object of this invention is to provide a construction that is effective in eliminating pumping when lowering a load. Pumping occurs on loads ranging upwards from 25 lbs. and is a direct result of handle rebound. During lowering, if the handle is released at the bottom of its stroke, the load (connected to the handle through the chain, sheave and ratchet wheel) forces the handle to move upward with considerable velocity. When the handle and its connected mechanism reaches the end of its stroke going upward, it rebounds at almost original speed. As the handle returns during rebound to the bottom of the stroke, the energy in the handle is transmitted to the ratchet sufficiently to urge the ratchet away from the load pawl the 4° (of rotation) necessary to release the latter from draft. Four degrees is mentioned because it has been widely adopted by the hoist industry as standard practice in the construction of these devices. In hoists capable of having the handle selectively operated from either side, the foregoing describes the action from one side only, reverse directions and forces applying in operations from the other side.

The instant invention overcomes this problem by greatly increasing the movement of the ratchet necessary to release the load pawl. In one preferred embodiment, the arcuate movement of the ratchet is increased from 4° to 18°. In addition, the reverse ring contains a novel construction that cooperates with the load pawl to position the latter positively and to actuate it upon the completion of the arcuate movement.

Another object of this invention is to provide a ratchet lever hoist having a control that is not accidentally operated but can be selectively manipulated by the operator to permit free-chaining in either the up or down directions. Another object of the invention is to provide a novel arrangement of elements in a ratchet lever hoist whereby the lever or handle can be operated from either side of the hoist. To this end, it is a further object of the invention to provide mechanism for permitting the handle to be changed from one side of the hoist to the other, whether the device be under load or not.

In connection with the latter objects, the reverse ring provides a novel construction having cam lobe surfaces which are inclined both to the plane of the cam and to the plane in which the ratchet wheel operates. These lobes cooperate with engaging means on the handle pawl in such a fashion as to permit the handle pawls to move either over or around the same when moving the handle from one side of the hoist to the other.

Other objects, advantages and features will be apparent from the following specification when read in conjunction with the attached drawings.

In the drawings:

FIGURE 1 is an assembly of a hoist according to my invention showing the external arrangement of some of the parts on the rear of the assembly;

FIGURE 2 is a section through 2—2 of FIGURE 1;

FIGURE 3 is a view of the housing with the handle removed;

FIGURE 4 is a view through 4—4 of FIGURE 3;

FIGURE 5 is a view of the inside of the handle when removed from the housing of FIGURE 3;

FIGURE 6 is a view through section 6—6 of FIGURE 5;

FIGURES 7—10 are plan, side perspective and detail views of the reverse ring;

FIGURES 11 and 12 show an exploded and an assembly view of the handle pawl assembly;

FIGURES 13—16 show positions of parts when changing the handle from one side to the other;

FIGURE 17 shows certain of the parts in an operating position during normal lifting;

FIGURES 18 and 19 show positions of certain parts during a sequence of operations as such operations occur during lowering;

FIGURES 20 and 21 show an enlarged detail of certain events occurring in FIGURES 18 and 19; and

FIGURE 22 shows the position of certain elements when in a position to permit free-chaining.

Throughout the drawings the same reference numeral refers to the same elements.

In FIGURES 1 through 6 a hoist 1 is shown having a housing 3 to which is rotatably connected a vertical support hook 5. A control lever 6 extends from the rear end of the housing and is secured upon a lever shaft 8 which is journaled in the housing to provide a means for selecting the direction in which a load is moved when operating the hoist.

A handle unit 10 is mounted to permit arcuate reciprocation relative to the housing. A cover portion 12 of the handle is integral with the lever portion 14, in order that the former can cooperate with the housing to enclose the moving parts.

Mounted on the forward, or handle, side of the hoist are a free chain lever 16 and a stop pin 18. The details of mounting of both of these will be explained below. For the present it is to be noted that both of these devices are accessible from the same side of the hoist. The stop pin 18 is so mounted as to cooperate with the housing bottom stops 20, 21 and the housing upper stops 24, 25. All of the stops are integral with the housing and present radially extending stop surfaces as enumerated for the engagement with the stop pin.

A shaft 30 is rotatably mounted in the housing by the rear and forward bearings 32, 33, respectively as seen in FIGURE 2, the shaft has various diameters appropriate to the bearings. A sheave 35 is mounted on the shaft between the bearings and has pockets 37 therein to engage the links in the load chain 38 that passes over the sheave. A portion of the housing 39 is shaped to define a chain guide to aid in passing a chain through the housing during the course of a moving operation with the hoist. A shedder 40 is secured to the housing beneath the load chain in a position between the two ends of the chain to assure that each end falls vertically free of the other and does not entangle itself therewith. A load hook 42 depends from one end of the chain and a chain stop 44 is secured to the other end to prevent it from passing through the housing. The chain stop may comprise a large nut and bolt secured to one of the last few links.

A snap ring 31 resiliently engages the groove 34 in the shaft 30 to position the latter axially by reason of restraint caused by engagement of the housing between the snap ring and the left shoulder of the sheave, as viewed in FIGURE 2.

The handle unit 10 is mounted for concentric clock-

wise and counterclockwise rotational motion relative to the shaft and housing. The mounting is accomplished by a screw 46 being threaded into the right end of the shaft (FIGURE 2) to hold a washer 48 against the cover portion 12 of the handle. A bearing 50 is provided between the handle and the shaft. In addition, the housing has a shoulder 52 extending forwardly (toward the handle) therefrom to engage the flange 54 that extends rearwardly from the handle, all as best seen in FIGURE 2. The engagement of the shoulder with the flange provides a means for defining an enclosure for the various parts.

A ratchet wheel 56 is secured to the shaft 30, forwardly of bearing 33, for co-rotation therewith. Preferably, the shaft is splined to engage corresponding contours on the ratchet wheel. A load pawl pin 58 is secured in recess 59 of the housing by a snap ring engaging grooves in both 58 and 59, or an expansion fit, or the like. A machined shoulder 60 provides a thrust bearing surrounding the recess and a load pawl assembly 62 (hereinafter load pawl) is secured to the pin by a snap ring 64. A load pawl spring 66 is held in tension between the load pawl and the housing by an anchor pin 70, that is secured to the housing in a fashion similar to the securing of pin 58, and a corresponding rearwardly extending pin 71 that is mounted on the load pawl. The ends of the spring are shaped to fit in circumferential grooves in pins 70 and 71, being held therein by the spring tension. An appropriate recess 72 is provided in the housing to assure clearance between the spring and the housing.

At the rear end of the load pawl (FIGURE 3) is located a pointed lowering cam surface 75 that presents an apex extending toward a portion of the reverse ring 80. The reverse ring will be described below relative to FIGURES 7—10.

As best seen in FIGURE 3, the control lever shaft 8 extends through the housing and terminates adjacent a portion of the reverse ring. A large cylindrical member 82 having a portion cut away therefrom to define a shoulder 84 is mounted on the end of the shaft 8. Manipulation of the lever 6 rotates the shoulder 84 in such a fashion as to shift the reverse ring 80 arcuately to determine the sequence of operations, hence the direction of movement of the load hook. A control lever spring 86 is wrapped around the shaft 8, a reverse lever spring anchor pin 88, and terminates in a spring arm that is biased against the side of the housing, as best seen in FIGURE 3.

As in FIGURES 5, 11 and 13, a handle pawl assembly 90 (hereinafter handle pawl) includes a handle pawl 91 that is secured for suitable rotation relative to the handle by means of a handle pawl pin 92. The handle pawl is located in such a position that it can engage the appropriate portions of the reverse rings and teeth on the ratchet wheel 56. The free chain lever 16 passes through a hole in the wall of cover 12 and is also pivotally mounted on the pin 92 at a location forward of the handle pawl. The pin may be force fitted into the cover of the handle. A handle pawl spring 94 is biased against the side of the handle and is located on the pin forwardly (as in FIGURE 2) of both the handle pawl and the free chain lever to engage and bias the lever for rotation counterclockwise as seen in FIGURE 6.

A trip pin 100 is slidably mounted for reciprocal motion in the handle pawl, preferably for motion perpendicular to a plane through which the handle pawl rotates relative to the handle, i.e. motion parallel to the axis of shaft 30. The trip pin is biased toward the right as seen in FIGURE 6 and extends rearwardly (FIGURE 2) to a position where it may engage the reverse ring, as explained below. The trip pin is resiliently slidably mounted in a hole 101 in the handle pawl that extends completely through the handle pawl and provides a shoulder 102 against which the trip pin spring 104 is compressed

by the enlarged rear end 105 of the trip pin. The forward end of the trip pin is secured against the forward edge of the handle pawl shoulder 102 by a snap ring 106 engaging a groove in the pin 100. A free chain engaging stop 108 is integral with the handle pawl and engages the notch 109 in the end of the free chain lever. The recess 93 in the cover 12 provides clearance for the pin 100 when moved against the bias of the spring 101.

A recess 110 (FIGURE 2) is provided in the handle adjacent the cover portion 12 thereof in order that the stop pin handle 112 can be seated therein and be out of the way of the operator. The stop pin 18 comprises an elongated cylindrical member having a T-shaped axial cross-section, with the cross-bar of the T extending toward the housing, all as best seen in FIGURE 2. A spring 114 biases the pin toward the housing by engagement with the shoulder 116 provided on the handle. The end 117 of the pin is thus continuously urged into sliding relation with the surfaces 115 of the housing. The stop pin handle 112 is secured to the T-shaped member by peening over the lower end of the T-shaped member. The recess in the handle is of such a size as to permit reciprocal movement of the stop pin when the handle is pulled downwardly as viewed in FIGURE 2. The reverse ring 80 is mounted on the shaft 30 immediately to the rear of the ratchet wheel (FIGURE 2).

The reverse ring construction may best be understood by reference to FIGURES 7-10. Broadly speaking, the reverse ring comprises a means for shifting a plurality of cams in unison to secure the desired sequential operation of the handle unload pawls. The sequence is explained below with reference to FIGURES 17 through 21. The reverse ring is a generally annular body member 120 having extending radially therefrom a control lever engaging arm 121 that permits the shifting of the entire ring responsive to selective movement of the control lever 6. It is disposed in the hoist adjacent the shoulder 84 on the control lever shaft, as seen in FIGURE 3. An open central portion 124 is defined by the reverse ring body, and it is through this portion that the shaft 30 passes and permits the mounting of the reverse ring on the shaft for rotation relative thereto. Located counterclockwise from the arm 121 is a radial extension presenting a first trip pin cam surface 122, the profile of which extends oblique to a radius from the body. Still moving in a counterclockwise direction, there is, facing 122, a first range-changing trip pin cam 128 that is disposed in a plane that is generally oblique to the plane of the body member 120. The slope and configuration of the range-changing cam 128 is appreciated from FIGURE 8. This cam 128 is faired into co-planar relationship with the body member 120. A reverse ring spring pin 130 (FIGURE 3) is rivetted with the head thereof flush with 120 as seen in FIGURE 3, to the co-planar portion of 128. The periphery of 128 is generally concentric with the open portion and defines a second trip pin range-changing cam surface 132 that is faired into a second trip pin cam surface 134 which latter is sloped obliquely in the same fashion as is 122. The cams 128, 132, 134 define a first radial lobe 135.

The reverse ring also includes a second lobe 136 extending generally radially therefrom and constructed in a fashion that is generally similar to that including the oblique surface 128, etc. However, the functions of this last lobe or radial extension are different in substantial degree from those of 135. A trip pin engaging surface 138 is positioned, like 128, in a plane that is oblique to the axis of the shaft on which the reverse ring is mounted. On the other side of the radial extension is a reverse ring apex cam 139 which comprises a concave apex 140 (FIGURE 10) for receiving the lowering cam surface 75 of the load pawl. The concave cam is mounted radially inwardly from a pointed, convex apex 142 that is immediately adjacent thereto. The apex 140 is thus an undercut portion.

It will be observed that the foregoing construction

permits forming a reverse ring from a single piece of metal, preferably carbon steel, as by stamping the same, and then striking down the two oblique surfaces 128 and 138. The function of the reverse ring will be understood better from reference to the following description of operation. Except for the oblique cam surfaces 128, 138, all of the cam surfaces are perpendicular to the body and extend parallel to the axis of the shaft 30.

Before commencing a description of the operation, FIGURE 3 is referred to for showing the reverse ring spring 150 which is supported in tension to bias the reverse ring in a counterclockwise direction. One end of the spring is secured to the pin 130 on the reverse ring, and the other end is supported on a pin 152, that is attached to the housing. Pin 152 may also comprise a rivet. The securing of the spring 150 is similar to that of the load pawl spring, although if desired, screws and washers can be employed to anchor the spring to the housing and ring.

FIGURE 17 shows the control lever, the reverse ring as positioned thereby, the pawl and the ratchet during a normal lifting operation with the load pawl in draft. By the term "draft" is meant that a pawl is supporting the load as transmitted thereto by the ratchet wheel. In this view, the handle 10 is positioned for movement of the stop pin 18 between the stops 20 and 24 on the housing. Initially, the control lever 6 is rotated counterclockwise to its lowermost position, i.e., adjacent the letter "UP" as seen in FIG. 1, and thereby rotates the shoulder 84 to the position shown in FIGURE 17, whereupon the reverse ring responds thereto and shifts clockwise as seen in the FIGURE 17 (viewed from the same direction as FIGURE 3). In effect, this renders the reverse ring inoperable during lifting operations. As seen in FIG. 17, the handle is then moved up and down (counterclockwise and clockwise) in a well known fashion, whereupon the handle pawl alternately moves into draft with the ratchet wheel responsive to (downward or clockwise motion of the handle), lifts the load by rotating the ratchet wheel 56 responsive to handle motion in a counterclockwise direction until such point as the stop 24 is engaged by the stop pin 18, at which point the load pawl has moved into draft position. By draft position is meant that the pawl may not yet be supporting the entire load, but it is in position to do so. As seen in FIG. 17, the handle, carrying the handle pawl with it is then moved clockwise (downwardly) to re-position the handle pawl for the next lifting operation. During the downward motion of the handle, the load pawl supports the ratchet wheel and prevents rotation thereof under the bias of the load supported on the load hook 42.

The clicking of the pawls into draft and draft position ordinarily advises the operator when he has reached the end of a particular stroke. The stops 20 and 24 are positioned to provide a liberal amount of stroke past the end positions for placing pawls into draft position as are their opposite numbers 21 and 25. In order that the stops and not the reverse ring, determine the ends of the stroke, the oblique surfaces 128, 138 on the reverse ring are provided. This permits the trip pin 100 on the handle pawl to engage the oblique surface 138 (when proceeding as in the preceding paragraph) and to resiliently slide up into the handle pawl when the latter is moved arcuately with the handle past the point of engagement of the trip pin with the oblique surface. When long strokes, i.e. past two draft positions of the load pawl, are taken, the stops cooperate with the stop pin.

Should it be desired to move the load by moving the handle and the ratchet wheel stepwise from the other (left) side of the housing, the stop pin is pulled downwardly (as viewed in FIGURES 14-16) so that it will not engage the bottom stop 20 and the handle is swung clockwise to a position where the stop pin is biased inwardly by the spring 114 to such a position that it can engage the other two limit stops 21 and 25. FIGURES 2 and 14 show the position of the elements of interest during the range-changing operation, i.e. during the op-

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eration where the handle was moved for jacking from one side of the hoist to the other. FIGURE 14 shows that the trip pin, in moving clockwise with the handle 10, follows the trip pin cam surface 134 and then moves into engagement with the peripheral surface 132. During this operation, the cylindrical surface of the trip pin end 105 slidably engages the cam surfaces 134, 132, in that order. The trip pin does not reciprocate or slide relative to the handle pawl at this time. It merely engages the cam surfaces in such a fashion as to swing the handle portion radially away from the axis of the shaft. Then lifting is performed from the new position (the left in FIGURES 3 and 15), it should be noted that the stop pin cooperates with the stop 21 to prevent any substantial movement of the trip pin upon the oblique cam surface 128. The load pawl 62 engages ratchet 56 during these events, thus enabling a change of range while the system is under load, i.e. while a weight is on hook 42.

When it is desired to change the range from the left side, as viewed in FIGURES 3 and 10 through 15, to the right side, the stop pin is moved down and the handle swung counterclockwise. In this operation, as seen in FIGURE 16, the flat end of 105 of the pin slides up this oblique surface 128 and the handle pawl does not swing radially away from the shaft as it did when moving in the opposite direction. Instead, the trip pin moves rearwardly (i.e. to the left of FIGURE 6), further compressing the trip pin spring 104 until such point as the trip pin end 105 has passed over the second trip pin surface 134, whereupon it is biased back to the position shown in FIGURE 4. In this fashion, the change can be accomplished when the handle pawl is in draft, i.e. while the system is under load.

When it is desired to lower a load connected to the load hook, or lower the hook when not under load, the control lever 6 is rotated counterclockwise (as in FIG. 1, clockwise as in FIGS. 3, 17) to the vertical position shown in FIGURE 1. The position of the shoulder 34 becomes that as seen in FIGURE 3 and also as seen in FIGURES 18 and 19. The reverse ring responds to this motion, under the bias of the reverse ring spring 150, by moving counterclockwise (as viewed in FIGURES 18 and 19). It should be noted that the reverse ring spring maintains this extension 121 in engagement with the shoulder. In all of these figures, it is assumed that the handle is being operated from the right side of the hoist as viewed in FIGURES 3 and 10 through 15, i.e. between the stops 20 and 24. Of course, operation from the other side would be in a similar fashion, the parts cooperating in similar fashion between stops 21 and 25.

The next thing that is done in a lowering operation is to remove the load pawl from draft (as in FIGS. 18 and 19) by moving the handle to place the handle pawl in draft, then moving the handle a sufficient amount counterclockwise with the handle pawl and ratchet engaged, to cause this to happen. The ratchet teeth are so proportioned that they cam against the underside of the load pawl as at 175 and force the load pawl to rotate clockwise responsive to such counterclockwise handle motion. A snap action takes place when the lowering cam 75 moves radially inwardly of the apex cam. When the load pawl 62 snaps out of draft, it is held out of draft by engagement of the pointed lowering cam surface 75 with the concave apex 140 and under the urging of the reverse ring spring 150, and in the position shown in FIGURES 19 and 21. While the load pawl assumes this position, the load is supported entirely by the handle pawl, which is then moved along with the handle in a clockwise direction of FIGURE 19 to thereby lower the load. Ordinarily, the ratchet proportions are such as to lower the load about the length of one link.

As the lowering operation proceeds with the handle pawl moving clockwise in draft, the periphery of the end 105 of the trip pin engages the trip pin cam surface 134 on the reverse ring, as seen in FIGURE 18. When

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this event occurs, the entire ring rotates slightly in a clockwise direction and concurrently with motion of the handle and handle pawl while the latter is in draft, the concave apex cam 140 releases the pointed lowering cam surface 75, whereupon the load pawl snaps into draft position under the bias of the load pawl spring 66 (FIGURES 18 and 20). The handle pawl is still in draft and to remove it from draft, continued clockwise rotation takes place to the end that the trip pin cam slides up 134 and forces the trip pin out of draft while the load is being transferred to the load pawl. To permit easy operation, the trip pin cam surface 134 is so contoured that the load is transferred from the handle pawl to the load pawl during an early portion of the engagement of the cam with the trip pin, and when the transfer is completed, further rotation just swings the handle pawl out of draft position to the position of FIGURE 18. When the handle is on the left side, as seen in FIGURES 13-19, the cam surface 122 operates in the same fashion as described for 134 above and below.

Still referring to a lowering operation, the next thing that the operator does is to reverse the direction that the handle is moving in order to repeat the above operations. In doing so, the reverse ring spring causes the reverse ring cam to follow the handle and handle pawl quite closely for an early portion of the return stroke. This holds the handle pawl out of draft position just long enough to position it relative to the next succeeding ratchet. Continued movement on the return stroke, through the angle of 18°, goes through the sequential phases of placing the handle pawl in draft under the urging of the handle pawl spring 94 to force it into draft, transferring the load from the load pawl to the handle pawl, and then a final phase where the load pawl is moved out of draft position. The final phase occurs by reason of moving the ratchet wheel 56 counterclockwise and in draft with the handle pawl a small amount necessary for a ratchet tooth to engage the back side of the load pawl and urge it to move radially outwardly. A slight amount of radially outward movement takes place, just sufficient to move the apex of the pointed lowering cam 75 radially inwardly of the convex apex cam 142 on the reverse ring. When this last event occurs, a snap action is brought about by reason of the leverage exerted by the apex cam on the lowering cam of the load pawl, whereupon the load pawl is snapped into a position with the lowering cam engaged by and held out of draft position by the concave apex cam surface 140 of the reverse ring 80. The handle pawl is now moved clockwise and the foregoing lowering operations are repeated to thereby move the load hook stepwise in the selected direction.

In describing the operation hereof, it is to be understood that the terminal portion of each stroke is positively determined by the engagement of the stop pin 18 with one of the stops on the housing.

It will be observed from the foregoing description of operation, taken with the drawings, that between the two pawls there is a certain amount of overlap of draft and draft position, i.e., when the handle pawl is in draft, but is approaching the end of its stroke during a lowering operation, it causes the load pawl to move into draft position through the agency of the reverse ring, and to do so well before the handle pawl is moved out of draft. Similarly, when the handle pawl is being moved to a new position, it moves into draft position before any transfer of load from the load pawl takes place. The reverse ring is designed to provide a large and substantial amount of overlap of draft position of one of the pawls while the other pawl is still in draft.

The danger of accidental free chaining while lowering is eliminated by providing a separate free chain control lever 16 which, as seen in FIGURE 22, moves the handle pawl completely out of any possible draft position and as long as the operator manually holds the lever 16 in position, positively maintains it out of draft position. However, in order to accomplish this, the operator must

himself move the free chain lever and maintain it in position, until the amount of free chain movement is completed. Before free chaining can take place, it is necessary to move the load pawl out of draft, if free chaining is to occur during lowering operations. The load pawl is moved out of draft and draft position by the same sequence of operations described above for a conventional lowering operation. Furthermore, it is held out of position by the reverse ring (FIGURE 19). Once the load pawl is out of draft, then the free chain control lever 16 is moved to the position shown in FIGURE 22, thereby moving the handle pawl completely out of draft and draft position.

To free chain for upward movement of the hook, with or without load, it is only necessary to pull downwardly on the end 44 of the chain, regardless of the indicated position (i.e. UP or DOWN) of the control lever 6.

When the handle is being operated from the other side of the hoist, i.e. the stop pin is moving between stop 21 and 25 (left side of FIGURE 3) the operation is the same, except the trip pin engages the first trip pin cam surface 122 in order to rotate the reverse ring and move the load pawl 62 into draft position.

The description of handle pumping given above generally fits the conditions when moving the handle from the left side of the hoist. In this position, release of the handle at the bottom of the stroke during lowering, and with prior art devices, transfers the load from the handle pawl to the load pawl, but does so with a rapid reverse movement of the ratchet, the handle and connected mechanism. As seen in FIGURES 3 and 10 through 15, this reverse movement would be in the clockwise direction and is caused by the load urging the ratchet wheel in such direction. The handle then moves upwardly with considerable velocity. When the handle with its connected mechanism reaches the end of its upward stroke it rebounds at almost original speed. When it rebounds, it again re-engages or again goes into draft with the ratchet wheel 56. The kinetic energy of the moving parts is sufficient, in prior art devices, to urge the load pawl out of draft, and the means for holding the same out of draft during the lowering operation then re-engages them, to the end that cycling or pumping begins. Prior art devices, due to industry-wide adoption of four degrees of rotation as the amount necessary to move the load pawl out of draft, quite readily permit handle pumping.

The instant invention overcomes handle pumping by greatly increasing the movement of the ratchet necessary to release the load pawl. In the preferred embodiment, 18° of rotation of the ratchet wheel 56 is required to release the load pawl from draft. Release is accomplished by a tooth of the ratchet wheel 56 camming against the underside of the load pawl at 175 to pivot the load pawl out of draft after 18° of movement. All of the ratchet wheel teeth are proportioned to accomplish this camming action. Movement out of draft occurs with a snap action after said 18°. This substantial arcuate movement eliminates handle pumping.

In review, it will be seen that the invention contemplates a novel construction employing a reverse ring of unusual and novel construction which provides a snap action to the load pawl and includes an apex cam having both concave and convex cam surfaces. Another feature of the reverse ring is the axially oblique cam surfaces 128, 138 which can be formed by striking down lugs formed on the one piece reverse ring. Conveniently the reverse ring can be constructed of one piece.

In addition to the novel construction of the reverse ring and the location of its parts to provide the requisite timed relationship in the various cycles of operation, the hoist when constructed according to the invention, also has a separate lever for permitting free chain operation. This lever is disposed to selectively remove the handle pawl from draft position by pivoting the latter out of engagement with the ratchet wheel and maintaining the same

there at the option of the operator by maintaining the lever in position. The proportions of the reverse ring, ratchet wheel, and of the locations of the various pawls and stops are such as to require a substantial amount of arcuate movement to cause either of the pawls to move into or out of draft position and when such movement does take place, it does with an overlap. By overlap is meant that at least one of the pawls is in draft while the other is in draft position, in such fashion that if the handle is continued to be moved in one direction, then the load is transferred from one pawl to the other. Overlap plus the requirement of intentional operation of the free chain control lever contribute to vastly superior safety in solving the problem of free chaining under load.

While the invention has been disclosed with respect to a specific embodiment, it is not my intention to be limited strictly to the configurations and proportions shown in the embodiment, but to include as my invention all the modifications thereof and equivalent means which are encompassed by the objects. Moreover, it is within the scope of the invention and it is my intention to consider as within the invention, all those modifications to, and equivalents of the elements be they modified or otherwise changed, the invention is described in the following claims:

What is claimed is:

1. A ratchet and pawl lever hoist comprising a shaft; a ratchet wheel coaxially mounted on the shaft; a load chain with a hook on one end thereof; a sheave, carrying the load chain, mounted on the shaft coaxially with the ratchet wheel and spaced along the shaft therefrom; a housing rotatably supporting the shaft; a load pawl pivotally supported from the housing to engage the ratchet wheel, and having a pointed lowering cam surface rearwardly of the ratchet engaging portion; a handle rotatably supported from the shaft and housing for coaxial rotation relative to both the shaft and housing; a handle pawl pivotally supported from the handle to engage the ratchet wheel; trip pin biasing means; a trip pin slidably supported from the handle pawl for motion relative to the handle pawl perpendicular to the plane through which the handle pawl pivots, and extending and resiliently urged by said biasing means toward the hereinafter described trip pin cam of the reverse ring; a free-chain control lever pivotally supported from the handle to engage the handle pawl and to pivot the latter out of engagement with the ratchet wheel; a reverse ring having a substantially flat body portion defining an open central portion, the reverse ring being rotatably mounted on the shaft between the ratchet wheel and sheave by passing the shaft through the open central portion, a first radial arm extending outwardly from the body portion and engaging the hereinafter defined reverse ring shifting means; a second radial arm having one face disposed to extend toward the rearward end of the load pawl and to present to the lowering cam surface an apex cam surface having a concave apex shaped to receive the lowering cam surface and a convex apex radially outward from said concave apex disposed to engage the lowering cam surface, a first oblique cam surface on the other face of the second radial arm and disposed obliquely to the body to angularly engage the trip pin and to move the trip pin relative to the handle pawl, a third radial arm having a first trip pin cam surface disposed to engage the trip pin, and a fourth radial arm disposed between the second and third arms and presenting a second trip cam surface towards the first oblique cam surface and also presenting to the third radial arm a second oblique cam surface constructed in like fashion as the first oblique cam surface and further defining a peripherally disposed by-pass trip pin cam surface connecting between the second trip pin cam surface and second oblique cam surface; and reverse ring shifting means for rotating the reverse ring from a first position wherein the apex cam surface is operatively effective to contact the load pawl to move it out of ratchet wheel engagement as the

handle is rotated in one direction, to a second position wherein the apex cam surface cannot operatively contact the load pawl, and means for urging the reverse ring toward first position.

2. For use with a positive control ratchet lever hoist, a reverse ring comprising a substantially flat body portion defining an open central portion, a first radial arm extending outwardly from the body portion; a second radial arm having an apex cam surface having one face presenting an undercut concave apex shaped to receive a pointed cam surface and a convex apex radially outward from said concave apex, a first oblique cam surface on the other face of the second radial arm and disposed obliquely to the body, a third radial arm having a first trip pin cam surface and a fourth radial arm disposed between the second and third arms and presenting a second trip cam surface toward the first oblique cam surface and also presenting to the third radial arm a second oblique cam surface constructed in like fashion as the first oblique cam surface and further defining a peripherally disposed by-pass trip pin cam surface connecting between the second trip pin cam surface and second oblique cam surface.

3. A reverse ring having a substantially flat generally circular body portion defining a ring with an open central portion, a first arm extending radially therefrom; a second arm radially extending from the body and arcuately spaced around the periphery of the body from said first arm, and having on one edge an apex cam surface disposed generally along a radius and including an undercut concave apex adjacent the body portion with a convex apex adjacent thereto and radially outward from said concave apex; at least one radially extending member presenting a sloping cam surface disposed in a plane oblique to that of the body and faired into the plane of the body; and at least one radial arm, coplanar with the body portion and presenting a cam surface one edge that is disposed at an oblique angle to any radius and is faired into the periphery of the body member.

4. A ratchet and pawl lever hoist comprising a shaft; a ratchet wheel coaxially mounted on said shaft; a load chain; a sheave, carrying said load chain and mounted on said shaft coaxially with the ratchet wheel and spaced along said shaft therefrom; a housing rotatably supporting said shaft; a load pawl pivotally supported from said housing and resiliently urged toward engagement with said ratchet wheel; a handle rotatably supported from the shaft; a handle pawl pivotally supported from said handle to engage said ratchet wheel; a trip pin slidably supported from said handle pawl for motion relative to said handle pawl at an angle to the plane through which said handle pawl pivots, said trip pin being resiliently biased in one direction, a reverse ring including a plurality of spaced cam projections having oblique cam surfaces, said reverse ring being shiftable to a position and engageable thereat by said trip pin when said handle is moved in one direction relative to said housing, said reverse ring being adapted to allow movement of said load pawl into draft position when the reverse ring is engaged by said trip pin said oblique cam surfaces being arranged for engagement by said trip pin to cause shifting movement of the trip pin; and means for selectively shifting said reverse ring to a position wherein it will not be engageable by said trip pin.

5. A ratchet and pawl lever hoist comprising a shaft; a ratchet wheel coaxially mounted on said shaft; a load chain; a sheave, carrying said load chain, mounted on said shaft coaxially with the ratchet wheel and spaced along said shaft therefrom; a housing rotatably supporting said shaft; a load pawl pivotally supported from said housing and resiliently urged toward engagement with said ratchet wheel; a handle rotatably supported from the shaft; a handle pawl pivotally supported from said handle to engage said ratchet wheel; a trip pin supported from said handle pawl for reciprocal motion rela-

tive to said handle pawl at an angle to the plane through which said handle pawl pivots relative to the handle, said trip pin being resiliently biased in one direction; reverse ring means including a plurality of spaced cam projections having oblique cam surfaces; said reverse ring being shiftable to a first position, for snap-actively moving said load pawl out of draft position while said handle pawl is in draft and for moving said handle pawl out of draft position while said load pawl is in draft position, said oblique cam surfaces being arranged for engagement by said trip pin to cause shifting movement of the trip pin; and means for selectively shifting said reverse ring means to said first position or to a second position wherein the reverse ring means is ineffective to control operative action of said load pawl and said handle pawl.

6. A ratchet and pawl lever hoist comprising a shaft disposed along an axis; a ratchet wheel coaxially mounted on said shaft; a load chain; a sheave, carrying said load chain, mounted on said shaft coaxially with said ratchet wheel and spaced along said shaft therefrom; a housing rotatably supporting said shaft; a load pawl pivotally supported from said housing to engage said ratchet wheel and having a cam surface; a handle rotatably supported from said shaft for coaxial rotation relative to said housing; a pair of stops arcuately spaced apart and secured to one of said housing or said handle; stop engaging means selectively disengageable from said stop and movably supported on the other of said housing or said handle; a handle pawl pivotally supported from said handle to engage said ratchet wheel; a trip pin slidably supported from said handle pawl for reciprocal motion relative to said handle pawl at an angle to the plane through which said handle pawl pivots relative to the handle; means movable to a selected position and carrying first, second and third cam surfaces all movable in unison, said first and second cam surfaces being respectively disposed for engagement with said trip pin and said load pawl cam surface, said third cam surface being disposed in a plane oblique to the axis of said shaft, and for snap-actively moving said load pawl out of draft position while said handle pawl is in draft and for moving said handle pawl into draft position while said load pawl is in draft position, all in the course of arcuately rotating said handle relative to said housing in respective opposite directions and between engagement of said stop engaging means with one of said stops, said third cam surface engaging the end of said trip pin to reciprocate the latter responsive to selective disengagement of said stop means from said stop and arcuate rotation of said handle pass said stop; means for selectively moving said means for snap-actively moving into and out of said position; and means for continuously urging said means for snap-actively moving into said selected position.

7. In a positive control ratchet lever hoist, a reverse ring-load pawl combination comprising a reverse ring, a load pawl, said load pawl having an angular rear shoulder, an apex cam surface on the reverse ring, said apex cam having an upper face and lower face meeting at a snap action apex, the lower face being undercut relative to the apex to thereby form a means responsive to pressure engagement between the rear shoulder of the load pawl and reverse ring shoulder for pivoting with a snap action, the load pawl rear angular shoulder snapping into nesting engagement with the reverse ring undercut face.

8. In a ratchet lever hoist having a ratchet with a plurality of teeth engageable with a revolvably mounted load pawl, a means for snap actively moving said load pawl out of draft with the ratchet wheel and comprising an angular rear shoulder on said load pawl; a reverse ring having an undercut apex disposed generally radially, the undercut being radially inwardly of the apex and proportioned to nestingly receive said rear shoulder, said reverse ring being disposed with said apex ad-

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jacent said shoulder; said ratchet wheel and load pawl being so proportioned that a predetermined arc of motion of said wheel in one direction revolves said load pawl partially out of draft by positive camming engagement between a tooth on said ratchet wheel and said load pawl; and means for biasing said apex into engagement with said shoulder with sufficient pressure to snap actingly move said load pawl completely out of draft responsive to movement of said ratchet wheel through said predetermined arc in one direction.

9. A ratchet lever hoist according to claim 8 wherein the proportions of said ratchet wheel and load pawl are

such as to require a predetermined arc of motion of 18 degrees.

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References Cited in the file of this patent

UNITED STATES PATENTS

1,469,084	Haseltine	Sept. 25, 1923
2,480,303	Pennell	Aug. 30, 1949
2,529,063	Williams	Nov. 7, 1950
2,537,270	Haseltine	Jan. 9, 1951
2,647,724	Coffing	Aug. 4, 1953
2,670,176	Coffing	Feb. 23, 1954
2,741,927	Hollander	Apr. 17, 1956