July 18, 1944. F. W. COFFING ET AL 2,353,648

FREE CHAIN PLANETARY HOIST

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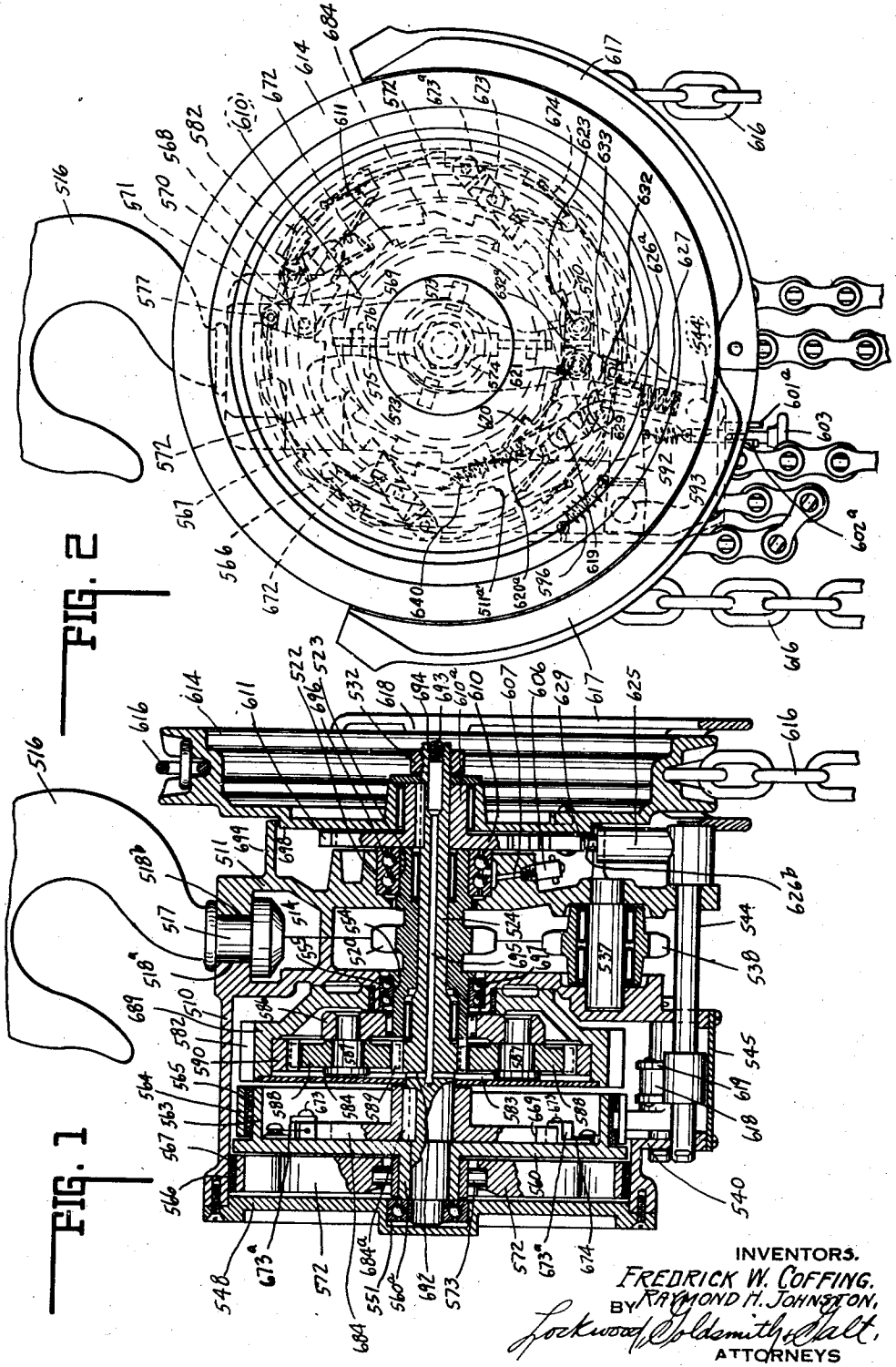

FIG. 2

FIG. 1

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FIG. 3

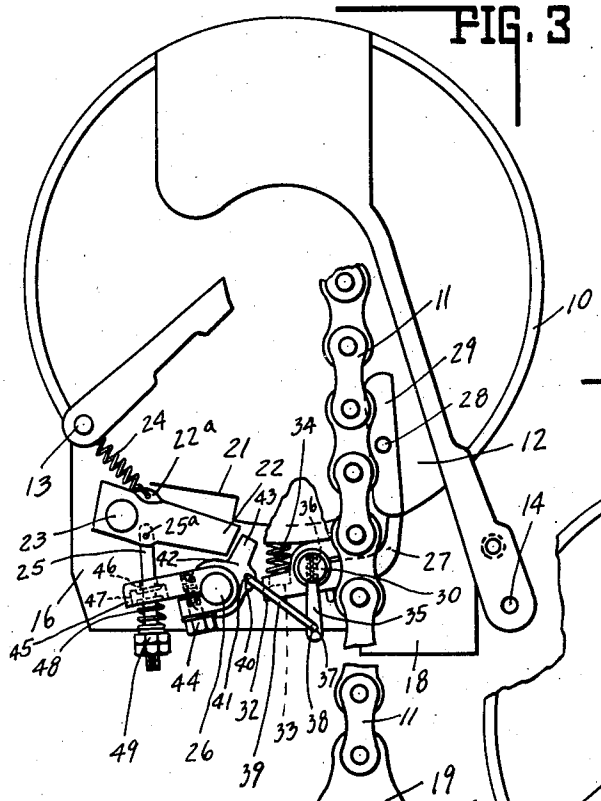

FIG. 6

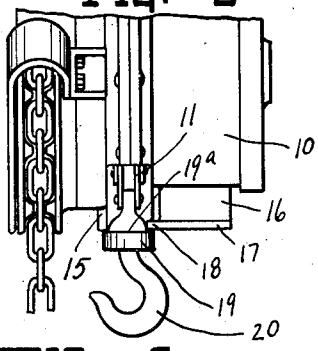

FIG. 4

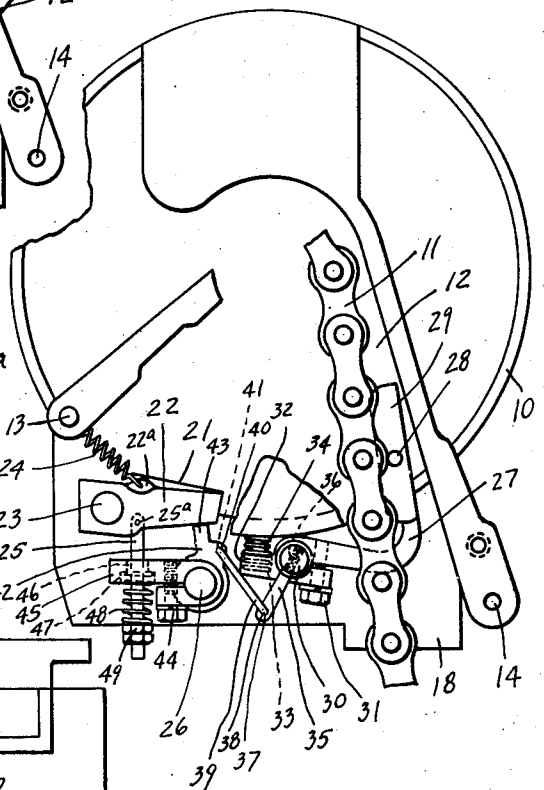

FIG. 5

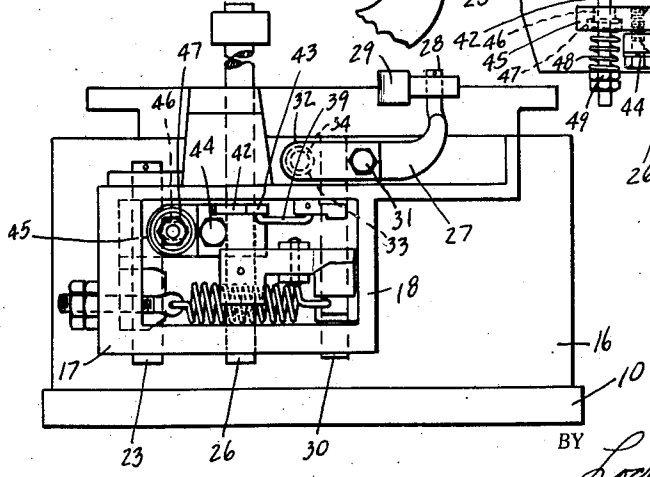

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FIG. 7

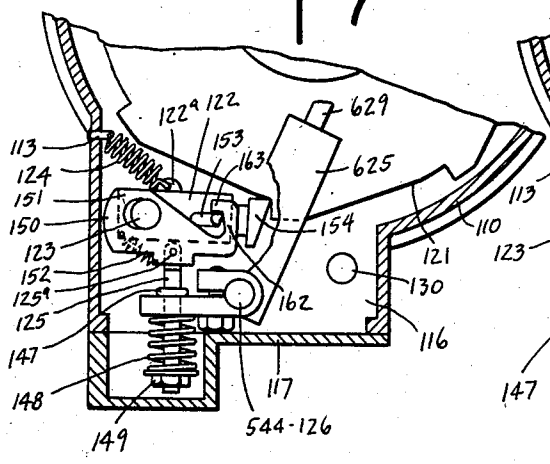


FIG. 9

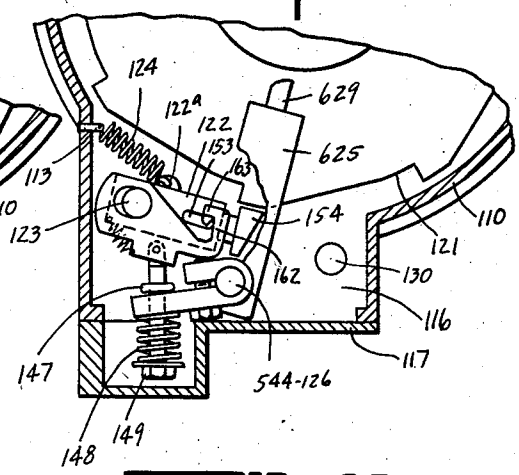


FIG. 8

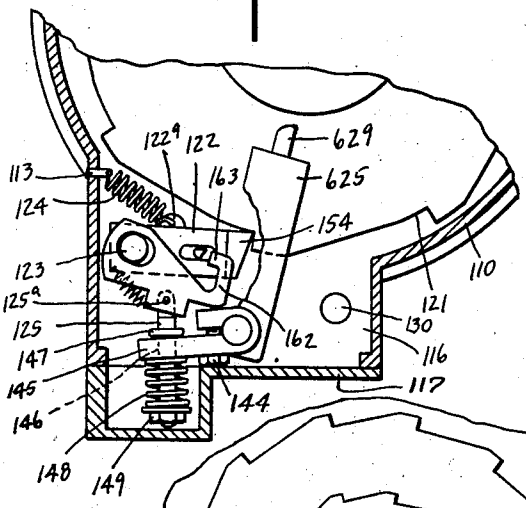


FIG. 10

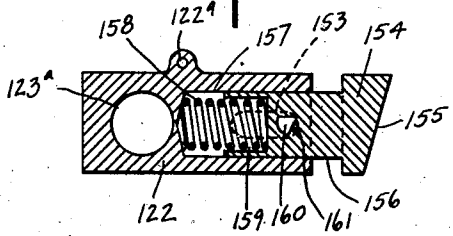
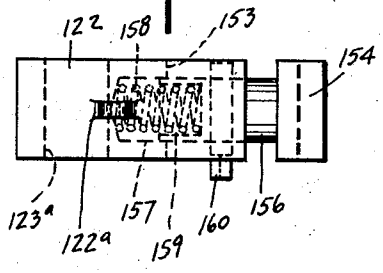


FIG. 11



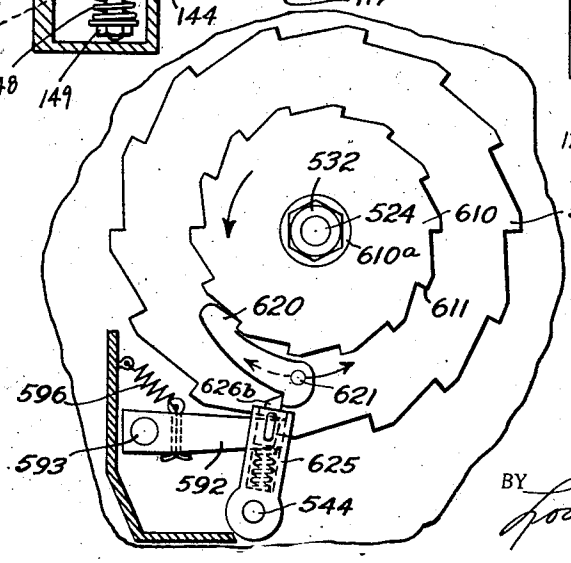


FIG. 2-A

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FREE CHAIN PLANETARY HOIST

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FIG. 12

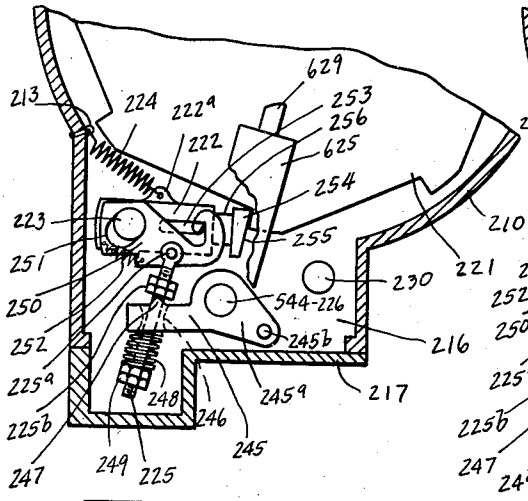


FIG. 13

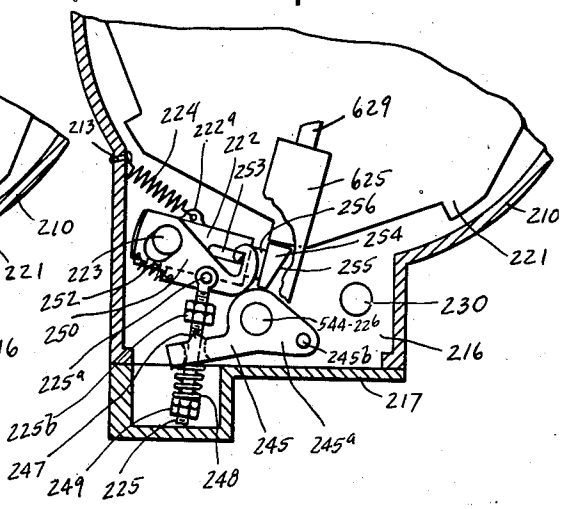


FIG. 14

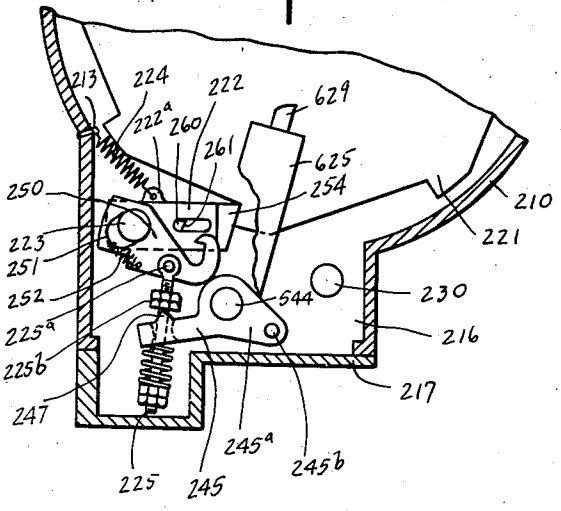


FIG. 15

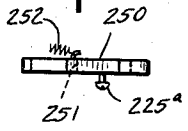
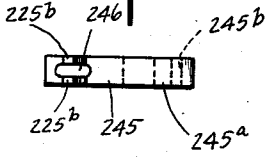


FIG. 16



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Patented July 18, 1944 2,353,648

UNITED STATES PATENT OFFICE

2,353,648

FREE-CHAIN PLANETARY HOIST

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Application July 20, 1940, Serial No. 346,486

19 Claims. (Cl. 254—171)

This invention relates to a free chain planetary type hoist.

This invention is an improvement upon that disclosed in a similarly entitled application, Serial No. 167,959, filed October 8, 1937, now Patent No. 2,269,438 dated January 13, 1942.

The chief object of the invention herein disclosed is to provide in a free chain hoist of the character illustrated, described and claimed in said patent, and more especially as illustrated in Figs. 8 to 11 thereof, a safety arrangement which is foolproof and positive, so that free chain movement, especially in the load lowering direction of chain movement, is impossible to attain as long as there is an appreciable weight on the chain, thereby preventing accidental dropping of the load if the free operation mechanism were accidentally actuated.

The chief feature of the invention resides in the load chain associated and power and chain operable mechanism for accomplishing the foregoing object.

Other objects and features of the invention will be set forth more fully hereinafter, such as the load sustaining hook stop, et cetera.

The full nature of the invention will be understood from the accompanying drawings and the following description and claims:

In the drawings, Fig. 1 is a central sectional view through a hoist of the character described, the load chain being omitted, and same is a substantial duplicate of Fig. 11 of the beforementioned copending patent.

Fig. 2 is a side elevational view of the hoist shown in Fig. 1 and is a substantial duplicate of Fig. 12 of said patent, said figures being included herein to facilitate an understanding of the character and operation of a hoist to which the present invention relates.

Fig. 2A is a view similar to Fig. 2, but omits all except a small part of the operating wheel cut away to show other parts with greater clearness.

Fig. 3 is a diagrammatic side elevation of the invention, the parts being shown in the "free chain" position.

Fig. 4 is a similar view of the same parts in the other or "lock out" position wherein "free chain" operation is impossible.

Fig. 5 is a diagrammatic bottom plan view of the parts shown in Figs. 3 and 4, the bottom plate being removed, and the brake operating mechanism, et cetera, being intentionally omitted for clearness.

Fig. 6 is a diagrammatic side elevation of the hoist embodying the invention and illustrating the chain stop.

Fig. 7 is a view similar to Fig. 4 and of a second embodiment of the invention in locking position.

Fig. 8 is a view similar to Fig. 7 and of the same embodiment and illustrating the parts in locking position preliminary to release.

Fig. 9 is a view similar to Fig. 3 and of the form shown in Figs. 7 and 8 and in the released position corresponding to that shown in Fig. 3.

Fig. 10 is an enlarged longitudinal sectional view of the ratchet wheel engaging structure in the extended position.

Fig. 11 is a top plan view looking down upon the pawl shown in Figs. 7 to 10 inclusive.

Figs. 12, 13 and 14 are views similar respectively to Figs. 7, 8 and 9 and of a third form of the invention and in corresponding positions.

Fig. 15 is a top plan view of pivoted catch member illustrated in Figs. 12 to 14.

Fig. 16 is a top plan view of the tiltable fulcrum providing member shown in Figs. 12 to 14.

The general type of hoist in which the present invention is incorporated is that illustrated in the beforementioned copending application and for illustrative purposes only, Figs. 1 and 2 hereof (substantial duplicates of Figs. 11 and 12 thereof) are included and brief reference will be made to the parts shown in Figs. 1 and 2 hereof as follows:

In Figs. 1 and 2 there is illustrated the brake mechanism, speed control mechanism, planetary transmission, one-way ratchet clutch mechanism, combination ratchet and ring gear mechanism and power applying mechanism embodied in the representation of the type of hoist to which the present invention applies.

In view of the copending application, now Patent 2,269,438, disclosure, parts shown in Figs. 1 and 2 hereof will be catalogued only and followed by a brief reference to the operation of the same.

516 indicates the hoist supporting hook, and **510—511** the housing structure closed by cover or end plate **548** and having a depending communicating well portion **540** closed by cover **545**. A main shaft **524** rotatably supports load sprocket **520**. Shaft **524** is rigid with sun gear **539** meshing with planetary pinions **588** on shafts **587** carried by plate **586**, keyed or otherwise secured to the load sprocket shaft **554**. The pinions mesh with annular internal gear **590** having ratchet teeth **582** externally thereof and engageable by pawl **592**, see Fig. 2, constrained thereto as at **596**.

Shaft **524** mounts the hub **610***a* of ratchet plate **610** having teeth **611**. Rotatable on the hub is the power wheel **614** which mounts operating chain **616**. The wheel and chain may be guarded as at **617**, if desired. The chain wheel and ratchet **610** are suitably connected together as set forth in the copending application for rotation of shaft **524** which, through the planetary system, rotates load sprocket **520** for "load elevation" movement of the load chain.

The ratchet **582**, see Fig. 1, annular internal

gear 590 and portion 689 constitute an inner housing for the sun and pinion gears and is closed by plate 584. This housing is arranged to receive lubricant, as indicated at 693—694—695—583.

The shaft 524 projects through plate 584 and is supported at 551 in cover plate 548. A hub 560a is rotatable on this shaft portion and includes plate 560 which pivotally supports at 673 ratchet engaging pawls 672 normally constrained to such engagement by plate carried springs 674. Ratchet 684 is keyed, as shown at 684a to shaft 524.

Plate 560 includes a peripheral brake drum portion 563 which nests the last mentioned pawl and ratchet arrangement and the drum is substantially encircled by band 564 which may be frictioned as at 565. This band is normally constrained to drum engagement and is released by operation of members 618—619 when shaft 544 is actuated or rocked by the pawl mechanism for load lowering.

In load elevation, the drum 563 remains stationary because the last mentioned ratchet 684 and multiple-offset pawl 672 arrangement acts as a one-way clutch. In load lowering, this clutch is effective to connect the drum 563 to the shaft and thus the band 564 holds or releases the load depending upon the control exercised upon the brake through shaft 544.

The governor is of the form shown in Fig. 6 of Patent No. 2,269,438 and, as shown herein in Figs. 1 and 2, plate 560 pivotally mounts in diametrical relation at 570 the speed control weights 572, the tails 571 of which connect to one end 577 of semi-circular shoes 567, frictioned as at 566, if desired. The other ends 568 are supported by links 569 also supported at 570. The weights are normally constrained to non-actuating position by springs 578 anchored thereto at 579 and also anchored at one end 580 to plate 560. Uniform action means such as 575—576 and weight collapsing stops 573 may also be provided if desired.

Upon the load-lowering movement speed exceeding that for which the governor is adjusted, the shoes 567 are caused to move outwardly (substantially radially) to engage the interior adjacent face of the housing 510 and prevent overspeeding. The greater the excess speed of lowering the greater will be the governor braking application or retarding force exerted by the governor to prevent overspeeding and thus prevent possible damage to either the hoist or the load. In load lowering, et cetera, the planetary system increases the lowering speed as applied to the governor as well as to the brake which are further factors for safety, all as more fully described in the copending application, made a part hereof.

It will be observed, see Fig. 1, that below load sprocket 520 in the sprocket chamber or recess is a shaft 537 upon which is rotatably mounted a sprocket 538.

No further detailed description of operation is believed necessary for a complete understanding of this type of hoist and its general operation.

Having thus briefly described the construction and operation of the type of hoist to which this invention applies and which is not specifically claimed herein and of which that illustrated herein is an operative portion, reference now is more particularly directed to Figs. 3, 4 and 5. In said figures, 10 indicates the housing generally; 11 the load chain and 12 the chain channel forming portion which, as noted, is flared to accommodate multiple runs of the chain when the hoist is arranged for two, three or four run action to obtain double, et cetera, power capacity with corresponding decrease in load travel. Reference numerals 13 and 14 indicate alternative load chain anchoring portion for chain end anchorage when different powers are desired.

Depending from a portion of the housing 10 is plate portion 15, see Fig. 6. Also adjacent thereto but spaced therefrom is a well portion 16 in which is mounted the brake controlling mechanism, said well portion being comparable to portion 540, see Figs. 1 and 2. Said well portion is closed by cover plate 17, see Fig. 6, which includes extension 18 terminating in spaced relation to plate portion 15. In the space therebetween is positioned chain 11, the free end of which may be connected to a support 19 swivably supporting load supporting hook 20, the same being, if desired, identical or similar to the swiveling hook structure illustrated in Fig. 8 of Patent No. 2,150,419, dated March 14, 1939. This support or connector 19 includes shoulder 19a which engages both plate portions when the chain is drawn into the hoist and prevents jamming of the hoist mechanism by the load supporting hook and the like.

In Figs. 3 and 4, 21 indicates the ratchet similar to ratchet 582 in Figs. 1 and 2, and 22 the pawl similar to pawl 592 in Fig. 2. Pawl 22 is pivoted at 23 similar to pivot 593 and is constrained into ratchet engagement by spring 24 similar to spring 596. Connected to pawl 22 is member 25 which is comparable to member 603. Pawl 22 permits counterclockwise rotation (see Fig. 3) of the ratchet including teeth 21 and at all times whether ratchet seated or otherwise. When seated, however, it prevents clockwise rotation, hence is unidirectional in operation. When positively unseated and held in that position, clockwise rotation of the ratchet is permitted.

Adjacent shaft 23 is a shaft 26 comparable to shaft 544 in said Figures 1 and 2. The brake connections and operating members, not shown herein, may be connected to these shafts, as illustrated in Figs. 3 and 5 of said copending application.

One feature of the present invention will now be set forth. Projecting upwardly into the chain channel is a curved arm 27 which at its upper end pivotally supports at 28 a chain engaging shoe 29. The arm is carried by shaft 30 that extends into and across well portion 16, as shown in Fig. 5. The arm is adjustably mounted on shaft 30 as indicated at 31, and a tail portion 32 of the arm is recessed as at 33 to seat spring 34, the other end of which may be suitably seated in or upon housing 10, thereby constraining at all times the arm 27 into position for shoe 29 engagement with the load chain 11.

Within the well 16 and secured to shaft 30 is the eyebolt or equivalent member 35, adjustably mounted as at 36 and providing socket 37 at its free end to receive one lateral arm 38 of U-shaped link 39, the other end 40 of which is seated in aperture 41 of the locking member 42. Locking member 42 is mounted on shaft 26 and rocks freely thereon. It includes a stop lug 43 adapted in locking position, see Fig. 4, to prevent locking pawl 22 from moving into ratchet release position as shown in Fig. 3, which is the "free chain" position.

As shown in Figs. 3 to 5 inclusive, shaft 26 adjustably mounts as at 44 an arm 45 which is

apertured at 46 and through which member 25 extends. The aperture is enlarged as at 47 to seat one end of a concentric spring 48 which bears on the adjustable bearing 49 carried by the free end of member 25. This bearing herein is shown as two nuts.

Spring 48 normally tends to retract pawl 22 from ratchet engagement. This, however, is prevented, see Fig. 4, by lug 43. Until lug 43 is moved to the position shown in Fig. 3, the pawl 22 cannot be released, and only then if the power is sufficiently applied to permit the pawl to clear the ratchet tooth, due to the draft relationship therebetween, as recited by the copending application.

Now if there be no load on the chain and the power wheel be reversed for load lowering, the parts, then, assume the position as shown in Fig. 3 and the chain can be moved freely through the hoist in either direction.

However, if there be a load upon the chain, due to the fact that the chain and load tends to center with respect to the center of gravity of the arrangement, the chain 11 engages and bears upon shoe 29 and tilts arm 27 and shaft 30 into the position shown in Fig. 4. This is the normal load sustaining position of the parts whether the load is being elevated, held stationary, or is being lowered. This positioning of the parts insures movement of lug 43 behind pawl 22 to lock the pawl 22 into ratchet 21 engagement in the closest tooth recess, as the ratchet is rotated incident to further hoist operation.

Thus, as long as there be any appreciable load on the chain, the lug 43 will be held in pawl seating locking position and thus dropping of the load is prevented. In all other respects, this form of hoist operates substantially as thus briefly described with reference to the hoist illustrated in Figs. 1 and 2 and briefly described herein and more fully illustrated, described and claimed in the copending application referred to.

As shown in Figs. 1 and 2, plunger 629 is yieldingly constrained by spring 627 within tubular arm 625 on shaft 544 into engagement with pawl 619. When rotated counterclockwise, see Fig. 2, plunger 629 recedes to permit pawl rotation without interference. Rotation in a clockwise direction causes the pawl tooth 632 adjacent plunger 629 to engage same and tilt it and arm 625 for rocking shaft 544 for the purpose described in the copending application.

In Figs. 3 to 5, shaft 26 is the same or corresponding shaft designated by 544 in Figs. 1 and 2. For clearness, the member or arm 625 and plunger 629 is omitted. This is the power for retracting pawl 22 from ratchet 21. This pawl release, however, as previously described, can only occur after arm 27 has retracted stop 43 from the position shown in Fig. 4 to the position shown in Fig. 3, it being noted that member 42 is merely located by shaft 26 and does not affect rotation thereof nor is affected by rotation thereof.

In Figs. 7 to 11, there is illustrated another form of the invention and in Figs. 12 to 16 there is illustrated a third form of invention. The chain operable or controlled stop form of the original form of the invention has been omitted from Figs. 7 to 16.

In Figs. 7 to 16, it is observed that the structure corresponding to pawl 22 in Figs. 3 to 5 is of multiple construction. In Figs. 7 to 11, numerals of the one hundred series, similar to primary numerals utilized in Figs. 3 to 5 designate like or corresponding parts. In like manner, numerals of the two hundred series in Figs. 12 to 16 designate like or corresponding parts. Numerals of the five and six hundred series employed in Figs. 7 to 16 indicate parts like or similar to those having the same numerals in Figs. 1 and 2.

In Figs. 10 and 11, 122 indicates the base portion of the ratchet locking pawl. It is apertured at 123a for pivotal mounting on pivot 123, a shaft utilized for other purposes, see the copending application. This body portion 122 is bored as at 157 and slidable therein is stem 156 chambered at its inner end as at 159. In this closed chamber is spring 158 normally projecting stem 156 outwardly.

The free end supports head 154 with relieved or retractive face 155 for clearance purposes. A pair of parallel elongated slots 153 are at opposite sides of the body portion. A pin 160 extends through stem 156 and the projecting ends ride in said slots. This pin limits relative movement between body and head longitudinally of the body and prevents relative rotation as well. The pin at one end is extended beyond the body, see Fig. 11, and one face is relieved as at 161 for clearance purposes.

In Figs. 7 to 9, spring 124 is connected at one end to housing 110 as at 113 and at its opposite end to anchorage 122a on body portion 122. Spring 158 normally projects head 154 toward the teeth of ratchet 121 and spring 124 normally constrains the entire pawl structure toward the ratchet.

With this multiple part articulated pawl structure, it is obvious that pawl-ratchet release requires positive action to telescope the parts in addition to rocking the pawl upon its pivot.

Instead of member 125 being connected directly to body 122, there is interposed a plate 150 having an elongated slot 151 therein in which is mounted pivot member 123. A pin 125a serves as a pivotal connection between members 150 and 125. A spring 152 normally constrains member 150 into elevated and retracted position relative to body portion 122 as shown in Fig. 7.

The forward end of member 150 has an upward extension 162 with rearwardly directed portion 163 forming a hook. The member 125 extends through aperture 146 in member 145 adjustably but rigidly mounted as at 144 upon shaft 544—126 in turn rockable by arm 625 and plunger 629.

A spring 148 concentric with member 125 bears on the washer retained by nut 149 by which the force of spring 148 is adjusted. Member 125 has an enlargement 147 which limits the movement upwardly on member 125 of member 145.

The operation is as follows: Power wheel 614, Figs. 1 and 2, can be rotated by chain 616 in either direction. With load on the chain 11, see Figs. 3 and 4, free-chain movement of said chain in load lowering direction is impossible. Controlled lowering through the planetary system, brake and governor is possible while the member 689, Fig. 1, is held by pawl 592 engaging ratchet teeth 582, see Fig. 2, or its equivalent, see the other figures. Observe that power from the chain wheel 614 rotates 524 and through the planetary rotates the load sprocket 520 for load elevation. In this rotation the ratchet and pawl connection within the brake drum permits load elevation without speed control or brake drum rotation. For load holding pawl 592 and ratchet 582 cause the load effort to lower by gravity to become effective upon the brake drum included

pawl and ratchet connection so that this load is then held by the brake band.

When shaft **544** is actuated to effect load lowering, observe that pawl **592** is still effective through teeth **582** to hold part **689** stationary. However, pawl and ratchet connection within the drum is effective and the brake drum rotates through gravity on the load and to the extent permitted by brake band release effected through shaft **545**. However, should excessive lowering speed result, the speed control becomes effective to hold the controller shoes to the hoist casing preventing excessive load lowering speed or load dropping.

Without load on the chain, it is obvious that the load chain can be readily pulled through the hoist, by a free-chain action, and in the load elevating direction. The only other action not described, is free-chain movement in the load lowering direction which will now be described.

In Fig. 2, when member **603** is pulled down, which is only possible when there is no load on the chain, free-chain action in load lowering direction is possible. To permit free-chain action it is required that ratchet **582** be initially rotated slightly in the load elevating direction to release the draft lock between the pawl **592** and ratchet teeth **582**. When so released the pawl **592** is retracted by the then extended spring between that pawl and member **603** in opposition to spring **596**.

Referring to Figs. 7 to 9, **544** is the brake release control shaft for normal load lowering as previously described. Here it also is the control shaft for free-chain operation in load lowering direction. When arm **625** is rocked counterclockwise the shaft **544—126** follows as shown in Fig. 8, as compared to Fig. 7. In this rocking motion, the arm **145** rotates counterclockwise and applies pressure on the spring **148** which, in turn, through the enlarged end **149** of the member **125**, pulls down on said member and lowers the member thereby extending the spring **152**, as shown in Fig. 8. With no load on the chain, when shaft **544—126** is rocked counterclockwise, stem **125** pulls down on hook **162**, see Fig. 7. In so doing hook end **163** bears on pin **160** and hence pawl **154** is pulled downward and thus released or disengaged from ratchet **121** while no load is on the ratchet, see Fig. 9. Now, when load is on the ratchet, as the stem **125** draws down the hook **162—163**, but due to the load, see Fig. 8, the pawl is collapsed and hook **162—163** is free of the pin **160** or disengaged so that hook **162—163** then cannot release the pawl **154—122** from the ratchet **121**.

Shaft **544**, Figs. 1 and 7, carries arm **145** carrying stem **125**. Shaft **544** carries, see Fig. 1, arm **625**, shown also in Figs. 7, 8 and 9. Wheel **614**, when rotated counter-clockwise (Fig. 2), lifts the load by ratchet **610**. To release the load, wheel **614** is rotated clockwise and pawl tooth **632** engages plunger **629**, which is carried by arm **625**, so that arm **625** is thus moved counter-clockwise to depress stem **125**. Ratchet **121** is not rotated by wheel **614** at any time.

When the parts are as illustrated in Fig. 9, the ratchet wheel is freed from the pawl or locking arrangement and free chain arrangement can be obtained because ratchet **121** is free.

In Figs. 12 to 16, numerals of the two hundred series indicate parts similar to those designated by numerals of the one hundred series and employed in Figs. 1 to 11 inclusive. The operation of the device is substantially the same as to the third form of the invention illustrated. The chief difference herein is that the member **245** is shown provided with a tail portion **245***a* and with an opening **245***b* therein. The main portion **245** is apertured as indicated at **246** and this is of Venturi type and the pull-down member **225** is seated therein and, as shown, carries the spring **248**.

Above the member **245** is an adjustable bearing in the form of a pair of locknuts **225***b* and the lower one rides on the abutment or fulcrum **247** on the member **245**. It will be noted that in both the last two forms of the invention the hook member is provided with an elongated aperture which receives a support **223**.

Figs. 7 and 12 represent the parts in normal position with the hoist under "no load." Figs. 4, 8 and 14 represent the parts in working position when the hoist is under load and "free chain" action is not permitted. Figs. 3, 9 and 13 represent the parts in "free chain" position with "no load" on the hoist and permitting free chain operation.

The second and third forms of the invention have the advantage of the load-locking pawl structure cushioning the ratchet (**121** or **221**) contact, spring **158** or **258**, respectively, serving as the shock absorber. This is not illustrative nor present in the first form of the invention, see Figs. 3 to 5.

One primary purpose is making the free chain action positive through the connection between the arm **625** operable shaft **544** (**26** in Figs. 3 to 5, **126** in Figs. 7 to 9, and **226** in Figs. 12 to 14, and member **25**, **125** and **225** respectively, as previously described).

It is to be noted that the chain has weight. For single chain the adjustments are made so that for any weight under approximately thirty pounds, the parts can be positioned for free chain action and pawl head extending spring **158** or **258** is strong enough to withstand a pressure of a thirty-pound load exerted by counterclockwise movement of ratchet **121** or **221** before compressing said spring thereby allowing pin **160** or **260** to move rearwardly to free catch **160** or **260** respectively from said pin. When the load sustaining pawl structure is collapsed, it, in effect, becomes a solid pawl similar to that shown in Figs. 2 and 3 to 5.

While the invention has been illustrated and described in great detail in the foregoing description, the same is to be considered as illustrative and not restrictive in character.

The several modifications described herein, as well as others which will readily suggest themselves to persons skilled in this art, all are considered to be within the broad scope of the invention, reference being had to the appended claims.

The invention claimed is:

1. In a free chain hoist, the combination with a ratchet, a load sustaining pawl normally constrained to ratchet engagement for load holding, and a load chain operatively connected to said ratchet, of means operable by the chain, a locking means for retaining said pawl in ratchet engagement, and means connecting said first and second mentioned means for pawl locking and releasable when the chain is of "no load" character.

2. In a free chain type of hoist including a load chain, a sprocket therefor, means for rotating the sprocket for load chain elevation, means operatively connected with the sprocket for load chain lowering, and means having cooperative association with the second mentioned means, said

third mentioned means conditioning the second mentioned means for free chain movement in the lowering direction, the combination of latch means for said third mentioned means, preventing free chain movement, and means operable by the chain for operating said latch means and normally constrained to latch release when the chain is not under load and effective when the chain is under load to prevent latch release.

3. In a hoist having a chain capable of free chain movement in the load lowering direction, a locking pawl normally constrained to prevent the free chain movement, means normally constrained to one position corresponding to that permitting the free chain movement and operable by the chain, and a movable stop connected to said means and normally constrained to free chain movable position and positionable to prevent locking pawl release for free chain movement, the first mentioned means being operable by chain movement due to load on the chain, in opposition to the means constraint, to prevent stop movement permitting pawl release.

4. In a chain hoist having a predetermined central plane and a load chain, said chain being movable laterally relative to the plan when under load whether of static or kinetic character, the combination of pivotally supported chain engaging means, a uni-directional lock permitting free chain movement when said lock is actuated to permit such chain movement, a movable stop for said lock, and means connecting the first mentioned chain engaging means to said stop for causing stop and lock engagement when the first mentioned chain engaging means is moved by lateral movement of said chain incident to the load thereon.

5. A device, as defined by claim 4, characterized by the pivotally supported means including a pivotally supported arm and a chain engaging shoe movable supported thereby and responsive to lateral movement of the chain for arm movement, said shoe having non-interfering engagement with the chain for linear movement thereof.

6. A device, as defined by claim 4, characterized by the pivotally supported means being normally constrained toward chain engagement.

7. A device, as defined by claim 4, characterized by the pivotally supported means being an angular arm pivoted at one end, and a chain engaging shoe pivotally supported by the arm at the opposite end.

8. A device, as defined by claim 4, characterized by the pivotally supported first mentioned means including an arm movable therewith, and the connecting means including a link between said arm and stop, the first mentioned means being normally constrained to chain engagement.

9. In a free chain hoist having a main control shaft, a load chain, a load holding ratchet operatively connected to said load chain, control means operable by the control shaft for load lowering and the like including a locking pawl engaging said ratchet and yieldingly connected to the control shaft for operation thereby and normally constrained to ratchet engagement, a stop for preventing pawl disengagement from the ratchet, and means operable by said chain and operatively connected to the stop and normally constrained to stop release position, and movable upon chain loading into pawl locking position in opposition to the constraint.

10. In a free chain hoist, the combination with a load chain, a load holding ratchet, a load holding pawl constrained to locking engagement therewith, and a main control shaft, of arm means for rocking said shaft, and a yielding connection interposed between said pawl and said shaft for shaft release of said pawl permitting free chain action when no load is on the chain, the yielding connection including a member depending from and pivotally connected to the pawl, an arm rigid with the shaft, and yielding means interposed between the member and arm and compressible upon shaft releasing movement for cushioning the arm pull upon the pawl to permit ratchet rotation in ratcheting direction to effect pawl clearance for pawl engagement when the arm pull exceeds the pawl constraint.

11. In a free chain hoist, the combination with a load chain, a load holding ratchet, a load holding pawl constrained to locking engagement therewith, and a main control shaft, of arm means for rocking said shaft, and a yielding connection interposed between said pawl and said shaft for shaft release of said pawl permitting free chain action when no load is on the chain, the yielding connection including a member depending from and pivotally connected to the pawl, an arm rigid with the shaft, and yielding means interposed between the member and arm and compressible upon shaft releasing movement for cushioning the arm pull upon the pawl to permit ratchet rotation in ratcheting direction to effect pawl clearance for pawl engagement when the arm pull exceeds the pawl constraint, the depending member extending through an aperture in the arm, and the yielding means being concentric with the depending member arm projecting portion.

12. In a free chain hoist, the combination with a load chain, a load holding ratchet, a load holding pawl constrained to locking engagement therewith, and a main control shaft, of arm means for rocking said shaft, and a yielding connection interposed between said pawl and said shaft for shaft release of said pawl permitting free chain action when no load is on the chain, the pawl including a pair of slidably associated members having limited sliding movement and normally constrained toward extended relation and when retracted forming a "solid" pawl arrangement.

13. In a free chain hoist, the combination with a load chain, a load holding ratchet, a load holding pawl constrained to locking engagement therewith, and a main control shaft, of arm means for rocking said shaft, and a yielding connection interposed between said pawl and said shaft for shaft release of said pawl permitting free chain action when no load is on the chain, the pawl including a pair of slidably associated members having limited sliding movement and normally constrained toward extended relation and when retracted in opposition to the constraint forming a "solid" pawl arrangement, a catch member carried by and movable with one of said slidably associated members, and a latch member movably associated with the other member and normally constrained to engage the catch member when in latching position, contraction movement in the pawl arrangement conditioning the latch-catch association for separation of the latch from the catch.

14. In a free chain hoist, the combination with a load chain, a load holding ratchet, a load holding pawl constrained to locking en-

gagement therewith, and a main control shaft, of arm means for rocking said shaft, and a yielding connection interposed between said pawl and said shaft for shaft release of said pawl permitting free chain action when no load is on the chain, the yielding connection including a member depending from and pivotally connected to the pawl, an arm rigid with the shaft, yielding means interposed between the member and arm and compressible upon shaft releasing movement for cushioning the arm pull upon the pawl to permit ratchet rotation in ratcheting direction to effect pawl clearance for pawl disengagement when the arm pull exceeds the pawl constraint, the pawl including a pair of slidably associated members having limited sliding movement and normally constrained toward extended relation and when retracted in opposition to the constraint forming a "solid" pawl arrangement, a catch member carried by and movable with one of said slidably associated members, and a latch member movably associated with the other member and normally constrained to engage the catch member when in latching position, contraction movement in the pawl arrangement conditioning the latch-catch association for separation of the latch from the catch, and the depending member being pivoted directly to the latch member.

15. In a free chain hoist, the combination with a load chain, a load holding ratchet, a load holding pawl constrained to locking engagement therewith, and a main control shaft, of arm means for rocking said shaft, and a yielding connection interposed between said pawl and said shaft for shaft release of said pawl permitting free chain action when no load is on the chain, the yielding connection including a member depending from and pivotally connected to the pawl, an arm rigid with the shaft, yielding means interposed between the member and arm and compressible upon shaft releasing movement for cushioning the arm pull upon the pawl to permit ratchet rotation in ratcheting direction to effect pawl clearance for pawl disengagement when the arm pull exceeds the pawl constraint, the depending member extending through an aperture in the arm, the yielding means being concentric with the depending member arm projecting portion, the pawl including a pair of slidably associated members having limited sliding movement and normally constrained toward extended relation and when retracted in opposition to the constraint forming a "solid" pawl arrangement, a catch member carried by and movable with one of said slidably associated members, and a latch member movably associated with the other member and normally constrained to engage the catch member when in latching position, contraction movement in the pawl arrangement conditioning the latch-catch association for separation of the latch from the catch, and the depending member being pivoted directly to the latch member.

16. In a free chain hoist, the combination with a load chain, a load holding ratchet, a load holding pawl constrained to locking engagement therewith, and a main control shaft, of arm means for rocking said shaft, and a yielding connection interposed between said pawl and said shaft for shaft release of said pawl permitting free chain action when no load is on the chain, the yielding connection including a member depending from and pivotally connected to the pawl, an arm rigid with the shaft, yielding means interposed between the member and arm and compressible upon shaft releasing movement for cushioning the arm pull upon the pawl to permit ratchet rotation in ratcheting direction to effect pawl clearance for pawl disengagement when the arm pull exceeds the pawl constraint, the depending member extending through an aperture in the arm, the yielding means being concentric with the depending member arm projecting portion, the depending member above the arm including a bearing arrangement, and the arm adjacent thereto including a bearing engageable fulcrum.

17. In a free chain hoist, the combination with a load chain, a load holding ratchet, a load holding pawl constrained to locking engagement therewith, and a main control shaft, of arm means for rocking said shaft, and a yielding connection interposed between said pawl and said shaft for shaft release of said pawl permitting free chain action when no load is on the chain, the yielding connection including a member depending from and pivotally connected to the pawl, an arm rigid with the shaft, yielding means interposed between the member and arm and compressible upon shaft releasing movement for cushioning the arm pull upon the pawl to permit ratchet rotation in ratcheting direction to effect pawl clearance for pawl disengagement when the arm pull exceeds the pawl constraint, the depending member extending through an aperture in the arm, the yielding means being concentric with the depending member arm projecting portion, the depending member above the arm including a bearing arrangement, and the arm adjacent thereto including a bearing engageable fulcrum, the bearing arrangement being adjustable longitudinally of the depending member.

18. In a free chain hoist, the combination with a load chain, a load holding ratchet, a load holding pawl constrained to locking engagement therewith, and a main control shaft, of arm means for rocking said shaft, and a yielding connection interposed between said pawl and said shaft for shaft release of said pawl permitting free chain action when no load is on the chain, the yielding connection including a member depending from and pivotally connected to the pawl, an arm rigid with the shaft, yielding means interposed between the member and arm and compressible upon shaft releasing movement for cushioning the arm pull upon the pawl to permit ratchet rototion in ratcheting direction to effect pawl clearance for pawl disengagement when the arm pull exceeds the pawl constraint, the depending member extending through an aperture in the arm, the yielding means being concentric with the depending member arm projecting portion, the depending member above the arm including a bearing arrangement, the arm adjacent thereto including a bearing engageable fulcrum, the bearing arrangement being adjustable longitudinally of the depending member, the pawl including a pair of slidably associated members having limited sliding movement and normally constrained toward extended relation and when retracted in opposition to the constraint forming a "solid" pawl arrangement, a catch member carried by and movable with one of said slidably associated members, and a latch member movably associated with the other member and normally constrained to engage the catch

member when in latching position, contraction movement in the pawl arrangement conditioning the latch-catch association for separation of the latch from the catch, and the depending member being pivoted directly to the latch member.

19. In a free chain hoist, the combination with a load chain, a load holding ratchet, a load holding pawl constrained to locking engagement therewith, and a main control shaft, of arm means for rocking said shaft, a yielding connection interposed between said pawl and said shaft for shaft release of said pawl, means for locking said pawl in ratchet engaging position, and chain engaging means operably connected to the locking means and operable by said chain when the chain is under load to prevent the locking means from releasing said pawl for free chain movement in lowering direction, the chain engaging means being normally constrained to pawl release position.

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