Aug. 26, 1958 H. C. LINDMARK 2,849,089

REVERSIBLE RATCHET MECHANISM

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Fig. 1

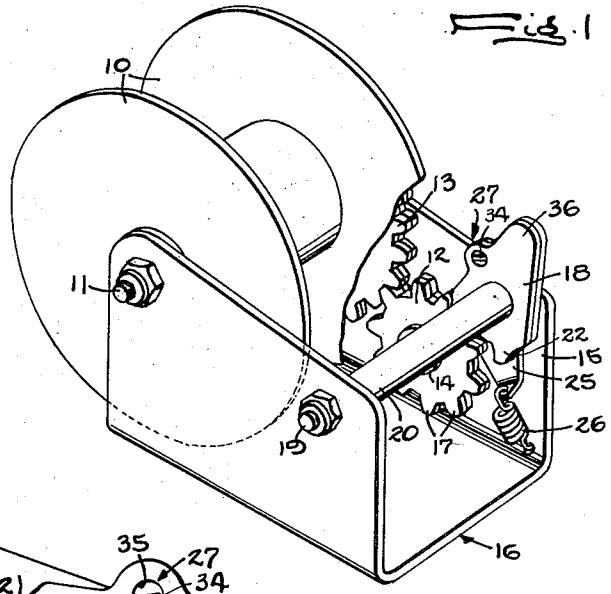


Fig. 2

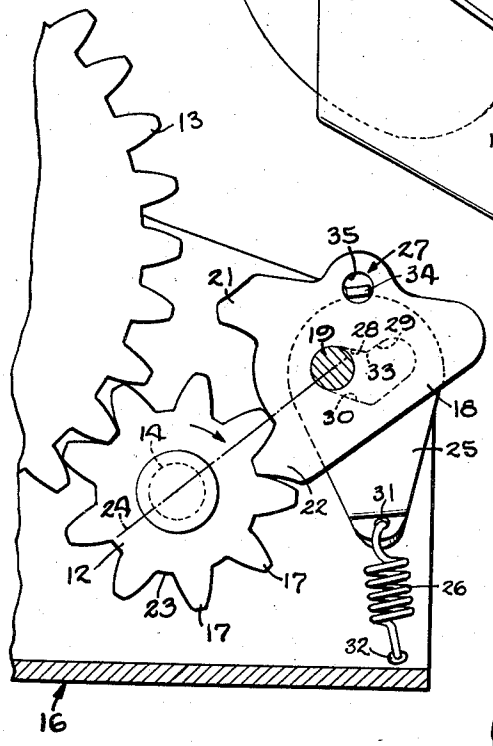


Fig. 3

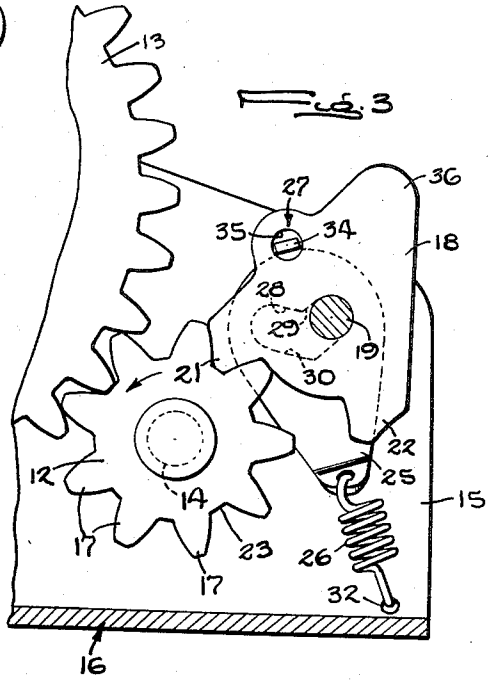
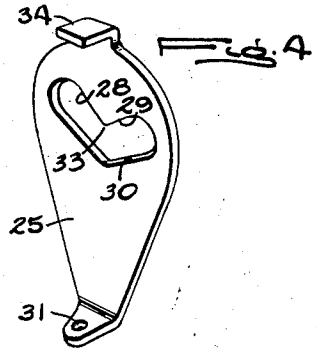


Fig. 4



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REVERSIBLE RATCHET MECHANISM

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6 Claims. (Cl. 188—82.2)

This invention relates to a reversible ratchet mechanism having a toothed ratchet element movable in opposite directions and a cooperating pawl movable over center between two limit positions and, when on either side of a center position, yieldably urged into the corresponding limit position to block movement of the ratchet element in one direction while permitting opposite movement thereof.

The general object of the invention is to provide novel reversible ratchet mechanism which, compared to similar prior mechanisms, is more reliable in its operation, is less susceptible of accidental reversal of the pawl, and is of simpler construction.

Another object is to provide, in mechanism of the above character, a novel connection for transmitting to the pawl a yieldable force urging the same away from the dead center position when the pawl is in any other position.

A further object is to provide a novel connection for transmitting to the pawl a yieldable force which remains substantially constant as the pawl approaches the dead center position from either side thereof.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawings, in which

Figure 1 is a perspective view of a winch with a reversible ratchet mechanism embodying the novel features of the present invention, a part of the winch drum being broken away.

Figs. 2 and 3 are enlarged fragmentary sectional views showing the pawl in different positions and taken through the winch in a longitudinal plane.

Fig. 4 is a perspective view of the force transmitting member.

The invention is shown in the drawings for purposes of illustration embodied in a ratchet mechanism which is selectively operable to hold the drum **10** of a winch against turning in one direction or the other about a supporting shaft **11** while permitting rotation of the drum in the opposite direction. Turning of the drum is effected through a pinion **12** which meshes with a gear **13** on the outer side of one drum end and which is secured on the inner end of a shaft **14** parallel to the drum shaft and journaled in an upstanding wall **15** of a supporting frame **16**. The outer end of the pinion shaft projects beyond the frame for attachment to a suitable crank (not shown).

The pinion **12** with its teeth **17** movable back and forth along a circular path herein constitutes one element of the ratchet mechanism whose other element is a pawl **18** mounted on the frame **16** for rotation about an axis spaced laterally from the path of the pinion teeth. In this instance, the pawl is of generally triangular shape with a central hole rotatably receiving the shank of a bolt **19** which defines a pivot for the pawl. The bolt spans upstanding walls of the frame and extends through

a spacer sleeve **20** which retains the pawl axially positioned on the bolt in the same plane as the pinion.

Two angularly spaced teeth **21** and **22** formed at corners of the pawl are shaped to fit between adjacent pinion teeth **17** and their outer ends are spaced from the pivotal axis of the pawl a distance greater than the spacing between this axis and the root circle **23** of the pinion along a straight line **24** joining the pinion and pawl axes (Fig. 2). With this arrangement, the pawl is movable angularly between two limit positions shown in Figs. 2 and 3 in which the respective pawl teeth abut the pinion at the root circle. When either pawl tooth is in such abutment, the other tooth is out of contact with the pinion teeth and the pawl blocks rotation of the pinion in a direction to move the engaged tooth inwardly toward the line **24** of axes while permitting rotation of the pinion in the opposite direction.

In accordance with the present invention, novel overcenter means is provided for resiliently holding the pawl **18** in each of its limit positions while permitting movement thereof to the other position through a dead center position. This means comprises an intermediate member **25** urged by a spring **26** in a generally radial direction with respect to the pawl axis and having a pivotal connection **27** with the pawl movable circumferentially about the pawl axis and transmitting the spring force to the pawl to urge the same either to one side or the other side of the dead center position. Such force is maintained substantially constant by the provision of cam and follower surfaces which are formed on the frame **16** and the member and cooperate to convert the force exerted by the spring on the member radially of the pawl axis to a force acting on the pawl through the pivotal connection in a circumferential direction with respect to the pawl axis. To simplify the construction, the pawl bolt **19** is utilized as the cam and the follower surfaces **28** and **29** define a V-shaped edge portion of a slot **30** in the member with the spring **26** acting in tension between the latter and the frame to urge the follower surfaces against the pawl bolt.

The intermediate member **25** in this instance is of flat teardrop shape and lies between the pawl **18** and the upstanding frame wall **15**. At its smaller end portion, the member is bent laterally and apertured at **31** to receive one end portion of the spring **26** whose other end portion is hooked around the edge of an aperture **32** in the frame wall. The follower surfaces **28** and **29** are generally straight and converge toward the smaller end of the member and the vertex **33** of the V which is intermediate the ends of the member. At the larger end of the member, a lug **34** integral therewith and disposed on a center line extending through the spring aperture **31** and the follower vertex **33** is bent laterally to extend into a hole **35** in the pawl to form the pivotal connection **27**, the fit of the lug in the hole being a loose one to permit limited sliding of the member radially relative to the pawl. The hole **35** is spaced angularly from the pawl teeth **21** and **22** so that, in the dead center position of the member with the center line thereof extending through the axis of the pawl bolt **19**, the pawl teeth are disposed at equal distances from the pinion root circle **23**.

In the operation of the improved ratchet mechanism, let it be assumed that the pawl **18** is in the limit position of Fig. 2 in which one pawl tooth **22** engages the pinion **12** and the latter is prevented from rotation in a counterclockwise direction but may rotate in the opposite direction indicated by the arrow. The pawl is held resiliently in this position by the spring **26** which urges the left follower surface **28** against the pawl bolt **19** to cam the intermediate member **25** downwardly and to the right and apply to the pawl through the pivotal con-

nection 27 a force acting in a generally circumferential direction relative to the pawl axis to urge the pawl clockwise. During clockwise rotation of the pinion, the pawl and the connection are shifted counterclockwise short of the dead center position but far enough to permit each pinion tooth 17 to pass the active pawl tooth 22, the pawl being urged back into the limit position after each pinion tooth passes. As an incident to the counterclockwise shift of the pivotal connection, the intermediate member 25 is shifted to the left along the pawl bolt and upwardly with respect to the pawl hole 35 as permitted by the loose fit of the lug 34 is the hole and the pawl bolt engages different parts of the left follower surface 28 approaching the vertex 33. Since this surface is straight, however, and due to the camming action, the force exerted on the pawl through the connection remains substantially constant in the different positions of the shaft along the surface.

To shift the pawl 18 to its other limit position shown in Fig. 3, the third corner of the pawl constituting a handle 36 is shifted counterclockwise far enough to move the center line of the intermediate member to the left of the pawl axis from the position of Fig. 2. During this movement, the spring force urging the connection and the pawl in a clockwise direction remains substantially constant until the parts reach dead center in which the follower surfaces engage the bolt 19 at the vertex 33 and the straight line through the latter and the lug 34 intersects the bolt axis. In this position, no component of the spring force acts to urge the pawl toward either limit position. However, as soon as the handle is shifted to move the vertex to the left of the bolt and bring the right follower surface 29 into contact with the bolt, the intermediate member 25 is cammed downwardly and to the left and the spring force is applied through the connection 27 to the pawl in a generally circumferential direction to urge the pawl counterclockwise. As before, this force remains substantially constant in different positions of the right follower surface along the bolt, the pawl blocking clockwise rotation of the pinion 12 but moving in a clockwise direction short of the dead center position to permit each pinion tooth 17 to pass the active pawl tooth 21 upon counterclockwise rotation of the pinion as indicated by the arrow in Fig. 3.

I claim as my invention:

1. Reversible ratchet mechanism having, in combination, a toothed ratchet element movable back and forth along a predetermined path, a fixed pivot spaced laterally from said path, a pawl journaled on said pivot and having two angularly spaced teeth alternately engageable with the teeth of said element, an elongated member having a transverse slot intermediate its ends slidably receiving said pivot, a tension spring connected to and acting on one end portion of said member to urge one edge of said slot against said pivot, and a pivotal connection between the other end portion of said member and said pawl movable with the latter back and forth about said axis through a dead center position and between limit positions in which one of said pawl teeth is in engagement and the other pawl tooth is out of engagement with said ratchet teeth, said slot edge having a V shape constituting a follower surface cooperating with said pivot when said connection is on each side of said dead center position to urge the member in a direction to move the connection circumferentially of the pivot and said pawl toward the corresponding limit position.

2. Reversible ratchet mechanism having, in combination, a toothed ratchet element mounted for movement back and forth along a predetermined path, a fixed pivot spaced laterally from said path, a pawl journaled on said pivot and having two angularly spaced teeth, an intermediate member, a pivotal connection between said member and said pawl movable with the latter back and forth about said pivot through a dead center position and between limit positions in each of which one of said pawl teeth engages and the other pawl tooth is out of engagement with the teeth of said element, a follower surface on said member slidably engaging said pivot and, when said connection is on each side of said dead center position and the surfaces are urged against the pivot, cooperating with the latter to shift the member in a direction to move the connection and said pawl toward the corresponding limit position, and resilient means connected to and acting on said member to urge said follower surfaces against said pivot.

3. Reversible ratchet mechanism having, in combination, a support, a toothed ratchet element mounted on said support for movement back and forth along a predetermined path, means on said support defining a fixed axis spaced laterally from said path, a pawl having two angularly spaced teeth and mounted for rotation about said axis, an intermediate member, a pivotal connection between said member and said pawl movable with the latter back and forth about said axis through a dead center position and between limit positions in each of which one of said pawl teeth engages and the other pawl tooth is out of engagement with the teeth of said ratchet element, cam and follower surfaces formed on said member and said support and cooperating, when engaging each other with said connection on either side of said dead center position, to urge the member in a direction to shift said connection generally circumferentially of said axis and said pawl toward the corresponding limit position, and resilient means connected to said member and acting between the latter and said support to urge said cam and follower surfaces into engagement with each other.

4. Reversible ratchet mechanism having, in combination, a support, a cam rigid with said support, a member movable relative to said support and having a follower surface thereon, a spring acting between said support and said member and cooperating with said cam and said follower surface to urge the member to either side of and away from a center position, a pawl rotatably mounted on said support and having a pivotal connection with said member for movement of the pawl back and forth with the member through said center position and between two limit positions, said pawl having angularly spaced teeth, and a toothed ratchet element movable in opposite directions on said support and having teeth engaged by the respective pawl teeth in the different limit positions of the pawl for blocking movement of the element in one direction while permitting movement thereof in the opposite direction during engagement of each pawl tooth.

5. Reversible ratchet mechanism having, in combination, a support, a toothed ratchet element mounted on said support for movement back and forth along a predetermined path, a pivot mounted on said support and defining a fixed axis spaced laterally from said path, a generally flat pawl having two angularly spaced teeth and journaled on said pivot for angular movement through a dead center position and between two limit positions in each of which a different one of the pawl teeth engages and the other tooth is spaced from the teeth of said ratchet element, a generally flat elongated member having one end portion extending alongside and pivotally connected to said pawl at a point on the latter spaced from said axis and another end portion disposed on the opposite side of the axis from the pivotal connection, a tensile spring stretched between said other end portion of said member and a part of said support disposed on said opposite side of said axis and located in alignment with the axis and said pivotal connection when said pawl is in said dead center position, said member moving with said pawl between said limit positions thereof and having a transversely extending slot formed intermediate its ends to receive said pivot during such movement.

6. Reversible ratchet mechanism having, in combination, a support, a toothed ratchet element mounted on said support for movement back and forth along a prede-

termined path, a pivot mounted on said support and defining a fixed axis spaced laterally from said path, a pawl having two angularly spaced teeth and journaled on said pivot for angular movement through a dead center position and between two limit positions in each of which a different one of the pawl teeth engages and the other tooth is spaced from the teeth of said ratchet element, an elongated member having one end portion pivotally connected to said pawl at a point on the latter spaced from said axis and another end portion disposed on the opposite side of the axis from the pivotal connection, a spring connecting said other end portion of said member and a part of said support on said opposite side of said axis and placing the member in tension along a line

through the axis and said pivotal connection when said pawl is in said dead center position, said member moving with said pawl between said limit positions thereof and having a slotted portion intermediate its ends receiving said pivot during such movement.

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