July 17, 1951 M. F. SASGEN 2,561,138

WINCH, HOIST AND THE LIKE

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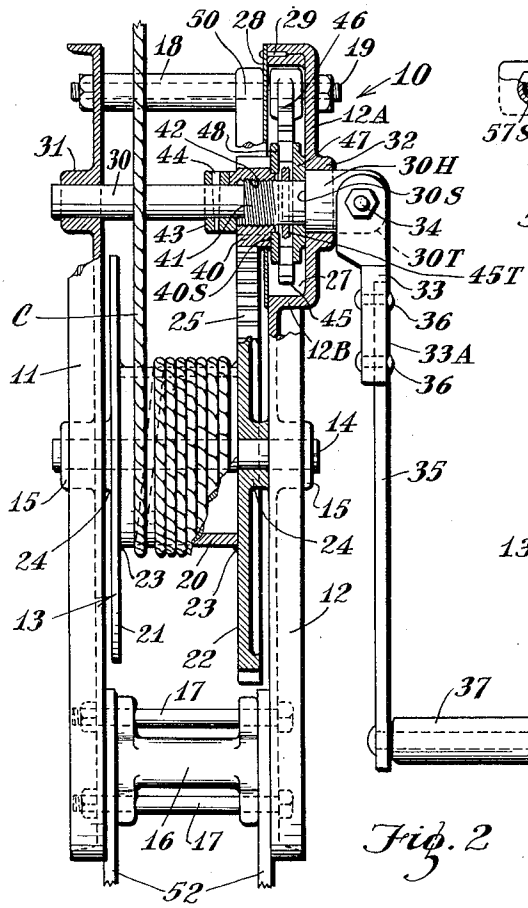

Fig. 2

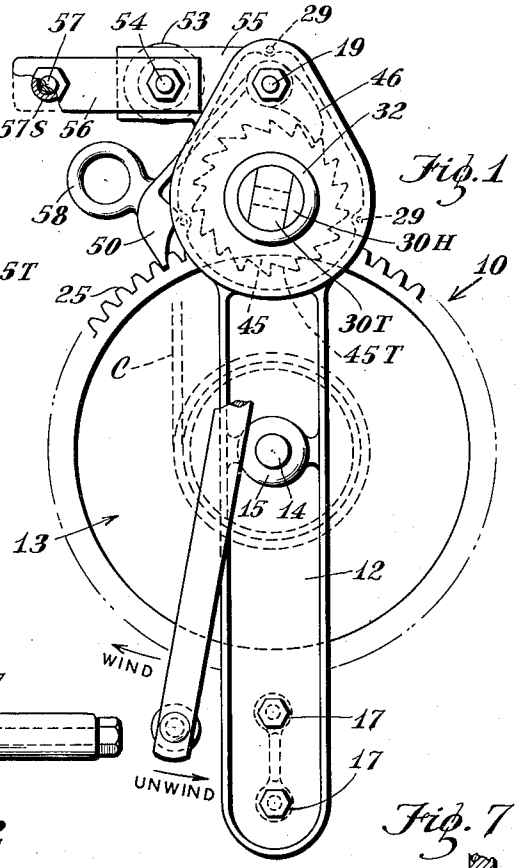

Fig. 1

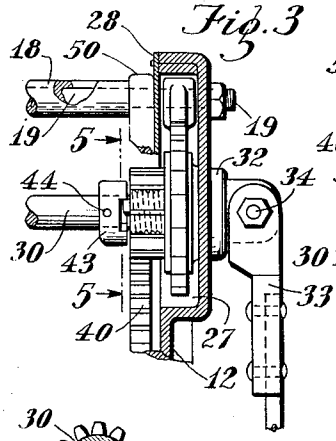

Fig. 3

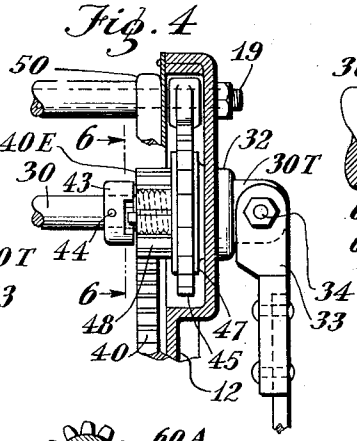

Fig. 4

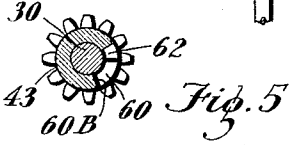

Fig. 5

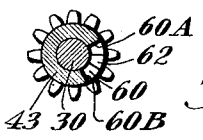

Fig. 6

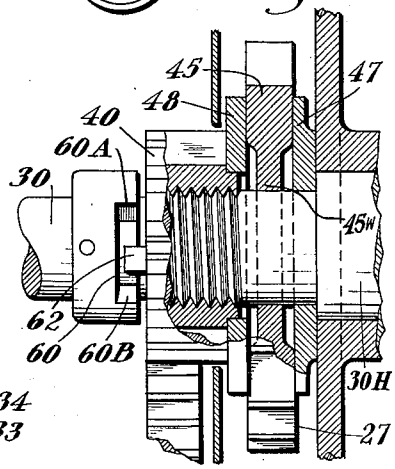

Fig. 7

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WINCH, HOIST, AND THE LIKE

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1 Claim. (Cl. 254—187)

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This invention relates to winches, hoists and like apparatus, and particularly the invention relates to such apparatus wherein the lowering of the load is controlled by an automatic braking action that requires positive actuation of the apparatus in a lowering direction.

In the patent to Jesse M. Benson, No. 2,254,989, patented September 2, 1941, there is disclosed a winch or hoisting apparatus that embodies an advantageous safety arrangement that tends to minimize the risk normally involved in hoisting of heavy loads or in raising and lowering scaffolds and the like, and an important object of the present invention is to increase the safety of operation of winches, hoists and apparatus such as that illustrated in the aforesaid Benson patent.

The safety feature that is thus disclosed in the aforesaid Benson patent comprises an automatic brake that is effective in a load-lowering operation to apply braking forces to the drum in such a manner as to require actuation of the operating means such as a crank handle in a lowering direction in order to cause lowering of the load. In the use of hoists or winches of the aforesaid character in the field it has been found that workmen place great reliance in the automatic braking action that is attained as aforesaid in the winches or hoists made under and in accordance with the Benson patent, and such reliance is in many instances such as to lead to careless manipulation of the apparatus, and to insure that careless or unskilled operation cannot adversely affect the braking function in such apparatus is a further and more specific object of the invention.

Other and further objects of the present invention will be apparent from the following description and claim and are illustrated in the accompanying drawings which, by way of illustration show a preferred embodiment and the principle thereof and what I now consider to be the best mode in which I have contemplated applying that principle. Other embodiments of the invention embodying the same or equivalent principle may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claim.

In the drawings,

Fig. 1 is an end elevational view of a winch embodying the features of the invention and showing the crank handle in safety position;

Fig. 2 is a side elevational view taken partially in transverse section and showing the winch with the crank handle in its normal or operating position;

Figs. 3 and 4 are fragmental sectional views

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showing the parts of the operating mechanism in different positions;

Figs. 5 and 6 are sectional views taken respectively along the line 5—5 of Fig. 3 and the line 6—6 of Fig. 4; and

Fig. 7 is an enlarged sectional view similar to Fig. 2, by showing the parts in the position of Fig. 4.

In the form chosen for disclosure herein the invention is embodied in a relatively small or light winch 10 having the operating means mounted permanently on the winch frame and adapted, for example, for use in raising and lowering a scaffold or the like, and as will hereinafter be described in detail the winch 10 has three safety features that cooperate in attaining safe operation even in the hands of an unskilled operator. Thus, as will be evident in Figs. 1 and 2, the winch 10 has a pair of elongated and vertically disposed side frames 11 and 12 connected together in spaced relation to afford space therebetween within which a winding drum 13 is rotatably supported on a transverse drum shaft 14 that extends between and is mounted in suitable bearing bosses 15 formed on the respective side frames 11 and 12. At their lower ends the side frames 11 and 12 are connected in the desired spaced relation by a spacer bar 16 and connecting bolts 17, while at their upper ends, a spacer sleeve 18 and a connecting bolt 19 serve to hold the frames 11 and 12 in the desired relation.

The drum 13 as herein shown comprises a cylindrical barrel 20 having a plain flange 21 and a driving or gear flange 22 secured to opposite ends thereof as by welding at 23, and the flanges 21 and 22 have central hubs 24 that embrace the shaft 14 and afford the desired rotatable bearings for the drum 13. The gear flange 22 in the present instance has external gear teeth 25 formed about the periphery thereof, and the gear flange 22 is disposed so as to be adjacent to the side frame 12, which is termed the crank frame of the winch, and this crank frame 12 is arranged to support, and in part to house, the actuating and control mechanism whereby the drum movements are controlled. Thus the side frame 12 is so formed at its upper end as to afford a chamber 27 that is disposed outwardly, or to the right in Fig. 2, from the outermost face of the gear flange 22, and this chamber is defined by a right hand wall 12A and side flanges 12B so as to open inwardly of the winch, or the left in Fig. 2. The open inner or left hand face of the chamber 27, Fig. 2, is closed by a closure plate 28 that is held in position by pins 29, so that the chamber 27 affords a housing for the major elements of a safety braking mechanism as will hereinafter be described in detail.

In affording the safety braking mechanism as

well as an actuating means for winding or unwinding a cable C on the drum 13, such means are mounted permanently on the frame of the winch, rather than as a separate unit or attachment as shown in the aforesaid Benson patent, but it will be recognized that the features of the present invention may be utilized in such a separate unit or attachment. Thus, an actuating shaft 30 is extended through the two side frames 11 and 12 so as to pass through the chamber 27 somewhat above the upper edge of the gear flange 22, and the left hand end of the shaft 30 is rotatably supported in a hub 31 formed on the side frame 11, while an enlarged cylindrical head 30H on the other end of the shaft 30 is rotatably supported within an outwardly projecting hub 32 formed on the wall 12A of the chamber 27. At its outer or left hand end the cylindrical head 30H has a radially related tongue 30T that projects to the right and is embraced by the bifurcated end of a handle-supporting casting 33, the casting 33 being pivoted to the tongue 30T by a pivot bolt 34 so as to permit reversal of the handle from the operating position of Fig. 2 to the safety position of Fig. 1. The handle casting 33 has a radial arm portion 33A in which a radial arm 35 is secured by rivets 36, and at the end of the arm 35 a laterally projecting crank handle 37 is mounted. Thus when the handle 37 is in the operating position shown in Fig. 3, the operator may grasp the handle 37 and impart rotative movements to the shaft 30, and such movements are effective to cause operation of the winding drum 13 as well as the safety braking mechanism.

In attaining such operation, the shaft 30 has a pinion 40 mounted thereon so as to mesh with the gear teeth 25 of the gear flange 22, and the portion of the shaft 30 that is embraced by the pinion 40 has external screw threads 41 formed thereon so as to engage internal threads 42 formed in the central bore of the pinion 40. To the left of the pinion 40, a stop collar 43 is secured on the shaft 30 by a pin 44, while to the right of the pinion 40, and within the chamber 27, a safety ratchet 45 is rotatably mounted on the shaft 30. A safety pawl 46, pivoted on the bolt 19 within the chamber 27, extends to the right in Fig. 1, and is arranged to engage teeth 45T of the ratchet 45 to prevent rotation of the ratchet 45 in a counter-clockwise or unwinding direction, Fig. 1. The ratchet 45 has a central web 45W that engages a smooth or cylindrical surface of the shaft 30, and the wider flange portion of the ratchet 45 outwardly of the web 45W is arranged to afford opposite faces formed flat and parallel so as to be disposed in planes perpendicular to the axis of the shaft 30, and these annular flat faces are utilized as friction clutch surfaces. Thus, a friction disc 47 is rotatably mounted on the shaft 30 between the ratchet 45 and an annular shoulder 30S formed so as to face to the left at the inner or left hand end of the head 30H. On the other or left hand side of the ratchet 45 a friction disc 48 is rotatably mounted on an annular rabbeted portion formed on the right hand end, Fig. 2, of the pinion 40, and this rabbeted portion affords an annular shoulder 40S, including the end faces of the teeth of the pinion 40, and facing to the right so that the friction disc 48 may be clamped between the shoulder 40S and the adjacent annular face of the ratchet 45.

When the winch 10 is being used for supporting a load, the cable C will of course apply the load to the drum 13 in what may be termed an unwinding direction so as to resist winding movement of the drum, and hence this load or force acts to hold the pinion 40 against rotation in a winding direction, and the lead of the threads 41 and 42 is such that when the crank handle 37 is operated in a clockwise or winding direction, Fig. 1, the effect will be to draw the pinion 40 to the right, Fig. 2. With this arrangement, the load will tend to produce a similar right hand movement of the pinion 40 when the shaft 30 is held against rotation. This will clamp the friction disc 47 between the ratchet 45, thereby to drivingly connect the shaft 30 to the ratchet 45, and at the same time the friction disc 48 is clamped between the shoulder 40S and the other face of the ratchet 45 to thereby drivingly connect the ratchet 45 to the pinion 40. Thus, the operation of the handle 37 in a winding direction serves through the threads 41 and 42 to engage friction clutch elements that connect the shaft 30, the ratchet 45 and the pinion 40 as a unit which transmits the winding motion of the drum 13. As such winding progresses, the pawl 46 rides over the teeth 45T of the ratchet, thereby to prevent retrograde motion of the ratchet, and this of course serves as a safety to prevent undesired unwinding of the drum. In addition, a safety pawl 50 is pivoted on the bolt 19 just to the left of the plate 28, Fig. 2, so as to project to the left, Fig. 1, and this pawl 50 rides over the teeth 25 of the gear flange 22 so as to hold the drum 13 against unwinding movement. It should be noted that while the safety pawl 50 is desirable, and affords an additional safety feature, it is common practice in winches of this character to rely entirely upon the ratchet 45 to hold the drum against unwinding movement, and to utilize the pawl 50 or its equivalent only in a brake or clutch releasing operation as will hereinafter be described.

In the use of the winch 10, as for example in the raising or lowering of a scaffold, the scaffold is connected to the lower spacer bolts 17 by means including hanger bars 52. The cable C has one end connected to the drum 13 and is then extended upwardly past and to the right, Fig. 1, of a cable guide spool 53 that is journaled on a bolt 54 that is extended between arms 55 that are extended to the left, Fig. 1, from the upper ends of the respective frames 11 and 12. Additional arms 56 are secured to the arms 55 by the bolt 54 so as to project additionally to the left, and a hand grip including a bolt 57 and a sleeve 57S is extended between the arms 56 so as to be disposed above an operating ring 58 formed adjacent to the end of the safety pawl 50. Thus the operator may grasp or rest one hand on the hand grip 57 while using one finger or the thumb of this hand to raise or release the pawl 50 when this is required to enable the load to be lowered.

With respect to the attainment of such lowering of the load, it should be observed that the pawl 50 is housed within the chamber 27 so as to be engaged with the ratchet 45 at all times, and hence the ratchet 45 is held against retrograde movement. Thus, in order to enable the desired lowering movement of the load to be attained, the pinion 40 must be released from the ratchet 45 in such a way as to permit controlled retrograde or lowering rotation of the pinion 40 with respect to the then stationary ratchet 45. It will be recognized that in the course of the preceding raising or lifting operation the operation of the crank handle 37 in a winding direc-

tion has been resisted by the load through the pinion 40 so as to thereby tightly clamp the friction discs 47 and 48 between the shoulders 30S and 40S and the opposed annular faces of the ratchet, and hence as a preliminary to a load lowering operation it is usually necessary to release or substantially reduce the clamping forces that have thus been set up between the various clutch elements. Thus while the safety pawl 50 is allowed to remain in its engaged or safety position, the crank handle 37 is turned slightly in a reverse or lowering direction, thereby to cause the screw threads 41 and 42 to back the pinion 40 in a left hand direction and toward the collar 43. This constitutes a releasing operation of the handle 37 and serves to release the previously established clamping forces between the various friction clutch elements, thereby to free the pinion 40 from the restraining influence of the then stationary ratchet 45. When such release of the pinion 40 has thus been accomplished the safety pawl 50 is still effective, thereby to hold the drum 13 against unwinding movement, and to initiate the desired lowering movement, the pawl 50 must be released. When this is to be done, the operator normally holds the crank handle 37 with one hand, while grasping the hand grip 57 and the pawl 50 with the other hand in the manner hereinbefore described. When the load is relatively small, the pawl 50 may be withdrawn without utilizing the crank handle to release the load or force on the pawl 50. In such an instance, when the pawl 50 is released, the shaft is held by the crank handle 37 against rotation, while the load normally becomes effective to rotate the pinion 40 slightly on the shaft 30 in a clamping direction so as to thereby cause the pinion 40 to move in a right hand direction, Fig. 2. This effects a clamping of the friction disc 48 between the shoulder 40S and the then stationary ratchet 45, and such clamping forces cause a braking action which stops the pinion 40 after but a slight rotation in a lowering or unwinding direction. In the event that the load is relatively great, it is usually necessary to rotate the handle in a winding direction in order to relieve the force on the safety pawl 50, and when this is done, the parts move to the clamped relation shown in Figs. 3 and 6. This relation thus conditions the apparatus for braking operation as the load is lowered.

In such lowering operation the handle is rotated in a lowering or unwinding direction, thereby to progressively tend to release the clutches that act on the ratchet 45, and as this releasing action takes place, the load acts on the pinion 40 so as to cause the same to follow the unwinding rotative movements of the handle. Hence the friction disc 48 is effective to control the lowering or unwinding movement of the pinion 40, and but little force is required in operating the handle. Moreover, this force must be positive in an unwinding direction, and the control or restraining forces exerted on the pinion are afforded by the friction clutch means in accordance with the load.

In prior winches and hoists made under and in accordance with the aforesaid Benson patent, the operation of the safety brake that is described in such Benson patent has in most instances been such as to afford complete safety of operation of the apparatus, but it has been found that in the hands of a careless or unskilled operator the safety brake may in effect be inadvertently disabled in the course of the release operation

that has been above described. In other words, the releasing of the various clutch elements by movement of the pinion or a connected part axially of the shaft may in the prior structures be carried to such an extent as to cause the pinion or the related element to be locked to the operating shaft so firmly that the load applied to the pinion from the drum of the winch will be unable to rotate the pinion relative to the shaft and back to its clamping position, and hence the full force of the load will be transmitted to the handle so as to break the operator's grip. Under the present invention means are afforded whereby such undesired locking of the pinion to the operating shaft is positively eliminated. Thus as will be evident in Figs. 2 to 7, means are afforded for so limiting the rotating movement of the pinion 40 with respect to the operating shaft 30 that endwise wedging movement of the pinion against the related or opposed end surface of the collar 43 is prevented, and the limiting means are of such a character that the limiting abutment of opposed elements is in the nature of a flat surface contact wherein the elements move toward and away from each other in a direction that is substantially perpendicular to the plane of their abutting contact. Thus the collar 43 has an arcuate slot 60 formed therein so as to afford abutment surfaces 60A and 60B at its opposite ends. The arcuate slot 60 is formed in the face of the collar 43 that is adjacent to the pinion 40, and the pinion 40 has a lug 62 formed on the adjacent end thereof so as to project into the slot 60. The slot 60 is so located in a rotative sense with respect to the shaft 30 that when the operating shaft 30 is rotated in an unwinding direction in the course of a releasing operation as above described, the end shoulder or surface 60A of the slot 60 will engage the adjacent side edge of the tooth 62 when such unwinding or releasing movement of the shaft has been carried to an extent sufficient to release the friction plates 47 and 48, and such engagement of the shoulder 60A with the tooth 62 takes place prior to the time when the adjacent end surface 40E of the pinion has engaged the end surface of the collar 43. It will also be observed that the length of the tooth 62 with respect to the depth of the slot 60 is such that when the elements are in the released position of Figs. 3 and 5, the end of the tooth will be spaced from the bottom of the slot 60. Thus it will be clear that the releasing movement of the pinion 40 with respect to the operating shaft 30 is limited solely by the engagement of the side edge of the tooth 62 with the end surface 60A of the slot, and because of this the pinion 40 does not have an opportunity to move into a wedging, end-to-end engagement with the collar 43. Thus the possibility of a locking engagement of the end surfaces of the pinion 40 and the collar 43 is avoided, and the pinion 40 may be freely returned to its active or braking position at any time when the load is allowed to become effective to rotate the pinion in a clamping or clutching direction.

When the operating shaft 30 is turned in a winding direction, the shoulder 60A of the slot 60 is moved away from the tooth 62 and the parts assume substantially the relationship shown in Figs. 4 and 6 of the drawings, and in this relationship it will be noted that the tooth 62 is spaced from the end wall or abutment 60B of the slot 60. This relationship is of course important in that the clamping action of the pinion 40 must be free so as to be limited only by attainment of

such clamping or clutching action. The slot 60 is preferably arranged so that the end 60B thereof will be so located that wear upon the friction elements 47 and 48 may take place in a reasonable amount without causing the tooth 62 to engage the abutment 60B when the parts are in the winding position of Fig. 4.

In the use of the winch of the present invention, the reversible handle may be located in the safety position of Fig. 1 so as to engage the frame of the winch to prevent unwinding movement thereof. In addition, the safety pawl 50 may be located in its safety position of Fig. 1 and this affords a second safety feature. The friction brake arrangement that is afforded by the screw threaded connection of the pinion 40 with the shaft 30 affords a third safety feature, and through the provision of a non-binding limiting stop for limiting the releasing movement of the handle with respect to the pinion 40, this safety brake is rendered foolproof, and the winch may therefore be relied upon to afford a safety of operation even when used by careless or unskilled operators.

Thus, while I have illustrated and described the preferred embodiment of my invention, it is to be understood that this is capable of variation and modification and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claim:

I claim:

In a hand operated winch or the like, a frame, a shaft rotatably mounted in said frame for rotation selectively in lifting and lowering directions, a ratchet loosely mounted on said shaft concentrically therewith, a pawl pivoted on said frame and normally engaged with said ratchet to hold the same against rotation in said lowering direction, a pinion mounted for rotation on said shaft adjacent to said ratchet, cooperating screw thread means on said shaft and said pinion having a lead direction arranged to shift said pinion axially in a brake applying direction along said shaft toward said ratchet when said pinion is rotated in a lowering direction relative to said shaft, a first friction disc non-rotatably fixed to said pinion in position to engage one side face of said ratchet when said pinion is shifted axially in said brake-applying direction, a second friction disc rotatably mounted on said shaft on the other side of said ratchet and in position to engage the other face of said ratchet, a shoulder on said shaft against which said second friction disc may bear to limit movement of said second friction disc by said first disc when said first disc is moved in said brake-applying direction, and stop means rigid on said pinion and said shaft respectively and engageable in a plane substantially parallel to the axis of said shaft to limit rotation of said pinion relative to said shaft.

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The following references are of record in the file of this patent:

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