Sept. 28, 1954 C. S. SCHROEDER 2,690,240

ONE-WAY BRAKE WITH AXIALLY MOVING DETENT

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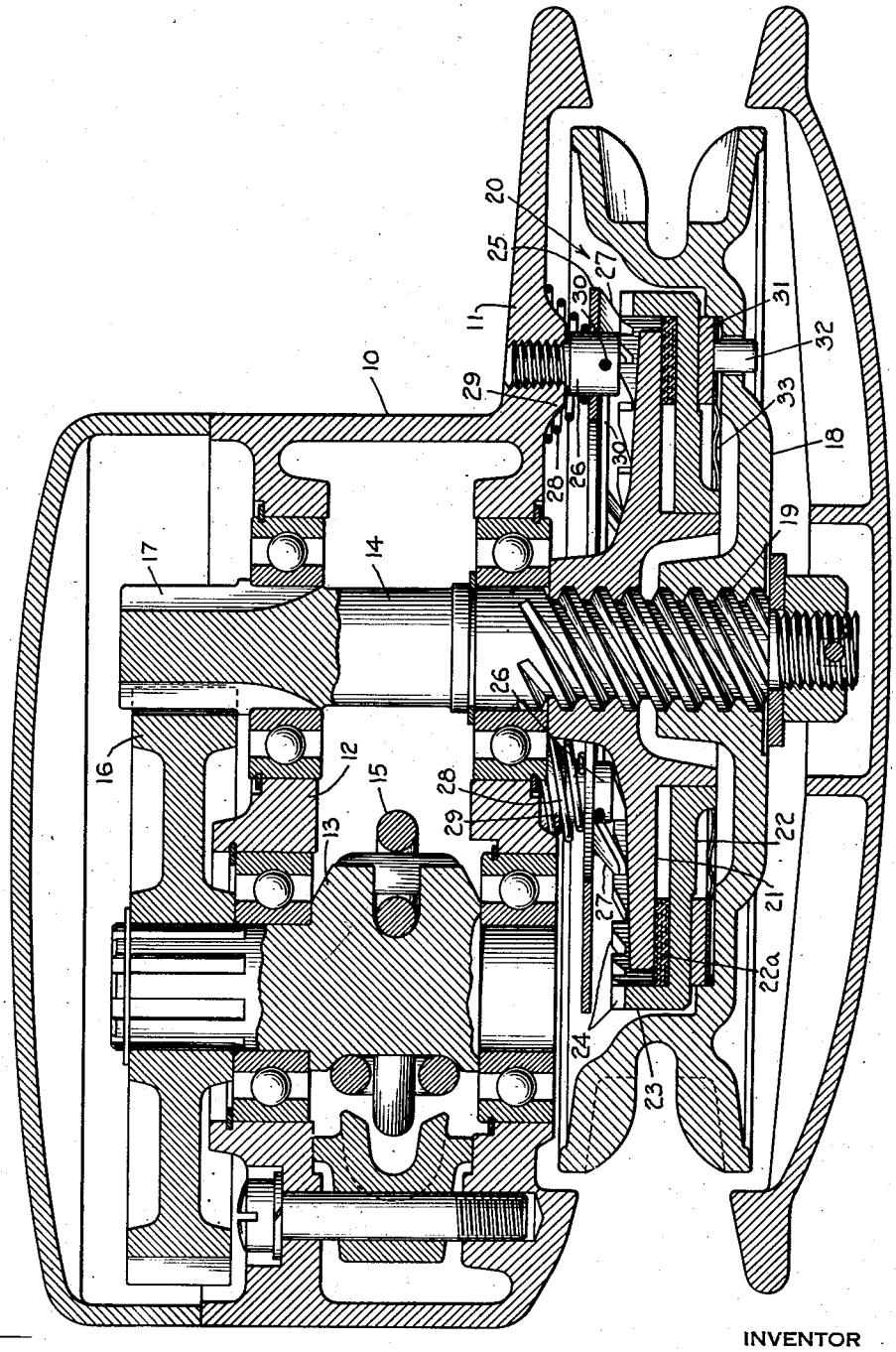


Fig. 1.

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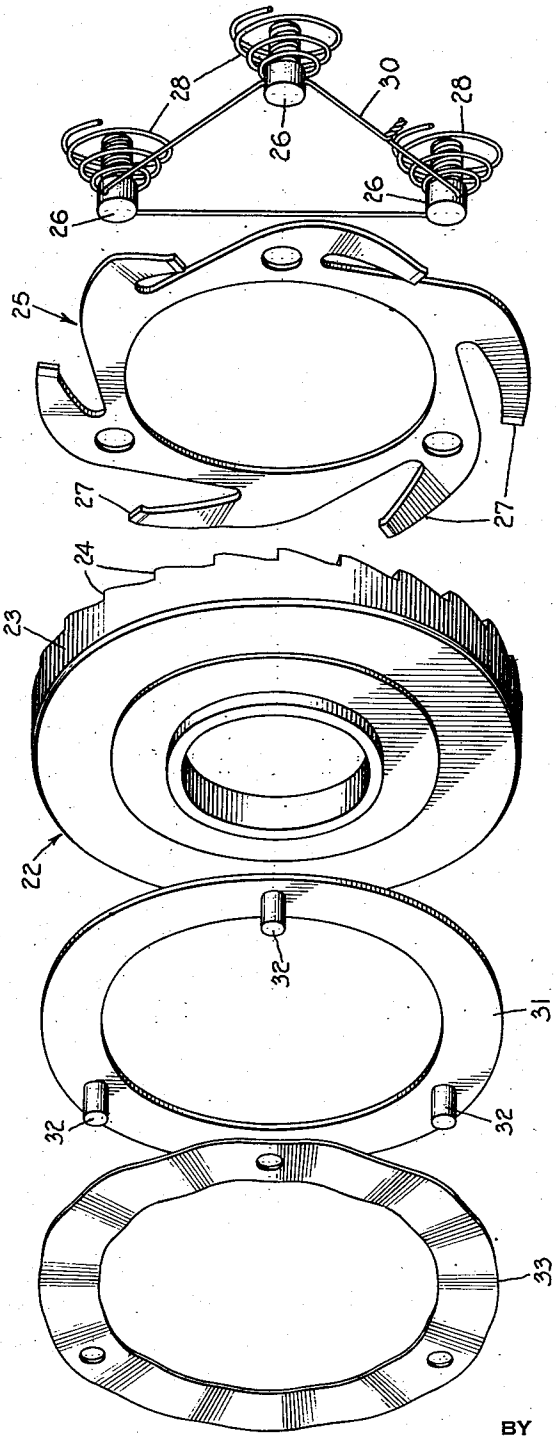


Fig. 2.

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2,690,240

ONE-WAY BRAKE WITH AXIALLY MOVING DETENT

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This invention relates to hoists, and more particularly to a hoist of the class in which a Weston brake is provided to hold and control a load applied to the hoist.

In hoists of this class, the load is raised by applying the driving force of a hand wheel or other operating member through a wedging and friction mechanism that I term broadly a clutch. When the driving force is discontinued, the clutch serves as a brake which is automatically applied, and thereby prevents the lowering of the load. When the hand wheel is turned in a reverse direction by the hoist operator to relieve the wedging and friction of the clutch, the load is permitted to descend by a slipping action of the clutch to an extent corresponding to the turning of the hand wheel, so that the load in effect follows the movements of the wheel.

The braking reaction in hoists of this particular class is accepted by a ratchet disc forming part of what I have called a clutch, this disc being held against rotation in other than a lifting direction, and so arranged that it will rotate to transmit the driving force of the hand wheel when the load is being raised.

It is the purpose of this invention to provide certain improvements which will impart greater dependability and efficiency to hoists of the class described than have been attainable heretofore, and which will result in certain structural advantages, as will be apparent hereinafter.

As one feature of the invention, the ratchet disc and a pawl coacting therewith are so constructed as to permit greater compactness of the hoist while avoiding any sacrifice in the mechanical advantage of the pawl. It may also be said, as an alternative way of describing this feature, that an increased mechanical advantage will be obtained in the pawl and ratchet disc without a corresponding increase in the size of the mechanism. This is accomplished by locating the pawl entirely at one side of the ratchet disc in opposed relationship to ratchet teeth projecting parallel to the axis of the disc. Such an arrangement requires no space for the pawl outwardly of the periphery of the ratchet disc, and permits the ratchet teeth to be located at a maximum distance from the center of rotation even when the disc is mounted in a limited space such as the interior of a hollow hand wheel. The ratchet teeth are preferably formed upon the edge of a lateral flange at the periphery of the disc, thus providing space within the confines of the ratchet disc for receiving the necessary parts of the friction clutch without interfering with the pawl.

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Another feature of the invention resides in the action of the pawl, which is so arranged as to provide a more efficient application of force to the ratchet disc with an attendant increase in the safety factor of the hoist. More specifically, the pawl is constructed to engage and stop the ratchet disc simultaneously and with equal pressures at a plurality of points which are symmetrically disposed with respect to the axis of the disc. In the event of failure of any part of the pawl, other parts of the pawl will remain effective and will thus prevent unintended dropping of the load.

As a specific feature of the invention, the pawl is in the form of a ring having teeth pressed against the ratchet teeth by a spring means which exerts its force in a direction parallel to the axis of the ratchet disc. This construction and arrangement of the pawl will avoid eccentric loading of the ratchet disc, thus providing smoother and more accurate control of the hoist and minimum wear and possible breakage of the parts.

Another feature of the invention residues in the manner in which the actuating force is applied to the clutch. The hand wheel, which is adapted to be rotated for applying a binding force through the ratchet disc to a friction ring, is provided with a cushioned pressure ring in engagement with the ratchet disc. The material of the pressure ring has a substantially uniform low coefficient of friction so that this, together with the cushioned feature of the ring, will permit the operator to have such close control of the clutch as to avoid sudden grabbing and uncontrolled slipping of the friction ring.

I have thus outlined rather broadly the more important features of my invention in order that the detailed description thereof that follows may be better understood, and in order that my contribution to the art may be better appreciated. There are, of course, additional features of my invention that will be described hereinafter, and which will form the subject of the claims appended hereto. Those skilled in the art will appreciate that the conception on which my disclosure is based may readily be utilized as a basis for the designing of other structures for carrying out the several purposes of my invention. It is important, therefore, that the claims to be granted me shall be of sufficient breadth to prevent the appropriation of my invention by those skilled in the art.

Referring now to the drawing, in which one embodiment of the invention is shown:

Fig. 1 is a view of the improved hoist in hori-

zontal cross section, showing the construction of the brake.

Fig. 2 is a perspective view showing the parts of the brake in exploded relationship.

In the drawing, the numeral 10 indicates generally a hoist body including parallel front and rear walls 11, 12, which have a load sheave 13 and a drive shaft 14 journalled in transverse horizontal positions therein. A hoist chain 15 is reeved over the load sheave 13 between the walls 11, 12, and the sheave is provided with a gear 16 in mesh with a pinion 17 formed on the rear end of the drive shaft 14 in order that a load attached to the hoist chain may be raised and lowered by rotation of said drive shaft.

Operation of the drive shaft 14 is provided in the particular form of my hoist through a hand wheel 18 rotatably engaged upon a screw threaded portion 19 of the drive shaft forwardly of the hoist body 10, said hand wheel being so arranged as to control the drive shaft through what is known in the industry as a Weston brake, indicated generally at 20.

The direction of the screw threads upon the threaded shaft portion 19 is so chosen that the weight of a load upon the chain 15 will tend to shift the hand wheel axially upon the drive shaft 14 for operating the brake. As shown, the threaded portion 19 of the drive shaft has right hand threads so that the hand wheel 18 will be shifted inwardly upon the shaft either by clockwise rotation of the hand wheel or alternatively by counter-clockwise rotation of the drive shaft 14, as viewed from the bottom of Fig. 1.

As is usual in Weston brakes, the brake 20 comprises a friction disc 21 mounted also upon the threaded shaft portion 19, and a ratchet disc 22 confined between the hand wheel 18 and the friction disc 21 in such a way as to be clamped therebetween when the hand wheel 18 is shifted inwardly by its rotation relatively to the threaded shaft portion 19. The ratchet disc 22 preferably is furnished with a friction ring 22*a* to enhance the frictional action between ratchet disc 22 and the friction disc 21. When the ratchet disc 22 is clamped in the manner described, the ratchet disc, the friction disc 21, the hand wheel 18, and the drive shaft 14 will be secured for rotation as a unit, thus permitting a load upon the chain 15 to be raised by clockwise rotation of the hand wheel 18. If the driving force of the hand wheel 18 is discontinued, the weight of the load on the chain 15 will tend to rotate the drive shaft 14 and the brake 20 in a reverse direction to lower the load.

The tendency for reverse rotation is resisted by the ratchet disc 22 in coaction with a pawl, and to this extent the ratchet disc operates in the manner of ratchets in previous hoists of the class described. In the present invention, however, the ratchet disc and the pawl have an entirely novel construction which results in a new and advantageous coaction between the ratchet and the pawl and other parts of the hoist. My novel ratchet disc 22 is formed with a continuous cylindrical flange 23 extending concentrically with the axis of the drive shaft 14 and formed upon its edge with a series of ratchet teeth 24 also projecting in a direction parallel to the axis of the drive shaft 14.

The ratchet teeth 24 are engaged by a pawl 25 in the novel form of a ring mounted concentrically with the drive shaft 14 at one side of the ratchet disc 22, and preferably having a diameter which is approximately equal to the outer diameter of

the disc. The pawl 25 is supported and held against rotation by a plurality of studs 26 which are carried by the front wall 11 of the hoist body 10 in positions which are symmetrical with respect to the axis of the drive shaft 14. Each of the studs 26 is engaged in an aperture of the pawl 25 in such a way that the pawl is held securely against rotation while being adapted for limited sliding movement in a direction parallel to the axis of the drive shaft 14. The pawl 25 is made of heavy gauge sheet spring metal and is flat over a major portion of its area, the metal at the periphery of the pawl being so formed, however, as to provide a symmetrical series of tangentially extending inclined teeth 27, the ends of which lie in a circle coinciding with the series of ratchet teeth 24.

It will be observed that the described construction of the ratchet disc 22 and the pawl 25 requires no space in a direction radially outward of the ratchet disc, so that the ratchet teeth 24 may be located upon a maximum radius when arranged within the limited space within the hand wheel 18, as shown in Fig. 1.

As a means for holding the pawl teeth 27 in operative engagement with the ratchet teeth 24, provision is made of a plurality of frusto-conical coil springs 28, which are arranged one around each of the studs 26 between the front wall 11 and the pawl 25. The coil springs 28 are constructed to have equal characteristics of stiffness and resilience, and inasmuch as these springs are located around the symmetrically positioned studs 26, it will be seen that the pawl 25 will be pressed toward the ratchet disc 22 uniformly so that the pawl teeth will engage the ratchet teeth simultaneously and with equal pressures when the ratchet disc is in operation.

The front plate 11 preferably is formed with tapered bosses 29 around each of the studs 26, these bosses being engaged within the springs 28 so as to maintain them in proper alignment and thus avoid the irregular spring action that might otherwise occur.

Accidental loosening of the studs 26 which might result from the vibratory action of the pawl 25 will be prevented by a bail wire 30 engaged through transverse apertures in the heads of the studs 26, the bail wire also serving as a means for holding the pawl 25 temporarily upon the studs during assembly or disassembly of the hoist.

It has been found that the brake construction described is capable of smooth operation, free from any uncontrolled grabbing or slipping. This is attributed in part to the axial direction in which the pawl is pressed against the ratchet disc, and to the uniform and symmetrical application of force to the ratchet disc by the pawl teeth 27. Contributing also to uniform control and operation is a cushioned pressure ring 31 through which the hand wheel 18 exerts pressure upon the ratchet disc 22. The pressure ring 31 is not relied upon for transmitting rotative force to the ratchet disc 22, such rotative force being imparted through the interaction of the hand wheel 18 and the friction disc 21 with the threaded shaft portion 19, and also with the friction ring 22*a*. It is important, however, that the friction between the pressure ring 31 and the ratchet disc 22 vary uniformly under varying conditions of pressure, so that the friction at this point will not result in aberrations in the operation of the hoist, and the brake 20 may be easily controlled by the hand wheel 18. The pressure ring 31 is therefore formed of a material having the described char-

acteristics, such as oil impregnated bronze. A plurality of studs **32** are integrally formed upon the back of the ring **31** and slidably received in apertures in the hand wheel **18** in order to hold the pressure ring **31** in place with respect to the hand wheel.

The cushioned action of the pressure ring **31** is provided by a corrugated ring **33** of spring material interposed between the pressure ring **31** and the hand wheel **18**, the effect of this action being to equalize any slight irregularities of the parts which might otherwise have an adverse effect upon the uniform pressures which are desired, in a circumferential sense, around the pressure ring **31** and the friction ring **22***a*. It will also be seen that the corrugated ring **33** will at all times support the ratchet disc **21** against the pressure of the pawl **25**.

The improved hoist will be operated in generally the same manner as other hoists of this general class, the hand wheel being rotated in one direction to lift the load, and rotated in a reverse direction to lower the load, the load being automatically held when the hand wheel is stationary, as will be understood by persons skilled in the art. The operator will find, however, that he will be afforded closer and more dependable control of the load without additional effort on his part.

Because of the fact that the pawl **25** is pressed against the ratchet disc **22** in an axial direction, and also because the pawl teeth **27** engage the ratchet teeth **24** at points spaced symmetrically around the ratchet disc, and finally because the axial pressure exerted through the pressure ring **31** is cushioned by the corrugated ring **33**, there will be no eccentric forces upon the friction disc **21**. This not only provides for uniformity in the frictional slippage between and gripping of the friction disc **21** and the friction ring **22***a*, but also greatly reduces the wear upon the parts, and provides smoother operation than has been obtainable heretofore.

Having thus fully described the invention, what is claimed as new and for which it is desired to secure Letters Patent, is:

1. In a hoist of the class described, a drive shaft rotatable to lift and lower a load, a ratchet disc formed as a part of a Weston brake for restraining rotation of the drive shaft and mounted for free rotation in the axis of said drive shaft, a series of ratchet teeth on said ratchet disc at one side thereof and projecting parallel to the axis of rotation, a pawl, a plurality of mounting means spaced about the axis of rotation mounting said pawl for movement in a direction parallel to the axis of rotation toward and away from the disc, said plurality of means engaging the pawl at points placed symmetrically relatively to the axis of rotation to hold the pawl against rotation, teeth formed integrally on said pawl and arranged symmetrically on the circumference of a circle, and spring means through which the pawl is pressed on its plurality of mounting means toward the ratchet disc whereby to oppose rotation of the drive shaft by engagement of the pawl teeth with the ratchet teeth.

2. In a hoist of the class described, a drive shaft rotatable to lift and lower a load, a ratchet disc formed as a part of a Weston brake for restraining rotation of the drive shaft and mounted for free rotation in the axis of said drive shaft, a series of ratchet teeth on said ratchet disc at one side thereof and projecting parallel to the axis of rotation, a ring-like pawl, a plurality of mounting means spaced about the axis of rotation mounting said pawl for movement in a direction parallel to the axis of rotation toward and away from the disc and holding the pawl against rotation, teeth formed integrally on said pawl and arranged symmetrically about said pawl, and spring means through which the pawl is pressed bodily on its mounting means toward the ratchet disc to bring its teeth against the teeth of said ratchet disc.

3. In a hoist of the class described, a drive shaft rotatable to lift and lower a load, a ratchet disc formed as a part of a Weston brake for restraining rotation of the drive shaft and mounted for free rotation in the axis of said drive shaft, a series of ratchet teeth on said ratchet disc at one side thereof, a pawl at said side of the disc, a series of pins positioned at points about the axis of rotation mounting said pawl for movement in a direction parallel to the axis of rotation, a spring pressing said pawl relatively to each pin toward the ratchet disc, teeth formed integrally on the pawl and pressed by the action of the springs into engagement with corresponding ratchet teeth, and said pins holding the pawl against rotation whereby to oppose rotation of the drive shaft in a direction corresponding to load lowering rotation of the drive shaft.

4. In a hoist of the class described, a drive shaft rotatable to lift and lower a load, a ratchet disc formed as a part of a Weston brake for restraining rotation of the drive shaft in one direction and mounted for free rotation in the axis of said drive shaft, a flange on said disc extending parallel to said axis of rotation, a series of ratchet teeth on the edge of said flange, a ring-like pawl axially spaced from said disc, a series of pins spaced about the axis of rotation and parallel thereto, said pawl being mounted on said pins for movement parallel to said axis of rotation, a spring pressing said pawl relatively to each pin toward the ratchet disc, teeth formed integrally on the pawl and movable therewith bodily into engagement with corresponding ratchet teeth, and said pins holding the pawl against rotation to oppose rotation of the ratchet disc in a direction corresponding to load lowering rotation of said drive shaft.

5. In a hoist of the class described, a drive shaft rotatable to lift and lower a load, a ratchet disc formed as a part of a Weston brake for restraining rotation of the drive shaft in one direction and mounted for free rotation in the axis of said drive shaft, a series of ratchet teeth on said ratchet disc at one side thereof, a ring-like sheet metal pawl, a series of pins mounted at points spaced about the axis of rotation, said pawl having openings whereby the pawl is mounted on the pins for movement toward and away from said side of the ratchet disc, a series of teeth formed integrally on said ring-like sheet metal pawl and extending therefrom, spring means pressing said pawl bodily relatively to each pin whereby to press the pawl teeth simultaneously against corresponding ratchet teeth on the disc, and said pins holding the pawl against rotation whereby to oppose rotation of the ratchet disc in a direction corresponding to load lowering rotation of the drive shaft.

6. In a hoist of the class described, a drive shaft rotatable to lift and lower a load, a ratchet disc formed as a part of a Weston brake and mounted for free rotation in the axis of said drive shaft, a friction disc on said drive shaft through which the ratchet disc is adapted to act for re-

straining rotation of the drive shaft in a load lowering direction, a series of ratchet teeth on the ratchet disc extending parallel to the axis of rotation and positioned outwardly from the periphery of the friction disc, a pawl positioned in parallel relation to the ratchet disc with the friction disc between the pawl and the ratchet disc, means mounting the pawl for movement relatively to the ratchet disc in an axial direction, a series of teeth formed integrally on said pawl, and spring means acting on said pawl to press the pawl teeth against corresponding ratchet teeth whereby all of the pawl teeth are effective to oppose rotation of the ratchet disc in a direction corresponding to load lowering rotation of the drive shaft.

7. In a hoist of the class described, a hoist body, a drive shaft rotatable in the hoist body to lift and lower a load, a ratchet disc mounted for free rotation in the axis of the drive shaft and formed as a part of a Weston brake for restraining rotation of the drive shaft in a load lowering direction, a hand wheel on the drive shaft for rotating the ratchet disc in a load lifting direction, a circumferential part on the hand

wheel extending toward the hoist body whereby to form a chamber enclosing the ratchet disc, teeth on the ratchet disc extending in said chamber toward the hoist body, a series of pins mounted on the hoist body about the axis of rotation, a ring-like pawl moving on said pins in a direction parallel to the axis of rotation and held by said pins against rotation, a series of teeth formed integrally on said pawl for engaging the ratchet teeth, and spring means pressing said pawl relatively to said pins toward said ratchet disc whereby all of the pawl teeth coact simultaneously with corresponding ratchet teeth to oppose rotation of the ratchet disc in a load lowering direction.

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