FIG. 1.
HOIST OVERLOAD PREVENTING DEVICE

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ABSTRACT OF THE DISCLOSURE

A ratchet disc acts in the usual way as a portion of a Weston brake mechanism on a hoist, but is formed in two parts that are assembled at opposed faces of a locking plate fixed to the hoist body. A Belleville spring actuates the ratchet parts and normally holds them in release relative to the locking plate. The spring will not accept excessive compressing forces, as when there is an overload on the hoist, and then will yield so that the ratchet parts will grip the locking plate, locking the hoist against movement.

This invention relates to a hoist of the type utilizing a Weston brake mechanism. More particularly, my invention relates to novel means for locking a hoist of that type against operation whenever it is overloaded.

Overload prevention devices for hoists have long been found highly desirable, because there is a tendency for users to lift or lower loads greater than that for which a hoist is designed. Thus, simply because there is not at hand a hoist of the proper rating, a relatively light hoist frequently will be utilized for lifting a load much greater than should be handled by the particular hoist. This naturally does considerable damage to the hoist, and may cause serious accidents.

Many of the earlier overload prevention devices utilize slipping clutches or other friction type mechanisms that are not satisfactory because they cannot always be depended upon, and also because they are subject to adjustment by the operator. Generally, it is possible for an operator, simply through movement of an adjusting screw or similar means, to render the overload device inoperable. There are overload prevention devices that are not readily adjusted, but so far as I know, there has not been developed until the present time a device that will offer effective protection against overloading a hoist, while also permitting the hoist to operate in a fully satisfactory manner when handling the load for which it is rated.

As a feature of my invention, I contribute an overload device that acts in a predetermined way as an operating part of the hoist and cannot, therefore, be subjected to adjustment by the operator.

It is a further feature of my invention that the overload device is positive in operation and will cause positive locking of the hoist mechanism whenever an overload occurs.

As I have earlier indicated, my mechanism is particularly adapted for utilization in connection with a Weston brake. In a Weston brake, the lifting and lowering operations take place incidental to a compression of certain parts on an operating shaft. Thus, mounted through screw threads on the operating shaft is an operating device such as a hand wheel or lever. In some cases the operating device is power driven. Movement of the operating device on the threads relatively to the shaft will force a compression of other means mounted relatively to the shaft, as for example, a loosely mounted ratchet. This ratchet is gripped through friction discs and rotates in one direction as the load is being lifted, the ratchet being free for such rotation through its particular relation to a holding pawl. Lowering movement of the load will occur when the parts of the hoist rotate relatively to the ratchet, the friction discs being released from the ratchet incidental to reverse rotation of the hand wheel or other operating device which is threaded on the shaft. Of course, when the operating device is brought to a standstill, the screw threads will cause the parts on the shaft to bind and to lock relatively to the ratchet, and since the ratchet cannot rotate in a direction to lower the load, the load will be held against lowering movement.

It is a feature of my invention that the compression of the parts of the Weston brake mechanism, when due to an overload, will bring about a locking of all of the parts relatively to a locking part on the hoist body. This locking does not take place under a normal load, preferably because of the action of a spring. On the other hand, when there is an overload, the action of the spring will be neutralized and locking will take place.

As a still more particular feature of the invention, two devices that form parts of the Weston brake mechanism are normally pressed away from each other on the operating shaft. Preferably, one of these devices will be the ratchet, and for this purpose the ratchet may be formed of two parts with the two parts separated by a spring. The two separated parts have between them a locking part that may float so as to be self-adjusting, but that is so fixed that it cannot move relatively to the hoist in a direction corresponding to lifting movement of the ratchet. Under overload conditions, the two parts of the ratchet will act against the operation of the spring to grip the locking part, and the ratchet will be locked against rotation. Obviously, no lifting then can take place.

Because the locking part is self-adjusting, it will function accurately and well even when there has been some wear of the operating shaft or of the parts on the shaft. In other words, locking will take place under overload, and not due to a wearing of the parts of the Weston brake mechanism. Further, the locking will not take place under normal load.

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.

Referring now to the drawings:

FIG. 1 shows a horizontal section of a hoist that utilizes my invention.

FIG. 2 shows an exploded view of parts of the hoist.

For the purpose of describing my invention, I show in FIG. 1 of the drawings a hoist construction that is much like the one shown in the earlier patent to Charles S. Schroeder, No. 2,690,240. I indicate my overload prevention device generally by the numeral 18, and I show the device associated with the Weston brake mechanism 11 of the hoist.

I believe that those persons skilled in the art will readily understand the type of hoist that is shown, and I shall merely point out here that there is an operating shaft 12 that rotates on the hoist body 13, and upon which a hand wheel 14 and an operating friction disc 15 are mounted through screw threads 16. Hand wheel 14 and friction disc 15 are devices forming parts of the Weston brake mechanism 11, that mechanism enabling an operator to control rotation of the operating shaft 12 merely by controlling wheel 14, as through a hand chain, not shown. Operating shaft 12 in turn controls the lifting and lower-
ing movements of a load chain 17, acting for that purpose through a pinion portion 18 meshing with a gear 19 on a load shaft 20. That shaft rotates on hoist body 13, and has a load wheel 21 engaging chain 17.

In the overload prevention device 10 that I have conceived by my invention, I prefer to utilize a locking plate 22 that is ring shaped, as best seen in FIG. 12, and that is illustrated as shown in FIG. 1, being juxtaposed to a face of a ratchet disc 23 forming a part of the brake mechanism 11. Locking plate 22 is formed with openings 24, and plate 22 is assembled by those openings to fingers 25 that are formed in an axially extending position on a bracket plate 26. A series of studs 27 is mounted on the hoist body 13 and engages openings 28 in the bracket plate 26, thus supporting that plate so that it cannot rotate. It will thus be seen that the locking plate 22 is fixed against rotation relatively to hoist body 13, but nevertheless may move somewhat on the fingers 25 so as to float relatively to the ratchet disc 23.

In the construction that I have chosen to illustrate, the ratchet disc 23 is mounted for axial and rotating movements on a hub portion 29 of the friction disc 15, with a friction ring 40 assembled between surfaces of discs 23 and 15. Disc 23 is formed with ratchet teeth 30 that are engaged by a shaped pawl 31 to which there yield to openings 32 whereby the pawl is mounted on the studs 27. Coil springs 33 are assembled about studs 27 to press pawl 31 in an axial direction against the ratchet teeth 30, whereby to hold ratchet disc 23 against rotation in a load lowering direction. In these respects the pawl 31 and ratchet disc 23 are quite like those of the Schudroch construction to which I have referred, though I might mention that the coil springs 33 in the present construction will act also against the bracket plate 26 on studs 27, holding plate 26 in operating position.

I prefer to equip the ratchet disc 23 with a further disc 34 that will act as a clutch plate, and that will be assembled at the opposed surface of locking plate 22, that is, toward the hand wheel 14 as seen in FIG. 1. The disc or clutch plate 34 is formed with a series of openings 35 that loosely engage pins 36 fixed to the ratchet disc 23, holding plate 34 and disc 23 so that they cannot substantially rotate relatively to each other, but allowing movements of adjustment between them. Snap rings 37 on the pins 36, FIG. 1, will limit the amount of separating movement that may take place between ratchet disc 23 and clutch plate 34, and there is a pressure ring 39 that will accept pressure between clutch plate 34 and hand wheel 14.

In effect, disc 23 and plate 34 will form a two-part ratchet disc that is adapted to coact with opposed surfaces of the locking plate 22. Between those parts, comprising disc 23 and plate 34, I assemble a Belleville spring 38 in position within the opening of the ring-shaped locking plate 22. That spring 38 normally presses disc 23 and plate 34 away from one another and out of pressure relating to locking plate 22.

**Operation**

Since a Weston brake acts through compression of the devices that form its parts, it will be understood that the hand wheel 14 in the present case will act through the pressure ring 39 to compress the two-part ratchet disc 23, 34. The amount of compression naturally is related to the load forces that the load chain 17 applies through operating shaft 12, which is to say that it is related to the force that must be applied through hand wheel 14 to lift the load. The Belleville spring 38 is particularly designed to accept the compression that need be developed when handling a load that is within the rating of the hoist. Therefore, spring 38 will not yield to any great extent when there is a normal compression of the two-part ratchet disc 23, 34, and that disc will remain in relatively free relation to the locking plate 22. Then, ratchet disc 23, 34 will merely act in a normal manner while controlled through hand wheel 14, compressing friction ring 40 and friction disc 15 so as to rotate or to hold the operating shaft 12, as the case may be, and permitting full normal operation of the hoist.

Let us now suppose that the load chain 17 engages an overload, and that the operator applies an excessive force to the hand wheel 14 for lifting the overload. By so doing, the operator will develop an excessive compressing force against the clutch plate 34. The Belleville spring 38 cannot accept that force and will yield. Thereby the compression will move clutch plate 34 and ratchet disc 23 toward one another so as to grip locking plate 22. Since locking plate 22 cannot rotate, ratchet disc 23 then will be locked and will act through friction to lock the friction disc 15 and hand wheel 14 against further movement.

Stated in another way, the opposing force of the load on the chain 17, reacting through operating shaft 12 and screw threads 16, will develop the compression causing Belleville spring 38 to yield and to effect locking.

While I have described a particular construction in which locking plate 22 is assembled in position intermediate the ratchet disc 23 and hand wheel 14, I do not wish to be limited by that construction because it is impossible that some persons will not require except while arranging a locking part in another position. It is merely necessary to know that the hoist overload preventing device that I have conceived utilizes a locking part mounted on the hoist body and normally in normal release relation to one device of a series of devices comprising a Weston brake mechanism, with said one device entering into locking engagement with the locking part due to compression of that device when there is an overload on the hoist.

I believe it will be understood that an operator cannot adjust the overload preventing device in my invention, because its operation may be predetermined through the choice of a spring that will have a particular degree of strength. Of course, it will be possible to substitute a different spring so as to achieve a different overload response, but to do that it will be necessary first to disassemble the hoist, will develop the compression causing Belleville spring 38 to yield and to effect locking.

I have referred to the self-adjusting movements of the locking plate 22, and it will be understood that those movements will enable parts of the Weston brake to coact effectively with plate 22. Actually, that coaction will continue substantially without change when there has been considerable wear on the parts of the Weston brake mechanism, as for example on the friction disc 15 and its ring 40, or on the screw threads 16.

Having thus described my novel overload preventing device and the manner in which it operates, I believe that my invention will be fully understood, and that its considerable merits will be appreciated by those persons who are skilled in the art.

I now claim:

1. A hoist of the type utilizing a Weston brake mechanism assembled to a hoist body, such mechanism comprising a rotatable series of devices on an operating shaft, and means whereby a load force tending to rotate the operating shaft will compress said series of devices in an axial direction to hold said devices in frictional engagement relatively to one another, overload preventing means that are provided by a locking part assembled in position juxtaposed to one device of said series of devices for accepting through said one device a compressing force applied by said first named means directly through said one device, mounting means holding said locking part fixed against rotating movement relatively to the hoist body, and yielding means compressing force on said one device and holding said one device and locking part in a release relation to each other to long as the compressing force is within bounds determined by the load rating of the hoist, an increase in compression such as is developed by an overload overcoming the opposition of said yielding means so as to be applied in
axial direction against the fixed locking part to effect locking between said one of the devices and said locking part.

2. In claim 1, the feature that said one device of the series of devices is formed of two parts arranged at opposed surfaces of said locking part, said two parts gripping said surfaces upon compression of the Weston brake devices when said hoist is operated under overload.

3. In claim 2, the feature that spring means press said two parts away from one another for holding those parts in release relation to the locking part.

4. In claim 2, the feature that said locking part is mounted for movement parallel to the operating shaft to compensate for wear of the devices on said shaft.

5. In claim 3, the feature that said locking part is mounted for movement parallel to the operating shaft to compensate for wear of the devices on said shaft.

6. In claim 2, the feature that one of said two parts is the one way ratchet of the Weston brake.

7. In claim 5, the feature that one of the two parts of said one device is the one way ratchet of the Weston brake.

8. In a hoist of the type utilizing a Weston brake mechanism, such mechanism comprising a series of rotatable devices that a load force on the hoist will compress in axial direction on an operating shaft of the mechanism, the improvement that comprises spring means acting between two of the devices and accepting an amount of compression that may be developed incidental to a normal load force, a locking plate held against rotation on the hoist and assembled in a relatively loose position between said two devices, and said spring means formed to yield so that one of said two devices will press the locking plate against the other of said two devices due to an increase in compression, whereby to lock said one device against rotation when an overload is applied to the hoist.

9. In claim 8, the feature that there is a bracket mounted on the hoist body and having portions engaging the locking plate to hold said plate against rotation, and said plate formed with surfaces movable on said bracket portions to permit movements of adjustment of said plate in axial direction.

10. In claim 8, the feature that the locking plate is assembled in opposed relation to a face of a ratchet disc that forms a device of the Weston brake, said locking plate frictionally engaging said face incidental to the overload compression of the brake devices.

11. In a hoist of the type utilizing a Weston brake mechanism assembled to a hoist body, such mechanism comprising a series of rotating devices that are movable in an axial direction and that will be axially compressed by a load force on the hoist, the improvement that comprises overload preventing means that are provided by a locking part juxtaposed to one device of said series of devices and fixed against rotation on the hoist body, surfaces formed in opposition to each other on said one device and on said locking part for engaging one another incidental to an axial movement of said device, spring means normally accepting the axial compression of said one device and acting in a direction to hold said surfaces of the part and device in release relation to each other, and said spring means formed to yield incidental to compression that is developed by an overload on the hoist so that said surfaces move into locking relation whereby to lock the hoist against movement.

12. In claim 11, the feature that a Weston brake ratchet disc forms said one device of the series of devices, and including a clutch disc mounted to rotate integrally with the ratchet disc while being movable in axial direction relatively to said ratchet disc, and a plate forming said locking part and arranged intermediate the clutch disc and ratchet disc for engagement by those discs.

13. In claim 12, the feature that a bracket is mounted on the hoist body and engages the plate that forms the locking part, and said bracket having portions on which said plate may move in an axial direction so as to accept uniform pressures when engaged by the clutch and ratchet discs.

14. In a Weston brake mechanism, such mechanism having a rotatable ratchet disc assembled between a friction disc and an operating device that apply pressure to the ratchet disc incidental to a load force acting through said mechanism, the improvement that comprises two axially aligned parts forming said ratchet disc, means connecting the parts of the ratchet disc to rotate integrally with each other while permitting movements in an axial direction between those parts, a locking plate fixed against rotation and assembled intermediate the two parts of the ratchet disc, spring means pressing the two parts away from one another and normally holding said parts in release relation to the locking plate, and said spring means formed to yield when the friction disc and operating device apply a predetermined amount of pressure to the ratchet disc, so that the two parts of the ratchet disc will grip the locking plate incidental to an excessive load force applied through the mechanism.

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