Nov. 30, 1943. C. SCHROEDER 2,335,571

CHAIN HOIST

Filed Jan. 28, 1941 2 Sheets-Sheet 1

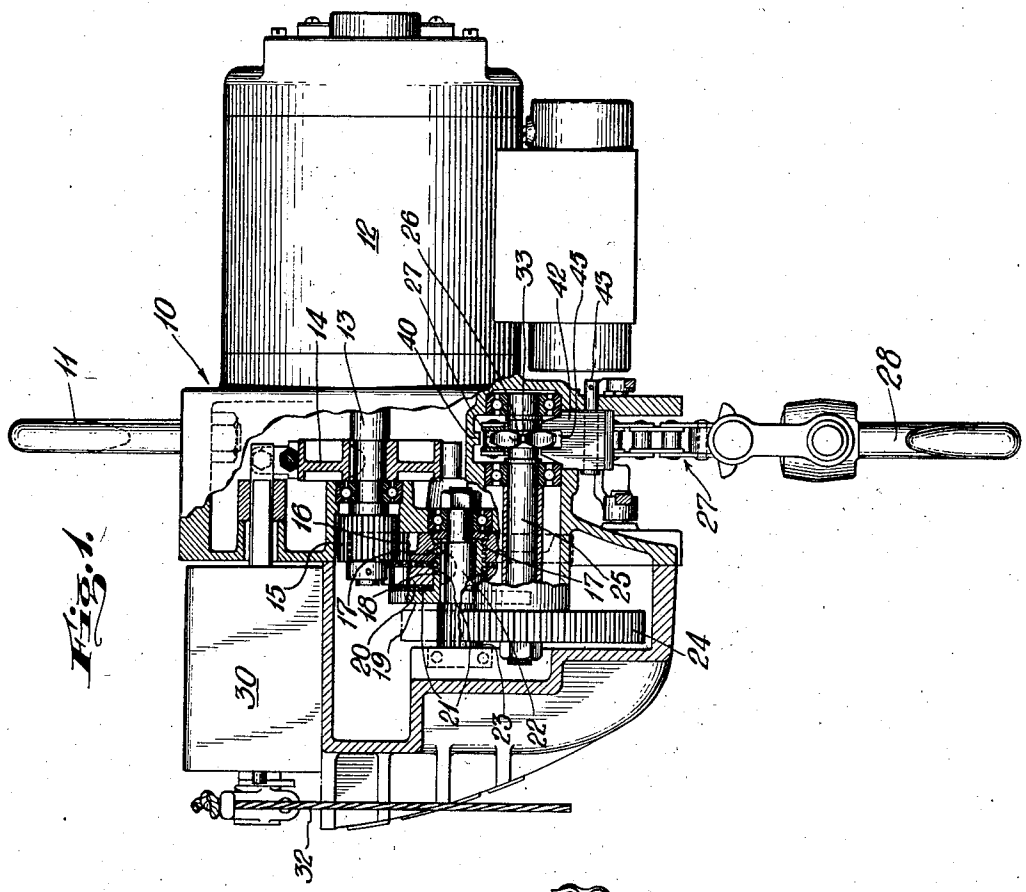


Fig. 1.

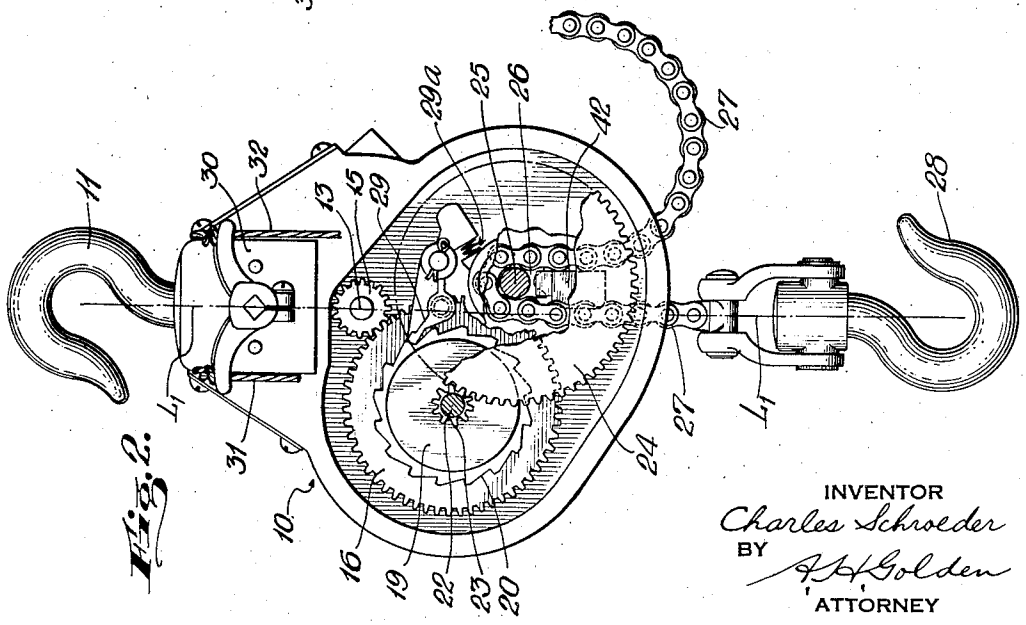


Fig. 2.

INVENTOR
Charles Schroeder
BY
A. A. Golden
ATTORNEY

Nov. 30, 1943. C. SCHROEDER 2,335,571

CHAIN HOIST

Filed Jan. 28, 1941 2 Sheets-Sheet 2

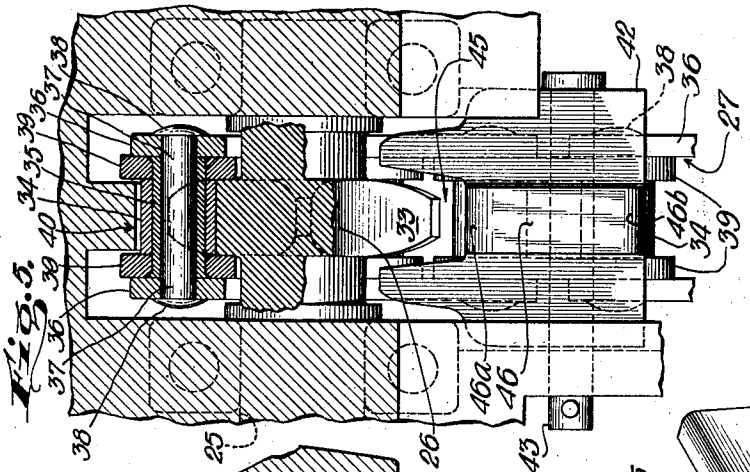


Fig. 5.

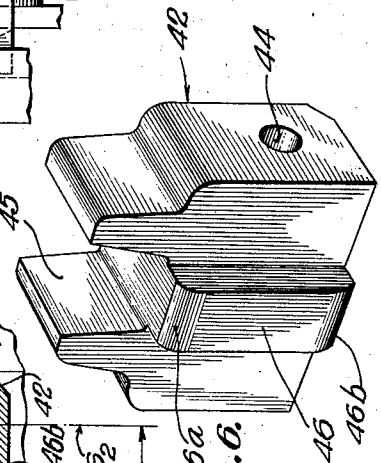


Fig. 6.

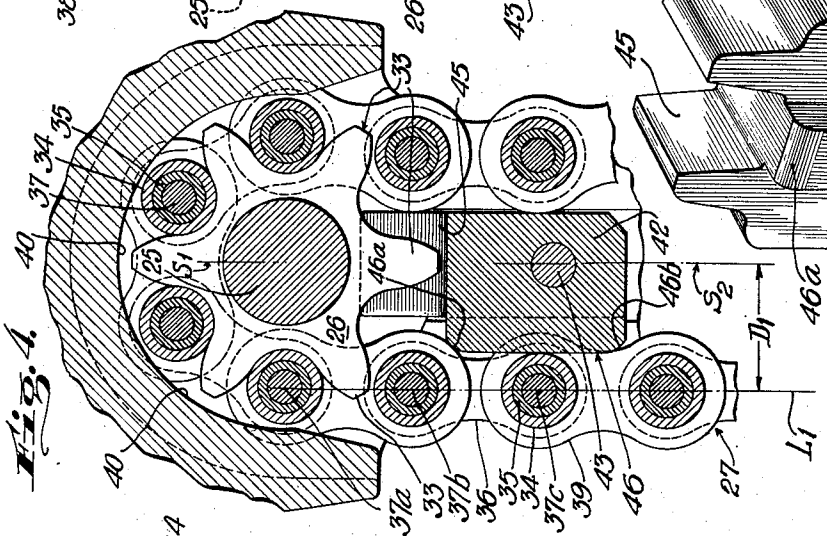


Fig. 4.

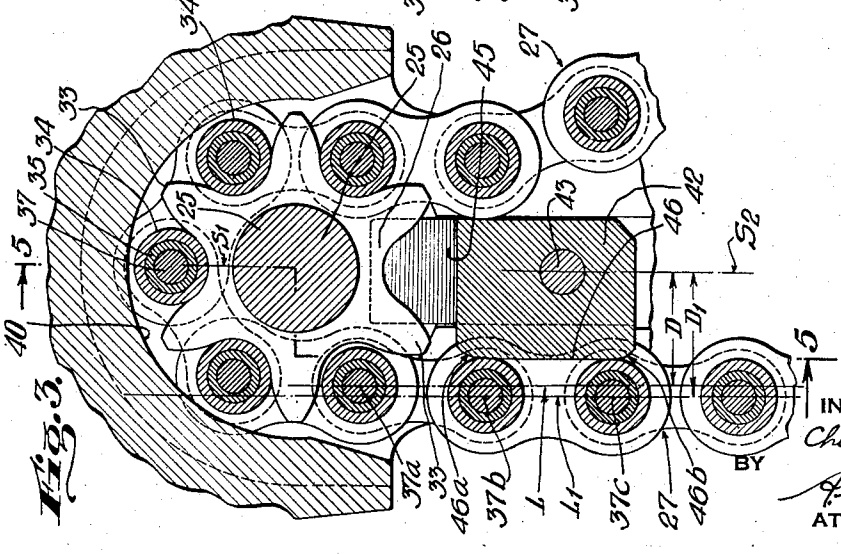


Fig. 3.

INVENTOR
Charles Schroeder
BY
A. H. Golden
ATTORNEY

Patented Nov. 30, 1943

2,335,571

UNITED STATES PATENT OFFICE

2,335,571

CHAIN HOIST

Charles Schroeder, Philadelphia, Pa., assignor to The Yale & Towne Manufacturing Company, Stamford, Conn., a corporation of Connecticut

Application January 28, 1941, Serial No. 376,300

12 Claims. (Cl. 254—168)

This invention relates to hoists, and more particularly to electric hoists in which a sprocket is rotated to actuate a chain, whereby to lift and lower a load secured to the load end of the chain.

More particularly, my invention relates to an electric hoist of the type utilizing a roller chain and a sprocket driven at relatively high speeds for lifting a load secured to a load hook at the end of the roller chain.

In hoists of this type, it will be readily appreciated that the load on the load chain, and the usual hook by which the hoist is suspended, will determine a vertical line, which I shall hereinafter call a load line. The weight carried by the load chain naturally determines the inertia of this vertical line. Those skilled in the art will also fully appreciate that the lateral distance between the center line of the chain actuating sprocket and the load line, will vary as the sprocket rotates in actuating the chain. There is therefore a tendency for the hoist to move relatively to the said load line as the sprocket rotates, with the frequency of movement determined by the number of the teeth and the speed of rotation of the sprocket. I have found that under certain conditions, this relation of the parts will cause a very serious vibration of a hoist of the class described, especially where the length of the load chain is such that this vibration coincides with the natural frequency of vibration of the hoist mechanism.

As a feature of my invention, I provide means whereby I successfully eliminate this vibration. One preferred form of the means which I have devised, is shown in the accompanying drawings, and will be described in this specification, but it should be understood that I consider my invention to be a relatively broad one, and I expect to obtain claims which will prevent the utilization of my contribution to the art in physical forms other than that herein shown and described. Also, while in describing one form of my invention I shall particularly point out what I now believe is the theory of operation thereof, I do not intend my invention to be limited in scope by that theory.

Referring now to the drawings, Fig. 1 is an elevation and partial section of a type of hoist to which my invention may be applied, and showing my invention installed. Fig. 2 is a partial section of Fig. 1 illustrating the coaction of certain of the parts. Figs. 3 and 4 are enlarged views showing the action of my invention. Fig. 5 is a section taken along lines 5—5 of Fig. 3. Fig. 6 is a perspective view showing the chain guide and stripper block.

Referring now more particularly to Figs. 1 and 2, I therein show a hoist assembly including a series of component parts which together comprise what I choose to call a hoist casing, designated generally by the reference numeral 10. This hoist casing is supported in the usual manner well known in the art by a hook 11, so that it may hang freely from any suitable support. Those skilled in the art will appreciate, of course, that my invention is equally applicable to hoists which are suspended in other ways.

The hoist mechanism includes a motor housed within the portion 12 of the casing and having a main drive shaft 13, to which is keyed the brake drum 14. At the extreme left end of the drive shaft 13, as seen in Fig. 1, is secured a driving pinion 15 in mesh with the gear 16 of a "Weston" drive. This "Weston" drive is, of course, familiar to those skilled in the art, and therefore will not be described in full detail here. The gear 16 is threaded at 17 to the sleeve 18, on the end of which is formed a disk 19. A "Weston" type ratchet plate 20 is freely mounted on the sleeve 18, and is separated from the disk 19 on the one side and the gear 16 on the other side by a pair of friction plates 21. The sleeve 18 is keyed to a shaft 22, and mounted on the left hand end of the shaft 22 is a pinion 23 in mesh with a gear 24 secured to one end of a lift shaft 25. The lift sprocket 26 is secured near the right end of this lift shaft 25, and is adapted to actuate a roller chain, designated generally by the reference numeral 27, whereby to lift and lower such loads as may be attached to the load hook 28 on the end of the chain 27.

Referring now to Fig. 2, it will be noted that the ratchet plate 20 is held against rotation in a direction corresponding to the lowering of the load, by a pawl 29 spring pressed in a holding direction by a spring 29a. Those skilled in the art will fully appreciate that when the motor shaft 13 rotates in one direction, it causes the gear 16 to move relatively to the threads 17 on the sleeve 18, whereby to bind the disk 19 and its sleeve 18 to the ratchet plate 20 through the intermediary of friction disks 21, whereby to rotate the sleeve 18 and the gear 16 together with the ratchet plate 20. This effects rotation of the shaft 22, and through the pinion 23 and gear 24, drives the load shaft 25.

When it is desired to lower the load, the motor must be actuated to rotate its shaft 13, whereby to rotate the gear 16 at a speed sufficient to pre-

vent the binding together of the gear 16, the disk 19, its sleeve 18, and the friction disks 21 relatively to the ratchet plate 20. So long as there is no binding of those elements, the sleeve 18 may be rotated with the shaft 22 incidental to the lowering rotation of the load shaft 25 and relatively to the ratchet plate 20. To halt the lowering movement of the load, it is merely necessary to stop the operation of the motor and its drive shaft 13. There will be an immediate binding of the gear 16, disk 19 and its sleeve 18 to the ratchet 20, so that the ratchet will, through its pawl 29, hold the parts against rotation. As has already been indicated earlier, the "Weston" mechanism is well known in this art, and it is thought no further description thereof need be given here.

For controlling the rotation of the motor of my hoist, I employ a type of controller well understood by those skilled in the art, and mounted within a box 30 for actuation by the ropes 31 and 32 in the usual standard manner.

Referring now to Figs. 2, 3 and 4, it will be noted that the roller chain 27 extends vertically into the casing of the hoist, and over the teeth 33 of the sprocket 26. The chain portions in direct contact with the teeth are in the form of sleeves or rollers 34 (Fig. 5), and are freely rotatable about sleeves 35 which in turn are mounted about pins 37. The pins 37 extend through the outer link plates 36 and are riveted at 38 to retain those link plates and the remaining elements assembled in the relation illustrated in Fig. 5. The sleeves 35 are used to hold assembled what I term inner link plates 39. The construction of the chain and its coaction with the sprocket teeth 33 is per se not part of my invention, and is well known by those skilled in this art.

The chain is guided and held in contact with the teeth 33 of the sprocket 26 by a substantially semi-circular guide surface 40 formed as part of the casing 10 of the hoist, as is best shown in Fig. 1. A stripper block 42 is secured to the casing through a shaft 43 extending through a bore 44 in the block, and directly under the sprocket 26, so that the teeth 33 of the sprocket will traverse a groove 45 in the stripper block. This movement of the teeth through the groove 45 is probably best illustrated in Figs. 1 and 5, and functions to strip the chain from the teeth of the sprocket. At this point, it may be well to add that the construction I have thus far described is not per se the invention herein to be covered.

Assuming now a load carried on the hook 28 at the lower end of the chain 27, and with the sprocket 26 rotating to lift or lower the load, let us first consider the position of the parts with the teeth 33 of the sprocket 26 in the position of Fig. 3. In this position of the parts, the distance between the center line of the sprocket 26, designated by reference letters S_1S_2, from the pin center 37*a* of the particular chain link roller 34 just entering into or out of engagement with the sprocket 26, is indicated by reference letter D. Were it not for means not yet described, the remainder of the chain links would be positioned so that their pin centers 37*b*, 37*c*, etc., would lie in the vertical load line L relatively to center line S_1S_2.

Referring now to Fig. 4, wherein the sprocket 26 is in a different rotated position, the distance from the sprocket center line S_1S_2 to the pin center 37*a*, is designated by reference letter D_1. It will be noted that the distance D_1 is considerably greater than the distance D. Moreover, the pin centers 37*a*, 37*b* and 37*c* in Fig. 4 now lie in a load line L_1 relatively to line S_1S_2. The lateral displacement of load lines L and L_1 is best shown in Fig. 3, and is of course equal to the distance D_1—D. It will therefore be appreciated that if the hoist is allowed at all times to assume a natural position relatively to the load chain, the center line S_1S_2 of the sprocket will move relatively to the load line of the chain. The distance from the load line of the chain to the center line of the sprocket will vary from the distance D to the distance D_1. In the case of a six-tooth sprocket, as shown, this variation occurs six times during each rotation of the load shaft 25 and the sprocket 26. I have actually found this vibration to be extremely serious, especially where the length of the load chain is such that the frequency of vibration coincides with the natural frequency of vibration of the hoist mechanism itself.

For avoiding this vibration, I form on my stripper block 42 a guide surface 46 which extends laterally a sufficient distance in the preferred form of my invention, to maintain at all times a distance D_1 between the load line L_1 of the chain and the center line S_1S_2 of the sprocket, as shown in Fig. 4. This means, of course, that even in the position of the sprocket 26 in Fig. 3, with the center 37*a* of the chain link pin displaced a distance D from the center line S_1S_2 of the sprocket, the distance D_1 will actually be maintained between the load line L_1 of the chain and the center line S_1S_2 of the sprocket. Because of this, there will be no variation in the distance between the center line of the sprocket and the load line of the chain as the sprocket rotates. It is well to add that I prefer to use my stripper block 42 as the support for my surface 46, but that it is not necessary that this be done.

In the preferred form of my invention, the guide surface 46 is rounded as at 46*a* and 46*b* to better cooperate with the chain in its lowering and lifting movements, while the vertical extent of the surface 46 is somewhat greater than the distance between the centers of any two rollers 34 of the chain. It will readily be seen that through cooperation of the surface 46 with a pair of rollers 34, as shown in Fig. 3, the positioning of the hoist relatively to the load line is best controlled. The width of the surface 46 is preferably substantially the width of the chain rollers 34 and is therefore helpful in maintaining the alignment of the chain.

Preferably, also, the surface 46 extends laterally only that distance which will maintain the load line L_1 displaced from the center line S_1S_2 of the sprocket a distance equal to the greatest distance which separates the centers 37*a*, 37*b*, 37*c*, etc., of the chain link rollers from the center line S_1S_2 of the sprocket in the natural operation of the hoist. This distance is actually D_1 in the drawings, and is so determined that the load line L_1 in Fig. 2 falls directly through the center line of the mounting of the hook 11, the center line of the load hook 28, and the pin centers of the chain 27 at or below the surface 46. Moreover, the relationship of the parts is such that the vertical line of the surface 46 is parallel to the load line L_1 of the chain.

I now claim:

1. In a hoist of the class described, a load sprocket of the type having a small number of teeth, a load chain engaged with the teeth of said sprocket whereby to be actuated by the

sprocket to lift and lower a load carried on the load end of said chain, said chain and sprocket moving laterally relatively to one another as the points of contact of the chain and sprocket change through rotation of the sprocket, and a chain guide secured to the hoist below said sprocket for contacting the load side of the chain, said chain guide holding said chain against moving toward the sprocket center line from a plane which is at least as far from the said center line as that into which the chain is farthest displaced relatively to the sprocket center line through said engagement with the sprocket teeth.

2. In a hoist of the class described, a casing, means for suspending said casing vertically, a load sprocket of the type having a small number of teeth, a load chain engaged with the teeth of said sprocket whereby to be actuated by the sprocket to lift and lower a load carried by the load end of said chain, said chain and sprocket moving laterally relatively to one another as the points of contact of the chain and sprocket change through rotation of the sprocket, whereby to vary the distance between the vertical plane in which the load chain operates and the center line of said sprocket, and a chain guide secured to said casing below said sprocket for contacting the load side of the chain, said chain guide holding said chain against moving toward the sprocket center line from a plane which is at least as far from the said center line as that into which the chain is farthest displaced relatively to the sprocket center line through said engagement with the sprocket.

3. In a hoist of the class described, a casing, a load sprocket of the type having a small number of teeth mounted in said casing, a load chain engaged with the teeth of said sprocket whereby to be actuated by said sprocket to lift and lower a load carried on the load end of said chain, said chain and sprocket moving laterally relatively to one another as the points of contact of the chain and sprocket change through rotation of the sprocket whereby to move said casing laterally relatively to said chain, and a chain guide fixed on said hoist casing below said sprocket for contacting and bearing against the load side of the chain for holding the hoist laterally displaced relatively to the said load chain a distance at least as great as the greatest natural displacement thereof determined by the sprocket and chain.

4. In a hoist of the class described, a casing, a load sprocket of the type having a small number of teeth mounted in said hoist casing, a load chain engaged with the teeth of said sprocket whereby to be actuated by said sprocket to lift and lower a load carried on the load end of said chain, said chain and sprocket moving laterally relatively to one another as the points of contact of the chain and sprocket change through rotation of the sprocket whereby to move said casing laterally relatively to said chain, and a chain guide fixed on said hoist casing below said sprocket for contacting and bearing against the load side of the chain for holding the hoist laterally displaced from the load chain a distance at least equal to the greatest relative natural displacement of said casing and chain as determined by the sprocket and chain.

5. In a hoist of the class described, a casing, a load sprocket of the type having a small number of teeth mounted in said hoist casing, a load chain engaged with the teeth of said sprocket whereby to be actuated by said sprocket to lift and lower a load carried on the load end of said chain, said chain and sprocket moving laterally relatively to one another as the points of contact of the chain and sprocket change through rotation of the sprocket whereby to move said casing laterally relatively to said chain, and a chain guide fixed on said hoist casing below said sprocket for contacting and bearing against the load side of the chain for holding the hoist laterally displaced from the load chain a distance at least as great as the greatest natural displacement which will take place with said hoist naturally suspended relatively to the chain.

6. In a hoist of the class described, a casing, a hook whereby said casing is hung freely from a support, a sprocket mounted for rotation on said casing and driven by power mechanism supported by the casing, said sprocket being of the type having a small number of teeth, a load chain engaged with the teeth of said sprocket whereby to be actuated by the sprocket to raise and lower a load carried by the load end of said chain, said chain and sprocket moving laterally relatively to one another as the points of contact of the chain and sprocket change through rotation of the sprocket, and a chain contacting surface on said casing contacting the load side of said chain and preventing lateral movement of said casing towards said chain beyond a position determined by the natural positioning of said sprocket relatively to the chain when the sprocket center line is displaced a maximum distance from the chain through its engagement with the chain.

7. In a hoist of the class described, a casing, a hook whereby said casing is hung freely from a support, a sprocket mounted for rotation on said casing and driven by power mechanism supported by the casing, said sprocket being of the type having a small number of teeth, a load chain engaged with the teeth of said sprocket whereby to be actuated by the sprocket to raise and lower a load carried by the load end of said chain, said chain and sprocket moving laterally relatively to one another as the points of contact of the chain and sprocket change through rotation of the sprocket, a chain contacting surface on said casing positioned parallel to the vertical natural line of the load side of said load chain and the casing hook suspension while bearing against the said chain, said surface preventing lateral movement of said casing towards said chain beyond a position determined by the natural positioning of said sprocket relatively to the chain when the sprocket center line is displaced a maximum distance from the chain through its engagement with the chain.

8. In a hoist of the class described, a casing, a hook whereby said casing is hung freely from a support, a sprocket mounted for rotation on said casing and driven by power mechanism supported by the casing, said sprocket being of the type having a small number of teeth, a load chain of the roller link type with rollers about each link pivot, said chain being engaged with the teeth of said sprocket whereby to be actuated by the sprocket to raise and lower a load carried by the load end of said chain, said chain and sprocket moving laterally relatively to one another as the points of contact of the chain and sprocket change through rotation of the sprocket, a chain contacting surface on said casing contacting the load side of said chain and preventing lateral movement of said casing towards said chain beyond a position determined by the natural positioning of said sprocket relatively to

the chain when the sprocket center line is displaced a maximum distance from the chain through its engagement with the chain, said surface having a length at least somewhat greater than the distance between the center lines of said rollers.

9. In a hoist of the class described, a casing, a hook whereby said casing is hung freely from a support, a sprocket mounted for rotation on said casing and driven by power mechanism supported by the casing, said sprocket being of the type having a small number of teeth, a load chain of the roller link type with rollers about each link pivot, said chain being engaged with the teeth of said sprocket whereby to be actuated by the sprocket to raise and lower a load carried by the load end of said chain, said chain and sprocket moving laterally relatively to one another as the points of contact of the chain and sprocket change through rotation of the sprocket, a chain contacting surface fixed on said casing contacting the load side of said chain and preventing lateral movement of said casing towards said chain beyond a position determined by the natural positioning of said sprocket relatively to the chain when the sprocket center line is displaced a maximum distance from the chain through its engagement with the chain, said surface having a width of approximately the width of said rollers whereby to assist in maintaining a proper alignment of the chain.

10. In a hoist of the class described, a casing, a hook whereby said casing is hung freely from a support, a sprocket mounted for rotation on said casing and driven by power mechanism supported by the casing, said sprocket being of the type having a small number of teeth, a load chain engaged with the teeth of said sprocket whereby to be actuated by the sprocket to raise and lower a load carried by the load end of said chain, the center of said sprocket being laterally displaced by contact with said chain from the vertical line determined by said hook supporting the casing and by the load side of the load chain under the influence of a load, the amount of said displacement varying as the sprocket rotates, and a chain contacting surface on said casing contacting the load side of said chain and preventing lateral movement of said casing towards said chain beyond a position determined by the natural positioning of said sprocket relatively to the chain when the sprocket center line is displaced a maximum distance from the chain through its engagement with the chain.

11. In a hoist of the class described, a casing, a hook whereby said casing is hung from a support, a sprocket mounted for rotation on said casing and driven by power mechanism supported by the casing, said sprocket being of the type having a small number of teeth, a load chain engaged with the teeth of said sprocket whereby to be actuated by the sprocket to raise and lower a load carried by the load end of said chain, the center of said sprocket being laterally displaced by contact with said chain from the vertical line determined by said hook supporting the casing and by the load side of the load chain under the influence of a load, the amount of said displacement varying as the sprocket rotates, a chain contacting surface fixed to said casing and bearing against the load side of the chain, said surface holding said casing spaced laterally relatively to the chain a distance greater than the natural displacement of said casing in certain rotated positions of the sprocket relatively to the chain when allowed to hang naturally relatively to the chain.

12. In a hoist of the class described, a casing, a hook whereby said casing is hung freely from a support, a sprocket mounted for rotation on said casing and driven by power mechanism supported by the casing, said sprocket being of the type having a small number of teeth, a load chain engaged with the teeth of said sprocket whereby to be actuated by the sprocket to raise and lower a load carried by the load end of said chain, the center of said sprocket being laterally displaced by contact with said chain from the vertical line determined by said hook supporting the casing and by the load side of the load chain under the influence of a load, the amount of said displacement varying as the sprocket rotates, a chain stripper carried by said casing and having a surface contacting the load side of said chain and preventing lateral movement of said chain towards said casing beyond a position determined by the natural positioning of said sprocket relatively to the chain when the sprocket center line is displaced a maximum distance from the chain through its engagement with the chain.

CHARLES SCHROEDER.