April 24, 1945. R. E. NELLES 2,374,450

CHAIN HOIST

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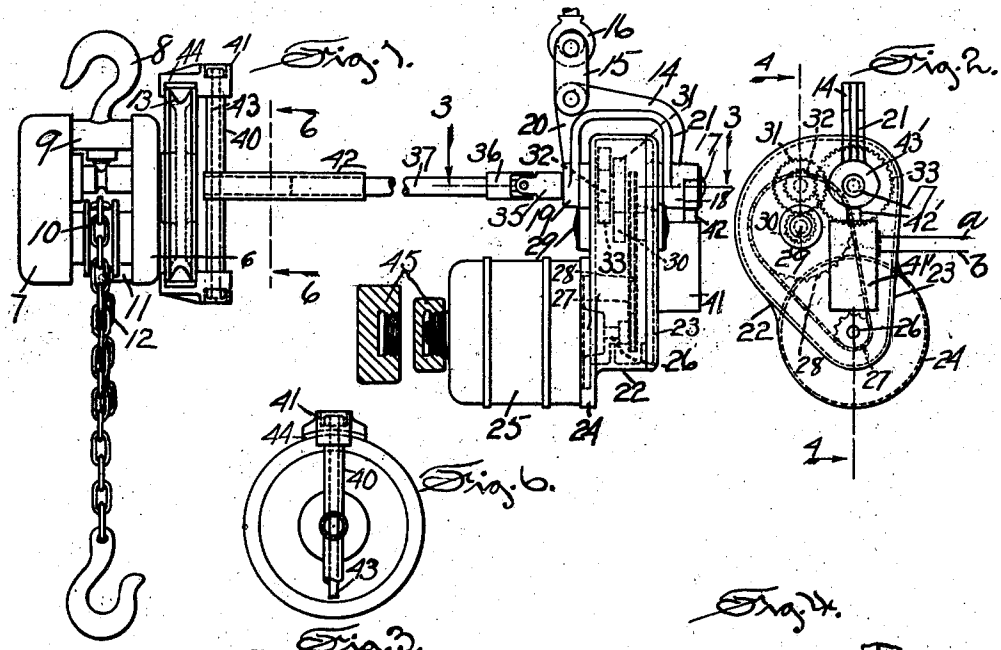


Fig. 1.

Fig. 2.

Fig. 6.

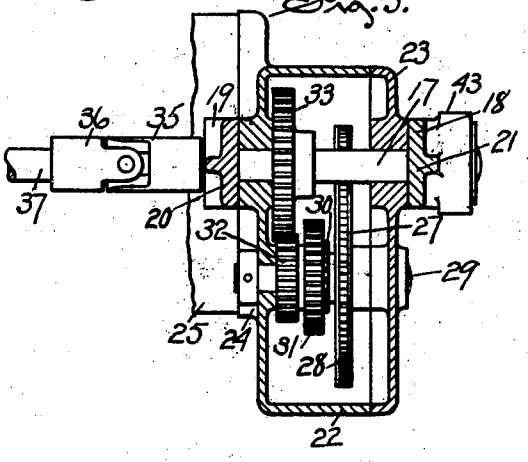


Fig. 3.

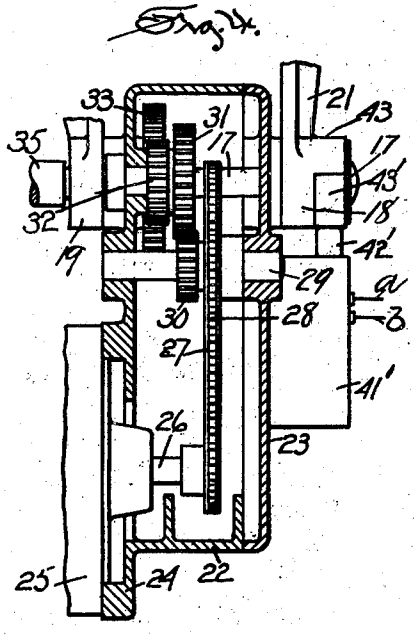


Fig. 4.

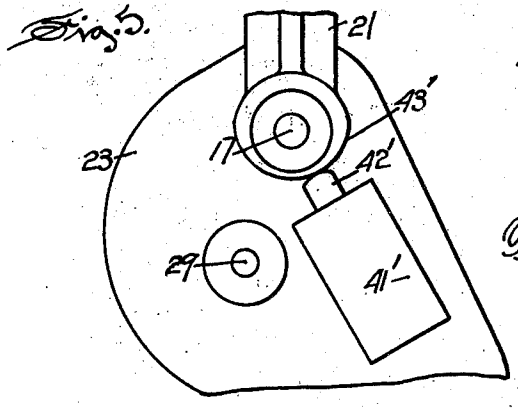


Fig. 5.

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CHAIN HOIST

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17 Claims. (Cl. 254—168)

My invention relates to that type of hoisting apparatus embodying a chain or sprocket wheel loosely supporting a chain commonly manually operated, said wheel being connected with the hoisting mechanism for operation thereof, and an object of the invention, among others, is the construction of a chain hoist provided with means for operating the chain wheel or sprocket by means of power mechanically applied and with a power unit supported independently of the hoisting unit; a further object of the invention is the provision of means whereby resistance offered by the hoisting unit to operation of the power unit will cause the latter to automatically operate an electric switch to control supply of power current to said power unit; and a still further object of the invention is the provision of means whereby operation of said switch may be automatically controlled in a manner to prevent overloading of the hoisting unit. Other objects will appear as the invention is unfolded by further description in connection with the drawing illustrating the mechanism in the construction and operation of which the objects herein set out, as well as others, may be attained. In said drawing—

Figure 1 is a view in elevation of my improved structure as a whole.

Figure 2 is a view in end elevation of the same.

Figure 3 is a view in horizontal section on enlarged scale of the mechanism connecting the driving power unit with the hoisting unit and on a plane denoted by the dotted line 3—3 of Fig. 1.

Figure 4 is a view on enlarged scale in section on a plane denoted by the broken line 4—4 of Fig. 2.

Figure 5 is a detail view on enlarged scale showing the electric switch and the means and method for operating it.

Figure 6 is a view in section on a plane denoted by the broken line 6—6 of Fig. 1.

As shown in the accompanying drawing the hoisting mechanism is of old and well known construction and a detailed showing and description is not required herein for a full understanding of the invention, it being sufficient to state that such mechanism is contained in a chain hoist housing comprising a front cover 6 and a back cover 7 spaced apart to accommodate a supporting hook 8 projecting from a supporting hook swivel 9 through the space between the covers, said mechanism further comprising parts not herein specifically described but including a load sprocket 10 and a load chain stripper 11 also extending through said space and supporting a load chain 12. I use a hand wheel 13 as heretofore employed supported outside of and adjacent one of the covers of said housing by mechanism extending through said cover, said wheel being illustrated herein merely as a convenient means for connecting my improved driving mechanism with a hoisting unit of existing construction.

The driving unit as illustrated herein comprises a supporting yoke 14 that, as well as the supporting hook 8, depends either stationary or movable from above, said driving unit employing a link 15 and eye 16. A driving shaft 17 is rotatably supported in bearings 18—19 at the outer ends of the arms 20—21 of the yoke 14, as shown in Figs. 1 and 3 of the drawing. A gear case and motor support 22 comprising a power unit housing is suspended between the arms 20 and 21, said case including a cap 23 fitted to close the open end of the case and secured in any suitable manner to the case adjacent the arm 21. A motor base 24 is formed as a part of the case 22 and a motor 25 is secured to the base and serves as a means for driving the mechanism within the case 22. The spindle 26 of the motor has a sprocket secured at its outer end and a chain 27 connects the sprocket with a sprocket wheel 28 mounted on a stud shaft 29 extending within the case. A pinion 30 rigid with the sprocket wheel 28 meshes with an intermediate gear 31 having an intermediate pinion 32 rigid therewith and in mesh with a driving gear 33. The gear and pinion 31—32 are suitably rotatably mounted within the case and the driving gear 33 secured to the driving shaft 17 is in mesh with the intermediate pinion 32. The driving shaft 17 is rotatably mounted within the case and has one member 35 of a flexible joint secured thereto, the other member 36 of said joint being secured to one end of a connecting shaft 37, the opposite end of said shaft being connected to the hand wheel 13 by means of a spider comprising a plurality of spider arms 40 which may be employed in such numbers as may be desired, two being shown herein. Each of these arms terminates at one end in a head 41 including a frictional shoe 44 formed to fit upon the rim of a conventional hand wheel. These arms comprise tubes forming spacers between the heads 41 and a tubular drive member 42 into which the shaft 37 extends and to which it is secured in any suitable manner. Bolts 43 extend through the heads 41, spacers, and drive member 42, these bolts serving to securely clamp the members together. This provides a yielding frictional con-

nection between my improved power unit and a conventional chain hoist without requiring any mechanical operations upon the hand wheel.

The power unit may be constructed as a separate unit for sale to present owners of standard chain hoists or such power unit may be sold complete with a chain hoist of any suitable character connected thereto, in which case the spider may be employed or equivalent means may be used as desired for connecting the extension shaft of the power unit to the hand wheel of a chain hoist, in either case the hoisting unit comprising an actuating member, as a chain operated wheel or other means, operatively connected with the hoisting mechanism for operating it, said mechanism including a hoisting member supporting a chain with a hook or other means for lifting or lowering a load.

It will have been seen from the foregoing description taken in connection with the drawing that the motor is supported underneath and in vertical alignment with the axis of the driving shaft 17 and the extension power shaft 37. When the motor is started the resistance to its rotation offered by the connection with the hoisting unit and the load being lifted thereby will, by reason of the torque established in the motor spindle, create in the motor to a limited extent a tendency to revolve the entire power unit about the axis of the driving shaft 17. The resistance offered by the weight of the motor, the gearing housing and gears therein disposed as shown will be sufficient to counteract the tendency of the power unit to revolve to a point inadequate for lifting the load for which the apparatus is designed, thereby cushioning said torque effect of the motor and this constitutes a material element of the invention. Should the power unit, owing to the forces generated by the starting of the motor, revolve to a slight permissible extent under the rated load, after normal speed is acquired the unit will gradually return to its normal position in vertical alignment with the shaft 17.

By the suspension arrangement of the power unit as herein explained and its tendency to yield whenever the hoisting unit is overloaded I have created in the power unit a counterpoise action and this is a most essential feature of my invention. So long as the load on the hoisting unit does not exceed in weight that for which it is designed the power unit will maintain its stability in its operation to raise the load. However, should the hoisting unit be overloaded to such an extent that the power unit is unable to lift the load then the force of the power unit will be exerted to raise itself and I have thus provided a counterpoise action or means for acquiring structural equilibrium which is an important feature and one that is practically new in connection with hoisting mechanism so far as I am aware.

Therefore in order to adjust the capacity of the device I have provided means for varying the capacity of the counterpoise action by providing for the removable application of weight of different sizes to the power unit, as herein shown and as a convenient means this weight 45 being removably affixed to the bell of the motor case, as by inter-engaging threaded means.

I have utilized this tendency of the power unit as a whole to revolve as hereinbefore described to limit the weight to be handled by the hoisting unit and thereby prevent overloading and also to prevent unintentional or accidental lifting of the load by the hoisting unit to an extent to create damage, as by contact of the load with the housing containing the hoisting mechanism, the action in either case being the same. In effecting this result I provide an electric switch which may be of any desired type and which will be operated by excessive revolving movement of the power unit hereinbefore referred to be break the electric circuit and shut off the current from the motor. This electric switch 41' comprises a plunger 42' which upon being pressed inwardly will operate in accordance with different types of switches to break the electric circuit and thereby shut off the current supplied to the motor through the wires *a*—*b* in a manner that will be readily understood. In the arrangement herein shown said switch is supported on the cap 23 of the gear case and the plunger 42' extends out of the end of the switch case in position to contact with a cam 43' which is secured to or formed on the end of the arm 21 of the supporting yoke 14. The radius of this cam will gradually increase equally in opposite directions from the normal position of the plunger 42' up to points on diametrically opposite sides of the cam where it is desired the plunger will be moved sufficiently to break the electric circuit, and from this point the periphery of the cam will be formed concentrically with the axis thereof. As an example the normal position of the plunger 42' may be vertical under the axis of the cam and the points at which this divergence of the cam will terminate may be diametrically horizontally opposite on said cam, and from these points the periphery of the cam will be concentric with its axis to a point in vertical alignment with the axis of the cam.

Some tolerance may be permitted for excess loading of the hoisting unit which may effect some slight normal revolution of the power unit but not to an extent to cause such revolution to a point for operating the switch to shut off the power. Should, however, the load on the hoisting unit be excessive this will be instantly reflected in the power unit causing it to revolve to an extent to operate the switch to shut off the power and prevent further lifting of the load, thereby permitting the parts to return to normal position. Should excessive movement of a normal load by the hoisting unit take place until such load comes in contact with the housing of the hoisting mechanism the same action will take place as though an overload were placed upon the hoisting chain and this will be at once reflected in the tendency of the power unit to revolve and the electric switch will be immediately operated to shut off the power and prevent injury to the meechanism.

The cam 43' is formed as above described so that it may accommodate itself to different types of mechanism in which the motor spindle may operate in different directions.

While I have shown in the drawing herein a flexible joint for connecting one end of the shaft 37 with the operating mechanism therefor, I contemplate that in some cases it may be desirable to so attach either or both ends of said shaft with the connecting mechanism and I wish therefore to have it understood that this connecting shaft may bear a universal joint at either or both ends or that such universal joint may be entirely dispensed with.

It will now be appreciated from the disclosure of this invention that the latter comprises a structure that is in the nature of a counterpoise in

that the power unit when operated will counterbalance forces set up by the hoisting unit in the action of raising respective or rated loads, this counterpoise action of the power unit being present during any normal operation of the hoisting unit and affording the safety feature when rated load upon the hoist hook is exceeded as predetermined resulting in abnormal operation of the hoisting unit.

While it is not absolutely essential that the power unit shall be positioned with the motor spindle in vertical alignment with the driving shaft, yet, it is desirable that said power unit shall have substantially this position and it will therefore be understood that the parts as shown in the drawing are so constructed as to distribute the weight to accomplish this purpose.

While I have disclosed herein my improved power unit as employed to operate a hoisting mechanism I contemplate that the invention is capable of a wider use and may be employed for the operation of mechanisms of various sorts and it is to be understood that the invention is therefore not limited, not only to the operation of a single mechanism but to use in connection with apparatus of any particular description.

In accordance with the provisions of the patent statutes I have described the principles of operation of my invention, together with the device which I now consider to represent the best embodiment thereof; but I desire to have it understood that the device shown is only illustrative and that the invention may be carried out by other means and applied to uses other than those above set out.

I claim:

1. In combination with a chain hoisting unit comprising hoisting mechanism and means for supporting said unit, a power unit comprising a yoke having supporting arms, means for suspending said yoke from an overhead support, a driving shaft rotatably mounted in said arms, an operative connection between said driving shaft and the mechanism of said hoisting unit, a case supported between said arms and into which said driving shaft extends, a motor supported by said case, and an operative connection within the case between said motor and said driving shaft.

2. In combination with a chain hoisting unit comprising hoisting mechanism and means for supporting said unit, a power unit comprising a suspension member, a driving shaft rotatably mounted in said suspension member, an operative connection between said driving shaft and the mechanism of said hoisting unit, a supporting member pivotally mounted on said driving shaft and depending therefrom, a motor affixed to said supporting member below the level of said driving shaft, and an operative connection between said motor and said driving shaft, said connection including a driving train of gears having one of its members secured to said driving shaft and another of its members operatively connected with the spindle of said motor.

3. In combination with a chain hoisting unit comprising hoisting mechanism and means for supporting said unit, a power unit comprising a suspension member, a driving shaft rotatably mounted in said suspension member, an operative connection between said driving shaft and the mechanism of said hoisting unit, the power unit comprising a supporting member mounted in swinging relation to said suspension member on the axis of and underneath said driving shaft, a motor mounted on said supporting member at the lower end thereof, and an operative connection between the spindle of said motor and said driving shaft whereby the torque created in said driving shaft effects a counterpoise action by said motor relatively to said hoisting unit.

4. In combination with a chain hoisting unit comprising hoisting mechanism and means for supporting said unit, a power unit comprising a suspension member with means for supporting it from an overhead support, a driving shaft rotatably mounted in said suspension member, an operative connection between said driving shaft and the mechanism of said hoisting unit, a supporting member pivotally suspended from said suspension member, a motor carried by said supporting member, an operative connection between said motor and said driving shaft, and an electric switch device for said motor and a switch actuating device mounted for relative movement, one deviee on each of said members, whereby movement of said supporting member will effect operation of said switch to break the electric current supply to said motor.

5. In combination with a chain hoisting unit comprising hoisting mechanism and means for supporting said unit, a power unit comprising a suspension member with means for supporting it from an overhead support, a driving shaft rotatably mounted in said suspension member, an operative connection between said driving shaft and the mechanism of said hoisting unit, a supporting member pivotally suspended from said suspension member for swinging movement thereon, a motor carried by said supporting member, an operative connection between said motor and said driving shaft whereby swinging movement of the supporting member is effected, an electric switch mounted on said supporting member to control supply of electric current to said motor, and means positioned for engagement with said switch as it is moved by movement of said supporting member to operate said switch to break the electric current supply to said motor.

6. In combination with a chain hoisting unit comprising hoisting mechanism and means for supporting said unit, a suspension member with means for supporting it from an overhead support, a driving shaft rotatably mounted in said suspension member, an operative connection between said driving shaft and the mechanism of said hoisting unit, a power unit comprising a gear case pivotally mounted on the axis of said driving shaft, a motor mounted on said gear case below said driving shaft, a geared driving connection between said motor and said driving shaft whereby excessive torque in said driving shaft will effect counterpoise action by said motor relatively to said hoisting unit, an electric switch mounted on said case, and a switch actuating member mounted on said suspension member and positioned for contact with said switch to operate it to cut off the electric current supply to said motor.

7. In combination with a chain hoisting unit comprising hoisting mechanism and means for supporting said unit, a power unit comprising a suspension member with means for supporting it from an overhead support, a driving shaft rotatably mounted in said suspension member, an operative connection between said driving shaft and the mechanism of said hoisting unit, a supporting member pivotally mounted on the axis of said driving shaft, a motor mounted on said supporting member below said driving shaft, an operative connection between said motor and

said driving shaft and mounted on said supporting member, an electric switch mounted on said supporting memer and comprising an actuating plunger, and a cam mounted on said suspension member for contact by said plunger to operate said switch to cut off the electric current supply to said motor.

8. In combination with a chain hoisting unit comprising hoisting mechanism and means for supporting said unit, a power unit comprising a suspension member with means for supporting it from an overhead support, a driving shaft rotatably mounted in said suspension member, an operative connection between said driving shaft and the mechanism of said hoisting unit, a gear case rotatably mounted on the axis of said shaft, a motor mounted on the lower end of said gear case, a train of gears located within said case and operatively connecting said motor with said driving shaft, an electric switch mounted on the outside of said case below said driving shaft, a switch actuating plunger comprised in said switch, and a cam mounted on said suspension member for contact by said plunger in the pivotal movement of said gear case to cut off the electric current supply to said motor.

9. In combination with a chain hoisting unit comprising a hand wheel member, a suspension member for said unit, a power unit comprising a suspension device, a driving shaft rotatably mounted in said suspension device substantially in line with the axis of said hand wheel member and operatively connected therewith, a supporting member rotatably mounted in said suspension device on the axis of said driving shaft, a motor supported by said supporting member, and an operative connection between said motor and said driving shaft.

10. In combination with a chain hoisting unit comprising a hand wheel member, a suspension member therefor, a power unit comprising a suspension device, a driving shaft rotatably mounted in this suspension device substantially in line with the axis of said hand wheel member and operatively connected therewith, a supporting member rotatably mounted in said suspension device on the axis of said driving shaft and adapted to swing in opposite directions from a normal position, a prime mover supported by said supporting member with the axis of its rotor located below the axis of said hand wheel member, means for establishing the degree of swinging movement of said supporting member within an arc of 160° (degrees) in either direction from its normal position, and an operative connection between said prime mover and said driving shaft.

11. In combination with a chain hoisting unit comprising hoisting mechanism, means for supporting said unit, and a power receiving shaft to receive power for operating said hoisting mechanism, a power unit comprising a pivotally mounted supporting member, a driving shaft within said supporting member, means for rotatably supporting said driving shaft, an operative connection between said driving shaft and said power receiving shaft, a prime mover supported by said supporting member in a plane, below said driving shaft and operatively connected therewith and by reason of said position providing weight in its normal position and independently of mechanical means to resist tendency of said supporting member to rotate about said driving shaft, means for readily adding weights to said power unit to increase the resistance of said supporting member against rotation about said driving shaft caused by the resistance of said hoisting mechanism to rotation by said driving shaft, cut-off mechanism on said supporting member to control supply of power to drive said prime mover, and means on said supporting member to operate said cut-off mechanism.

12. In combination with a chain hoisting unit comprising hoisting mechanism, means for supporting said unit, a power unit comprising a pivotally mounted supporting member, a driving shaft within said supporting member, an operative connection between said driving shaft and said hoisting mechanism, means for rotatably supporting said driving shaft, a prime mover supported by said supporting member in a plane below said driving shaft and operatively connected therewith and thereby providing weight in its normal position and independent of mechanical means to resist tendency of said supporting member to rotate about said driving shaft in opposite directions from a normal position, means on said prime mover for readily adding weights whereby the weight necessary to maintain said supporting member within a definite arc of movement in either of opposite directions from its normal position can be added to said prime mover to oppose the normal resistance to rotation of said driving shaft, electric switch cut-off means located on said supporting member and switch actuating means interposed in the path of movement of said switch cut-off mechanism on opposite sides of said supporting member to control supply of power to drive said prime mover upon movement of said supporting member in either of said opposite directions.

13. In combination with a chain hoisting unit comprising a hoisting mechanism including a chain wheel shaft, a chain wheel supported by said shaft, means for supporting said hoisting unit, a power unit including a prime mover and a driving shaft operatively connected therewith, an operative connection between said driving shaft and the hoisting mechanism, said connection including spider arms and means for removably attaching said arms to said chain wheel and to a member of said operative connection, said attaching means comprising a yielding frictional member located between said spider arms and the chain wheel.

14. In combination with a chain hoisting unit comprising hoisting mechanism and means for supporting said unit, a counterpoise power and controlling unit operatively connected with said hoisting unit and including a suspension device, a driving shaft rotatably supported by said device and operatively connected with said hoisting unit, a supporting member swingingly supported by said driving shaft and depending therefrom, a motor carried by said supporting member, and an operative connection between said motor and said driving shaft whereby torque created by said motor and the resistance of said hoisting unit will effect a swinging movement of the supporting member on said driving shaft and thereby create a counterpoise function in said power unit.

15. In combination with a chain hoist unit comprising hoisting mechanism and means for supporting said unit, a power unit comprising a suspension member, a driving shaft rotatably mounted in said suspension member, an operative connection between said driving shaft and mechanism of said hoisting unit, said power unit also including a supporting member pivotally mounted on said driving shaft and thereby supported by said suspension member, a power pro-

ducing member attached to said supporting member, and an operative connection between said power producing member and said driving shaft, the weight of said supporting member being disposed to counterbalance forces set up by the chain hoisting unit in raising a load, said power unit thereby acting as a counterpoise weight for said hoisting unit.

16. In combination with a chain hoisting unit comprising hoisting mechanism and means for supporting said unit, a suspension member, a power unit suspended from and for swinging action underneath said suspension member, said power unit comprising a driving shaft rotatably mounted in said suspension member, a supporting member pivotally suspended from said driving shaft, an operative connecting means between said driving shaft and the mechanism of said hoisting unit, a motor constituting a part of said power unit and affixed to said supporting member, and an operative connection between said motor and said driving shaft whereby the torque created in said driving shaft effects counterpoise action by said motor relatively to said hoisting unit.

17. A power unit comprising a pivotally suspended member, a driving shaft journaled and supported on said member, a depending support solely supported for pivotal movement on and about said shaft, a motor on said support, drive connections between said motor and said shaft, means for attaching weights on the motor, a switch and operating device for said motor, one on the suspension member and the other on the supporting member whereby predetermined movement of said supporting member will effect operation of said switch to break the electric current supplied to said motor upon predetermined resistance of said shaft to said drive motor.

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