Feb. 18, 1958 C. N. HOOD, II 2,823,896

LIFTING AID

Filed Dec. 14, 1953 2 Sheets-Sheet 1

Fig. 6.

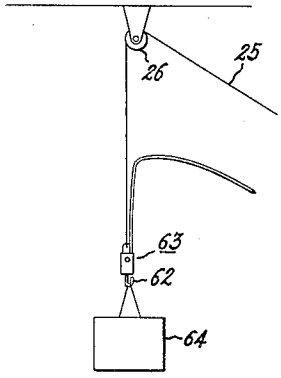


Fig. 2.

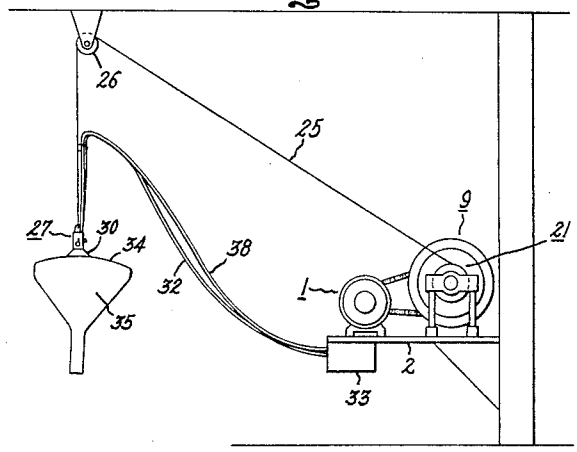
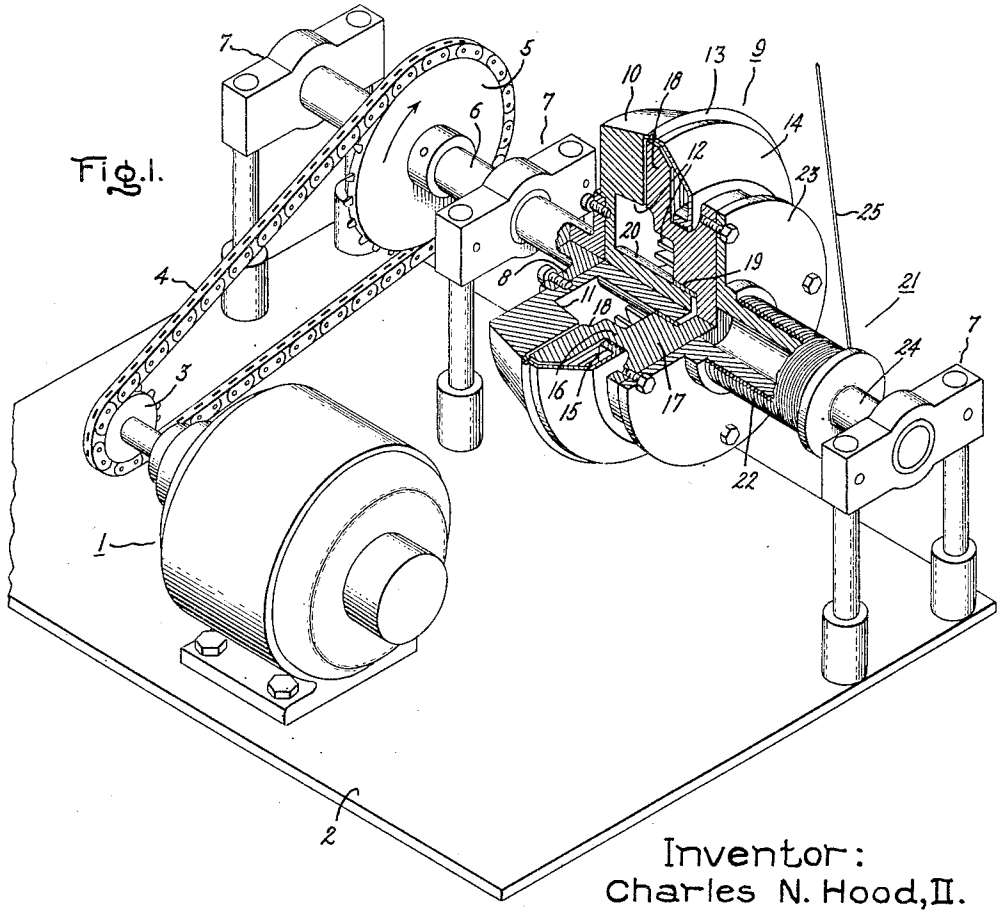


Fig. 1.



Inventor:
Charles N. Hood, II.
by Nathan Coulter
His Attorney.

Feb. 18, 1958 C. N. HOOD, II 2,823,896

LIFTING AID

Filed Dec. 14, 1953 2 Sheets-Sheet 2

Fig.3.

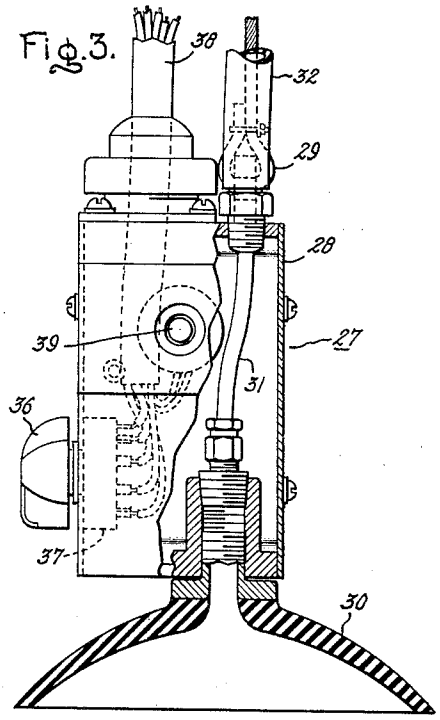


Fig.4.

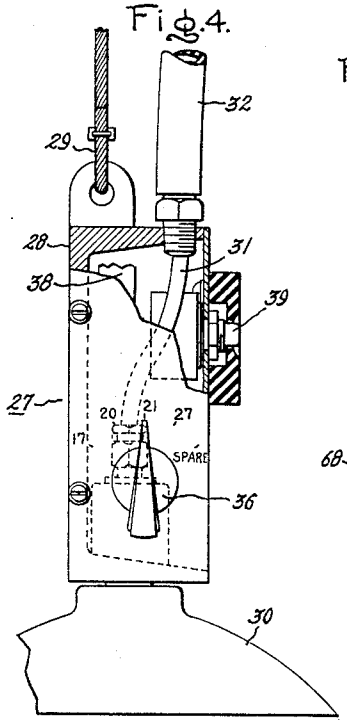


Fig.7.

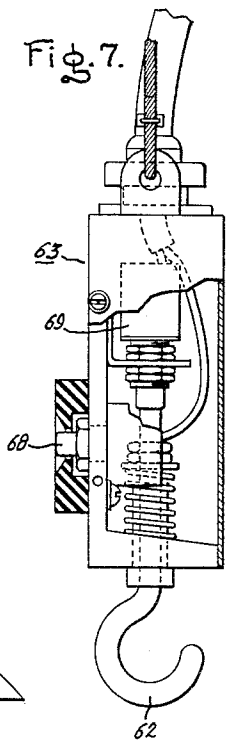


Fig.5.

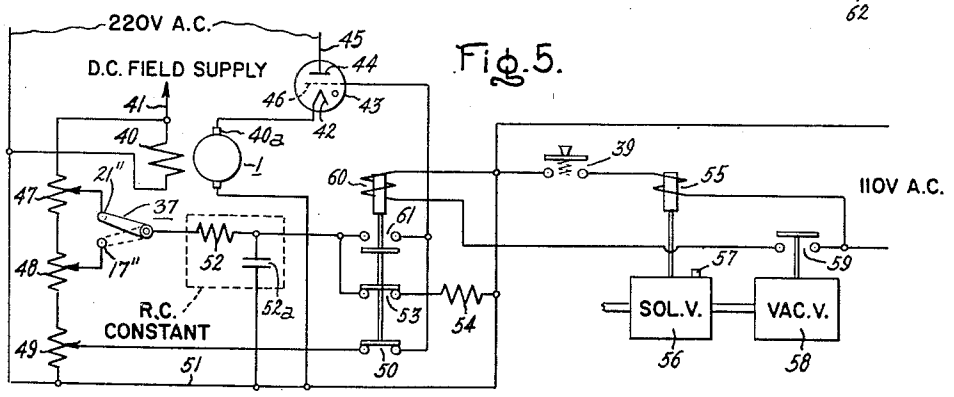
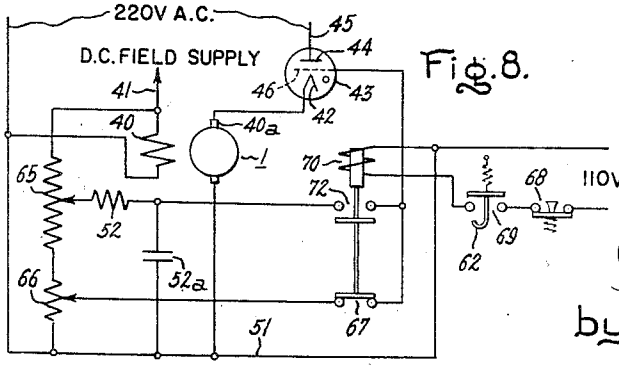


Fig.8.



Inventor:
Charles N. Hood, II.
by Nathan Kompfner
His Attorney.

United States Patent Office 2,823,896 Patented Feb. 18, 1958

2,823,896

LIFTING AID

Charles N. Hood II, Schenectady, N. Y., assignor to General Electric Company, a corporation of New York

Application December 14, 1953, Serial No. 397,849

21 Claims. (Cl. 254—168)

My invention relates to lifting aids and pertains more particularly to new and improved means for aiding an operator in lifting and accurately positioning heavy objects.

In many manufacturing operations such as in the processing, packing and installation of cathode ray tubes, it is necessary both to lift heavy objects and to position them accurately. For this purpose it has been proposed to use a hoisting arrangement having controls within easy reach of an operator and whereby an operator can mechanically control the vertical positioning of the object while manually guiding it horizontally. Such an arrangement would be satisfactory in that it would relieve the operator of the actual lifting of the object. However, with such an arrangement, and owing to the mechanical control of the vertical movement, control of the vertical movement of the object being lifted would not be as quickly responsive to the will of the operator as the horizontal movement which the operator would directly control manually. Consequently, it is considered conceivable that in using such a hoisting arrangement accurate positioning of the object would be more difficult and slower to obtain than if both the horizontal and vertical movements were manually controlled. Accordingly, the primary object of my invention is to provide new and improved means for aiding an operator in lifting a heavy object and which leaves the operator in complete direct manual control of the positioning of the lifted object.

Another object of my invention is to provide a new and improved lifting aid which is selectively operable for use with objects of various weights.

Another object of my invention is to provide a new and improved lifting aid including means for insuring smooth operation upon a change in the load applied thereto.

Another object of my invention is to provide a new and improved lifting aid including means for controlling operation of the aid in accordance with application of a load thereto.

Still another object of my invention is to provide a lifting aid which is simple to operate and leaves both hands of an operator free to control the positioning of the object lifted.

Further objects and advantages of my invention will become apparent as the following description proceeds and the features of novelty which characterize my invention will be pointed out with particularity in the claims annexed to and forming part of this specification.

In carrying out the objects of my invention I provide a variable speed driving means and a slippable coupling between the driving means and hauling means. Connected to the hauling means is means for securing thereto objects to be lifted. The speed of the driving means is selectively presettable to correspond to the weight of objects to be lifted for applying proportionate torques to the hauling means through the coupling for counterbalancing the objects to be lifted. The counterbalance and the slippable coupling permit an operator to hold the objects still

and to move them in any direction with only the effort required to overcome friction and inertia in the device. The drive means is adapted for running at an idling speed when no object is being lifted, which applies a torque to the hauling means just sufficient to counterbalance a line thereof and the means for securing objects thereto. Means is provided for insuring smooth transition from the idle speed of the driving means to the selectively presettable speeds when a load to be counterbalanced is applied to the device. Additionally, means is provided for permitting the speed transition to take place only when the object to be counterbalanced is satisfactorily secured to the hauling means.

For a better understanding of my invention, reference may be had to the accompanying drawing in which:

Fig. 1 is a perspective view of a preferred embodiment of my invention partially broken away to illustrate the coupling means;

Fig. 2 is a reduced end view of the preferred embodiment showing a cathode ray tube secured to the line thereof;

Fig. 3 is an enlarged partially sectionalized side view of the vacuum head;

Fig. 4 is an enlarged partially sectionalized front view of the vacuum head;

Fig. 5 is a wiring diagram of the controlling circuit of the device used with the vacuum head;

Fig. 6 is a fragmentary reduced illustration of a modified arrangement for securing objects to the line of the windlass;

Fig. 7 is an enlarged fragmentary side view of the hook head; and

Fig. 8 is a wiring diagram of the control circuit of the device used with the hook head.

Referring to Fig. 1, I have shown a preferred embodiment of my device including a variable speed motor **1** suitably mounted on a base plate **2**. Suitably secured on the shaft of the motor is a drive sprocket **3**. Fitted on the sprocket **3** is one end of a drive chain **4**, the other end of which is fitted on a driven sprocket **5**. The sprocket **5** is suitably secured on a shaft **6**. The shaft **6** is suitably journaled on either side of the sprocket **5** in a pair of spaced standards generally designated **7**.

One end of the shaft **6** extends outwardly of its corresponding journal and is formed to include a flange **8** for having secured thereto the drive end of a slippable coupling such as a fluid coupling generally designated **9**. The fluid coupling **9** includes a member **10** secured axially to the shaft **6** by means of the flange **8**. The member **10** is formed to include a reentrant portion **11** and a plurality of impeller blades **12** arrayed about the portion **11**. Additionally, the member **10** is formed to include a rim **13**. Suitably secured to the rim **13** in a fluid-tight manner is a collar **14**. The collar **14** is formed with a central aperture in which is provided a gland **15**. Fitted for rotation in the gland **15** in a fluid-tight manner is an intermediate portion **16** of a driven member **17**. The member **17** includes a plurality of blades **18** disposed in the space between the blades **12** on the member **10** and the collar **14**. The member **17** is further provided with a bearing **19** in which is journaled the end of a stub shaft **20** formed centrally in the reentrant portion **11** of the member **10**.

In the arrangement described to this point the members **10** and **17** are arranged for relative rotation about a common axis. Additionally, the coupling **9** is adapted for containing a quantity of suitable power transmission fluid (not shown) such as oil. Upon rotation of the member **10** clockwise in Fig. 1, as effected by the motor **1** through the chain and sprocket drive and the shaft **6**, the blades **12** cause the oil in the coupling to be rotated clockwise. The clockwise rotating oil in turn operates on the blades on the member **17** to cause it to rotate clockwise also. It will be seen that the just described

fluid coupling is substantially the same as that which is well-known in the automotive art. It will be seen further that in this type of arrangement, rotation of the driven member 17 can be arrested or rotated opposite to the movement of the oil without effecting a stalling condition on the drive motor 1 since the latter will continue to run and the drive member 10 of the coupling will continue to rotate the oil therein even when rotation of the driven member 17 by the rotating oil is prevented.

The above-described coupling 9 is adapted for placing a torque on hauling means such as a windlass generally designated 21. It will be seen that while I prefer using a windlass, any suitable device for pulling or drawing with force can be alternatively employed in my structure. The windlass 21 includes a drum 22 on one end of which is formed a flange 23 whereby it is suitably secured axially to the end of the member 17. Formed axially off the outer end of the drum 22 is a stub shaft 24 which is suitably journaled in another vertical standard 7. The windlass 21 further includes a line 25 having one end portion wound about the drum. As seen in Fig. 2, the line 25 may extend over a pulley 26 suitably mounted in an elevated position relative to the windlass. Provided for securing objects to be lifted to the end of the line 25 is securing means which in one form of my invention may comprise vacuum gripping means in the form of a suction head 27.

As shown in detail in Figs. 3 and 4, the suction head 27 includes a box-like structure 28 adapted for being suitably secured at its upper end as at 29 to the free end of the windlass line 25. Secured to the lower end of the box 28 is a suction cup 30 formed of rubber or some similarly flexible material. A tube 31 is provided for extending through the box and connecting the suction cup with a flexible suction line 32 suitably connected to the top side of the box and extending to vacuum pumping means (not shown) which may be housed in a box 33 secured to the underside of the base plate 2 in the manner shown in Fig. 2.

As seen in Fig. 2 the suction cup 30 is adapted for engaging a surface of an object to be lifted such as the face plate 34 of a cathode ray tube bulb 35. The size of the cup 30 and the capacity of the vacuum pumping means are such that when the suction cup is evacuated by energization of the vacuum pumping means and through the line 32 and the tube 31 the cup grips the tube sufficiently firmly to be able to hold it aloft in the manner shown in Fig. 2.

Now it will be seen that by running the motor 1 at a predetermined speed it is possible to place on the windlass 21 through the fluid coupling 9 a proportional torque adequate for just overcoming or counterbalancing the weight of the line 25 and the suction head 27 but not great enough to overcome the friction in the device. Thus the motor is operated at this predetermined speed for providing an idling speed at which the line and suction head are counterbalanced. Additionally, at the idling speed the operator can raise the head 27 for moving it into position to engage the surface of an object to be lifted simply by exerting a lifting force thereto sufficient for overcoming the friction in the device. Also, the operator can move the head downwardly which would move the windlass opposite to the torque applied thereto through the coupling. Owing to the fluid coupling between the drive motor and the windlass this will not result in the motor operating under a stalled condition. It will be seen that the motor 1 can be operated at a predetermined higher operating speed for placing on the windlass through the fluid coupling 9 a proportional torque adequate for just overcoming or counterbalancing the weight of the tube 35 or other object to be lifted and the line and gripping means on the line but again not great enough to overcome the friction in the device. Thus the operator is relieved of the task of actually lifting the object and may cause the tube to be lifted simply by exerting a lifting force thereto sufficient for overcoming the friction in the device.

Further, again owing to the fluid coupling between the drive motor and windlass the operator may during a positioning operation manually hold the lifted object still or move it downwardly which would cause the windlass and therefore the bladed member 17 to be arrested or moved opposite to the rotation of the fluid in the coupling without causing the motor to operate under a stalled condition.

As seen in Figs. 3–5 the speed of rotation of the motor and therefore the torque applied to the windlass for counterbalancing an object secured to the line 25 is selectively presettable in accordance with the particular weight of an object to be lifted. For instance, when the device is to be used in aiding in the lifting of cathode ray tubes the knob 36 of a selector switch 37 mounted in the head 27 in the manner shown in Figs. 3 and 4 may be set for aiding in lifting any one of several differently sized tubes. It will be understood of course that while the dial of the selector switch is marked in accordance with the size of the tube to be lifted, the switch 37 actually is settable for differently weighted objects rather than differently sized objects. The switch 37 is suitably connected to the driving arrangement by a plurality of wires comprising a cable 38 which, like the vacuum line 32, connects the head 27 with the box 33. Also carried in the head 27 is a vacuum control switch 39 to which is connected lead wires which also extend to the box 33 through the cable 38. The operation of the selector switch 37 and the vacuum control switch 39 will now be described in detail with reference to the wiring diagram shown in Fig. 5. In Fig. 5 the selector switch 37 is shown to include only two positions, namely, the 17 inch and the 21 inch tube positions. This, however, is only for simplification of illustration and description and it will be understood that the switch can include all of the operating positions shown in Fig. 4 and more if desired. As also shown in Fig. 5 the motor coil 40 is adapted for being supplied with a direct current and the motor armature 40*a* is adapted for being supplied with rectified voltage from the cathode 42 of a thyratron 43, the plate 44 of which is supplied with alternating current through a line 45. The thyratron is well-known in the art and need not be described in detail herein, it being sufficient simply to indicate that the magnitude of the voltage supplied to the armature of the motor, and therefore the speed of rotation of the motor, is controlled by the voltage supplied to the grid 46 of the thyratron.

Normally, as when the suction head 27 is not secured to an object to be lifted, a direct current idling circuit is completed through the motor coil 40, a first potentiometer 47, a second potentiometer 48, a third potentiometer 49, and a pair of normally closed contacts 50 for providing a predetermined low voltage on the thyratron grid 46. This voltage causes a predetermined low rectified current to flow from the cathode 42 through the motor armature 40*a* to a ground 51. Thus the motor 1 is normally operated at an idling speed for applying a relatively small torque on the windlass. By means of the potentiometer 49 the idling speed of rotation of the motor and therefore the torque on the windlass can be preset for only counterbalancing the weight of the windlass line and the suction head 27. Thus in positioning the head 27 for gripping an object an operator can raise the head during idling simply by exerting a lifting effort sufficient for overcoming the friction in the device. Also, if the operator must lower the head to reach an object to be lifted he needs simply to pull downwardly on the head 27. This will result in movement of the windlass opposite to the torque applied thereto but the fluid coupling 9 will be effective for preventing operation of the motor under a stalled condition.

As pointed out above the selector switch 37 is such

that it may be selectively preset for handling objects of different weights. Additionally, in the presettable arrangement the switch need not be turned to an "off" position during idling operation. As seen in Fig. 5 the switch 37 can be preset in any one of a plurality of operating positions. For instance, it can be set for handling a 21 inch cathode ray tube in the manner shown in solid lines or it can be set for handling a 17 inch tube in the manner shown in dash lines in Fig. 5. In either position the switch 37 is grounded during idling operation through a resistor 52, a pair of normally closed contacts 53 and another resistor 54, the purpose of all of which will be brought out hereinafter. Thus, although the switch 37 may be preset for handling a tube of a particular size, the switch will be grounded out and thereby rendered ineffective during idling of the device. Additionally, the control 53 when closed is effective for grounding out a capacitor 52*a*, the purpose for which will also be brought out in detail hereinafter.

When it is desired to secure an object to be lifted to the line 25 of the windlass by means of the suction head 27 the head is positioned for the suction cup to engage a relatively flat surface of the object, which as shown in Fig. 2 may be the face plate 34 of the cathode ray tube 35. The vacuum control switch 39 is normally open so that a relay 55 of a solenoid valve 56 controlling a vent 57 is normally deenergized and the vacuum pumping means which may be contained in the box 33 is normally energized by means not shown for drawing a vacuum on the suction cup 30. This vacuum source continues effective for drawing a vacuum on the suction cup so long as the switch 39 remains open to keep the solenoid valve 56 deenergized and the vent 57 closed. When the suction cup engages a flat surface of an object to be lifted and a vacuum sufficient for securing the head to the object is obtained for thereby satisfactorily securing the load to the windlass line a vacuum valve 58 closes and holds closed a vacuum switch 59 for completing a circuit through a control relay 60. Relay 60 when energized in this manner opens the normally closed contacts 50 and 53 and closes a pair of operating speed control contacts 61. When the contacts 50 are opened the idling speed control potentiometer 49 is cut out and is no longer effective for determining the speed of rotation of the motor. When the contacts 53 are opened the ground circuit of the switch 37 and the capacitor 52*a* is broken. The contacts 61 when closed complete a direct current circuit through the potentiometer 47 or 48, depending upon the preset position of switch 37, and the resistor 52 for providing a higher voltage on the grid 46 of the thyratron to determine the magnitude of the current flow to the motor armature. The magnitude of this current determines the speed of rotation of the motor and, therefore, the torque applied to the windlass through the coupling 9. It will be seen that the magnitude of the current applied to the grid, and therefore the speed of rotation of the motor, will depend upon the preset position of the switch as to which potentiometer the operating circuit will be completed through and will also depend on the presetting of the potentiometer through which the circuit is completed. With the switch set to correspond to the weight of the object to be lifted, as when the device is set for a 17 inch tube and a 17 inch tube is secured to the line of the vacuum head 27, the torque applied to the windlass will be just sufficient for counter-balancing the tube plus the weight of the line and the means for securing the bulb to the line. Thereafter in order to raise the tube the operator simply exerts a lifting force on the tube sufficient for overcoming the friction in the device. Additionally, in subsequently positioning the tube, the operator has complete direct manual control without recourse to switches or other controls and may lift and lower the tube at will. If the operator lowers the tube the windlass will move opposite to the torque applied thereto but the fluid coupling 9 will prevent the motor from operating under a stalled condition.

The above referred to resistor 52 and capacitor 52*a* comprise means for insuring a smooth transition from the idling speed to any one of the higher operating speeds. When the contacts 53 are opened as when the device changes from the idling condition to the operating condition the ground on the capacitor 52*a* is broken. Thereafter the voltage across the capacitor 52*a* will build up gradually in accordance with a rate of charge largely determined by the resistor 52. As a result the voltage supplied to the grid 46 will build up gradually for thereby effecting a gradually increasing flow of current to the armature of the motor to bring the motor up to the preset operating speed gradually, thereby to avoid any jerking movement of the line 25.

Following positioning of the lifted object by the operator the suction head 27 is released therefrom by closing the normally open switch 39 for energizing the relay 55 of the solenoid valve 56 thereby to open the system to the atmosphere through the vent 57. When vacuum is lost in this manner the vacuum switch 58 opens, deenergizing the relay 60. The relay 60 when deenergized opens the contacts 61 for cutting out the selector switch 37, closes the contacts 50 for causing the device to return to its idle operation, and closes the contacts 53 for grounding the switch and capacitor. The above referred to resistor 54 prevents sudden discharge of the capacitor 52*a* and is thereby effective in avoiding arcing at the contacts 53. Thus the device is returned to its idling condition and is conditioned for operation in aiding an operator to lift and position another object. It will be seen that while the diagram of Fig. 5 shows the selector switch 37 as having only two positions, namely, the 17 inch and 21 inch tube positions, it can, as seen in Figs. 3 and 4, include any number of operating positions and corresponding potentiometers. It will be seen further that while I have shown and described my device in use for aiding in lifting and positioning cathode ray tubes, it is equally employable for operation with any object to be lifted which includes a surface to which the suction cup 30 will adhere.

In Figs. 6 and 8 is illustrated a modified form of means for securing an object to be lifted to the windlass line, including a hook 62. The hook 62 is mounted in a head 63 suitably secured to the end of the line 25. Shown in Fig. 8 is a control circuit employable when the hook arrangement is to be employed. In this form of the invention the motor 1 is adapted for having a direct current supplied to the field coil 40 thereof through a line 41. The armature 40*a* of the motor is adapted for being supplied with rectified voltage from the cathode 42 of a thyratron 43, the plate 44 of which is supplied with alternating current through a line 45. The magnitude of the voltage supplied to the armature of the motor and therefore the speed of rotation of the motor is controlled by the voltage supplied to the grid of the thyratron 43. To this point the present embodiment is identical to the above-described first embodiment.

Normally, as when no load such as an object 64 in Fig. 6 is applied to the hook 62, a direct current idling circuit is completed through the motor coil 40, a first potentiometer 65, a second potentiometer 66 and a pair of normally closed contacts 67 for providing a voltage on the thyratron grid 46. This voltage causes a predetermined low rectified current to flow from the cathode 42 through the motor armature 40*a* to a ground 51. Thus the motor is normally operated at an idling speed for applying a torque on the windlass. Through the potentiometer 66 the idling speed of rotation of the motor and therefore the torque on the windlass can be preset for only counterbalancing the weight of the windlass line and the hook head 63. Thus in positioning the hook or attaching it to the object 64 an operator can raise the hook head during idling simply by lifting it with a force

sufficient for overcoming the friction and inertia in the device. Also if the operator must lower the hook to reach the object 64 he needs simply to pull down on the line 25. As in the above described first embodiment downward movement on the line will result in movement of the windlass opposite to the torque applied thereto but the fluid coupling 9 will be effective for preventing operation of the motor under a stalled condition.

The potentiometer 65 is such that it is selectively presettable for corresponding to objects of different weights. Before an object is lifted its weight is determined and then the potentiometer 65 is preset accordingly. Thereafter when it is desired to secure the object 64 to the line the head 63 is positioned for having the hook engage the object. As seen in Fig. 8 a release switch 68 is normally closed and the hook 62 is biased to a position in which it normally maintains open a pair of contacts 69. When a load is applied to the hook 62, as when the hook is engaged with the member to be lifted, the contacts 69 are closed, thereby completing a circuit for energizing a relay 70. The relay 70 when energized opens the contacts 67 for cutting out the idling potentiometer 66 and for completing a circuit through the potentiometer 65 thereby to provide a voltage corresponding to the setting of the potentiometer 65 on the grid 46 of the thyratron for effecting operation of the motor 1 at a speed corresponding to the presetting of the potentiometer 65. Thus, the load or object 64 will be counterbalanced for relieving the operator of the task of lifting it.

It will be seen that although only one potentiometer is used in the present embodiment it is selectively presettable for corresponding to the weights of objects of different weights to be lifted. Additionally, if it is desired the single potentiometer 65 can be replaced by a plurality of serially connected potentiometers and a selector switch substantially identical to switch 37 described above with regard to the first embodiment. Also, as with the first described embodiment the lifted object can be moved in any direction under the direct manual control of the operator without causing the motor 1 to operate under a stalled condition. The present embodiment also includes a resistor 52 and a capacitor 52*a* for comprising means for insuring a smooth transition from the idling speed to the higher operating speed. When the contacts 72 are closed the voltage across the capacitor 52 will build up gradually in accordance with a rate of charge determined by the resistor 52. As a result the voltage on the grid 46 will build up gradually for thereby effecting a gradually increasing flow of current to the armature of the motor to bring the motor up to operating speed gradually. Thus in this form of my invention sudden jerking movements of the line 25 are avoided.

Following positioning of the lifted object and in order to disengage the hook 69 the switch 68 is opened. This deenergizes the relay 70 to return the device to the idling condition. In the idling condition the hook may be easily pulled down and disengaged. Following removal of the load from the hook in this manner the contacts 69 are opened and the switch 68 may be released to return to its normally closed condition. Thus, the device is conditioned for transition to the operating condition upon application of another load to the hook.

While I have shown and described specific embodiments of my invention I do not desire my invention to be limited to the particular forms shown and described, and I intend by the appended claims to cover all modifications within the spirit and scope of my invention.

What I claim is new and desire to secure by Letters Patent of the United States is:

1. A lifting aid comprising; driving means, hauling means, a slippable coupling between said driving and hauling means, and means operating said driving means at a speed providing a torque on said hauling means through said coupling effective only for counterbalancing a predetermined load on said hauling means by maintaining 100% slip in said coupling, said coupling permitting arrestation of said hauling means and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition.

2. A lifting aid comprising; driving means, a windlass including a line, a slippable coupling between said driving means and windlass, means operating said driving means at a speed providing a torque on said windlass through said coupling effective for counterbalancing a load on said windlass by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition, and load-sensitive switching means on said line determining the operation of said driving means.

3. A lifting aid comprising; driving means, a windlass, a fluid coupling between said driving means and windlass and having said windlass directly connected to one side thereof, and means operating said driving means at a speed providing a torque on said windlass through said coupling effective only for counterbalancing a predetermined load on said windlass by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition.

4. A lifting aid comprising; a variable speed driving means, a windlass, a fluid coupling between said driving means and said windlass, and means for presettably varying the operating speed of said driving means to correspond with different predetermined loads applied to said windlass thereby to provide different torques on said windlass each effective for just counterbalancing one of said predetermined loads by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition.

5. A lifting aid comprising; a variable speed driving means, a windlass, a fluid coupling between said driving means and said windlass and having said windlass directly connected to one side thereof, and means for selectively presetting the operating speed of said driving means to correspond with different predetermined loads to be applied to said windlass thereby to provide different predetermined torques on said windlass each effective only for counterbalancing said loads by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition.

6. A lifting aid comprising; a variable speed driving means, a windlass including a line and means for securing a load to said line, a fluid coupling between said driving means and said windlass, means normally operating said driving means at an idling speed at which a torque effective only for counterbalancing said line and securing means is applied to said windlass through said coupling, whereby said coupling operates at 100% slip, means for operating said driving means at a higher speed corresponding to the load to be secured to said line thereby to provide a torque on said windlass effective only for counterbalancing said load and said line and securing means by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition, and load-sensitive switching means included in said means for securing a load to said line controlling the operation of said driving means at said higher speed.

7. A lifting aid comprising; a variable speed driving means, a windlass including a line and means for securing a load to said line, a fluid coupling between said

driving means and said windlass and having said windlass directly connected to one side thereof, means normally operating said driving means at an idling speed at which a torque effective only for counterbalancing said line and securing means is applied to said windlass through said coupling, whereby said coupling operates at 100% slip, means for operating said driving means at a higher speed corresponding to the load to be secured to said line thereby to provide a torque on said windlass effective only for counterbalancing said load and said line and securing means by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition, and means for insuring a gradual transition from said idling speed to said higher operating speed of said driving means.

8. A lifting aid comprising; a variable speed driving means, a windlass including a line and means for securing a load to said line, a fluid coupling between said driving means and said windlass and having said windlass directly connected to one side thereof, means normally operating said driving means at an idling speed at which a torque effective for just counterbalancing said line and securing means is applied to said windlass through said coupling, whereby said coupling operates at 100% slip, and means for selectively presetting the operating speeds of said driving means to correspond with predetermined different loads to be applied to said windlass thereby to provide different predetermined torques on said windlass each effective for just counterbalancing one of said loads and said line and securing means by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition.

9. A lifting aid comprising; a variable speed driving means, a windlass including a line and means for securing a load to said line, a fluid coupling between said driving means and said windlass, means normally operating said driving means at an idling speed at which a torque effective only for counterbalancing said line and securing means is applied to said windlass through said coupling, whereby said coupling operates at 100% slip, and means for selectively presetting the operating speeds of said driving means to correspond with predetermined different loads to be applied to said windlass thereby to provide different predetermined torques on said windlass each effective only for counterbalancing predetermined ones of said loads and said line and securing means by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition, and means for insuring a gradual transition from said idling speed to any one of said preset operating speeds of said driving means.

10. A lifting aid comprising; driving means, a windlass, a fluid coupling between said driving means and windlass, means operating said driving means at a speed providing a torque on said windlass through said coupling effective only for counterbalancing a load on said windlass by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition, and speed-controlling means enabling operation of said driving means at said speed for counterbalancing said load only when said load is applied to said windlass.

11. A lifting aid comprising; a variable speed driving means, a windlass including a line and means for securing a load to said line, a fluid coupling between said driving means and said windlass, means normally operating said driving means at an idling speed at which a torque effective for just counterbalancing said line and securing means is applied to said windlass through said coupling, whereby said coupling operates at 100% slip, means for operating said driving means at a higher speed corresponding to the load to be secured to said line thereby to provide a torque on said windlass effective for just counterbalancing said load and said line and securing means by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition, and means carried on said line adapted for enabling operation of said driving means at said higher speed only when a load is secured to said line.

12. A lifting aid comprising; a variable speed driving means, a windlass including a line and means for securing a load to said line, a fluid coupling between said driving means and said windlass, means normally operating said driving means at an idling speed at which a torque effective for just counterbalancing said line and securing means is applied to said windlass through said coupling, whereby said coupling operates at 100% slip, means for selectively presetting the operating speeds of said driving means to correspond with predetermined different loads to be applied to said windlass thereby to provide different predetermined torques on said windlass effective for just counterbalancing said loads and said line and securing means by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition, and switching means carried on said line enabling operation of said driving means at any of said preset operating speeds only when a load is secured to said line.

13. A lifting aid comprising; driving means, a windlass including a line and vacuum gripping means for securing an object to be lifted to said line, a fluid coupling between said driving means and windlass, said driving means being adapted to operate at a speed for providing a torque on said windlass through said coupling effect for just counterbalancing said object to be lifted and said line and gripping means by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition, and pressure-responsive switching means associated with said vacuum gripping means enabling operation of said driving means only when said vacuum gripping means is effective in securing said object to said line.

14. A lifting aid comprising; driving means, a windlass including a line and a hook for securing an object to be lifted to said line, a fluid coupling directly connected between said driving means and windlass, said driving means being adapted to operate at a speed for providing a torque on said windlass through said coupling effective only for counterbalancing said object to be lifted and said line and hook by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition, and means operated by said hook enabling operation of said driving means only when a load is placed on said hook.

15. A lifting aid comprising; a variable speed driving means, a windlass including a line and vacuum gripping means for securing an object to be lifted to said line, a fluid coupling between said driving means and windlass, means normally operating said driving means at an idling speed at which a torque effective only for counterbalancing said line and said gripping means is applied to said windlass through said coupling, whereby said coupling operates at 100% slip, means for operating said driving means at a higher speed corresponding to the weight of the object to be secured to said line thereby to provide a torque on said windlass effective only for counterbalanc-

ing said load and said line and gripping means by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition, and pressure-operated switching means associated with said gripping means permitting transition from said idling speed to said higher operating speed of said driving means only when said vacuum gripping means is effective in securing said object to said line.

16. A lifting aid comprising; a variable speed driving means, a windlass including a line and a hook for securing an object to be lifted to said line, a fluid coupling between said driving means and said windlass, means normally operating said driving means at an idling speed at which a torque effective only for counterbalancing said line and hook is applied to said windlass through said coupling, whereby said coupling operates at 100% slip, means for operating said driving means at a higher speed corresponding to the weight of the object to be secured to said line thereby to provide a torque on said windlass effective only for counterbalancing said object and said line and hook by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition, and switching means associated with said hook and operative for enabling transition from said idling speed to said higher operating speed of said driving means only when a load is placed on said hook.

17. A lifting aid comprising; a variable speed driving means, a windlass including a line and vacuum gripping means for securing an object to be lifted to said line, a fluid coupling between said driving means and said windlass, means normally operating said driving means at an idling speed at which a torque effective only for counterbalancing said line and vacuum gripping means is applied to said windlass through said coupling, whereby said coupling operates at 100% slip, means for selectively presetting the operating speeds of said driving means to correspond with predetermined different weights of objects to be secured to said line thereby to provide different predetermined torques on said windlass each effective only for counterbalancing predetermined one of said objects and said line and gripping means by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and said movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition, and vacuum-operated switching means associated with said vacuum gripping means and adapted for being operated to enable transition from said idling speed to any one of said preset operating speeds of said driving means by fluid pressure in said vacuum gripping means when said vacuum gripping means is effective in securing an object to said line.

18. A lifting aid comprising; a variable speed driving means, a windlass including a line and a hook for securing an object to be lifted to said line, a fluid coupling between said driving means and said windlass, means normally operating said driving means at an idling speed at which a torque effective only for counterbalancing said line and hook is applied to said windlass through said coupling, whereby said coupling operates at 100% slip, means for selectively presetting the operating speeds of said driving means to correspond with the predetermined weights of different objects to be secured to said line thereby to provide different predetermined torques on said windlass each effective only for counterbalancing predetermined ones of said different objects and said line and hook by maintaining 100% slip in said coupling, said coupling permitting arrestation of said windlass and movement thereof opposite to said driving means without causing said driving means to operate under a stalled condition, and switching means associated with said hook adapted for being actuated to enable a transition from said idling speed to any one of said preset operating speeds of said driving means by the placement of a load on said hook.

19. A device for aiding an operator to lift an object comprising: a windlass including a line adapted for extending vertically downward from an elevated position and being secured to an object to be lifted, a fluid coupling, one side of which is directly connected to said windlass for applying a torque thereto, and driving means connected to the other side of said fluid coupling and adapted for being operated to provide a torque on said windlass through said coupling effective for resulting in an upwardly directed force on said line only just sufficient for counterbalancing said object in any vertical position thereof by maintaining 100% slip in said coupling, whereby an operator may move said object upward merely by overcoming the friction in the device and downward by overcoming the counterbalancing force on said line.

20. A device for aiding an operator to lift an object comprising; a windlas including a line adapted for extending vertically downward from an elevated position and being secured to an object to be lifted, a fluid coupling one side of which is directly connected to said windlass for applying a torque thereto, a variable speed driving means connected to the other side of said fluid coupling and adapted for providing a variable torque on said windlass through said coupling effective for resulting in a variable upwardly directed force on said line, and means for selectively presetting the operating speed of said driving means in accordance with the weight of an object to be lifted thereby to effect a force on said line only just sufficient for counterbalancing said object in any vertical position thereof by maintaining 100% slip in said coupling, whereby an operator may move said object upward merely by overcoming the friction in the device and downward by overcoming the counterbalancing force on said line.

21. A device for aiding an operator to lift an object comprising; a windlass including a line adapted for extending vertically downward from an elevated position, vacuum gripping means carried by said line for securing thereto an object to be lifted, a fluid coupling one side of which is directly connected to said windlass for applying a torque thereto, and driving means connected to the other side of said fluid coupling and operative only when said vacuum gripping means is effective for securing said object to said line to provide a torque on said windlass through said coupling effective for resulting in an upwardly directed force on said line only just sufficient for counterbalancing said object in any vertical position thereof by maintaining 100% slip in said coupling, whereby an operator may move said object upward merely by overcoming the friction in the device and downward by overcoming the counterbalancing force on said line.

References Cited in the file of this patent

UNITED STATES PATENTS

2,342,020	Stevens	Feb. 15, 1944
2,390,242	Engler	Dec. 4, 1945
2,600,887	Lannen	June 17, 1952
2,646,965	Addicks	July 28, 1953
2,666,876	Sinclair	Jan. 19, 1954