UNITED STATES PATENT OFFICE

2,622,564

SERVOMOTOR AND A THROTTLING MEANS FOR ITS FLUID SUPPLY

Joseph Kellogg, Milwaukee, Wis., assignor to Nordberg Manufacturing Company, Milwaukee, Wis., a corporation of Wisconsin

Application February 24, 1948, Serial No. 10,249

4 Claims. (Cl. 121—38)

1. My invention relates to an improvement in hoists, and, in particular, to control means for hoists.

One purpose is to provide an improved control for mine hoists and the like.

Another purpose is to provide an improved snubber for automatically operated hoists.

Another purpose is to provide means for employing normally manually controlled mechanisms for maintaining automatic control of mine hoists and the like.

Other purposes will appear from time to time in the course of the specification and claims.

I illustrate my invention more or less diagrammatically in the accompanying drawings wherein:

Figure 1 is a vertical section with parts in side elevation;

Figure 2 is an enlarged showing of part of the structure shown in Figure 1, with parts in side elevation and parts in vertical section; and

Figure 3 is a vertical section of the valve structure shown in Figure 2, with the parts in a different position.

Like parts are indicated by like symbols throughout the specification and drawings.

Referring to the drawings, 1 generally indicates any suitable base structure. 2 indicates any suitable bearings adapted to receive the hoist shaft. 3 generally indicates the hoist brake drum, and 5 and 6, interconnected brake shoes therefor. Since the details of the hoist, the brake drum and the shoes are not of themselves part of the present invention, they will not be described. 7 is a lug projecting from the brake shoe 5.

Pivoted, at 8, is the lever 9. Pivoted concentrically with it is the parallel motion link 10, pivoted at its lower end, as at 11. The right-hand end of the lever 9, referring to the position of the parts as shown in Figure 1, has pivoted to it, as at 12, the link 13, the opposite end of which is pivoted, as at 14, to the brake shoe operating lever 15. Pivoted, as at 16, on the opposite side of the center 8 of the lever 9 is the link 17, which is pivoted at its upper end, as at 18, to a second brake-operating lever 19, one on each side. The left end of the lever 9, as shown in Figure 1, has pivoted to it, as at 20, an actuating link 21, the opposite end of which is pivoted to the piston block or crosshead 22, which slides in the open-ended guide 23. Suspended from it is the link 24, carrying the weight 25. Extending upwardly from it is the piston rod 26 extending to the piston 27 in the open-ended cylinder 28.

29 is any suitable stuffing box, it being understood that the space between the piston 27 and the stuffing box 29 may be subjected to pressure by means of the below described structure.

30 generally indicates a valve housing. 31 is a bracket on the guide 23, which carries any suitable solenoid 32. The details of the solenoid do not form part of the present invention, but it includes any suitable coil which may receive current through any suitable conductors 33, the current being controlled by means which do not, of themselves, form part of the present invention. 34 indicates the outwardly projecting part of the solenoid armature or core, which has pivoted to it, as at 35, a valve operating rod 36.

It will be understood that oil, or another suitable liquid, is normally directed under pressure to the interior of the valve housing 30. I illustrate, for example, the inlet passage 37 which delivers oil to the chamber 38 which is connected by a valve passage 39 with the cross-passage 40. The cross-passage, in turn, delivers to a passage 41 through a valve aperture 42. The passage 41 is connected by the passage 43 with the cylinder space. It is also connected or connectable, by the valve passage 44, with the relief passage 45. The stem 36 is unitary with a compound valve structure having an upper valve cylinder 46, a lower valve cylinder 47, and an intermediate guide or stopper 48.

When the parts are in the position of Figure 2, the valve inlet passage 37 is effectively closed, by the positioning of the valve cylinder 46 in the valve aperture 39. The valve cylinder 47, however, is out of the passage 44, and oil can escape, under the influence of the weight 25, through the passage 43 to the relief passage 45.

At the same time, a second valve structure is positioned by the stem 50 with an upper valve cylinder 51 and a lower valve cylinder 52. When the parts are in the position of Figure 2, the valve members 51 and 52 are not performing any function, since the pressure passage 37 is closed, and the piston passage 43 is open to the outlet 45. It will be noticed, however, that the valve stem 50 is movable in direct response to movement of the lever 8. The movement results from the following linkage or connections.

A link 53 is pivoted, as at 54, for movement about a fixed pivot. The outer end of the link 53 is pivoted, as at 55, to a valve actuating link 56 and to a second or control link 57. The link 57 is pivoted at one end for movement about the end of link 58 on the lever 8. It is also pivoted, as at 60, to the member 51. The mem-
number 61 may constitute a hand actuating rod, when the herein described structure is used for hand operation. But when the structure is employed in accordance with my invention, the member 61 is locked in position, and the pivot 60 is fixed or substantially fixed. Such a lock means may take any conventional form such as a spring biased plunger 61a selectively engaging a series of locking recesses 61b in the member 61. With the pivot 60 fixed, any rotation of the lever 8 about its center 8 will cause a movement of the valve members 51 and 52.

When the parts are in the full-line position of Figure 2, the brake shoes 5 and 6 are in braking position, and the weight 25 is effective to urge the brake shoes against the brake drum. When in the braking position, the downward movement of the weight 25 is effective to expel the oil from beneath the piston 27, the oil being free to flow through the passages 43 and 44 to the relief passage 45. At that time, it will be understood that the solenoid 32 is in the non-actuated position and the valve assembly, including the valve cylinders 46 and 47, stays, by gravity, in the downward position in which it is shown in Figure 2.

Assume that the user wishes to release the brake. He employs any suitable control means, not herein shown, to energize or actuate the solenoid 32. The result is an upward movement of the valve members 46 and 47. Initially, the valve cylinders 51 and 52 are in position to leave the passage 42 open. The solenoid actuation of the valve members 46 and 47 clears the passage 39, and permits the inflow of oil under pressure from the inlet 37. This oil flows through the passage 40, through the opening 42, and along the passages 41 and 43 to the space below the piston 27. At the same time, the valve member 47 has risen to close the valve opening 45, thus preventing escape of oil through the outlet 45.

The result of this admission of oil under pressure is to raise the piston 27. This, in turn, raises the weight 25 and rotates the lever 9 in a clockwise direction, referring to the position of the parts in Figure 2. This, in turn, causes a depression of the stem 50 toward a position in which it will close the passage 42 by downward movement of the valve element 51. In Figure 2, the release position of the lever 9 and of the linkage in question is shown in dotted line. But in Figure 3, the valve member 51 is shown in an intermediate position, as it moves toward closure of the passage 42. When the parts are in the dotted line position of Figure 2, the valve 51 just closes the aperture 52. In effect, by the restriction of flow through the passage 42, followed by the final closure, an efficient snubbing action is obtained. It will be noted, also, that the parts are so proportioned that when the valve member 51 closes the passage 42, the aligned lower passage 42a is still closed by the upper end of the valve member 52.

In order to actuate the device, it is understood that any suitable mechanical controls may be employed for the solenoid 32. When the solenoid 32 is moved to brake-releasing position, the brake lever rises from the full line to the dotted line position of Figure 2, and, as it rises, it controls the position of the valve 51 to obtain, automatically, the above described snubbing action.

The valve housing 30 may also be provided with an exterior passage 62 affording communication between the outer ends of valve members 46, 47, 51 and 52 and permit relative freedom of movement thereof. Said passage also may serve to collect escaping oil at the ends of said valve members.

I will utilize that whereas I have illustrated and described an operative device, still many changes may be made in the size, shape, number, arrangement and disposition of parts without departing materially from the spirit of my invention. I wish, therefore, that my showing be taken as in a broad sense diagrammatic, rather than as limiting me to the precise showing.

The use and operation of the invention are as follows:

The interconnected brake shoes 5 and 6 are set or gripped relative to the hoist brake drum 4 through the influence of weight 25 acting through link 24, crosshead 22, link 21 and the brake actuating lever 9 which is pivoted at 8 on lug 7 projecting from the brake shoe 5. Depending upon the position of the port 45 by the weight actuates the links 13 and 17 connected to the brake shoe operating levers 16 and 19 respectively. During the depression of the brake actuating lever 9 the solenoid 32 is energized and the valve cylinders 46 and 47 in the valve casing 30 will be urged to the uppermost position, as shown in Figure 2, so as to relieve all hydraulic pressure below the piston 27 and cylinder 28 by opening the passage or port 44 in the valve casing from the outlet 43 to the relief passage 45.

When it is desired to release the brake the solenoid 32 is energized so as to lift the valve rod 35 upwardly in the valve casing. This causes the valve cylinder 47 to close the passage or port 44 and also moves the valve cylinder 46 upwardly to open the passage or port 43 leading to the inlet passage 37. Oil under pressure from the inlet passage then flows through the passage 40 and aperture or port 42 into the horizontal passage 41 and then into the outlet passage 43 into the lower end of the cylinder so as to raise the piston and the acting arm 9. The various connections previously described. It will be observed when the brake operating lever 9 is in its lowest position, the stem 50 which controls the valve members 51 and 52, is held in its upper position in such a manner that the port 45 is fully open when the lever arm 9 starts its downward movement. The movement of the valve members 51 and 52 however, is normally responsive only to the movement of said lever arm by reason of the control linkage consisting of links 53, 56, 57 and 58. The link 57 is fulcrum on member 61 which is normally fixed during the operation of the mechanism, although as previously described, said member 61 may be hand operated as will hereinafter more fully appear. During the fulcrum arrangement of link 57 on member 61 the shorter end of link 57 will gradually lower as the longer end of said link is raised by the lever 9. As the lifting movement of the lever arm 9 proceeds the valve cylinder 51 is gradually lowered while it reaches a position substantially like that shown in Figure 3 wherein the port 42 and restricts the passage of oil through the latter in gradually decreasing amounts until the passage 42 finally becomes closed to stop further lifting action on the lever arm 9. In this manner the movement of the brake operating lever is controlled and limited automatically by the movement of said brake op-
erating lever to provide the desired snubbing action during the closing movement of the valve means.

It will be further observed that the member $\delta$ on which link $\delta$ is fulcrumed may be raised or lowered by hand in the position of the brake-actuating lever $\delta$, when desired, so as to afford manual control of the valve member $\delta$. Such manual control may be found useful under exceptional circumstances, as for instance, when it is desired to hasten the closing of said valve member while the actuating lever $\delta$ is being raised, thus stopping the movement of said arm in any desired position.

I claim:

1. In a control assembly for a brake operating lever, and in combination with such lever, and a cylinder and piston connected to said lever, a valve control means including a casing having inlet, outlet, and relief passages, said outlet passage being positioned for communication with the space within said cylinder and piston, valve means selectively operable in one position to close said inlet to said outlet, and in a second position to open said inlet to said relief passage, and in a second position to open said inlet to said outlet and to close said valve means interposed between said inlet and outlet passages, an electromagnetically actuating member for the first-mentioned valve means, and a compound linkage connection between the second valve means and the brake operating lever, including a first link pivoted to the brake operating lever, a second link pivoted at a fixed point, and a third link pivoted at its other end to opposed ends of the first two links, and a normally fixed support to which said first link is pivoted intermediate its ends, the normally fixed support being mounted for manual movement to control and limit movement of the second valve means under gradually reduced flow during the closing movement of said second valve means.

2. In a control assembly for a brake operating lever, and in combination with such lever, and a cylinder and piston connected to said lever, a valve control means including a casing having inlet, outlet, and relief passages, said outlet passage being positioned for communication with the space within said cylinder and piston, valve means selectively operable in one position to close said inlet to said outlet, and in a second position to open said inlet to said relief passage, and in a second position to open said inlet to said outlet and to close said outlet to said relief passage, second valve means interposed between said inlet and outlet passages, means for actuating said first mentioned valve means, and a compound linkage connection between the second valve means and the brake operating lever, including a first link pivoted to the brake operating lever, a second link pivoted at a fixed point, and a third link pivoted at its other end to opposed ends of the first two links to control and limit movement of the second valve means under gradually reduced flow during the closing movement of said second valve means.

JOSEPH KELLOGG.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,684,847</td>
<td>Mills</td>
<td>June 17, 1913</td>
</tr>
<tr>
<td>1,544,751</td>
<td>Haynes</td>
<td>July 7, 1925</td>
</tr>
<tr>
<td>1,633,873</td>
<td>Woodson</td>
<td>July 12, 1927</td>
</tr>
<tr>
<td>1,698,604</td>
<td>Moore</td>
<td>Jan. 8, 1929</td>
</tr>
<tr>
<td>1,807,231</td>
<td>Weeks</td>
<td>May 20, 1931</td>
</tr>
<tr>
<td>2,174,044</td>
<td>Schmidt</td>
<td>Sept. 26, 1939</td>
</tr>
<tr>
<td>2,307,426</td>
<td>Smak</td>
<td>Jan. 5, 1943</td>
</tr>
<tr>
<td>2,434,949</td>
<td>Cumming</td>
<td>Jan. 13, 1949</td>
</tr>
</tbody>
</table>

FOREIGN PATENTS

<table>
<thead>
<tr>
<th>Number</th>
<th>Country</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>481,831</td>
<td>Great Britain</td>
<td>Aug. 7, 1936</td>
</tr>
</tbody>
</table>