HOIST CONTROLLER

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Filed Aug. 30, 1959, Ser. No. 52,870

3 Claims. (Cl. 74—785)

This invention relates to a mechanism for shadowing the control of a mine hoist and is generally known as a controller and is so referred to herein.

Controllers are in use which incorporate gears and other mechanism which must be specifically selected and built into the apparatus to suit the specific program of hoisting required. Whenever changes must be made in such program, serious alterations must be made in the internal gearing, the dial cams, and the drive to any governor, to make them suitable for the new conditions.

It is the object of this invention to modify controllers to make them more suitable in their application to mining hoists generally and more easily adjustable to the required operating of the particular hoist to which they are attached.

In accordance with this invention a controller for a winding hoist driven by a shaft connected to the hoist drum and having a cam dial for regulating the winding trips is provided with an epicyclic gear train driven by the hoist drum driving shaft and having the cam dial driven by the epicyclic gear.

The invention provides also for the controller to have a single cam dial for regulating both the up and down trips with mechanical links between the epicyclic gear operating to rotate the dial through less than 180° in one direction for one trip and less than 180° in the opposite direction for the return trip.

The invention further provides adjustable lugs on the epicyclic gear for regulating the length of the trips before the controller is brought into operation, and a mechanical linkage from the hoist driver’s controls for the adjustment of stops cooperating with said lugs for adjustment of the controller when rock or men are hauled.

The invention is illustrated schematically in the accompanying drawings, in which:

FIG. 1 is a side elevation of the controller showing the cam dial,
FIG. 2 is a section on the line 2—2 of FIG. 1,
FIG. 3 is an exploded view of the train of gears driving the cam dial,
FIG. 4 is a view showing the mechanical linkage between the centrifugal governor and the safety control switches,
FIG. 5 shows the drive from the hoist to the governor and the cam dial,
FIG. 6 shows the mechanical linkage between the levers manipulated by the driver of the hoist and the controller for regulating the control for hoisting men or rock, and
FIGS. 7, 8 and 9 shows diagrammatically various positions of the cam dial.

In the drawings the hoist controller is mounted in and on a closed chamber 11 which is made fluid tight so that oil may be made to circulate for the gearing housed therein.

Into one side of the chamber 11 the drive shaft 12 enters through a suitable bearing and said shaft is driven directly from the hoist drum 13 indicated in FIG. 5. From this drive shaft 12 through a worm 14 and worm wheel 15, the sun wheel 16 of an epicyclic gear is driven. Said epicyclic gear comprises an internally toothed ring 17 with one or more planetary wheels 18. In the form presently described there are two wheels 18 diametrically opposite one another and carried rotatably on an arm 19 in FIG. 5, so that they mesh both in the sun wheel 16 and the toothed ring 17 in the well known arrangement of an epicyclic gear train.

As shown in FIG. 5 the arm 19 of the gear train and the cam dial 20 carrying the control cams 22 are attached to the same shaft 21.

The dial 20 may be mounted outside of one side of the gear chamber 11. On the opposite side 23 of the chamber 11 is carried a box 24 in which are assembled the various control switches and switches for lights indicating the particular condition or functioning of the controller at any specific period of the winding trip. Such auxiliary electrical devices are well known and need not be described.

On the top of the chamber 11 is carried a centrifugal governor 25 which is specially constructed to run at a speed sufficiently high that when its speed is reduced to the minimum at which it is called upon to function it will still have sufficient power to control the operation it is necessary for it to perform. In other words a single centrifugal governor is sufficient with this controller.

As shown in FIGURE 1, the circumference of the dial 20 is considered as divided into two parts, 26 and 27 and the two cams 22, thereon are shaped to control the lengths of the hoist at the ends of lowering and raising trips respectively. That is one part 26 of the dial circumference with one cam 22 thereon is used to control the up and the other half 27 with its cam 22 the down trip.

To the shaft 21 is secured the arm 19 (FIGURE 3) of the epicyclic gear train and also the cam dial 20. In line with shaft 21 but not keyed to it is shaft 28 to which is keyed the worm wheel 15 and the sun wheel 16. Shaft 21 and 28 are mounted in line. On shaft 28 the internally toothed ring 17 runs freely and the discs 29, 30 are mounted to be freely rotatable about the axis of the shaft 21. The discs 29, 30 each carry a projecting pin 31 and 32 respectively which are each adapted to co-operate with stops 33, 34 secured in suitable positions on the rim of the internally toothed ring 17. The pins 31, 32 and the stops 33—34 co-operate as hereafter described to stop when required, the ring 17 from rotating.

The discs 29, 30 are held from rotating and in their required position by a series of linkages attached to projecting lugs 35 and tying them to the driver’s control lever 36 (FIG. 6). It will be understood that when the internally toothed ring 17 is prevented from rotating by a stop 33 or 34 making contact with a pin 31 or 32 the arm 19 of the epicyclic gear train will rotate shaft 21 and therefore cam disc 20. Such rotation is required at the termination of a winding trip either down or up as hereafter explained.

The discs 29, 30 are rotated through levers 35 by movement by the driver of lever 36. Such movement will be necessary to regulate the travel of the hoist when raising men or hauling rock, as is well known. It will be understood that the rotation of discs 29, 30 will bring the epicyclic gear into operation to control the speed of the end of the trip as required.

It is common practice to provide a cam on the cam dial of a controller to eliminate the action of the deceleration cam in the initial acceleration portion of the trip. In FIG. 4 is shown a cam 37 for this purpose. According to this invention and as shown the cams 37 are attached to cams 22 but in a different parallel plane and operate a suitable and well known form of acceleration switch indicated at 38. Both cams 22 are provided with the usual cams 39 to operate a limit switch 40 to come into action in the case of danger of overwind.

The centrifugal governor 25 is driven through a bevel gear wheel 41 on the drive shaft 12. 42 is a bevel gear on shaft 43 which also carries a gear wheel 44 meshing with a smaller gear wheel 45 on the shaft of the governor 25 as shown in FIG. 5.
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As shown in FIGURE 4, the vertical plunger 46 of the governor 25 connects with the end of a lever 47 which through mechanical linkage 48 and lever 49 contacts an over speed and alarm switch 50. This mechanical linkage 45 has its action modified by the lifting of one end of the lever 51 by the operation of the control cam contact lever 52 through lever 53. It is however well known to use the lever 52 brought into operation by the cam 22 to modify by the co-operation of the levers 51 and 47 to regulate the permitted speed of the hoist through governor 25 and the controller according to this invention has a similar provision (see FIG. 4) which need not be further described.

In order to illustrate the working of the controller described reference is made to the cam dial 20 diagrammatically illustrated in FIGS. 7, 8 and 9.

In FIG. 7 the controller lever 52 is in its neutral position. The dial 20 is stationary and the hoist is being lowered at the speed of the drive motor. In FIG. 8 the drum of the hoist has rotated so that the vehicle is approaching the bottom of the shaft. The stops have operated to stop the rotating wheel 17 of the epicyclic gear and the dial 20 rotates in the direction of the arrow.

This means that the cam 37 is immediately brought into contact but cannot operate until the usual direction switch (not shown) has operated on the start of the next trip. In FIGURE 4, the acceleration switch indicated at 38 and operated by cams 37 energises a solenoid 54 which alters the fulcrum point of lever 49 permitting maximum speed to be attained without operation of over speed switch 50 during the acceleration period.

As shown in FIGURE 9, 22 is raising arm 52 and it can be assumed that the driver has control of the operation of the hoist to reduce the speed of the drum 13 and finally stop it. The rotation of the drum 13 is now reversed and the dial 20 therefore is rotated in the reverse direction. The weight 55 which is attached by a chain 56 to the bottom of dial 20 will return the dial from a tilt to bring the cam 22 on the other half of the dial to its mid position (FIG. 7) but the control of the rate of acceleration will have been removed by the operation of the cam 37 and the acceleration switch 38.

With the dial stopped in its neutral position the cam 22 on the opposite or other half of the dial 20 is positioned to come into operation to control the end of this next trip and the program of operations is repeated but in the reverse direction as shown in FIG. 9.

This invention provides a controller for a hoist which uses one cam dial for controlling the winding trip in both the up and down directions. This cam dial is driven through an epicyclic gear and the program of the hoist trips up or down can readily be arranged by the positioning of the stops 33 and 34 and this is, in the normal way, the only operation required for adjusting the controller for use when the trips must be varied in length as for instance on the deepening of the shaft.

What I claim as new and desire to secure by Letters Patent is:

1. A controller for a bidirectional winding hoist and driven thereby, comprising in combination, two shafts in line, coupling means from the hoist to the first shaft, an epicyclic gear train having both a sun wheel and planet wheels together with a carrier of the planet wheels and an internally toothed ring wheel, means securing the first shaft to the sun wheel of said train, means securing the second shaft to the carrier of the planet wheels in said train, integral lugs projecting from the outer surface of the toothed ring wheel of the train, stops adapted to engage said lugs to stop rotation of the ring wheel in either direction of travel and thereby rotate said carrier of the planet wheels, a cam disc attached to said second shaft having a cam located for presentation near the end of the wind of the hoist in either direction, and a means between said cam disc and the hoist to control the speed of the hoist at the end of its wind in either direction when it encounters the cam.

2. A controller for a bidirectional winding hoist comprising coupling means for driving the controller in either of two directions at a speed consistent with the speed of the hoist, an epicyclic gear train having an internal toothed wheel and a planetary gear, means constantly driving said train by said coupling means, a normally stationary cam dial, lugs positioned on the internal toothed wheel of the epicyclic gear train, means to engage the lugs to hold the internal toothed wheel in either direction of rotation, said cam dial coupled to the planetary gear to rotate therewith in a direction corresponding to the direction in which the hoist is being driven when the lugs are engaged, and speed control means operable by said cam dial near the extremities of hoist travel in either direction.

3. A controller as defined in claim 2, including means for disengaging the lugs and bringing said cam dial to a neutral position between said extremities.

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