July 19, 1938. W. LEHMAN 2,123,904

SLACK TAKE-UP FOR THRUST ROPES OF POWER SHOVELS

Filed March 26, 1937 2 Sheets-Sheet 1

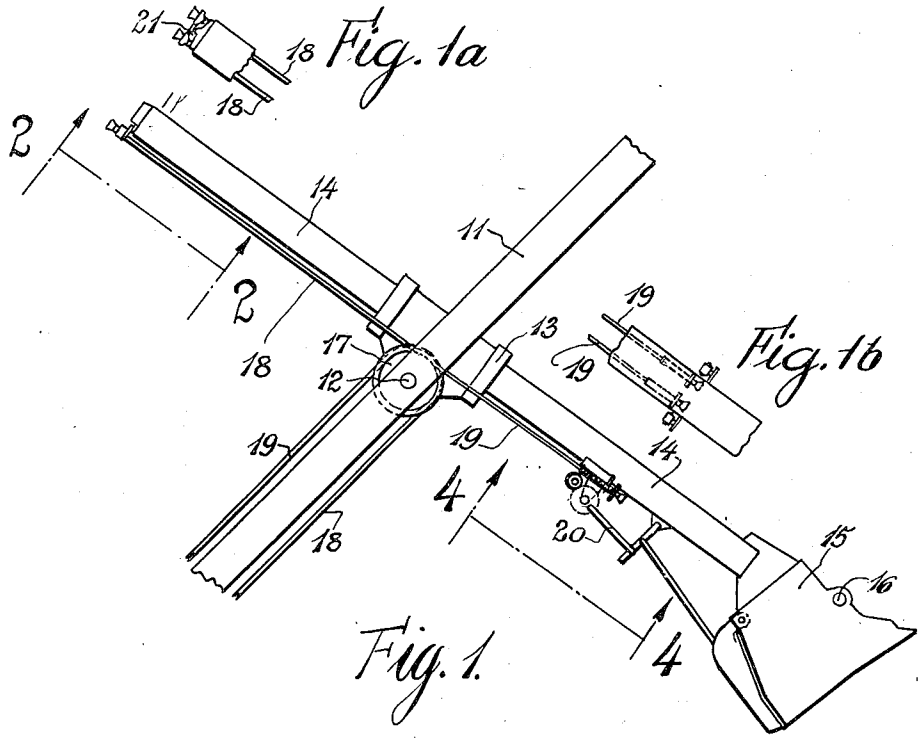


Fig. 1.

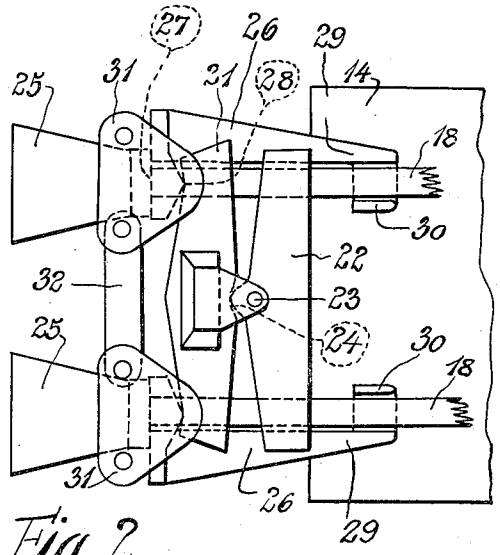


Fig. 2.

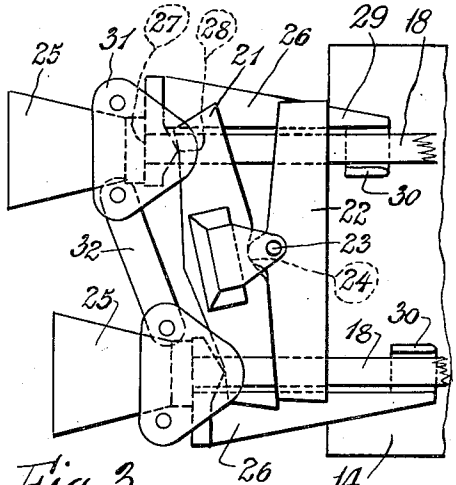


Fig. 3.

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SLACK TAKE-UP FOR THRUST ROPES OF POWER SHOVELS

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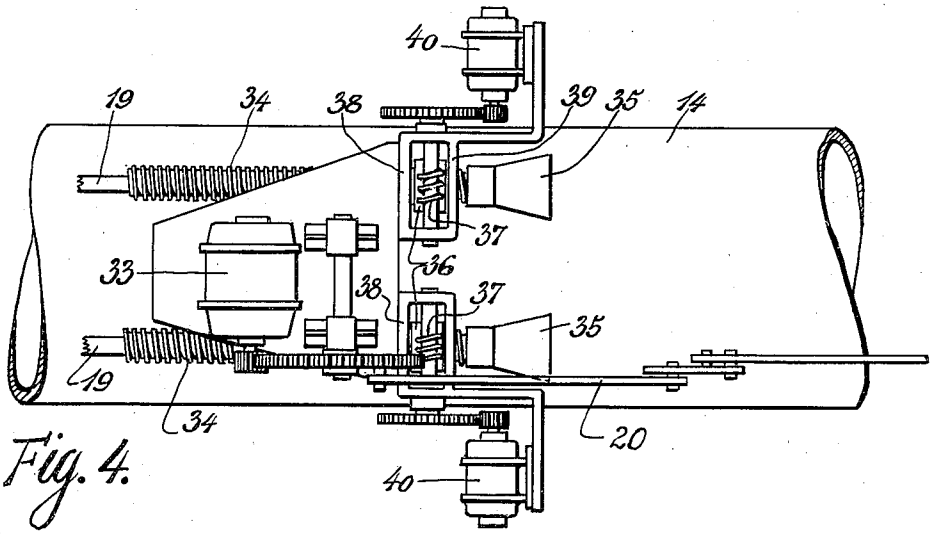


Fig. 4.

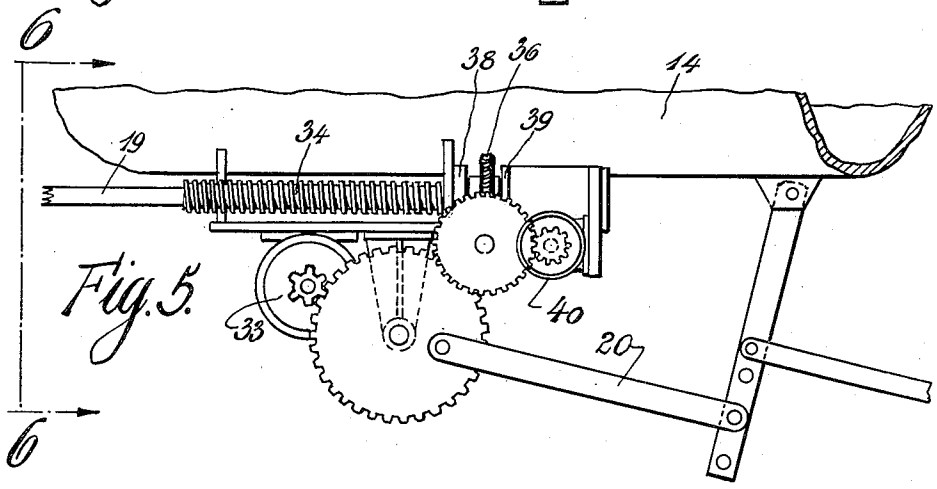


Fig. 5.

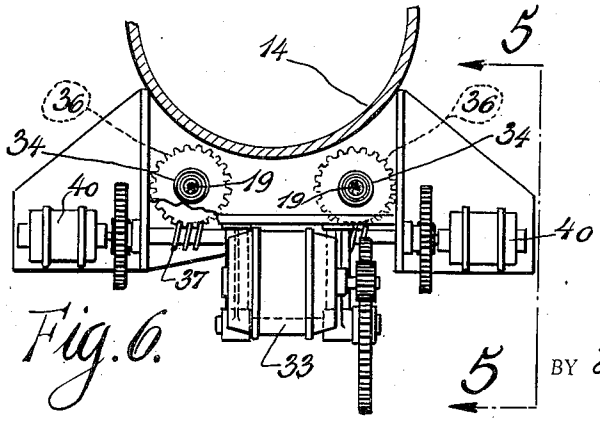


Fig. 6.

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Patented July 19, 1938 2,123,904

UNITED STATES PATENT OFFICE

2,123,904

SLACK TAKE-UP FOR THRUST ROPES OF POWER SHOVELS

Werner Lehman, South Milwaukee, Wis., assignor to Bucyrus-Erie Company, South Milwaukee, Wis., a corporation of Delaware

Application March 26, 1937, Serial No. 133,125

11 Claims. (Cl. 214—135)

My invention relates to new and useful improvements in slack take-ups for thrust ropes of power shovels.

The conventional power shovel, well-known in the art, has a main base, with a boom projecting diagonally upward therefrom. On this boom, about midway of its ends, is a shipper-shaft, on which is mounted a dipper handle for reciprocation and swinging in a vertical plane. At the outer end of this handle there is mounted a digging dipper. The swinging is effected by means of a hoist-rope, passing from the dipper, or from a point on the handle adjacent thereto, over a sheave on the outer end of the boom, to a winch on the main frame.

The reciprocation may be effected in any one of a number of conventional ways. In the type of shovel to which my present invention more particularly pertains, the reciprocation is effected by means of two pairs of thrust-ropes. One pair extends from a pair of anchorages on the rear end of the dipper handle, around a pair of sheaves on the shipper-shaft, to a winch on the main frame. A second pair of ropes extends from a pair of anchorages on the front end of the dipper handle, around a second pair of sheaves on the shipper-shaft, to the winch last above mentioned.

Due to the natural characteristics of wire rope, these four ropes gradually stretch with use. Accordingly, in order to eliminate backlash therein, and the resulting damaging shocks to the mechanism, it has heretofore been necessary to shut down the shovel at frequent intervals, in order to take up the slack.

A shovel earns no money while shut down for repairs or readjustments.

Accordingly it is the principal object of my present invention to provide means for the automatic taking up of slack in the thrust ropes, as fast as it occurs.

In addition to my principal object, above stated, I have worked out a number of novel and useful details, which will be readily evident as the description progresses.

My invention consists in the novel parts and in the combination and arrangement thereof, which are defined in the appended claims, and of which one embodiment is exemplified in the accompanying drawings, which are hereinafter particularly described and explained.

Throughout the description, the same reference number is applied to the same member or to similar members.

Figure 1 is a side elevation of the associated parts of a power shovel, considerably conventionalized, showing the location of my invention. Figure 1 also includes two partial auxiliary plan views of the two ends of the dipper handle of the main view of that figure seen from above, numbered respectively *1a* and *1b*.

Figure 2 is a view from underneath, of the equalizer at the rear end of my dipper handle, taken along the lines 2—2 of Figure 1.

Figure 3 is the same view of the same equalizer, when the same has tilted to accomplish equalization.

Figure 4 is a view, from underneath, of the dipper-trip and take-up mechanism at the front end of my dipper handle, taken along the lines 4—4 of Figure 1.

Figure 5 is a side elevation of this dipper-trip and take-up mechanism, taken along the lines 5—5 of Figure 6, and

Figure 6 is a rear elevation, partly in section, taken along the lines 6—6 of Figure 5.

Referring now to Figure 1, we see that 11 is a portion of the boom of a power-shovel. The shipper-shaft 12 pivotally supports a saddle-block 13, through which reciprocates the dipper handle 14, carrying the dipper 15. A hoist-rope (not shown) is attached at 16 to the dipper 15, by any appropriate means (not shown). The shipper-shaft 12 also carries four sheaves 17, of which only the one nearer the observer is shown. Twin ropes 18, of which only the one nearer the observer is shown, serve to thrust the dipper handle outwardly, i. e. to the right in the drawings. Twin ropes 19 (of which only the one nearer the observer is shown) serve to retract the dipper handle, i. e. to reciprocate it to the left in the drawings.

20 is an electric dipper-trip, preferably of the type shown and described in U. S. Patent Re. 16,393, issued July 27, 1926, to Paul S. Stevens.

Before proceeding to describe the details of my invention, I shall discuss its general operation, with particular reference to the auxiliary views of Figure 1. When either or both of ropes 19 become slack, automatic take-up means (to be hereinafter described) on the front of the handle takes up the slack. When both of ropes 18 become slack, this same take-up means shifts the dipper handle rearwardly, thus taking up the slack. When one only of ropes 18 becomes slack, the yoke 21 (to be hereinafter described) tilts, thus distributing this slack equally to the two ropes 18; and then this equalized slack is taken up by the rearward shifting of the dipper handle by the take-up means on the front of the handle.

Turning now to Figure 2, I shall describe the yoke 21 and its associated parts. A block 22 is secured to the rear end of the handle 14 by any conventional means (not shown) such as bolting or welding. The yoke 21 is pivoted on this block, as at 23, but preferably bears on a rolling surface 24, rather than on the pivot. The ends of the yoke 21 are bifurcated or holed for the passage of ropes 18, as are the ends of block 22. Each rope terminates in a rope-socket 25.

Interposed between each rope-socket 25 and one end of the yoke 21 is a bearing-piece 26, inwardly bifurcated to fit above and below the rope 18. This bearing-piece has a flat surface 27 for engaging the rope-socket 25, a rocking edge 28 for engaging an end of the yoke 21, and a forward extension 29, carrying a hook 30, to engage the rope 18, and thus steady the piece.

Integral with each piece 26 is a triangular plate 31. These two plates are pivotally connected to each other by a bar 32.

Figure 3 shows the assembly of Figure 2, with the yoke 21 rocked to equalize an unequal slack in the two ropes 18.

Other equivalent forms of yoke could be used.

Turning now to Figures 4 to 6, I shall discuss my automatic slack take up at the other end of the handle. This is an inventive feature per se, and could be used on a single rope. As already stated, 20 is an electric dipper trip. It is intermittently actuated by electric motor 33, through intermediate gearing (shown, but not specifically described herein), whenever a button (not shown) is pressed by the operator of the shovel.

Each of ropes 19 passes through a hollow screw 34, and terminates in a rope-socket 35, against which the screw bears. Internal-external gear 36 is cut internally to engage the screw 34, and externally to engage the worm 37, and is held against axial motion by plates 38 and 39. Worm 37 is actuable by motor 40, through intermediate gearing not specifically numbered.

Due to the fact that the rotation of an internally screw-threaded gear will translate a screw, but the attempted translation of the screw will not rotate the gear; and to the fact that a worm will drive a worm-gear, but not vice versa; we have a double means for holding taut a rope 19, when once tautened. This principle will be referred to in the claims as "a non-reversible gearing".

Each of motors 40 is of a peculiar type well-known in the art, which, when energized, will run until it encounters a certain maximum torque, whereupon it will stall without burning out or other damage. Such motors will be called in the claims: "maximum torque motors". The gear reduction and the stalling torque are so chosen and adjusted, that not more than a certain predetermined advisable maximum dead tension is set up in ropes 19.

It would be possible to have motors 40 constantly energized throughout the operation of the shovel, but this would entail a great waste of current. Or it would be possible to arrange to have the operator intentionally energize these motors from time to time, but this would render my device non-automatic.

Accordingly I have found it advisable to avoid each of these extremes, by placing my motors in circuit with some other electric instrumentality intermittently energized, for example: motor 33 of the dipper-trip. The details of the wiring for this purpose form no part of my invention, and hence are not shown; this may be done in any convenient conventional manner.

I preferably associate my slack take-up motors with the inward, rather than with the outward, thrusting ropes for two reasons. First this locates the motors 40 adjacent the dipper-trip motor 33, with which they are wired. And, secondly, it associates them with the pair of ropes which bear the lesser live tension.

Having now described and illustrated one form of my invention, I wish it to be understood that my invention is not to be limited to the specific form or arrangement of parts hereinbefore described, except insofar as such limitations are specified in the appended claims.

I claim:

1. A slack take-up device for the thrust ropes of a power shovel, comprising, in combination with a pair of outward thrusting ropes and a pair of inward thrusting ropes, equalizing means for one pair of ropes; and, associated with each rope of the other pair, a non-reversing gearing for tautening the rope, and a maximum torque motor to actuate the gearing.

2. A slack take-up device for the thrust ropes of a power shovel, comprising, in combination with a pair of outward thrusting ropes and a pair of inward thrusting ropes, equalizing means for the outward thrusting pair of ropes; and, associated with each rope of the other pair, a non-reversing gearing for tautening the rope, and a maximum torque motor to actuate the gearing.

3. A slack take-up device for the thrust ropes of a power shovel, comprising, in combination with a pair of outward thrusting ropes and a pair of inward thrusting ropes, equalizing means for one pair of ropes; and, associated with each rope of the other pair, a non-reversing gearing for tautening the rope, and a maximum torque motor to actuate the gearing, said motor being in circuit with some intermittent source of power.

4. A slack take-up device for the thrust ropes of a power shovel, having an electric dipper-trip, comprising, in combination with a pair of outward thrusting ropes and a pair of inward thrusting ropes, equalizing means for one pair of ropes; and, associated with each rope of the other pair, a non-reversing gearing for tautening the rope, and a maximum torque motor to actuate the gearing, said motor being in circuit with the electric dipper-trip of the shovel.

5. A slack take-up device for a thrust rope of a power-shovel, comprising a non-reversing gearing for tautening the rope, and a maximum torque motor to actuate the gearing.

6. A slack take-up device for a thrust rope of a power-shovel, comprising a non-reversing gearing for tautening the rope, and a maximum torque motor to actuate the gearing, said motor being in circuit with some intermittent source of power.

7. A slack take-up device for a thrust rope of a power-shovel, having an electric dipper-trip, comprising a non-reversing gearing for tautening the rope, and a maximum torque motor to actuate the gearing, said motor being in circuit with the electric dipper-trip of the shovel.

8. A slack take-up device for the thrust ropes of a power shovel, comprising, in combination with a pair of outward thrusting ropes and a pair of inward thrusting ropes, equalizing means for one pair of ropes; and, associated with each rope of the other pair, a maximum torque motor for tautening the rope.

9. A slack take-up device for the thrust ropes of a power shovel, comprising, in combination

with a pair of outward thrusting ropes and a pair of inward thrusting ropes, equalizing means for one pair of ropes; and, associated with each rope of the other pair, a maximum torque motor for tautening the rope, said motor being in circuit with some intermittent source of power.

10. A slack take-up device for the thrust ropes of a power shovel, having an electric dipper-trip, comprising, in combination with a pair of outward thrusting ropes and a pair of inward thrusting ropes, equalizing means for one pair of ropes; and, associated with each rope of the other pair, a maximum torque motor for tautening the rope, said motor being in circuit with the electric dipper-trip of the shovel.

11. In a thrusting device for power shovels, the combination of: a pair of outward thrusting ropes; an inward thrusting rope; equalizing means for the outward thrusting ropes; and, associated with the inward thrusting rope, non-reversing gearing for tightening the rope, and a maximum torque motor to actuate the gearing.

WERNER LEHMAN.