July 23, 1929. J. J. ARNAUD 1,721,761

ROPE THRUSTING SHOVEL

Filed May 28, 1926

Fig. 1.

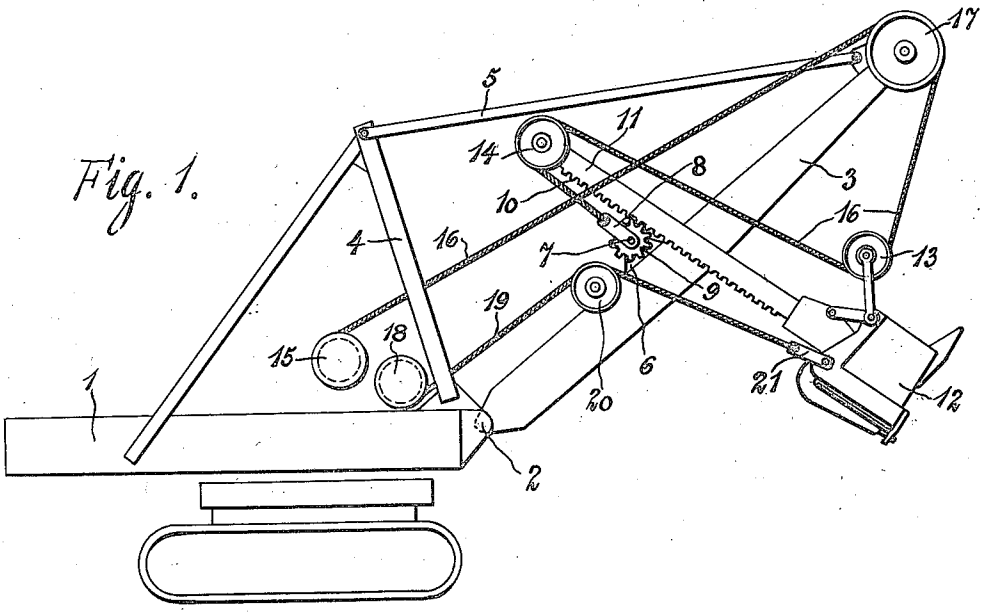
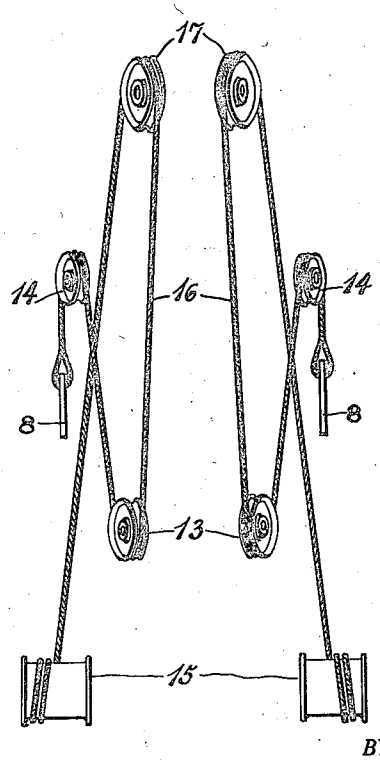


Fig. 2.



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UNITED STATES PATENT OFFICE.

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ROPE-THRUSTING SHOVEL.

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The invention relates to rope-thrusting shovels, more particularly of the type in which the hoisting rope passes first from a winch to a sheave at the outer point of the boom, thence to a hoisting association with the dipper, and thence directly to a thrusting association with the dipper; and still more particularly to the type in which this thrusting association consists in the passage of the hoist-rope over a sheave on the rear end of the dipper-handle, rather than in the anchorage of the hoist-rope to a drum keyed to the same shaft which bears pinions in operative engagement with racks on the dipper-handle. Figure 1 of U. S. Patent No. 1,564,791 illustrates such a device as I have just described.

I shall employ the term, "rope-thrusting shovel," to designate that power shovel mechanism whereby the thrusting is accomplished by the tension in the hoist-rope acting upon the dipper handle; and the term, "rackless rope-thrust," to designate a rope-thrust in which the tension in the hoist-rope acts upon the dipper handle through a direct association therewith, rather than through a drum, a shaft, a pinion or pinions, and a rack or racks on the handle. This nomenclature is common to, and well understood by, the power shovel trade.

The chief advantage of this type of reeving, in combination with this type of thrusting association, as shown in said patent, is that no part of the rope ever bends in more than one direction. A corresponding disadvantage of the type shown in said patent is that the elimination of the above mentioned racks and pinions eliminates the possibility of securing a bracing effect in digging by utilizing wide-spread dipper handles, straddling the boom. This bracing effect is similar to that resulting from the customary wide-spread placing of the feet of a man engaged in digging with a hand-shovel.

It should be noted that said patent shows interchangeably a split handle and a single handle passing through an opening in a split boom, there being no object in using a divided handle in the device of that patent, in view of the lost advantage above referred to.

The principal object of my invention is to attain all the advantages above enumerated for the combination of reeving and thrusting means above described, and at the same time attain the advantage of a braced, divided dipper-handle, this latter advantage being obtained in my invention by the addition of racks on the two parts of the dipper-handle and by the further addition of a shaft carrying two pinions in engagement with such racks.

In my invention I not only adopt a divided handle, but also I employ a pair of hoist-ropes, one passing each side of the boom, and thereby attain a further advantage and object, by adding to the bracing effect of the divided dipper-handle the steadying effect of two points of hoist-connection with the dipper.

A still further object of my invention is to divide the strain between two reaches of rope without thereby reducing the hoist-speed, as would be the case if these two reaches were two parts of one continuous rope as illustrated by Figures 3 and 4 of said patent.

In the description which follows, other objects and advantages will be disclosed and exemplified so as to be evident to one skilled in the art.

The invention consists in the novel parts and in the combinations and arrangements defined in the appendant claims, and of which one embodiment is exemplified in the accompanying drawings, which are hereinafter described and explained.

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

Well-known details of structure, and other well-known parts of an excavating shovel, since they form no part of this invention, have been everywhere omitted, wherever such omission will conduce to clearness.

Figure 1 shows the side view of a rope-thrusting shovel constructed in accordance with my invention.

Figure 2 shows diagrammatically a front view of the reeving of the twin hoist-ropes of my invention. This figure is more or less distorted, as will be later explained, for the purpose of exposing all the reaches of rope to view.

Referring more particularly to the drawings, it will be seen that 1 represents the revolving frame of a power shovel, at a point 2

of which is pivoted the foot of a boom 3. The revolving frame 1 carries an A-frame 4, from the top of which extends a rod 5, or other appropriate supporting means, to the outer end of the boom 3.

Mounted on the boom 3, by means of a bracket 6, is a transverse shaft 7, carrying on its outer ends two anchorages 8, and intermediate thereof two pinions 9 keyed to the shaft. Each of these pinions engages a rack 10 on the under side of one of the parallel parts of a dipper-handle 11, which straddle the boom 3. On the outer end of this handle is secured a digging dipper 12, which carries two hoist-sheaves 13. On the rear end of each part of the handle 11 is mounted a sheave 14.

In speaking, either in the specification or in the claims, of sheaves 13 as attached to the dipper or the rope 16 as connected to the dipper, it is to be understood that exactly the same result would be attained were these sheaves to be attached to the handle adjacent the dipper; and accordingly the word "dipper", whenever used in this connection, is to be taken and construed to mean "the dipper, or the handle adjacent to the dipper."

On the revolving frame 1 is mounted a winch drum (or two drums operating in unison) 15, actuated by any convenient means not shown. Only one of the hoist-ropes 16 will be described, as these are identically reeved. This rope passes from one of the drums 15 over a sheave 17 on one side of the outer end of the boom, thence downward and around the sheave 13 on the dipper 12, thence rearwardly around the sheave 14 on the rear end of the dipper handle 11, and thence to the anchorage 8 on the shaft 7.

From a second drum (or pair of drums), 18, mounted on the revolving frame 1, there pass twin retracting ropes 19 over twin sheaves 20 on the side of the boom 3, to points of anchorage 21 on the dipper 12 or on the dipper handle adjacent thereto.

Referring now more particularly to Figure 2, it should be mentioned that sheaves 13 and 14 and anchorage 8 will, in practice, probably each be spaced from its mate by practically the same distance as the other, whereas sheaves 17 will probably be spaced more closely together than the others. This will necessitate canting sheaves 17 slightly, as is exaggeratedly shown in Figure 2, whereas sheaves 13 and 14 will be parallel, the canting of these shown in Figure 2 being merely for the purpose of preventing the overlapping of the ropes in the diagram.

From the foregoing description, it is evident that, if rope 19 be held, and rope 16 be paid out or hauled in, the dipper 12 will be respectively lowered or raised, without any thrusting motion of the dipper handle 11. If, on the other hand, rope 16 be held, and rope 19 be paid out, then the weight of the dipper and contents, by applying a tension to rope 16, will cause the dipper-handle to thrust out, with some resulting lowering of the dipper. The hauling-in of rope 19 will effect retracting and some resulting raising of the dipper. By a proper combination of the motions of these two ropes, any desired motions of the dipper can be accomplished. It should be noted that, when the dipper is hooked into the bank during digging, the downward pressure of the bank on the dipper, due to the upward pull on the dipper, increases the tension in the rope 16, and results in a more powerful outward thrust than is obtained ordinarily by the mere weight of the dipper and contents.

Inasmuch as both of the pinions 9 are keyed to the same shaft 7, and as each pinion engages one of the racks 10, there results a bracing of the dipper-handle, which prevents sideward movement of the dipper, by requiring that both parts of the dipper-handle move in unison. This not only gives a better braced effect in digging, but also prevents the prying apart of the dipper-handle and its binding on the boom. This bracing effect I shall designate in the claims by the words "steadying the dipper-handle."

The employment of twin hoist-ropes 16 and twin sheaves 13 on the dipper, prevents the dipper from twisting on the end of the dipper-handle during digging.

Although the application of my invention to only one type of shovel has been illustrated, it must be understood that the details of my invention have considerably wider application. Accordingly I do not intend to be limited to the exemplification shown, but expect protection coextensive with the scope of my claims.

I claim:

1. In a power shovel, the combination of: twin pinions, rotatable only in unison; a dipper-handle carrying two racks, each rack engaging one of said pinions; a digging dipper, carried by said handle; means for hoisting and lowering said dipper, and for effecting a shifting movement of said handle in one direction only without operating through said racks and pinions; and means to control said shifting movement and to shift said handle in the other direction; said two pinions and said two racks being each pair sufficiently spaced apart laterally as to brace the dipper against lateral movement.

2. In a power shovel, including a winch, a boom, and a dipper and dipper-handle mounted on said boom, for reciprocation and vertical swinging, the combination of: a rackless rope-thrust; two racks on the dipper-handle; two pinions on the boom, meshing with said racks; and twin hoist-ropes, passing from the winch over sheaves on the boom, to asociations with the dipper and handle, to steady the dipper; said two pinions and said

two racks being each pair sufficiently spaced apart laterally as to brace the dipper against lateral movement.

3. In a power shovel, including a winch, a boom, and a dipper and dipper-handle mounted on said boom, for reciprocation and vertical swinging, the combination of: a rackless rope-thrust; two racks on the dipper-handle; and two pinions on the boom, meshing with said racks; said two pinions and said two racks being each pair sufficiently spaced apart laterally as to brace the dipper against lateral movement.

4. In a power shovel, having a boom and a divided dipper-handle straddling the boom, for swinging in a vertical plane and for reciprocation with respect to the boom, the combination of: means for utilizing the tension in the hoist-rope to effect thrusting; and means, independent of said first-mentioned means, for steadying the handle against lateral movement.

5. In a power shovel, having a boom and a divided dipper-handle straddling the boom, for swinging in a vertical plane and for reciprocation with respect to the boom, the combination of: means for thrusting the dipper into the work; and means, independent of said first-mentioned means, for bracing and steadying the handle against lateral movement.

6. In a power shovel, the combination of: a supporting boom; a transverse shaft on said boom; pinions secured to said shaft to rotate therewith; a divided dipper-handle; each branch of said handle carrying a rack engaging one of said pinions; a digging dipper, carried by said handle; twin sheaves at the outer end of said boom; twin sheaves on the dipper; twin sheaves on the rear end of the dipper-handle; twin winch-drums on the shovel; twin ropes, pasing from the drums around the sheaves in the order named, to twin anchorages on the boom, whereby the tension in said ropes produces an outward bias on the dipper-handle; and means for opposing and controlling said bias.

7. In a power shovel, the combination of: a supporting boom; twin pinions on said boom, rotatable only in unison; a divided dipper-handle; each branch of said handle carrying a rack engaging one of said pinions; a digging dipper, carried by said handle; means, including a line of cable, for hoisting and lowering said dipper, and for effecting an outward-shifting movement of said handle without operating through said racks and pinions; and means opposing the shifting action of said hoisting cable, to control said shifting movement and to shift said handle inwardly.

8. In a power shovel, the combination of: a supporting boom; a transverse shaft on said boom; pinions secured to said shaft to rotate therewith; a divided dipper-handle, straddling the boom; each branch of said handle carrying a rack engaging one of said pinions; a digging dipper, carried by said handle; twin sheaves at the outer end of said boom; twin sheaves on the dipper; twin sheaves on the rear end of the dipper-handle; twin winch-drums on the shovel; twin ropes, passing from the drums around the sheaves in the order named, to twin anchorages on the boom, whereby the tension in said ropes produces an outward bias on the dipper-handle; and means for opposing and controlling said bias.

9. In a power shovel, the combination of: a supporting boom; twin pinions on said boom, rotatable only in unison; a divided dipper-handle, straddling the boom; each branch of said handle carrying a rack engaging one of said pinions, a digging dipper, carried by said handle; means, including a line of cable, for hoisting and lowering said dipper, and for effecting an outward-shifting movement of said handle without operating through said racks and pinions; and means opposing the shifting action of said hoisting cable, to control said shifting movement and to shift said handle inwardly.

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