Nov. 4, 1930. M. L. FYKSE 1,780,351

ROPE THRUSTING SHOVEL WITH DIFFERENTIAL THRUST

Filed July 14, 1928 2 Sheets-Sheet 1

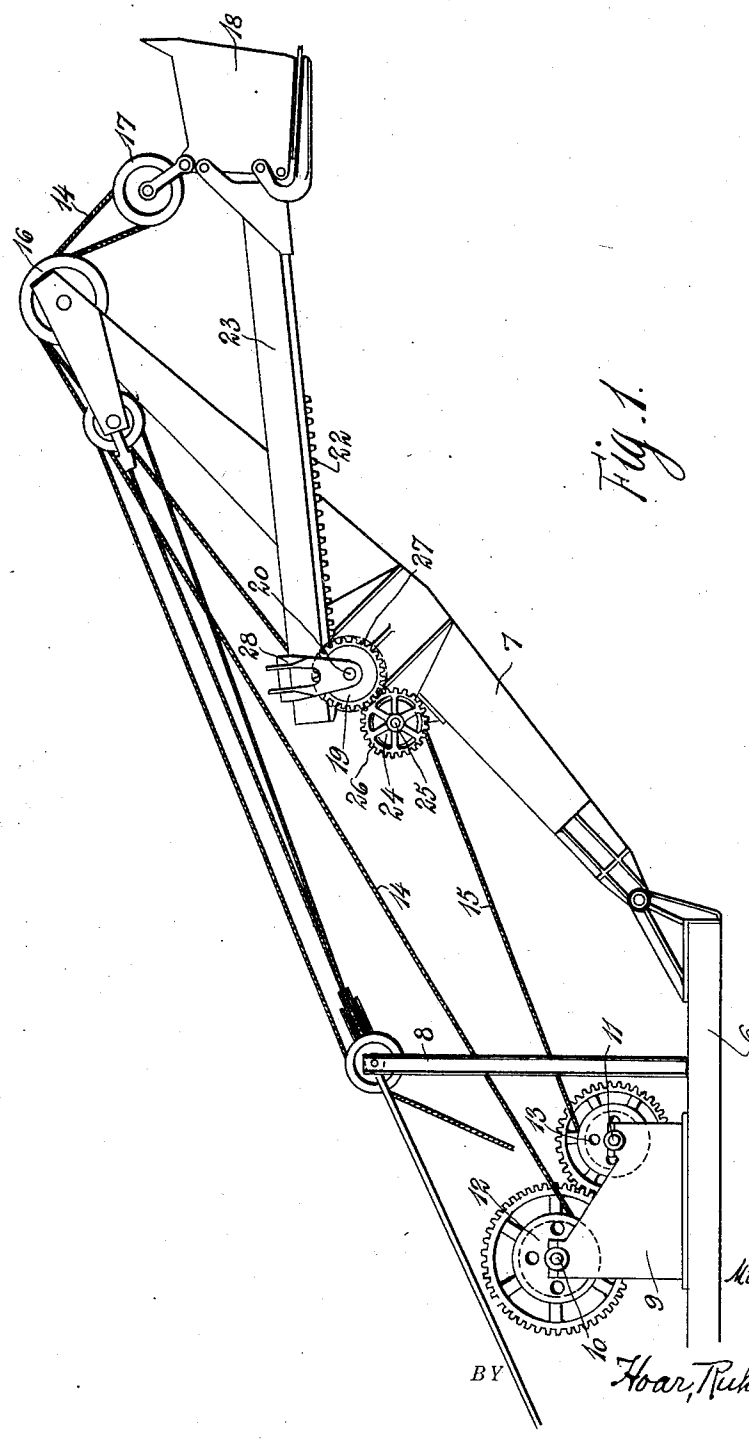


Fig. 1.

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ROPE THRUSTING SHOVEL WITH DIFFERENTIAL THRUST

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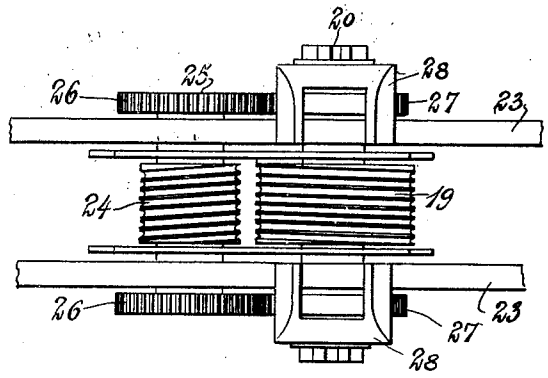


Fig. 2

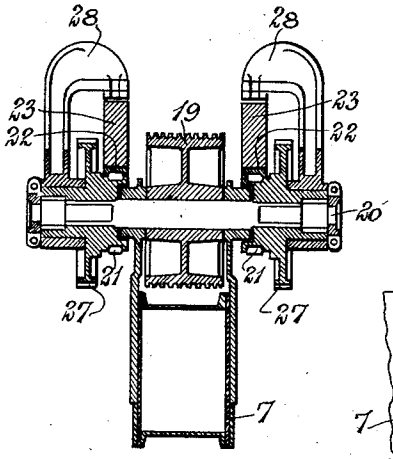


Fig. 4

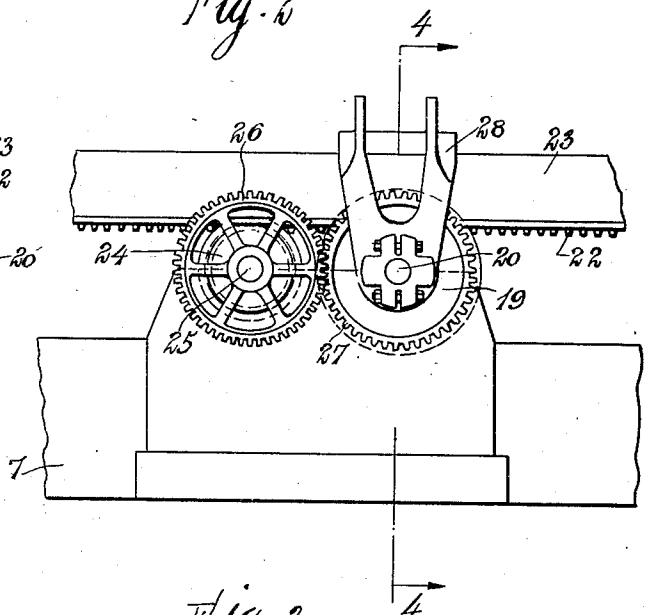


Fig 3.

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UNITED STATES PATENT OFFICE

MITCHELL L. FYKSE, OF SOUTH MILWAUKEE, WISCONSIN

ROPE-THRUSTING SHOVEL WITH DIFFERENTIAL THRUST

Application filed July 14, 1928. Serial No. 292,779.

My invention relates to new and useful improvements in rope thrusting shovels with differential thrust.

Steam-shovels are well known in the excavating art. They have a boom, with a dipper and dipper handle mounted thereon for motion with respect to a fixed pivot, located about half way up the boom, known as the "shipper-shaft." A hoist-rope passing from the dipper, over a sheave at the outer point of the boom, to a winch on the main frame of the excavator, serves to move the dipper in a circular arc about the shipper-shaft, this motion being known as "hoisting". A boom-engine serves to reciprocate the handle, thus moving the dipper radially with respect to the shipper-shaft, this motion being known as "thrusting". All the digging operations are performed by a proper combination of hoisting and thrusting at the will of the operator.

With the advent of gasoline and Diesel power in the field of excavation, a gasoline or Diesel boom-engine was found to be impractical and this situation finally resulted in the development of "rope-thrusting" shovels, now well-known in the art. A rope-thrusting shovel is one which has no boom-engine, but rather accomplishes thrusting by means of the tension in the hoist-rope, which tension is due to the weight of the dipper-handle, dipper and contents, plus the resistance of the bank during digging.

In one type of rope-thrusting shovel the hoist-rope passes from a winch on the main frame of the machine, over a sheave at the point of the boom, thence under a sheave on the dipper, thence back over a sheave at the point of the boom, thence to an anchorage on a drum on the shipper-shaft. This drum is known as the shipper-shaft drum. Thus the tension in the hoist-rope tends to rotate this drum. This tendency is controlled, and may be reversed, by another rope running direct from the winch to the shipper-shaft drum, and known as the retracting rope. Keyed to the same shaft as the shipper-shaft drum are pinions, engaging racks on the dipper-handle, so that the rotation of the shipper-shaft drum effects reciprocation of the dipper-handle.

Rope-thrusts have been found in practice to be much superior to the expedient of conveying power up the boom from the main engine to the shipper-shaft, by sprocket chain, ropes, or shafting.

However, it has been found that when the dipper is thrust way out, especially in the case of excavators with extra-long dipper handles, the tension in the hoist rope is not alone sufficient to give as powerful a thrust as may be desired, especially when digging in frozen ground. And the situation is no better, in the machines which convey the power up the boom, as already mentioned.

Accordingly it has been proposed to employ a spiral shipper-shaft drum, so that, when the dipper is thrust way out, the ropes will lie on grooves of large diameter and hence impart a more powerful thrust in this position. But this has the advantage that the retraction in this position will be slow. Also this arrangement does not give the powerful thrust necessary when digging in frozen ground close in under the foot of the boom.

My invention obviates this disadvantage by employing a large diameter shipper-shaft drum for the thrusting, and a small-diameter shipper-shaft drum for the retraction, thus securing a powerful thrust and a speedy retraction, in all positions of the dipper.

And by placing the two drums on separate, although cooperating shafts, I secure plenty of room for winding my ropes, without thereby unduly widening or weakening my boom.

These are the principal objects of my invention.

Further objects and advantages of my invention will be readily evident, as the description progresses.

The invention consists in the novel parts, and in the combinations and arrangements 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 refer-

ence number is applied to the same member or to similar members.

Figure 1 is a side elevation of a power shovel embodying my invention.

Figure 2 is a plan view of the drums and associated machinery, mounted on the boom.

Figure 3 is a side elevation of the parts shown in Figure 2.

Figure 4 is a section along the line marked 4—4 in Figure 3.

Referring to the drawings, it will be seen that 6 is the main base of the power shovel, supporting the boom 7, A-frame 8 and main winch 9.

The main winch 9 includes two constantly rotating shafts 10 and 11, rotated by any convenient power source (not shown).

On shaft 10 is drum 12, provided with a brake (not shown) and a clutch (not shown) whereby to clutch it to the constantly rotating shaft 10.

On shaft 11 is drum 13 with its brake (not shown) and clutch (not shown).

Drums 12 and 13 serve to haul in on ropes 14 and 15 respectively.

By means of the clutches and brakes on drums 12 and 13 either of the two ropes 14 and 15 can be paid out, held or pulled in at the will of the operator.

Rope 14 is the hoist rope. It passes from the drum 12 over one of two sheaves 16 at the outer end of the boom 7, around a sheave 17 attached to the dipper 18, back around the other sheave 16 to an anchorage on drum 19 keyed to shipper shaft 20.

Also keyed to this shipper shaft are two pinions 21 which engage two racks 22, each of which is mounted on the underside of one of the twin dipper handles 23.

It will thus be seen that the tension in the hoist rope 14 tends to rotate the drum 19, and hence the shipper shaft 20, and hence the pinions 21, all in a clockwise direction as shown in Figures 1 and 3, and thus tends to thrust the dipper and handle outwardly, i. e. to the right in those two figures.

This tendency is restrained by the rope 15, which is wound on the drum 24. Drum 24 is keyed to shaft 25. Keyed to this same shaft are two gears 26, which engage corresponding gears 27, keyed to the shipper shaft 20. Rope 15 is wound on drum 24 in the same direction that rope 14 is wound on drum 19, so that a pull on rope 15 will tend to counteract and overcome the tension in rope 14. Drum 24 has a smaller effective diameter than drum 19, which may be accomplished either by having the actual diameter of drum 24 smaller than that of drum 19, as shown, or by establishing proper gear-ratios.

Accordingly when the rope 15 is paid out, and rope 14 is held, the tension in rope 14 is thereby permitted to effect thrusting out of the dipper; whereas, when the rope 15 is hauled in, this results in retracting the dipper. If rope 15 be held, the hauling in of rope 14 effects hoisting, and the paying out of rope 14 effects lowering of the dipper.

The thrusting tendency of the tension in the hoist rope 14 is sufficient to thrust out the dipper with sufficient force in all positions of the dipper, due to the large size of drum 19.

The dipper handles 23 are held with their racks 22 in engagement with pinions 21, by means of saddle blocks 28.

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 in so far as such limitations are specified in the appended claims.

I claim:

1. In a power shovel, including a boom, and a dipper and dipper handle mounted thereon for reciprocation and swinging with respect thereto, the combination of: racks on said handle to effect reciprocation; pinions mounted on said boom and engaging said racks; two drums on the boom to rotate with said pinions; a hoist rope to swing said dipper, and wound upon only one of said drums, in such a way that the tension in the hoist rope exerts a constant tendency to thrust said dipper outwardly; and a retracting rope wound upon only the other of said drums, thereby being available at will to resist and control said tendency; said second drum being of an effective diameter less than that of said first drum.

2. In a power shovel, including a boom, and a dipper and dipper handle mounted thereon for reciprocation and swinging with respect thereto, the combination of: racks on said handle to effect reciprocation; pinions mounted on said boom and engaging said racks; two drums on the boom to rotate with said pinions; a hoist rope to swing said dipper, and wound upon only one of said drums, in such a way that the tension in the hoist rope exerts a constant tendency to thrust said dipper outwardly; and a retracting rope wound upon only the other of said drums, thereby being available at will to resist and control said tendency; said two drums being arranged in tandem on separate shafts geared together.

3. In a power shovel, including a boom, and a dipper and dipper handle mounted thereon for reciprocation and swinging with respect thereto, the combination of: racks on said handle to effect reciprocation; pinions mounted on said boom and engaging said racks; two drums on the boom to rotate with said pinions; a hoist rope to swing said dipper, and wound upon only one of said drums, in such a way that the tension in the hoist rope exerts a constant tendency to thrust said dipper outwardly; and a retracting rope wound upon only the other of said drums,

thereby being available at will to resist and control said tendency; said second drum being of an effective diameter less than that of said first drum; said two drums being arranged in tandem on separate shafts geared together.

4. In a rack-and-pinion rope thrusting shovel: the utilization of two shipper-shaft drums of different effective diameter, arranged in tandem on two separate shafts, geared together, in place of the conventional single drum.

5. In a rack-and-pinion rope thrusting shovel: the utilization of two shipper-shaft drums of different effective diameter, in place of the conventional single drum; the drum associated with the hoist rope having a larger effective diameter than that of the drum associated with the retracting rope.

6. In a rack-and-pinion rope thrusting shovel: the utilization of two shipper-shaft drums of different effective diameter, in place of the conventional single drum; the drum associated with the hoist rope having a larger effective diameter than that of the drum associated with the retracting rope; the two drums being arranged in tandem on two separate shafts geared together.

In testimony whereof I affix my signature.

MITCHELL L. FYKSE.