Dec. 17, 1935. L. WHITE 2,024,557

EXCAVATING MACHINERY

Filed April 3, 1934 2 Sheets-Sheet 1

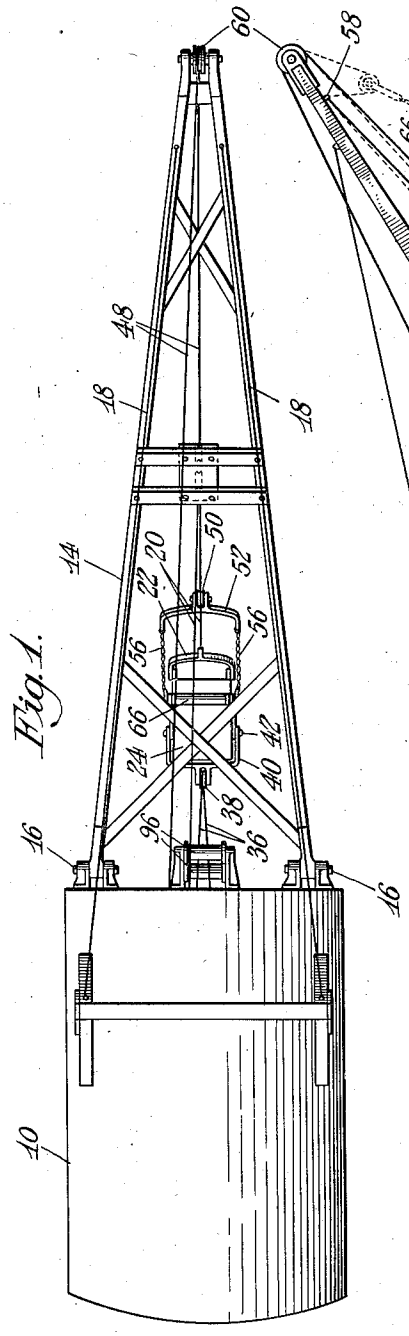

Fig. 1.

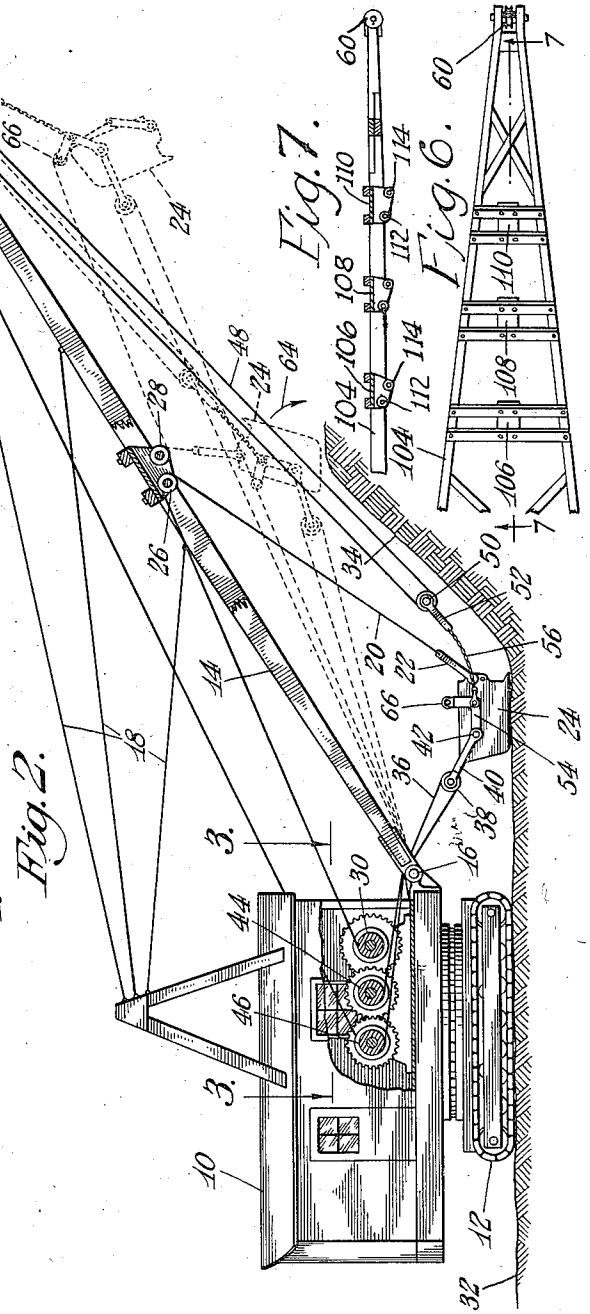

Fig. 2.

Fig. 7.

Fig. 6.

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Fig. 3.

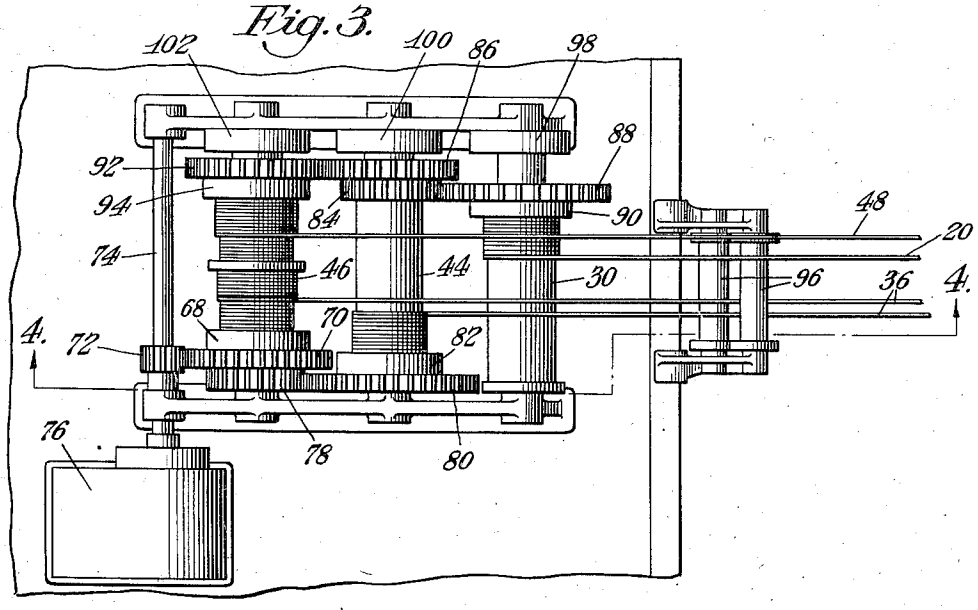


Fig. 4.

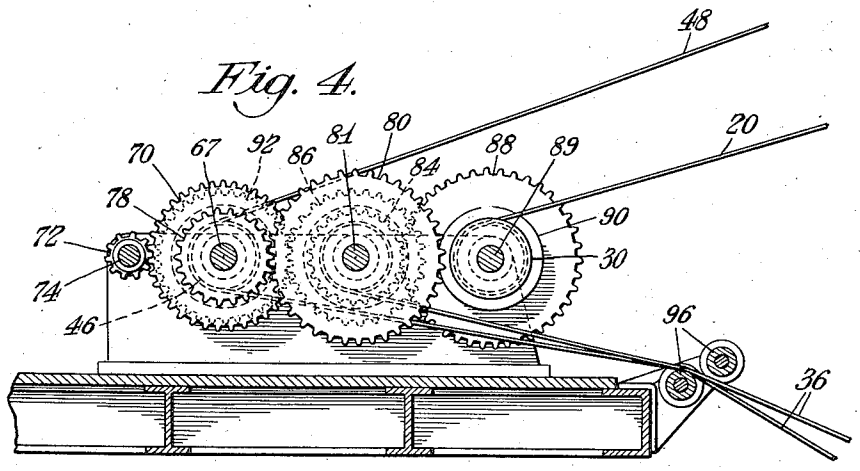
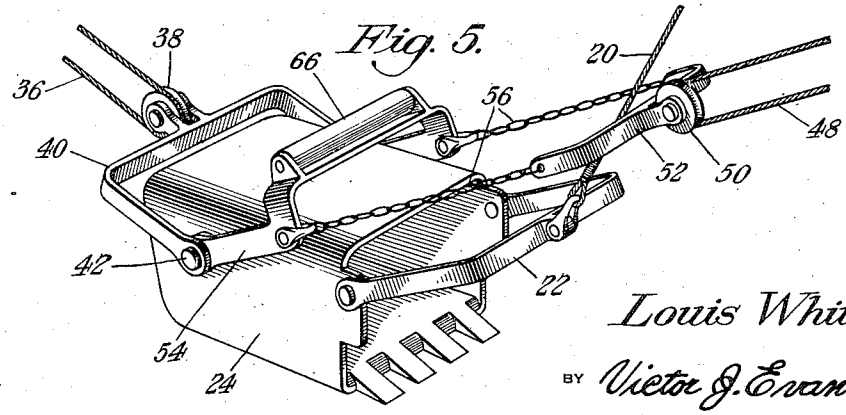


Fig. 5.



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UNITED STATES PATENT OFFICE

2,024,557

EXCAVATING MACHINERY

Louis White, Wilmington, Ill.

Application April 3, 1934, Serial No. 718,837

3 Claims. (Cl. 37—116)

My invention relates to excavating machinery, and has among its objects and advantages the provision of an improved boom construction in combination with a novel arrangement of hoist, loading and drag lines.

The invention embodies means whereby a boom of relatively long reach may be employed in connection with the hoist line and an arrangement in which the pull transmitted to the boom during the loading of a bucket is applied to the boom remote from its outer end.

A further object is to provide a machine in which the dipper may be effectively controlled for loading purposes without the use of the usual dipper sticks, and in which the necessity for boom-mounted motors is entirely eliminated.

Another object is to provide an arrangement in which an unlimited amount of power may be utilized for loading purposes in connection with a boom of relatively long reach.

A further object is to provide an excavating machine in which the bucket is loaded by an upward and outward movement with respect to the boom, and in which I attain the long spoiling range characterizing drag line devices.

This invention also consists in certain other features of construction and in the combination and arrangement of the several parts, to be hereinafter fully described, illustrated in the accompanying drawings and specifically pointed out in the appended claims.

In describing my invention in detail, reference will be had to the accompanying drawings wherein like characters denote like or corresponding parts throughout the several views, and in which:

Fig. 1 is a top plan view of the invention;

Fig. 2 is a side elevation;

Fig. 3 is a top plan view of a part of the power mechanism;

Fig. 4 is a sectional elevation taken along the line 4—4 of Fig. 3;

Fig. 5 is a perspective view of the bucket illustrating its bails in conjunction with the drag, hoist and loading lines;

Fig. 6 is a diagrammatic view of a boom embodying a plurality of load line sheaves; and

Fig. 7 is a sectional view along the line 7—7 of Fig. 6.

In the embodiment selected to illustrate my invention, I make use of a power plant 10 mounted for rotary movement upon a supporting truck in the usual way. This truck comprises in part caterpillar threads 12. One end of a boom 14 is pivotally connected at 16 with the power plant. This boom may be moved for changing its angularity with respect to the horizontal through the medium of supporting cables 18.

In strip mining it is desirable to provide a boom having a relatively long reach so that a large spoiling range may be attained. Heretofore the pull exerted on the boom during the loading of the dipper has been applied to the outer end of the boom, with the result that the effective leverage tending to tilt the power plant would materially limit the length of the boom. Then, too, conventional excavating machines embody boom-mounted motors which increase in a large measure the effective load, in addition to requiring a boom structure of heavy design. The conventional dipper sticks add to the load. All these features combined make it impossible to design a boom embodying the necessary strength in combination with a relatively long reach such as that characterizing the present invention. If the boom is designed to provide the necessary strength, it becomes too heavy; and if it is designed within certain limits as to weight, it lacks the necessary strength.

In the instant case the bucket is loaded by an upward and outward movement with respect to the boom through the medium of a load line 20 connected with the bail 22 associated with a bucket 24. I arrange the line 20 to pass over a supporting sheave 26 and in operative relation with a guide sheave 28 arranged to hold the line out of contact with the frame structure of the boom when the dipper is moved outwardly along the boom. The supporting sheave 26 is positioned at a considerable distance inwardly of the boom. This line is connected with an operating drum 30.

In Fig. 2 I illustrate the machine as moving over the excavated surface 32 and operating against the bank 34 comprising material to be moved. Additional control for the bucket 24 comprises a drag line 36 connected with the bucket through the medium of a sheave 38 carried by a bail 40 pivotally connected with the bucket at 42. One end of the drag line is connected with a drum 44, and the other end is connected with a drum 46.

The hoist line 48 passes around a sheave 50 carried by a bail 52 attached to the bail part 54 through the medium of chains 56. This bail is pivotally connected with the bucket at 42. One end of the hoist line is connected with the outer end of the boom 14, as at 58, and passes over a sheave 60 for connection with the drum 46.

Referring to Fig. 3, it will be noted that the drum 46 is provided with a flange 62 arranged to separate the convolutions of the hoist line 48 from the convolutions of the drag line 36.

In operation, the power plant is maintained at a proper operating distance from the bank 34. The bucket is loaded by giving the drag line 36 the necessary slack and positioning the bucket at the bottom of the bank 34. At this time the loading line 20 is shortened through the medium of the drum 30 for pulling the open end of the bucket into the bank 34 upwardly and outwardly with respect to the outer end of the boom 14. The pull transmitted to the boom 14 during the loading of the bucket is determined by the position of the pulleys 26 and 28. In placing the pulleys close to the power plant with respect to the outer end of the boom 14, I shorten the lever tending to tilt the power plant.

The arrangement further permits the entire length of the loading cable 20 between the bail 22 and the pulley 26 to assume a position substantially paralleling the face of the bank 34. Thus, the boom 14 may extend a considerable distance beyond the top of relatively high banks without interfering with the efficient operation of the bucket. A slight tension may be placed in the hoist line 48 during the loading period to control the angularity of the dipper 24. Thus I attain an effective control of the dipper without the use of dipper sticks and boom-mounted motors.

After the bucket 24 has been loaded, it is moved through the medium of the hoist cable 48 and dumped. The pivotal connections 42 are positioned in such a manner that the loaded bucket tends to tip in the direction of the arrow 64 when the load line 20 is slackened. However, a slight tension is maintained on the load line during the shifting of the bucket to the end of the boom so that the bucket will carry in its upright position. After the bucket has been shifted to the end of the boom 14, it is emptied by slackening the line 20, at which time the bail 22 swings back over the top of the bucket with the load line 20 passing over a roller 66 carried by the bail 54.

In Figs. 3 and 4, I have indicated the transmission machinery for operating the drums 30, 44 and 46. The drum 46 is carried by a shaft 67 and is provided with a conventional clutch 68 and a large gear 70 connected with the shaft and arranged in mesh with a gear 72 connected with a shaft 74 driven by a reversible motor 76. A gear 78 associated with the gear 70 is arranged in mesh with a large gear 80 connected with a shaft 81 and associated with a conventional clutch 82 for operating the drum 44. The shaft 81 is provided with a gear 84 upon its opposite end in association with a larger gear 86. The gear 84 is arranged in mesh with a gear 88 connected with a shaft 89 for operating the drum 30. A conventional clutch 90 is associated with the gear 88 and the drum 30.

I illustrate a gear 92 upon the opposite end of the shaft 67 in connection with a second clutch 94 for operating the drum 46 when the clutch 68 is inoperative. The meshing gears 86 and 92 are of different ratios than the gears 80 and 78 so that the drum 46 may be operated at two different speeds, depending upon which clutch is used.

My arrangement is such that the drums 30 and 46 wind up the load line 20 and the hoist line 48 at the same speed that the drum 46 unwinds the drag cable 36. During the loading period the drum 44 is braked against rotation but may be operated to tighten the drag line. This feature provides additional control for the dipper in that it may be pulled away from the bank 34, to permit swinging of the boom, should the dipper become loaded before it has moved to the top of the bank. However, the drum 44 may be operated in either direction when the drums 30 and 46 are inactive. Similarly, the drums 30 and 46 may be individually operated in the same way as the drum 44.

I provide rollers 96 for protecting the drag line 36 from being damaged by contact with the frame structure of the power plant.

Suitable brakes 98, 100 and 102 may be associated with the drums 30, 44 and 46, respectively.

The sheaves 38 and 50 may be of the padlock type to prevent the lines 36 and 50 from falling off their respective sheaves during operation of the machinery.

Fig. 6 illustrates a boom 104 having a series of sheave units 106, 108, and 110 each including sheaves 112 and 114 corresponding to the sheaves 26 and 28, respectively, in Fig. 2, to provide sheave mountings positioned at different points along the boom with respect to the power plant. Such a construction provides a large range of adjustment which may easily be made by merely associating the loading line with the desired series.

Without further elaboration, the foregoing will so fully explain my invention that others may, by applying current knowledge, readily adapt the same for use under various conditions of service.

I claim:

1. An excavating device comprising a boom having an end movably connected with a supporting structure, a bucket, a load line connected with the loading end of the bucket, a rotatable member carried by the boom and positioned intermediate its ends for supporting the load line, the bucket being loaded by a movement outwardly of the boom, a hoist line connected with the bucket, a rotatable member carried by the boom at its free end for supporting the hoist line, and power means for operating said load and hoist lines.

2. An excavating device comprising a boom having an end movably connected with a supporting structure, a bucket, a load line connected with the loading end of the bucket, a rotatable member carried by the boom and positioned intermediate its ends for supporting the load line, the bucket being loaded by a movement outwardly of the boom, a hoist line connected with the bucket, a rotatable member carried by the boom at its free end for supporting the hoist line, power means for operating said load and hoist lines, a drag line connected with said bucket for moving the same inwardly of the boom, and power means for operating the drag line.

3. An excavating device comprising a boom having an end movably connected with a supporting structure, a bucket, a load line connected with the loading end of the bucket, a plurality of rotatable members carried by the boom and positioned intermediate its ends for individually supporting the load line at different points along the boom, the bucket being loaded by a movement outwardly of the boom, a hoist line connected with the bucket, a rotatable member carried by the boom at its free end for supporting the hoist line, and power means for operating said load and hoist lines.

LOUIS WHITE.