March 10, 1936. T. DAVIDSON ET AL 2,033,883

COUNTERWEIGHT FOR EXCAVATORS

Filed Aug. 19, 1935 2 Sheets-Sheet 1

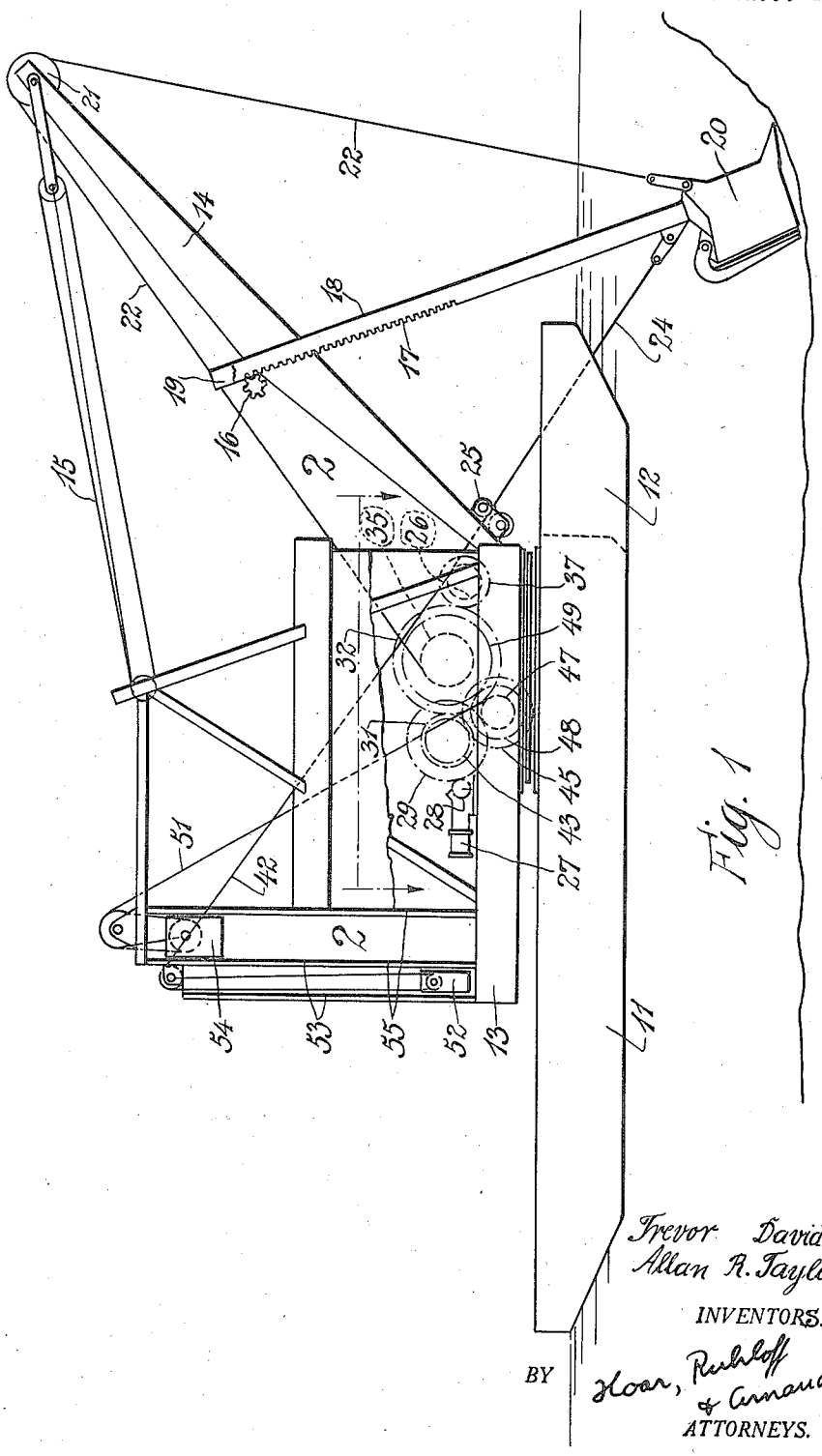


Fig. 1

Trevor Davidson
Allan R. Taylor
INVENTORS.

BY Hoar, Ruhloff & Arnaud
ATTORNEYS.

March 10, 1936. T. DAVIDSON ET AL 2,033,883

COUNTERWEIGHT FOR EXCAVATORS

Filed Aug. 19, 1935 2 Sheets-Sheet 2

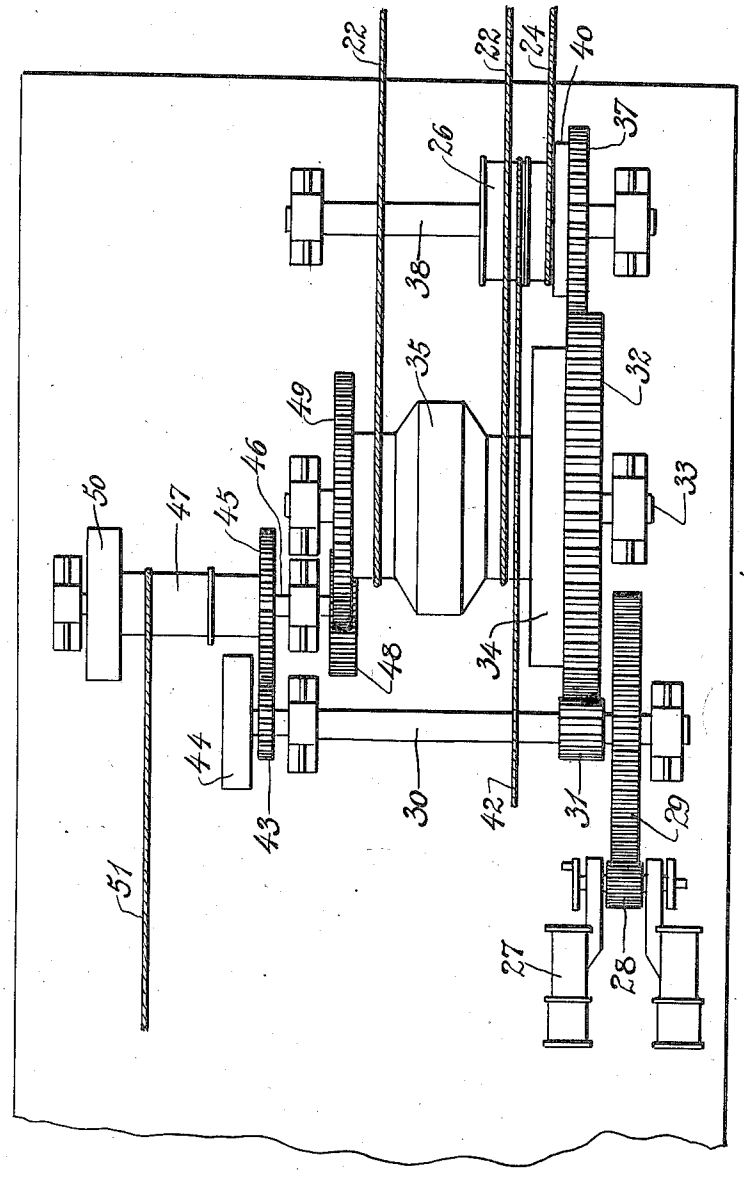


Fig. 2.

Trevor Davidson.
Allan R. Taylor.
INVENTORS.

BY Hoar, Rublaff & Gerard
ATTORNEYS.

Patented Mar. 10, 1936 2,033,883

UNITED STATES PATENT OFFICE

2,033,883

COUNTERWEIGHT FOR EXCAVATORS

Trevor Davidson and Allan R. Taylor, Milwaukee, Wis., assignors to Bucyrus-Erie Company, South Milwaukee, Wis., a corporation of Delaware

Application August 19, 1935, Serial No. 36,802

7 Claims. (Cl. 214—135)

Our invention relates to new and useful improvements in counterweights for excavators, and more particularly to excavators of the type having a boom and an outward digging dipper mounted on the end of a handle, which handle is reciprocable with respect to a point on the boom known as the shipper shaft, the dipper being movable in a circle about this point as a center.

It is old in the art, with respect to such an excavator, to provide a vertically movable counterweight attached to a rope, which in turn is so attached to the main hoist-winch as to bias this winch to rotate in a direction tending to hoist the dipper.

In the past, however, this arrangement has been confronted with a dilemma, namely as follows. If the weight of the counterweight approached too closely to that of the empty dipper and one-half the handle, the dipper would descend too slowly when lowered. If, on the other hand, the weight of the counterweight did not closely approach that of the empty dipper and one-half the handle, the counterweighting effect would thereby be reduced. And, if we chose an intermediate compromise, both of these mentioned disadvantages would be encountered.

A solution of this difficulty was made by Joseph Penglase, in his copending application Serial No. 712,827. By providing a reversible engine for the winch, he was enabled to more than counterbalance the weight of the empty dipper and one-half the handle, and yet by running the winch forcibly in the reverse direction was able to lower his dipper with as high a rate of speed as though he had no counterweight. Thus he obtained the maximum counterweighting advantage, with no sacrifice in cycle-speed whatever, an advantage not obtainable by the non-reversing winch-engines of the prior art.

It is the principal object of our present invention to attain the same advantages accomplished by Mr. Penglase, without departing from the prior-art practice of having a non-reversing engine.

It is a further object of our invention to attain these advantages with that type of a dipper-dredge which has a so-called backing-line.

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

Our 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 reference number is applied to the same member or to similar members.

Figure 1 is a side elevation of a dipper dredge embodying our invention.

Figure 2 is an enlarged plan view of the winch-mechanism of our invention.

Referring to the drawings, it will be seen that 11 is a floating hull having a slotted portion 12. Mounted on this hull is a main machinery frame 13, which may or may not be built revolvable as shown, in any conventional manner. This frame carries the conventional boom 14, held in an inclined position by suspension-tackle 15.

About half way up the boom there is a pair of pinions 16 actuated by any convenient and conventional machinery (not shown). These pinions engage two racks 17 on the bottom edges of a pair of dipper handles 18 and 19. Secured to the lower end of this handle is a conventional out-digging dipper 20. At the upper end, or point, of the boom 14, there is a hoist-sheave, or pair of sheaves, 21. A hoist rope, or pair of ropes, 22 passes from the dipper 20, or the handles adjacent to the dipper, over the hoist sheave or sheaves 21, and thence to the main winch-drum 23. A backing line 24 passes from the rear of the dipper 20, or from the handles adjacent thereto, through the slotted portion 12 of the hull 11, and thence through a fairlead 25 to an auxiliary winch-drum 26.

A non-reversing engine 27 rotates a pinion 28, which engages a gear 29 on a shaft 30. This gear 29 and shaft 30 rotate to the left in Figure 2, counterclockwise in Figure 1. Keyed to this shaft 30 is a pinion 31 which engages a gear 32 on shaft 33. This gear 32 is clutchable by means of clutch 34 to main winch-drum 35 which carries the twin hoist-ropes 22. When gear 32 is clutched to drum 35, it tends to unwind these ropes.

Gear 32 engages gear 37 on shaft 38. Gear 37 is clutchable to drum 26 by means of clutch 40. Drum 26 is divided into two parts, one of which constitutes an auxiliary winch-drum, and the other of which constitutes an auxiliary counterweight drum. From the auxiliary winch-drum runs the backing-line 24. From the auxiliary counterweight drum runs the auxiliary counterweight line 42.

Reverting to shaft 30, it will be seen that this shaft carries, floating free pinion 43, which is

clutchable to this shaft by means of clutch 44. Pinion 43 engages gear 45, which is keyed to shaft 46 and to main counterweight drum 47. Shaft 46 carries keyed thereto pinion 48, which engages gear 49 keyed to main winch-drum 35.

Shaft 46 also carries brake 50, which thereby serves as a brake to the main winch-drum 35.

When clutch 44 is engaged, main winch-drum 35 is rotated in a direction to haul-in on twin hoist ropes 22.

From main counterweight drum 47 there extends main counterweight line 51.

Auxiliary counterweight line 42 extends to auxiliary counterweight 52, which runs in guides 53. Main counterweight line 51 extends to main counterweight 54, which runs in guides 55.

Thus it will be seen that we have provided a novel and useful main counterweight device for successfully counterweighting the dipper and handle of an excavator, while still employing a non-reversing engine.

In its particular application, however, to a dipper dredge, this counterweighting device, or in fact any counterweighting devices, introduces a complication, which requires the exercise of further invention.

Backing-lines are old in the art, their object being to pull the dipper toward the hull, while it is being lowered to begin a digging stroke. Ordinarily, the winch-engine, during the lowering of the dipper by pure gravity, has nothing to do, and thus may be employed to haul in on the backing-line. But, with the presence of a counterweight device such as ours, the engine is employed in raising the counterweight during the lowering of the dipper, and the engine-speed necessitated by this operation may not be consistent with the engine-speed necessitated by the hauling-in of the backing-line. Accordingly I have provided auxiliary counterweight 52, to assist the engine in hauling-in on the backing-line, in case the engine itself be running too slowly for this purpose.

Having now described and illustrated one form of our invention, we wish it to be understood that our 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.

We claim:

1. In an excavator, having an outwardly digging dipper, mounted on a handle for reciprocation with respect to, and raising and lowering about, a fixed point on an inclined boom, the combination with these conventional features of: a non-reversing winch-engine; two pinions, rotatable thereby; a main winch-drum; two gears, rotatable therewith, one of these gears engaging one of the pinions; an intermediate pinion, engaging the other gear and the other pinion; two clutches, one in each thus-described gear-train; a main counterweight drum, rotatable with the main winch-drum; a brake for the main winch-drum; a hoist-line, extending from the dipper and handle to the main winch-drum; a main counterweight, vertically movable; a line extending from this counterweight to the main counterweight drum; an auxiliary winch-drum; means to couple it to the engine; an auxiliary counterweight drum; a backhaul line, extending from the dipper and handle to the auxiliary winch-drum; an auxiliary counterweight, vertically movable; and a line extending from this counterweight to the auxiliary counterweight drum.

2. In an excavator, having an outwardly digging dipper, mounted on a handle for reciprocation with respect to, and raising and lowering about, a fixed point on an inclined boom, the combination with these conventional features of: a non-reversing winch-engine; a main winch-drum; a direct drive gear-train, and a reversing gear-train, operatively connecting the engine to the main winch-drum; two clutches, one in each gear-train; a main counterweight drum, rotatable with the main winch-drum; a hoist-line, extending from the dipper and handle to the main winch-drum; a main counterweight, vertically movable; a line extending from this counterweight to the main counterweight drum; an auxiliary winch-drum; means to couple it to the engine; an auxiliary counterweight drum; a backhaul line, extending from the dipper and handle to the auxiliary winch-drum; an auxiliary counterweight, vertically movable; and a line extending from this counterweight to the auxiliary counterweight drum.

3. In an excavator, having an outwardly digging dipper, mounted on a handle for reciprocation with respect to, and raising and lowering about, a fixed point on an inclined boom, the combination with these conventional features of: a winch-engine; a main winch-drum, drivable thereby; a main counterweight drum, rotatable with the main winch-drum; a hoist-line, extending from the dipper and handle to the main winch-drum; a main counterweight, vertically movable; a line extending from this counterweight to the main counterweight drum; an auxiliary winch-drum; means to couple it to the engine; an auxiliary counterweight drum; a backhaul line, extending from the dipper and handle to the auxiliary winch-drum; an auxiliary counterweight, vertically movable; and a line extending from this counterweight to the auxiliary counterweight drum.

4. In an excavator, having an outwardly digging dipper, mounted on a handle for reciprocation with respect to, and raising and lowering about, a fixed point on an inclined boom, the combination with these conventional features of: a winch-engine; a main winch-drum, drivable thereby; a hoist-line, extending from the dipper and handle to the main winch-drum; a main counterweight, vertically movable; a line extending from this counterweight to an operative connection with the main winch-drum; an auxiliary winch-drum; means to couple it to the engine; a backhaul line, extending from the dipper and handle to the auxiliary winch-drum; an auxiliary counterweight, vertically movable; and a line extending from this counterweight to an operative connection with the auxiliary winch-drum.

5. In an excavator, having an outwardly digging dipper, mounted on a handle for reciprocation with respect to, and raising and lowering about, a fixed point on an inclined boom, the combination with these conventional features of: a non-reversing winch-engine; two pinions, rotatable thereby; a winch-drum; two gears, rotatable therewith, one of these gears engaging one of the pinions; an intermediate pinion, engaging the other gear and the other pinion; two clutches, one in each thus-described gear-train; a counterweight drum, rotatable with the main winch-drum; a hoist-line, extending from the dipper and handle to the winch-drum; a counterweight, vertically movable; and a line extending from this counterweight to the counterweight drum.

6. In an excavator, having an outwardly digging dipper, mounted on a handle for reciprocation with respect to, and raising and lowering

about, a fixed point on an inclined boom, the combination with these conventional features of: a non-reversing winch-engine; a winch-drum; a direct drive gear-train, and a reversing gear-train, operatively connecting the engine to the main winch-drum; two clutches, one in each thus-described gear-train; a counterweight drum, rotatable with the main winch-drum; a hoist-line, extending from the dipper and handle to the winch-drum; a counterweight, vertically movable; and a line extending from this counterweight to the main counterweight drum.

7. In an excavator, having an outwardly digging dipper, mounted on a handle for reciprocation with respect to, and raising and lowering about, a fixed point on an inclined boom the combination with these conventional features of: a non-reversing winch-engine; a winch-drum; a direct drive gear-train, and a reversing gear-train operatively connecting the engine to the main winch-drum; two clutches, one in each gear-train; a hoist-line, extending from the dipper and handle to the main winch-drum; a main counterweight, vertically movable; and a line extending from this counterweight to an operative connection with the winch-drum.

TREVOR DAVIDSON.
ALLAN R. TAYLOR.