Oct. 7, 1941. W. BAKER ET AL 2,258,478

EXCAVATING SHOVEL

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Fig. 1

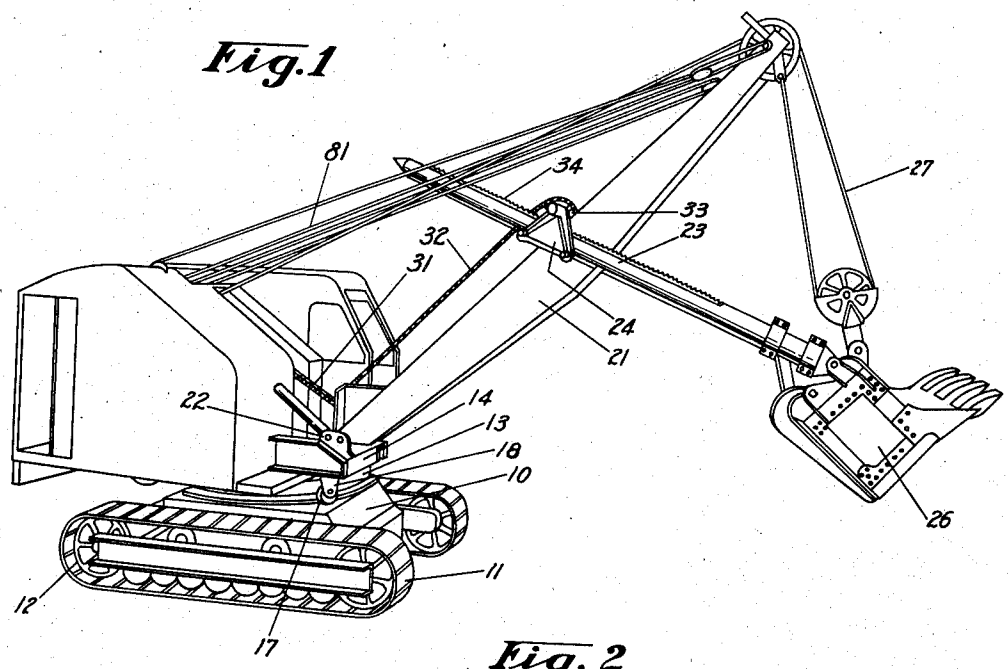
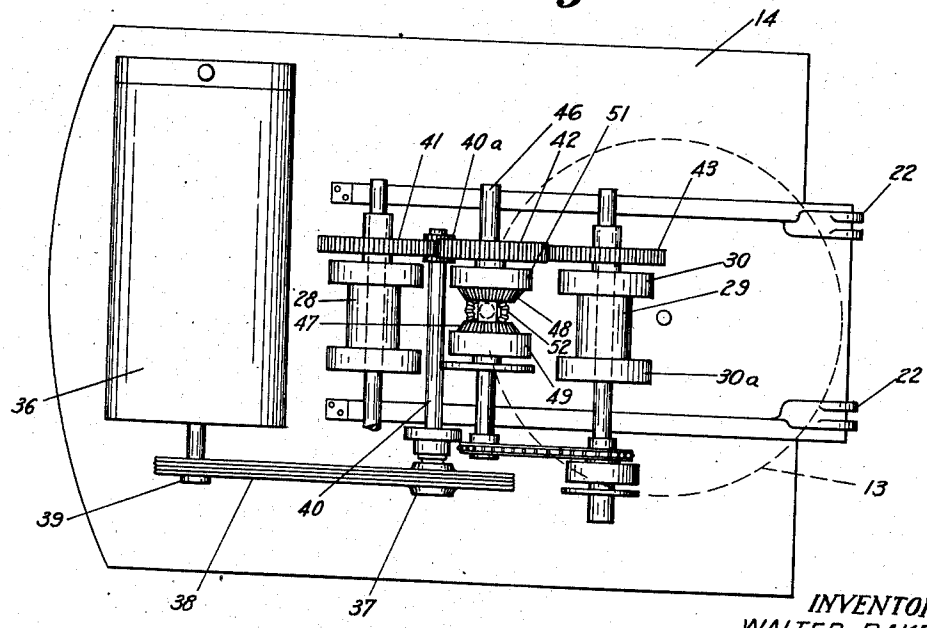


Fig. 2



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Fig. 3

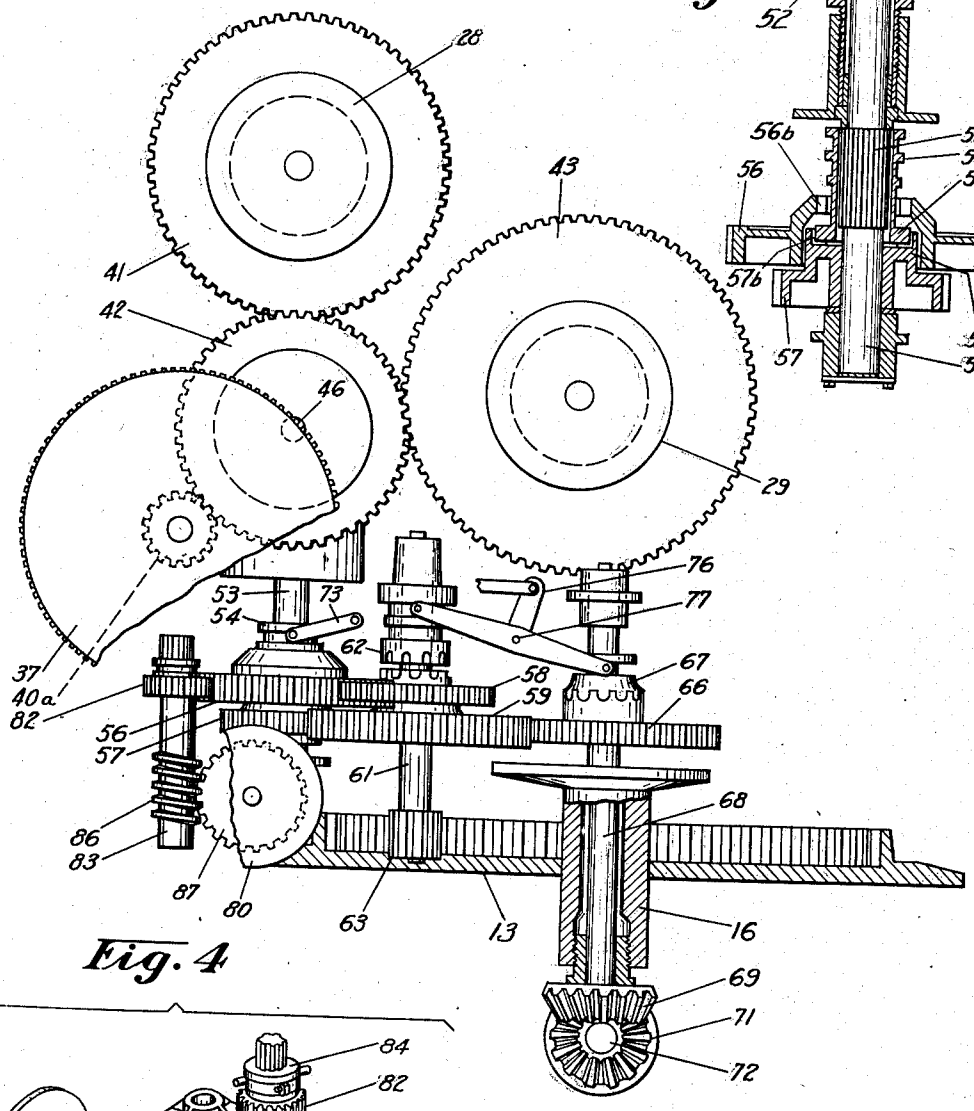
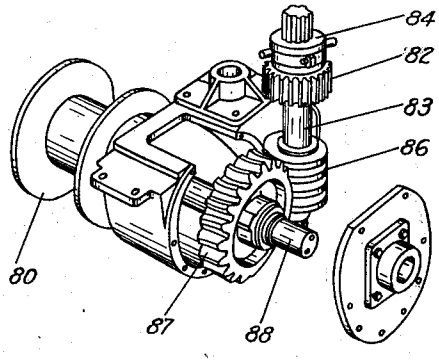


Fig. 5

Fig. 4



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EXCAVATING SHOVEL

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5 Claims. (Cl. 214—135)

This invention relates to excavating shovels and the like and has particular relation to a means for driving and actuating various mechanisms of the shovel, particularly the boom hoist, the swing mechanism, and the travel mechanism.

In mechanisms of the character here considered, it is desirable that two different speeds of the driving or traction mechanism be provided whereby movement of the shovel, while used in excavating, shall be relatively slow but with great power and such that movement of the shovel from place to place may be accomplished at relatively higher speed.

It is desirable also that other mechanisms of the shovel, such as the swing mechanism and the boom hoist, be driven at two or more speeds. A two speed drive suitable for the purpose should be located within the turntable base where it is protected from the abrading influence of dirt, rock and the like, and furthermore such a drive should be quite simple in order that it may be sufficiently strong to withstand the high torque employed.

It is among the objects of our invention to provide a simple, reliable, and relatively inexpensive structure which shall meet the above requirements and which shall be effective to selectively drive the travel mechanism, the swing mechanism, and the boom hoist at a plurality of speeds, and further, to provide for locking the boom at any point to prevent downward movement except under controlled power.

Other and further features and objects of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawings and following specifications, wherein is disclosed a single exemplary embodiment of the invention, with the understanding, however, that such changes may be made therein as fall within the scope of the appended claims, without departing from the spirit of the invention.

In said drawings:

Figure 1 is a view in perspective of a shovel to which our two speed driving mechanism has been applied.

Figure 2 is a plan view, more or less in schematic diagram, of the driving mechanism for effecting drive of the various hoists and the like and for furnishing power for driving the traction, swing and boom hoist.

Figure 3 is a view partly in elevation and partly in section, also diagrammatic in character, illustrating how drive of the travel, swing, and boom hoist is secured from the main hoisting apparatus shown in Figure 2.

Figure 4 is a view in exploded relation of the boom hoist drive mechanism, a portion of which is shown in Figure 3, and

Figure 5 is a fragmentary view, partly in section and partly in elevation, of the clutch mechanism by which selective drive of the gear trains is effected.

Referring now more particularly to Figure 1, our driving mechanism may be employed in an excavating shovel such as that shown in this figure. This shovel is of more or less conventional design and has a base platform 10 mounted on crawler tracks 11 which are driven by means of suitable sprockets 12.

A bull ring 13 is mounted on the upper face of the base 10 and a turntable platform 14 is mounted for rotation on the platform 10 by means of a collar 16 (Figure 3) and hold-down rollers, such as illustrated at 17, rotatably mounted by means of brackets 18 on the under side of the turntable or upper platform 14.

A boom 21 is supported on the turntable 14 by means of brackets 22 in which the boom is pivotally mounted.

A two-part dipper stick, illustrated at 23, is slidably supported for in and out and pivotal movement by the saddle block 24, all in accordance with usual practice.

The excavating shovel 26 is mounted on the end of the dipper stick 23 and may be raised and lowered for digging movement by means of the hoisting cable 27. The hoisting cable is wound on the hoisting drum 28 illustrated in Figure 2. The hoisting drum is not shown in Figure 2 in its true position for the sake of clearness.

Crowding of the excavating shovel downwardly and outwardly and retraction thereof is secured by the reversible crowd drum 29, the forward or reverse operation of this drum being accomplished through selective clutches 30 and 30a.

The drum 29 drives the chain 31 which rotates sprockets at the pivotal axis of the boom. The drum 29, through the agency of the chains 31 and 32, the sprocket 33, and gear rack 34, retracts the dipper stick 23 or crowds it outwardly.

Power for driving the mechanism of the excavating shovel is furnished by a gasoline motor or other prime mover enclosed in housing 36. This motor drives a main drive pulley 37 through the V-belt 38 and drive pulley 39. The drive pulley 37 is mounted upon a main shaft 40 which has a drive pinion 40a mounted on the other end there-

of. This drive pinion is enmeshed with the spur gear 42 which drives the main cross shaft 46 upon which oppositely disposed bevel gears 47 and 48 are mounted.

Clutches 49 and 51 are provided to selectively engage the bevel gears 47 or 48 to the shaft, and by means of these bevel gears a vertically mounted bevel gear 52 may be rotated in one direction or the other as desired.

The hoist and crowd drums are driven from the main cross shaft 46 by gears 41 and 43 engaged with the drive gear 42.

The bevel gear 52 is secured on the upper end of a vertical drive shaft 53 and a two way clutch 54 is disposed so that an upper drive pinion 56 or lower drive pinion 57 may be engaged by the clutch so that rotation of the shaft 53 will rotate either of the gears 56 or 57 as desired.

The construction and arrangement of the drive gears 56 and 57 and their selective drive clutch 54 is shown in Figure 5. The larger drive gear 56 is journaled upon a cylindrical portion 57*a* of the smaller drive gear 57, this last gear being supported, in turn, for rotation on the vertical drive shaft 53. The selective clutch 54 is slidably received on a splined portion 53*a* of the drive shaft to permit a toothed portion 55 of the clutch to be engaged with matching clutch teeth 56*b* or 57*b* on either of the drive gears.

The gear 56 is in mesh with the swing shaft idler gear 58. The gear 57 is in mesh with the lower swing shaft gear 59. The gears 58 and 59 are rotatably mounted on the shaft 61 and engagement of these gears with the shaft is effected through the jaw clutch 62. Engagement of the shaft 61 with the gears 58 and 59 will rotate the swing shaft pinion 63. This swing shaft pinion engages the bull ring 13 to swing the turntable 14 in either direction as desired.

The lower gear 59 is in mesh with the travel gear 66 and a jaw clutch 67 may selectively engage or disengage this gear with the travel drive shaft 68. The bevel gear 69 mounted on the lower end of the travel shaft 68 is engaged with a horizontal traction drive gear 71 mounted on shaft 72 on which sprockets (not shown) are also mounted and which drive the traction drive sprocket 12.

It is undesirable that the swing shaft be actuated at the same time that the travel shaft is rotated. Therefore the jaw clutches 62 and 67 are controlled for selective engagement by means of clutch forks controlled by a lever 76 which is pivotally mounted as at 77. Movement of the lever 76 to the left disengages the travel clutch 67 and engages the swing clutch 62. Movement of the lever to the right disengages the swing shaft and engages the travel shaft.

A cable 81 is mounted over a suitable number of sheaves for raising and lowering the boom. This cable is trained over a boom hoist sheave 80 and this boom hoist sheave is driven by means of a gear train I am about to describe. An exploded view of the boom hoisting means is shown in Figure 4.

A pinion 82 is adapted to be engaged with one of the selective drive gears 56 or 57 on the vertical shaft. This pinion 82 is slidably mounted on a drive shaft 83 and may be disengaged from its drive gear by means of a clutch fork connected to the collar 84.

A worm 86 is mounted on the shaft 83 and engages a worm gear 87 which is in turn engaged on the shaft 88 to drive the boom hoist sheave 80.

Now if the jaw clutch 54 is engaged to the upper drive gear 56 and the clutch 84 engages the pinion 82 on the shaft 83, the shaft 83 will be directly rotated at a relatively high rate of speed. If, however, the jaw clutch 54 is engaged to the lower selective drive gear 57, this drive gear will rotate the idler gear 59. Since the idler gears 59 and 58 are secured to each other, the spur gear 58 will rotate the drive gear 56 as a driven or idler gear, and the gear 56 acting as an idler gear in the gear train will rotate the gear 82 at a comparatively low speed. It is therefore apparent that the boom hoist sheave 80 may be rotated or driven at two different speeds, and this is of considerable importance in raising and lowering the boom.

For instance, if the load is light the boom may be rapidly raised inasmuch as a large number of turns of the cable on various sheaves are required to properly support the boom, this high speed movement for winding up the boom hoisting cable is very desirable. If there is a heavy load on the shovel the lower speed is used so that much greater power is supplied for winding the boom hoist cable on the drum 80.

It is apparent that we have provided a very simple and a very rugged drive means for driving either the travel, the swing or the boom hoist at plural or variable speeds. The drives are adequate to meet the heavy torsional forces applied to them. The main portion of the gear train may be enclosed within the turntable frame 13 where it is readily protected from abrasive effect of sand, gravel, dirt and the like. Control of the direction of rotation of all three of these members is secured by means of clutches 49 and 51 which may be controlled by a single lever. Control of the travel, swing and boom hoist is secured by a minimum number of control levers.

Although we have described a specific embodiment of our invention, it is apparent that modifications thereof may be made by those skilled in the art. Such modifications may be made without departing from the spirit and scope of our invention as set forth in the appended claims.

We claim as our invention:

1. In a drive means for an excavating shovel, a main vertical drive shaft, a swing shaft and a travel shaft, a pair of drive gears on the main vertical drive shaft, a pair of idler gears rotatably mounted on the swing shaft and in mesh with the drive gears, a clutch for selectively engaging one or the other of the drive gears, boom hoist drive gearing in mesh with one of the drive gears whereby when one of the drive gears is engaged by the clutch to the drive shaft, the boom hoist gear in mesh with that gear is rotated at one speed, and whereby, when the other drive gear is in mesh with the drive shaft, the first drive gear is rotated at a different speed through the idler gears on the swing shaft, a travel drive gear engaged with one of the idler gears, and means for selectively engaging or disengaging said travel drive gear with the travel shaft.

2. In an excavating shovel, the combination and arrangement of means providing for plural speed drive of a traction drive shaft and a boom hoist comprising a main cross shaft, a vertical drive shaft, means for selectively driving the vertical drive shaft forward or backward from the main cross shaft, a pair of drive gears mounted for rotation on the vertical drive shaft, two-way clutch means for selectively engaging the vertical drive shaft with one or the other of the drive gears, a boom hoist, a boom hoist gear engaged with one of the drive gears, means for disengaging

the boom hoist gear from the drive gear, a pair of connected idler gears meshed with both of the drive gears, a traction drive gear engaged with one of the idler gears, a traction drive shaft, and means for selectively engaging or disengaging same with the traction drive gear.

3. In an excavating shovel having a mobile lower frame and a rotatable upper frame, a boom hoist, plural speed means for driving the boom hoist comprising a vertical drive shaft extending downwardly through the upper frame, a pair of drive gears rotatably mounted on the vertical drive shaft between the upper and lower frames, clutch means for selectively engaging the said drive shaft and one or the other of the drive gears, a boom hoist drive gear, means for selectively engaging and disengaging the boom hoist drive gear and one of the drive gears, and a pair of connected idler gears also disposed between the upper and lower frames and engaged with the drive gears whereby the boom hoist drive may be driven at one speed directly from one drive gear or at another speed through the other drive gear, through the connected idler gears, and through the first mentioned drive gear used as an idler gear.

4. In a drive means for machines of the character described, a vertical drive shaft, a vertical driven shaft, at least two horizontally disposed and closely parallel gear trains between the drive shaft and the driven shaft, a two-way clutch at the drive shaft for selectively driving one or the other of the gear trains, and a boom hoist shaft and gear in mesh with one of the drive gears of the gear trains, the driven gears being connected together, whereby in one position of the two-way clutch, drive of the boom hoist gear is direct from one of the drive gears, and whereby in another position of the clutch, drive of the boom hoist gear is through the other drive gear, the driven gears, and the first drive gear.

5. In an excavating shovel having a mobile lower frame and a rotatable upper frame, a main drive shaft extending transversely above the upper frame, a vertical drive shaft extending downwardly through the upper frame, a bevel gear on the upper end of the vertical shaft and a pair of opposed bevel gears on the main drive shaft engaged with the first mentioned bevel gear, means for selectively driving the first mentioned bevel gear from one or the other of the opposed bevel gears for driving the vertical drive shaft in forward or reverse direction, a pair of horizontally disposed drive gears mounted for rotation on the vertical shaft between the upper and lower frames, a swing shaft, a pair of connected idler gears mounted for rotation on the swing shaft and engaged with the drive gears, a traction shaft, a traction gear mounted for rotation thereon and engaged with one of the idler gears, a boom hoist including a worm and worm gear drive, a drive pinion for the boom hoist slideably engaged with one of the pair of drive gears, clutch means for selectively engaging or disengaging the traction shaft with the traction gear, clutch means for selectively engaging or disengaging the swing shaft with the idler gears, and two-way clutch means for selectively coupling the vertical drive shaft and either of the drive gears, whereby the traction shaft, swing shaft or boom hoist may be selectively driven at either of two speeds in either forward or reverse direction.

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