Sept. 5, 1944. B. S. FERGUSON 2,357,462

BOOM HOIST

Filed Sept. 16, 1941 2 Sheets-Sheet 1

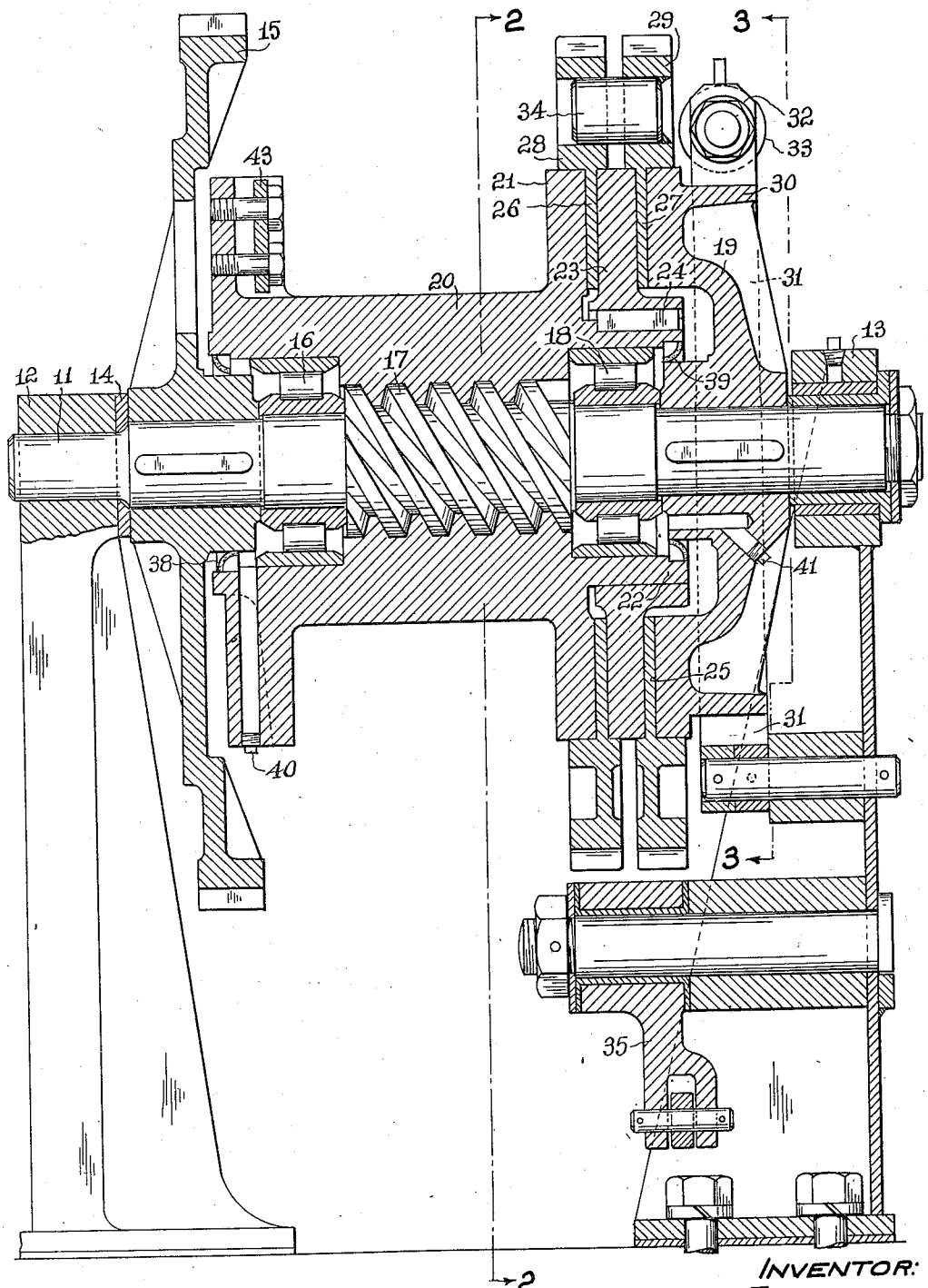


FIG. 1

INVENTOR:
BERLIN S. FERGUSON
BY Robert W. Wilson
ATTORNEY.

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BOOM HOIST

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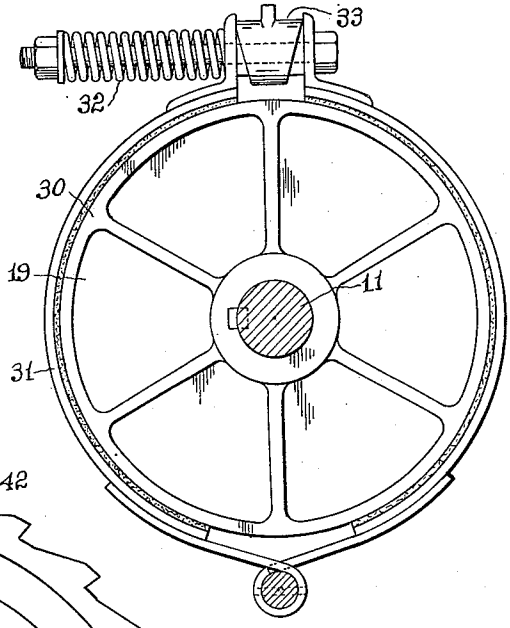


FIG. 3

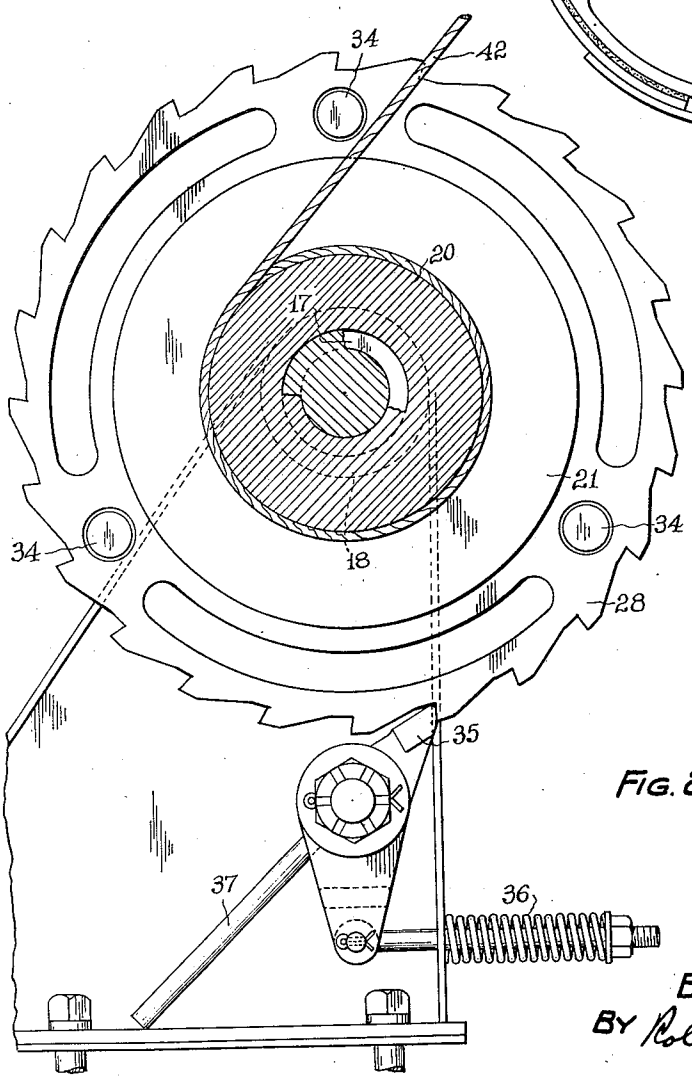


FIG. 2

INVENTOR:
BERLIN S. FERGUSON
BY Robert W. Wilson
ATTORNEY.

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2,357,462

BOOM HOIST

Berlin S. Ferguson, Ravenna, Ohio, assignor to Byers Machine Company, Ravenna, Ohio, a corporation of Ohio

Application September 16, 1941, Serial No. 411,005

7 Claims. (Cl. 254—187)

In material-handling equipment of the type to which power shovels belong the main boom is generally rigged for raising and lowering by a compound line running over a series of sheaves and wound upon one of the smaller drums of the mechanism. Such machinery includes shovels, drag-line scrapers, certain sorts of cranes, and like mechanism. Often the working arrangements are interchangeable, so that one machine can be used for all the purposes named by changing the attachments. One characteristic of such machines is that the power plant and operative gearing must be placed in a small space, and that there must be several drums transverse to the assembly so that the numerous cables can be led as directly as possible. This need gives rise to the further requirement that the principal shafts be transversely disposed, and that such shafts carry more than one drum.

The wear on all parts of the mechanism is severe, which gives rise to the need of adequate areas for wearing parts in spite of the strict limitations of space. This also makes it necessary to provide ample facilities for lubrication, but again the necessity to gather the machinery into close quarters makes it difficult to get at the parts for oiling and greasing.

Since failure of the boom hoist would allow the boom to fall, it has been a common practice to give the boom hoist drum an irreversible drive, not relying on brakes to hold it against running out. Consequently a worm drive is used for the purpose, but since the worm shaft is at right angles to the worm wheel, such a drive requires bevel or other right angle change of direction in the gear train from the principal shafting to the worm wheel, or else places the boom hoist drum axis lengthwise instead of crosswise, necessitating carrying the line around a leader pulley.

My invention is for the purpose of providing a boom hoist retaining the advantages of a worm drive while avoiding its disadvantages, thus affording a compact assembly, fitting in with the usual arrangements of the machinery, giving large bearing and holding surfaces, not dependent upon a separate brake for its holding action, capable of lowering the boom only by driving the hoisting shaft in the opposite direction, with the bearing surfaces all constantly lubricative and easily accessible for renewal of the lubricant, all parts so arranged that repairs can be readily made when necessary. These features are combined with a transverse location of the drum, conforming to that of the other drums, and such location does not require any additional gearing.

These and other advantages will be apparent to those skilled in the art from the description and illustrations which accompany the description.

It will be understood that I have shown and described herein a preferred form of the invention, but that the principles thereof may be employed with differences in detail.

In the accompanying drawings:

Fig. 1 is a central axial vertical section of the mechanism, certain parts being shown in elevation;

Fig. 2 is a transverse section indicated by line 2—2 of Fig. 1, looking in the direction of the arrows; and

Fig. 3 is an end elevation indicated by the line 3—3 of Fig. 1, looking in the direction of the arrows.

The entire mechanism is carried upon a shaft 11 mounted in appropriate bearings 12, 13 at its opposite ends, this shaft being preferably of different diameters, in steps decreasing from the middle towards each end, so that the various parts carried thereby may be readily assembled thereon and removed therefrom.

Beginning for convenience at the left end of the shaft 11 as seen in Fig. 1, the shaft comprises successively a journal in the bearing 12, preferably provided with washers 14 to take leftward end thrust; a large driving gear 15 keyed or otherwise suitably secured upon the shaft; a roller bearing 16; heavy threads 17 upon the central portion of the shaft; another roller bearing 18; a friction and brake disk 19 keyed or otherwise suitably fast both axially and circumferentially on the shaft; and finally a journal in the bearing 13. The threaded section is preferably integral with the shaft 11, although it could be separately made and keyed or otherwise fixed upon the shaft.

A boom hoist drum 20 is carried in the manner of a nut upon the threads 17, the drum being correspondingly internally threaded. This drum 20 is supported on the shaft 11 by the roller bearings 16 and 18 recessed in the respective ends of the drum. Both bearings, as shown in Fig. 1, allow axial movement of the drum. The right flange 21 of the drum is inset from the end, leaving a shank 22 to which a friction ring 23 is suitably fastened, relatively movable axially but not radially as by a key 24. The brake disk 19 has an inwardly-directed transverse face 25 positioned opposite the friction disk

23 but spaced therefrom. The face 25, ring 23 and flange 21 are all of about the same size and shape to receive sandwiched between them the inner webs 26 and 27 of two ratchet wheels 28 and 29. The brake disk 19 also includes a rim 30 surrounded by a band brake 31 of conventional type, applied by a spring 32 and released by a cam 33.

The ratchet wheels 28 and 29 are alike. Their rims are enlarged outside their webs 26, 27 to ride on the peripheries of the members 21, 23 and 19, and free rotation is possible except when axial movement of the drum 20 clamps the parts. The two wheels are held for rotation together, and their ratchet teeth are kept in alignment, by studs 34, which allow axial movement. If necessary the studs may be secured to one of the wheels, shown in Fig. 1 as 29. A pawl 35, Fig. 2 is constantly pressed against the teeth by spring 36, but can be released by handle 37.

As to lubrication, the ends of the drum 20 overlap roller bearings 16 and 18. Outside these bearings there are lubricant seals 38 and 39, between the drum end and the hub of gear 15 at the left, and between the drum end and the hub of brake disk 19 at the right. Grease or oil can be applied at the left end by a filling hole 40 through the rim of the left flange of drum 20 and at the right end by a filling hole 41 through the hub of brake disk 19. It will be observed that both filling holes are always accessible; 40 cannot be blocked by a line wound on the drum. In this way both ends of the mechanism can be lubricated and kept full of lubricant, which will work into the threads 17.

The operation of the mechanism will now be described, it being understood that the hoist line 42 is secured to the drum, for example by clamp 43, and that turning the drum counterclockwise as seen in Fig. 2 winds up the line to hoist the boom, while the unwinding movement is clockwise.

The operation is that when the shaft 11 is stationary, gravity pull on the line 42 by weight of the boom starts an unwinding action, turning the drum 20 clockwise as seen in Fig. 2. The shaft 11 cannot move axially, consequently the drum 20, acting as a rotating nut on a stationary bolt, moves to the right until elements 21, 26, 23, 27 and 25 are all frictionally clamped together, after which further unwinding is prevented by the pawl 35 holding the ratchets. Normally the shaft 11 is held stationary by its driving gear 15 and the train of driving mechanism, but the brake 31 is added as an extra precaution.

To pay out the line 42 to lower the boom it is necessary to drive the shaft 11 clockwise as shown in Fig. 2. Such drive, by reason of the action of the threads 17, first moves the drum axially in translation leftward sufficiently to clear the friction plates. This frees the drum to turn clockwise by the pull on the line. If the drum turns faster than the shaft 11, it tightens itself against the friction plates, thus checking the descent momentarily until the shaft 11 again releases the frictions. Obviously if the line 42 runs out no slower than the turning of the shaft, the successive momentary checks will not occur.

To hoist, the shaft is driven counterclockwise, the drum at first acting as a nut in tightening the friction system, and thereafter driving and clicking the ratchets over the pawl 35.

The foregoing description (with the drawings) of a preferred embodiment of my invention shows a form suitable for the boom hoist of a medium size power shovel, or for other duty of similar requirements. Appropriate modification in relative sizes, areas and numbers of friction elements and other features of my invention can be made according to the weights to be handled, speeds of movement of parts, and other factors, as will be apparent to those skilled in the art. Consequently it will be understood that the foregoing description and accompanying drawings are by way of illustration rather than of limitation, and that the invention is susceptible of modification in its details, all within the scope of the claims.

I claim:

1. A boom hoist mechanism comprising, a driving element operably associated with said shaft, a drum on said shaft, a hoist line wound on said drum, said line being secured to said drum, bearings between said drum and said shaft at opposite ends of said drum, threads connecting said drum and said shaft intermediate said bearings, and a disk fast axially and circumferentially on said shaft, releasable means for restraining rotation of said disk, a friction flange on one end of said drum, a friction ring on the same end of said drum as said flange movable axially but fast circumferentially with respect to said drum, a friction wheel rotatably mounted between said flange and said ring, another friction wheel rotatably mounted between said ring and said disk, ratchets on said friction wheels, and a pawl engaging said ratchets, the relative direction of said threads being such that turning said drum relatively to said shaft in the direction against said pawl moves said friction elements together, while turning said shaft relatively to said drum in the direction against said pawl moves said faces away from said disk.

2. A boom hoist mechanism for a material-handling machine comprising in combination a shaft, a drum threaded thereon for limited independent endwise movement thereon, bearings between said drum and said shaft at opposite ends of said drum upon which the drum rotates and slides, and oil seals between said drum and said shaft disposed outwardly of said bearings, said drum being internally oil-tight whereby said seals and the interior of said drum define an oil chamber containing said threads and said bearings.

3. A boom hoist mechanism for a material-handling machine comprising in combination a shaft, a drum threaded thereon for limited independent endwise movement thereon, bearings between said drum and said shaft at opposite ends of said drum upon which the drum rotates and slides, oil seals between said drum and said shaft disposed outwardly of said bearings, said drum being internally oil-tight whereby said seals and the interior of said drum define an oil chamber containing said threads and said bearings; and lubricant supply passages opening into opposite ends of said chamber.

4. In a boom hoist mechanism of the character described, a shaft having a screw threaded portion and bearing portions at opposite ends of the threaded portion, a drum having an axial bore internally threaded to screw on the threaded portion of the shaft and counterbores at opposite ends thereof, and anti-friction bearings for the drum mounted within the said counterbores, said drum being slidable axially on said bearings and said bearings being held against axial movement on the shaft.

5. In a boom hoist mechanism of the character described, a shaft having a screw threaded

portion and bearing portions at opposite ends of the threaded portion, a drum having an axial bore internally threaded to screw on the threaded portion of the shaft and counterbores at opposite ends thereof, and a roller bearing within each counterbore, each roller bearing having an outer race ring fitting in the counterbore and an inner race ring fitting upon a bearing portion of the shaft, said inner race ring being secured against axial movement on said shaft and said outer race ring being axially movable with respect to the inner race ring.

6. In a boom hoist mechanism, a shaft having an enlarged central portion provided with a screw thread, supports in which said shaft is journaled, a winding drum having an axial bore provided with an internal thread engageable with the screw thread on the shaft, said drum having counterbores in its opposite ends, an antifriction bearing interposed between the drum and shaft in each of said counterbores, a gear fixed to the shaft adjacent one end of the drum and having a hub projecting into the adjacent drum counterbore, a friction disk fixed to the shaft adjacent the opposite end of the drum and having a hub projecting into the adjacent drum counterbore, sealing rings interposed between the ends of the drum and said hubs, a friction wheel interposed between the drum and disk, and means for restraining the rotation of said friction wheel.

7. In a boom hoist mechanism of the character described, a shaft having a screw threaded portion intermediate its ends, a drum having an axial bore internally threaded and screwed upon said threaded portion of the shaft, said drum being movable axially on said shaft and having counterbores at its opposite ends, antifriction bearings in said counterbores upon which said drum has rotary and axial sliding movements, and oil sealing rings interposed between the drum and shaft within said counterbores and outwardly of said bearings to retain lubricant in the space within the drum in which the screw threads and bearings are located.

BERLIN S. FERGUSON.