

May 29, 1945.

F. P. LAWLER

2,376,972

DOUBLE DRUM HOIST

Filed Jan. 3, 1944

3 Sheets-Sheet 1

FIG. 1

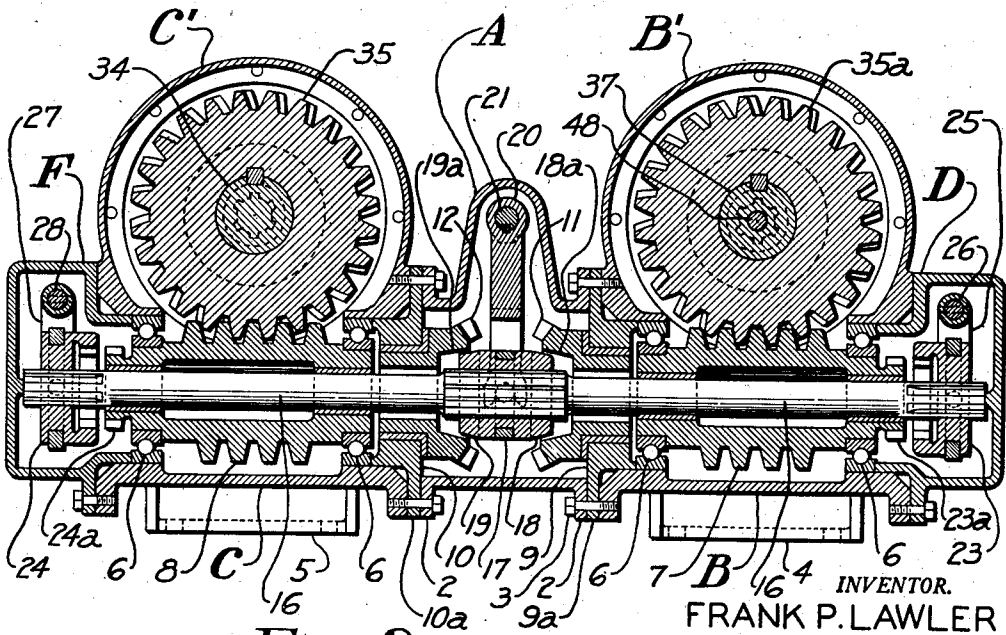
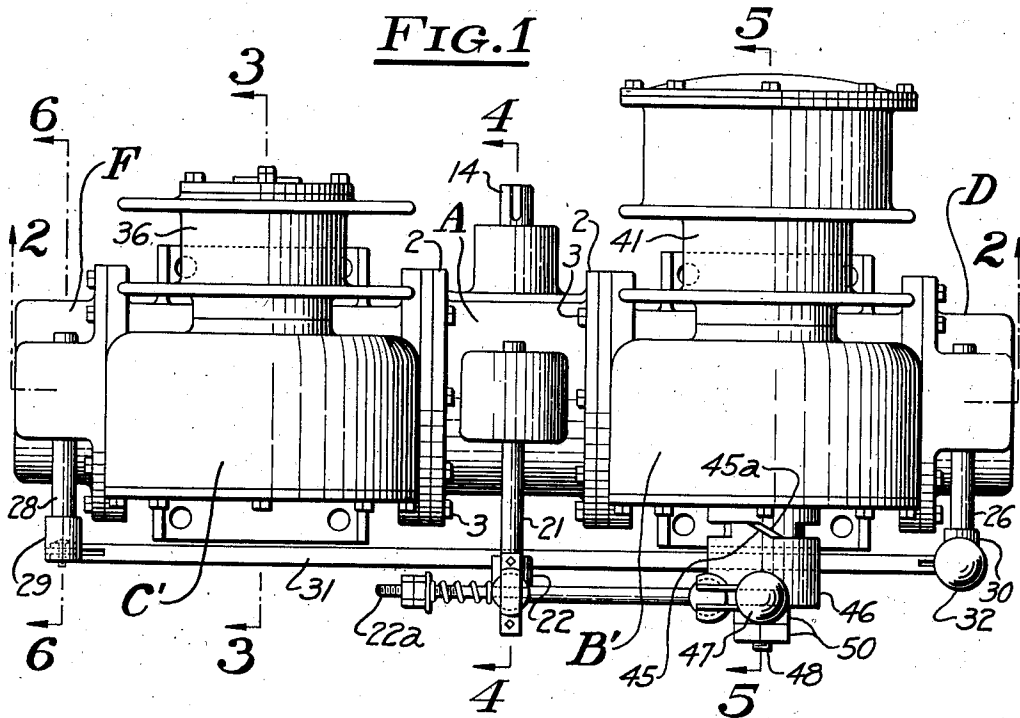


FIG. 2

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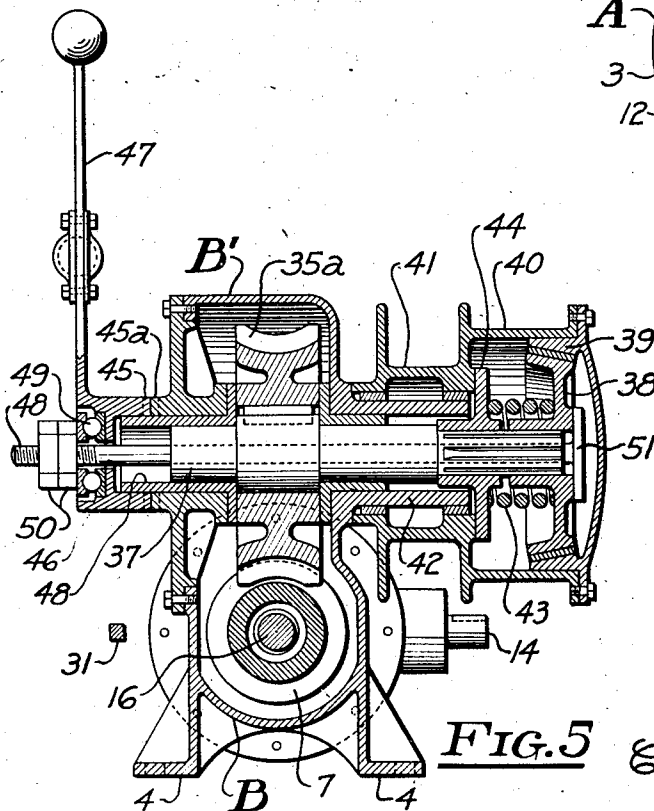
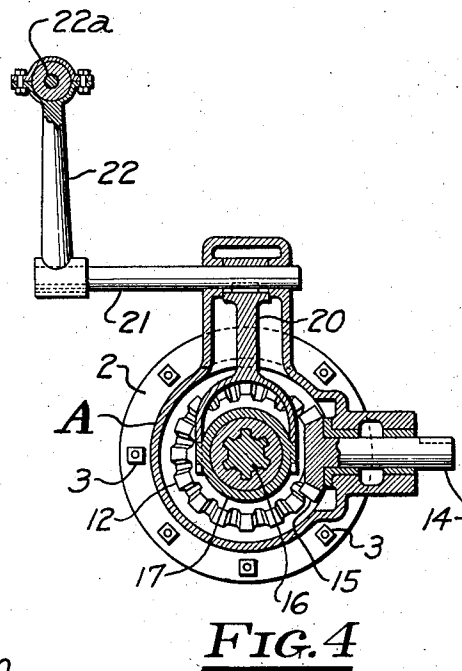
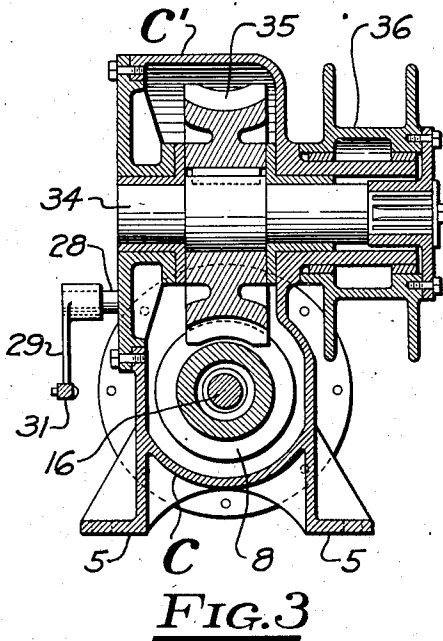
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3 Sheets-Sheet 3

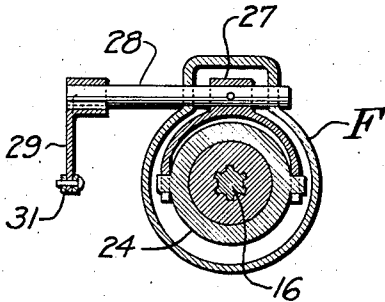


FIG. 6

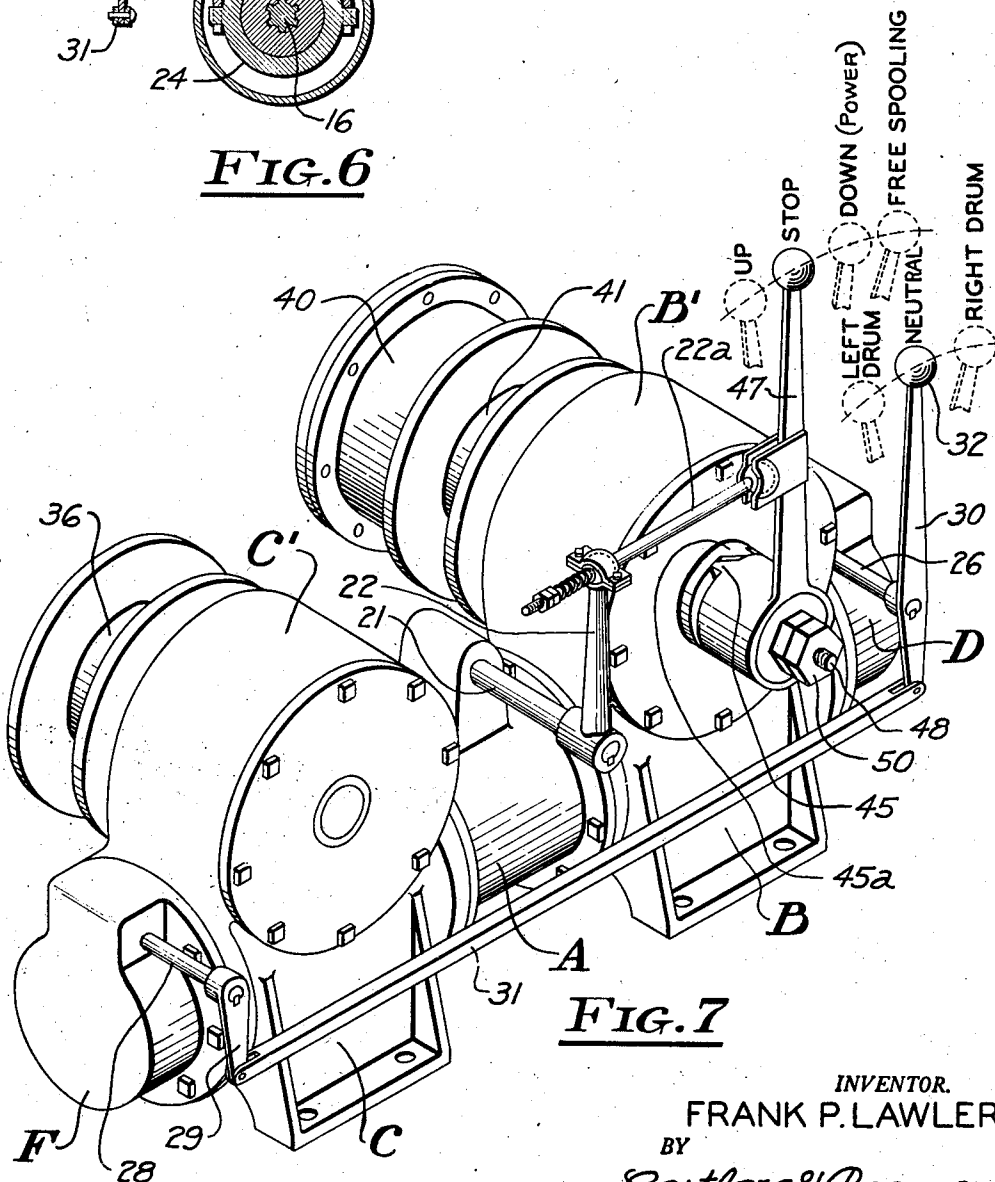


FIG. 7

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DOUBLE DRUM HOIST

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Application January 3, 1944, Serial No. 516,836

3 Claims. (Cl. 254—185)

This invention relates to a double drum hoist unit which is especially adapted for use as a power control unit for the operation of lifting cranes and the like.

The object of the present invention is generally to improve and simplify the construction and operation of double drum hoists; to provide a crane power control unit which is substantially fool-proof and which embodies a maximum number of safety features; to provide a double drum hoist unit in which one of the drums can only be driven under power in both directions, while the other drum can optionally be so controlled, or free-spoiled as conditions require; to provide a double drum hoisting unit in which a common reversing gear set, controlled by a single lever, is arranged so that it can drive either drum in a forward or reverse direction; to provide a double drum hoisting unit in which the two drums and connected driving mechanism are substantially identical to permit interchange of parts and to provide a crane power control unit which can be completely controlled by means of only two levers.

The double drum hoist is shown by way of illustration in the accompanying drawings in which Fig. 1 is a plan view of the double drum hoist; Fig. 2 is a section taken on line 2—2 of Fig. 1; Fig. 3 is a cross section on line 3—3 of Fig. 1; Fig. 4 is a cross section on line 4—4 of Fig. 1; Fig. 5 is a cross section on line 5—5 of Fig. 1; Fig. 6 is a cross section on line 6—6 of Fig. 1; and

Fig. 7 is a perspective view of the complete double drum hoist.

Referring to the drawings in detail and especially Figs. 1, 2 and 7, A indicates a centrally disposed housing which is flanged at 2 on each side. Secured by bolts 3 or similar means to the flanges 2 are a pair of worm gear pinion housings B and C and secured to the top or upper surface of said housings are worm gear housings B' and C'. The pinion housings B and C are provided with pedestals or bases 4 and 5 to permit them to be secured to a suitable frame or support, and the outer ends of the housings B and C are closed by clutch housings D and F.

A ball or any friction bearing 6 is disposed at opposite ends of each worm gear pinion housing B and C and in these bearings are journaled worm gear pinions 7 and 8. Bearing bushings 9 and 10 are secured by flanges 9a and 10a between the central housing A and the worm gear pinion housing B and C and in these bushings are journaled a pair of bevelled gears 11 and 12.

Journalled in the central housing A is a drive

shaft 14 and secured on the inner end thereof in a position where it will mesh and simultaneously drive the gears 11 and 12 is a drive gear pinion 15. Extending through the worm gear pinions 7 and 8 and through the bevelled gears 11 and 12 is a countershaft 16. Splined to said shaft between the bevelled gears 11 and 12 is a clutch 17 having cone faces 18 and 19 formed at opposite ends thereof, and formed on the inner faces of the bevelled gears 11 and 12 are cooperating cone clutch faces 18a and 19a. A forked arm 20 straddles the clutch 17. This arm is secured on a shaft 21 extending through the central housing A and the outer end of said shaft is provided with a selector lever 22, the function of which will hereinafter be described. The countershaft 16 extends beyond the outer end of each worm gear pinion 7 and 8. These extending ends carry jaw clutches 23 and 24 which cooperate with jaw clutches 24a and 23a formed on the adjacent ends of the respective worm gear pinions 7 and 8. The clutch member 23 is straddled by a forked arm 25 which is secured on a shaft 26. The clutch member 24 is similarly straddled by a forked arm 27 secured on a shaft 28. The shafts 26 and 28 project outside of the housings D and F and the outer ends are provided with levers 29 and 30 (see Fig. 7) which in turn are connected by a link 31. The lever 30 is provided with a knob or handle 32 whereby both levers 29 and 30 are operated in unison. When the lever 30 assumes a position indicated as neutral in Fig. 7 both of the jaw clutches 23 and 24 will be out of engagement. On the other hand, if the lever 30 is swung either to the right or the left one or another of the jaw clutches will be engaged and power will thus be transmitted to one or another of the worm gear pinions 7 or 8.

Journalled in the housing C' is a drum driving shaft 34. Secured on said shaft and intermeshing with the worm gear pinion 8 is a worm gear 35 and secured on the shaft 34 exterior of the housing C' is a cable drum 36. Similarly journaled in the housing B' is a drum driving shaft 37. Secured on said shaft is a worm gear 35a which meshes with the worm gear pinion 7 and splined to one end of shaft 37 is a cone clutch 38 which is adapted to move into or out of engagement with a cooperating clutch face 39 formed in the interior of a housing 40 which forms a part of a cable drum 41. This drum is journaled on a sleeve extension 42 forming part of the housing B' (see Fig. 5). A spring 43 is interposed between the cone clutch 38 and a thrust collar 44 and normally functions to maintain the clutch members

38 and 39 in engagement. The clutch 38 may, however, be disengaged by a cam member 45 (see Fig. 7) formed on the hub 46 of a lever 47. This hub is rotatable on a bearing sleeve 48 carried by the housing B' and when rotated by means of lever 47 it moves into or out of engagement with a cooperating cam 45a forming part of the housing B'. The drum driving shaft 37 is a tubular shaft. A rod 48 projects therethrough and through the hub 46 of lever 47. A thrust bearing 49 is mounted in the outer end of the hub 46 and this is engaged by nuts 50 secured on a threaded extension of the rod. The opposite end of the rod is provided with a head 51 which engages the clutch 38. Thus when lever 47 is rotated to bring the cams 45 and 45a into engagement, clutch 38 is moved inwardly or away from the cooperating clutch 39 thus causing disengagement of the drum drive.

From the foregoing, it will be noted that two cable drums are provided. Thus the structure forms a double drum hoist unit which in this instance is particularly designed for the operation of cranes and the like. In practically all crane structures a boom is provided which must be raised or lowered. Thus, one drum is provided for the purpose of raising or lowering the boom and the other drum is provided for the purpose of raising or lowering a load. Experience has shown that the cable which controls the raising or lowering of a boom should be operated through a self-locking worm gear set so that the boom must always be power driven both up and down. In the present structure, the cable drum 36 is employed for raising and lowering the boom and it cannot be operated except by a power drive. This drum will hereinafter be referred to as the "boom-topping-drum." The boom cannot be accidentally dropped with this arrangement.

The drum indicated at 41 will hereinafter be referred to as the "load-line-drum." This is also power driven when raising or lowering a load, but as a clutch is provided as indicated at 38 it is possible to free the drum with relation to the driving shaft 37 so as to render the drum free-spooling. Free-spooling of the drum is only resorted to in cases of emergency. For instance, if the driving motor fails and a load is suspended, it is possible to lower the load by partially releasing the clutch 38. In other words, the double drum hoist, here shown, provides a boom-topping-drum and a load-line-drum which have all the safety features and desirable operating characteristics required for all classes of crane operation and because a common reversing gear is employed all of these desirable features are available through the movement of only two control levers; to wit, a drum selector lever indicated at 30 and a control lever indicated at 47.

In actual operation, let it be assumed that the double drum hoist, here shown, is mounted on a tractor and that power to operate the hoist is transmitted from the power take-off shaft of the tractor to the shaft 14 of the hoist. Power from the tractor motor is thus transmitted to operate the double drum hoist and power may be transmitted to either cable drum as conditions demand. For instance, if it is desired to raise or lower the boom, jaw clutches 24 and 24a will be engaged so as to transmit power from the counter shaft 16 to the worm gear pinion 8 and intermeshing worm gear 35. This in turn transmits power through shaft 34 to drum 36 and as this is connected to a boom by a cable, not shown,

it is possible to either raise or lower the boom by driving the counter shaft 16 in one direction or another, said drive being controlled by the clutch 17 engaging one or another of the bevelled gears 11 or 12. Whether the boom is being raised or lowered, power will be required. If it is desired to raise or lower a load, jaw clutch members 23 and 23a are engaged and power will thus be transmitted from the counter shaft to the worm gear pinion 7. This in turn drives the worm gear 35a and shaft 37 and through clutch 38 the load raising or lowering drum will be driven and it will be power driven either when raising or lowering by engaging clutch 17 with one or another of the bevelled gears 11 or 12. If the tractor motor should fail while a load is suspended, drum 41 may be released as previously described by partially releasing clutch 38 through means of the lever 47. This lever is connected with lever 22 which actuates clutch 17 through a rod 22a.

From the foregoing it should be noted that the double drum hoist is completely controlled by two levers, to wit, the lever 30 which through the clutches 23 and 24 determines which cable drum is to be driven, and the lever 47 which controls clutch 17 and, through cams 45 and 45a, clutch 38. In other words, lever 30 controls or selects the drum to be driven while lever 47 first controls the direction of rotation of the drum which is driven and besides that controls free-reeling of one of the drums. Under normal conditions both drums are positively driven in both directions; a safety factor which is of considerable importance; besides that the load line drum 41, may be rendered free-reeling in cases of emergency or otherwise. Both drum structures and connected driving mechanism is substantially identical thus permitting interchanging of parts whenever necessary. The drive for each drum is based on self-locking worm gears (having a helix angle of four degrees or less) so that the instant the drive through either worm gear set is released by clutch action the connected drum becomes automatically locked against rotation. In other words, the load on either cable drum due to pull on the cable cannot drive the connected worm gears.

While this and other features of my invention have been more or less specifically described and illustrated, I nevertheless wish it understood that changes may be resorted to within the scope of the appended claims, and that the materials and finish of the several parts employed may be varied according to the experience of the manufacturer and varying conditions of use may demand.

Having thus described and illustrated my invention, what I claim and wish to secure by Letters Patent is:

1. In a hoist of the character described a housing, a drive and a countershaft journaled therein, a pair of opposed freely rotatable bevel gears journaled in the housing and through which the countershaft extends, a bevel gear pinion on the drive shaft and meshing the opposed bevel gears to drive said gears in opposite directions, a clutch member on each of the adjacent faces of the opposed bevel gears, a clutch member splined to the countershaft between the opposed bevel gears, means for selectively engaging said clutch with the clutch member of either of the opposed bevel gears to drive the countershaft in one direction or the other, a pair of worm gear pinions journaled in the housing and through which the

countershaft extends, a clutch member on each worm gear pinion, a pair of cooperating clutch members splined to the countershaft, one adjacent each worm gear pinion, clutch means for selectively engaging one or another of said pair of clutches with an adjacent worm gear pinion clutch to drive one or another of the worm gear pinions, a pair of cable drums, and means for transmitting power from each worm gear pinion to a cable drum.

2. In a hoist of the character described a housing, a drive and a countershaft journaled therein, a pair of opposed freely rotatable bevel gears journaled in the housing and through which the countershaft extends, a bevel gear pinion on the drive shaft and meshing the opposed bevel gears to drive said gears in opposite directions, a clutch member on each of the adjacent faces of the opposed bevel gears, a clutch member splined to the countershaft between the opposed bevel gears, means for selectively engaging said clutch with the clutch member of either of the opposed bevel gears to drive the countershaft in one direction or the other, a pair of worm gear pinions journaled in the housing and through which the countershaft extends, a clutch member on each worm gear pinion, a pair of cooperating clutch members splined to the countershaft, one adjacent each worm gear pinion, clutch means for selectively engaging one or another of said pair of clutches with an adjacent worm gear pinion clutch to drive one or another of the worm gear pinions, a pair of drum driving shafts journaled in the housing, a worm gear on each of said shafts and meshing with the respective worm gear pinions, and a cable drum adapted to be driven by each drum driving shaft.

3. In a hoist of the character described a housing, a drive and a countershaft journaled therein, a pair of opposed freely rotatable bevel gears journaled in the housing and through which the countershaft extends, a bevel gear pinion on the drive shaft and meshing the opposed bevel gears to drive said gears in opposite directions, a clutch member on each of the adjacent faces of the opposed bevel gears, a clutch member splined to the countershaft between the opposed bevel gears, means for selectively engaging said clutch with the clutch member of either of the opposed bevel gears to drive the countershaft in one direction or the other, a pair of worm gear pinions journaled in the housing and through which the countershaft extends, a clutch member on each worm gear pinion, a pair of cooperating clutch members splined to the countershaft, one adjacent each worm gear pinion, clutch means for selectively engaging one or another of said pair of clutches with an adjacent worm gear pinion clutch to drive one or another of the worm gear pinions, a pair of drum driving shafts journaled in the housing, a worm gear on each of said shafts and meshing with the respective worm gear pinions, a cable drum positively secured to one drum driving shaft and driven thereby, a second cable drum, a clutch normally forming a drive between said second named drum and the other drum driving shaft, and means for releasing said clutch to permit free-spooling of said second named drum.

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