Oct. 31, 1933. G. MORGAN 1,932,983

REVERSING MECHANISM

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Fig. 1

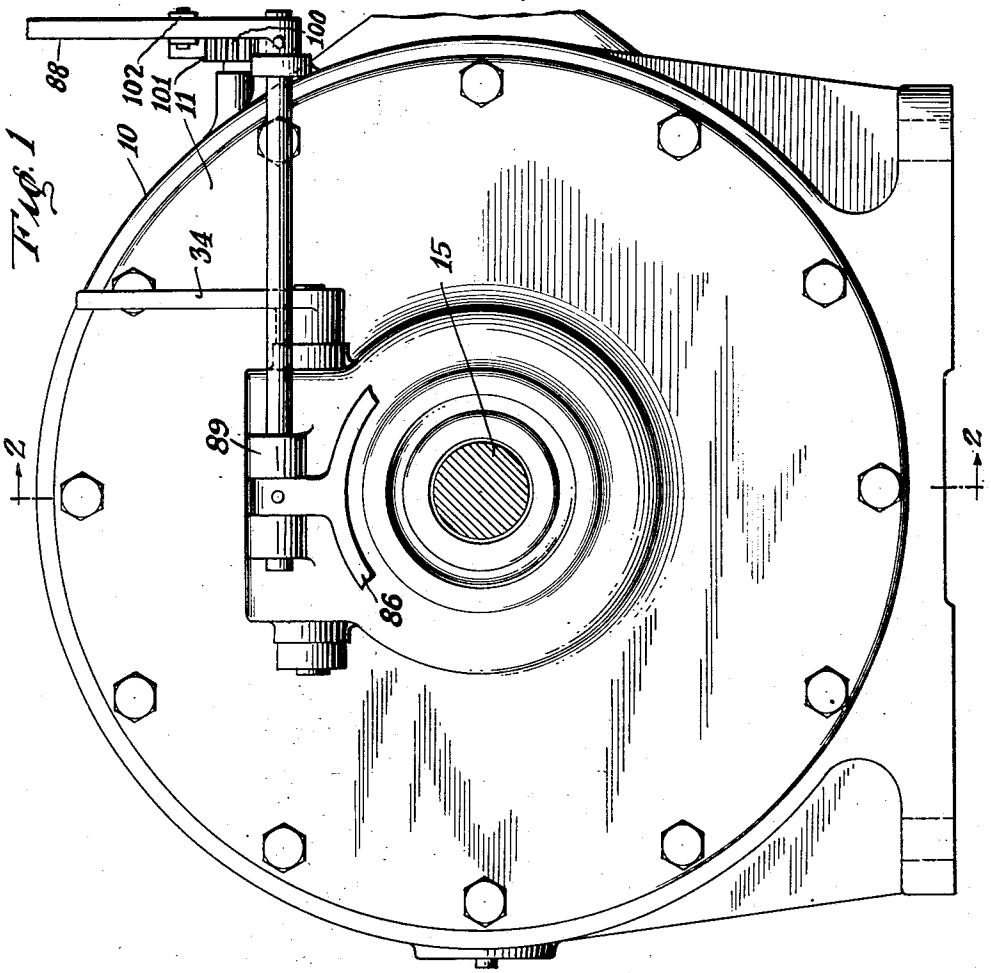
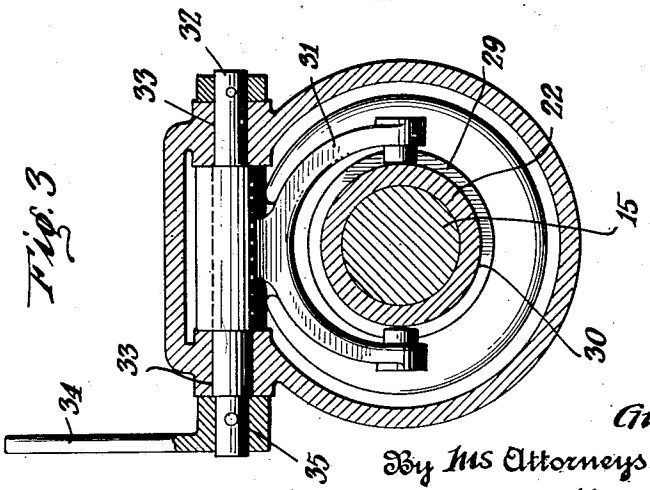


Fig. 3



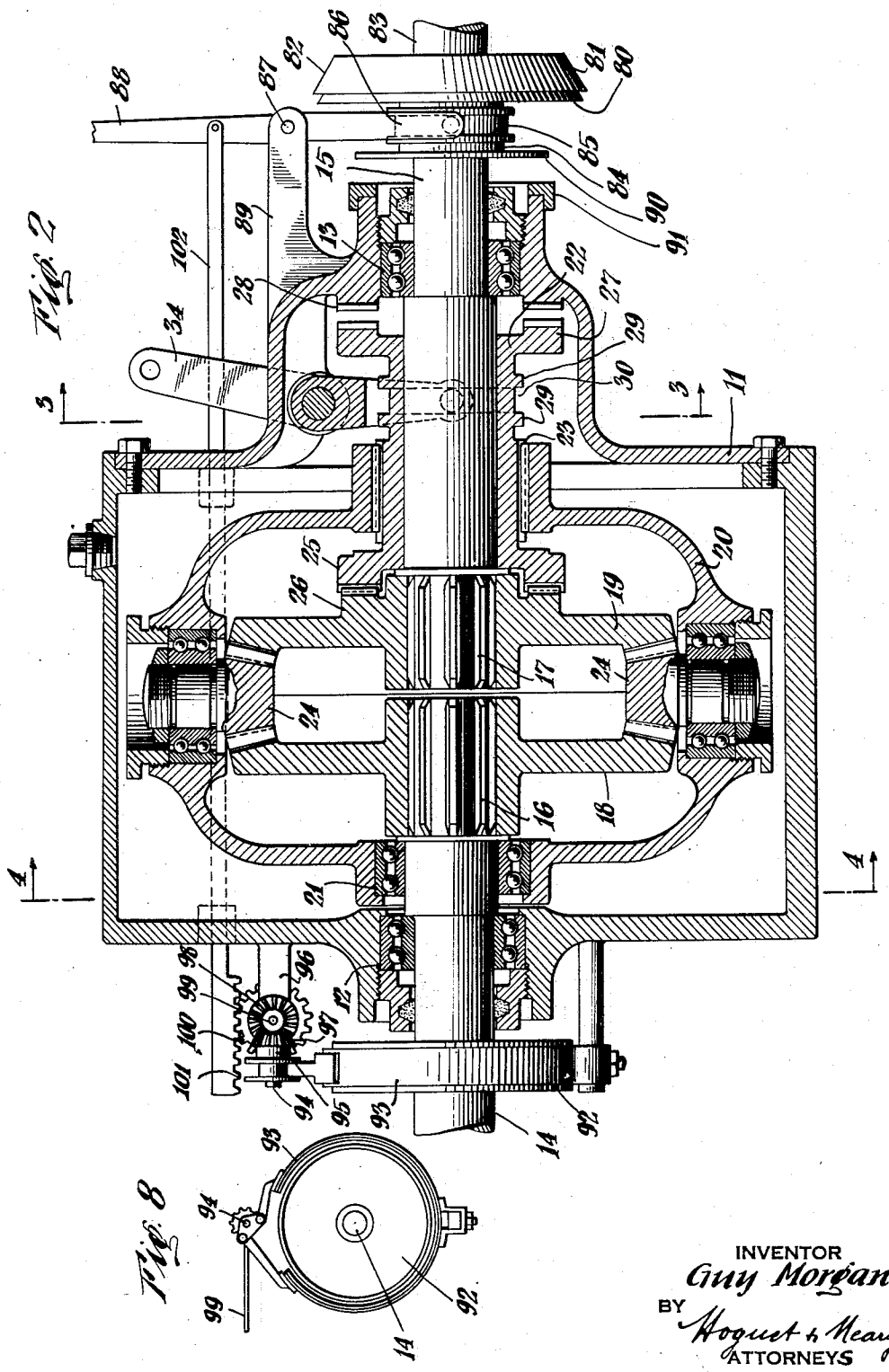
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REVERSING MECHANISM

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REVERSING MECHANISM

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Fig. 4

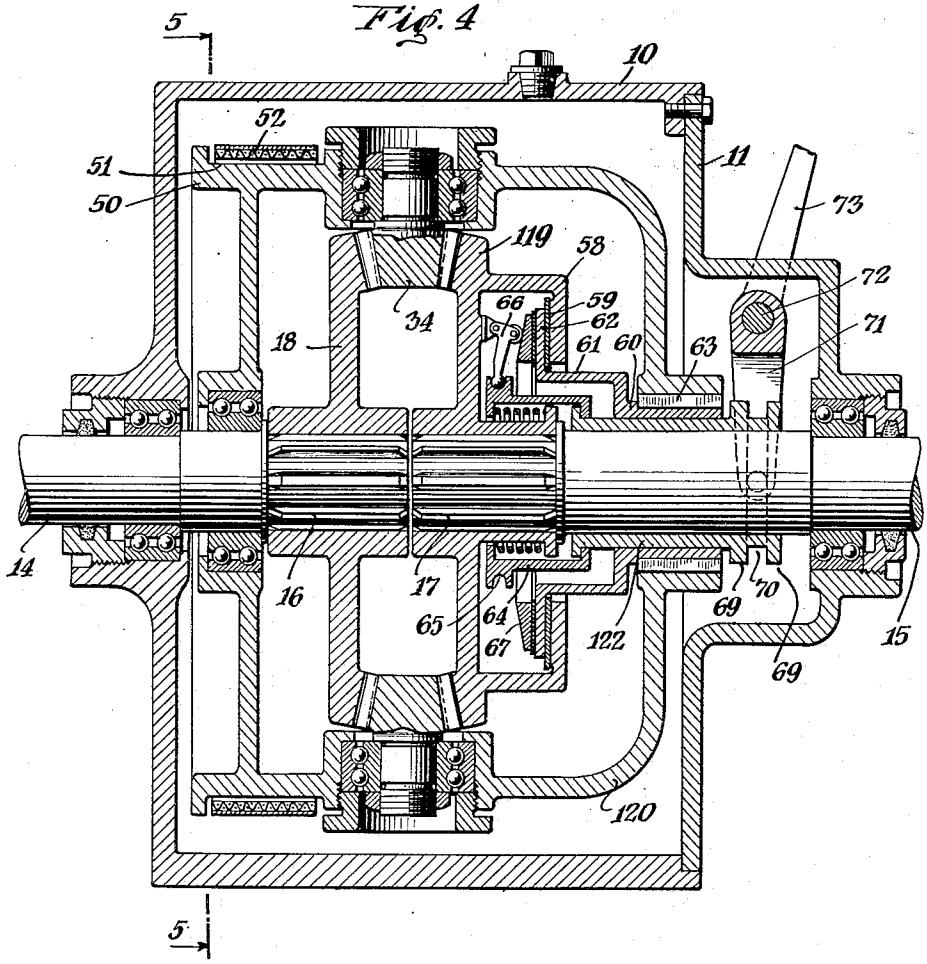
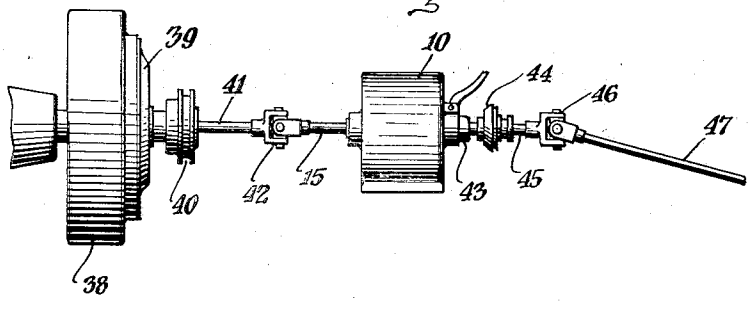


Fig. 7



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Fig. 5

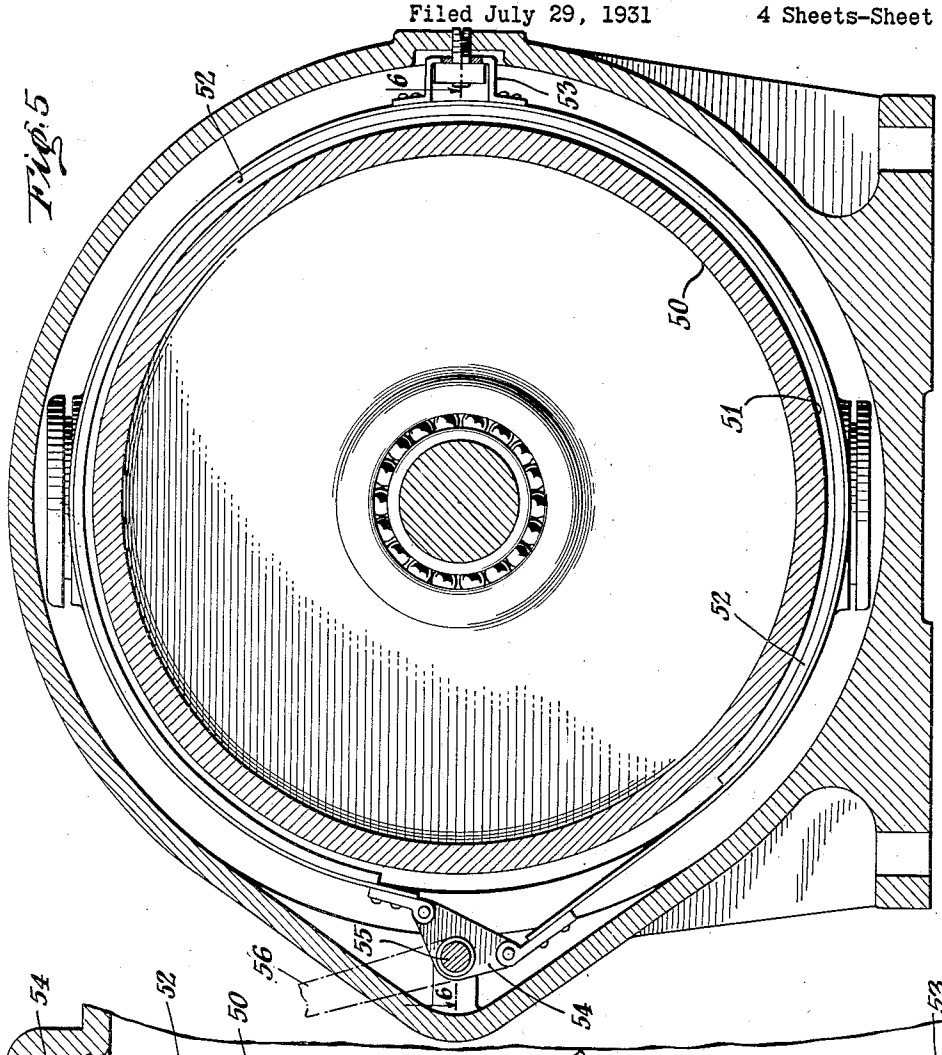
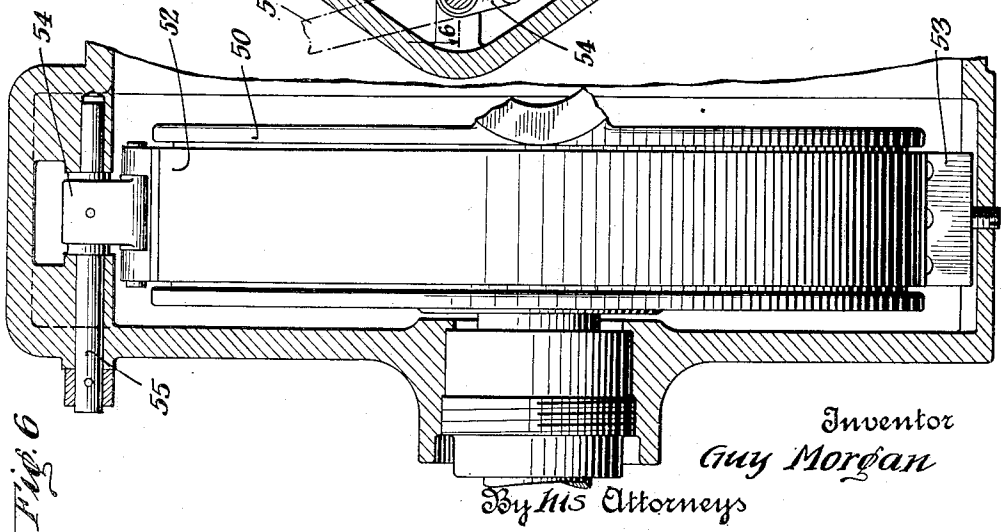


Fig. 6



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UNITED STATES PATENT OFFICE

1,932,983

REVERSING MECHANISM

Guy Morgan, New York, N. Y., assignor to The Warford Corporation, a corporation of New York

Application July 29, 1931. Serial No. 553,880

6 Claims. (Cl. 74—34)

This invention pertains to transmissions and particularly to transmissions of the heavy duty type.

The invention will be described in connection with towboats. However, it is understood that this is merely for the purposes of illustration and that the invention may have many other uses.

Internal combustion engines are finding use in towboat service. This is particularly true of internal combustion engines of the Diesel type. These engines may have a direct or gear connection with the propeller shaft but in order to reverse the propeller it is necessary to reverse the engine. With engines of the Diesel type, this is accomplished by stopping the engine and starting it in a reverse direction by means of compressed air. Experience has shown that this method of reversing the propeller is cumbersome and impractical, and is not sufficiently rapid to avoid dangers of collision, fouling of lines, etc., in the ordinary use to which towboats are put.

With my invention, internal combustion engines may be retained for this type of service. I have provided between the engine and the propeller shaft a transmission of a heavy duty type adapted for rapid changes from direct to reverse drive and vice versa. It is unnecessary to stop the engine to reverse the motion of the propeller and the motion of the propeller may be changed from one direction to the other as rapidly as with steam, electric or other drives.

Referring to the drawings in which like reference characters are appended to like parts in the various figures.

Figure 1 is an end view of my novel transmission.

Figure 2 is a section on line 2—2 of Figure 1.

Figure 3 is a section on line 3—3 of Figure 2.

Figure 4 is a sectional elevation of a modification of the invention.

Figure 5 is a section on line 5—5 of Figure 4.

Figure 6 is a section on line 6—6 of Figure 5.

Figure 7 is a diagrammatic illustration of the manner of connecting my transmission to an internal combustion engine.

Figure 8 is an end view of the band-brake mechanism disclosed in Figure 2 and shown with the scale reduced.

Referring to Figures 1, 2 and 3, at 10 is shown a case provided with an end cover plate 11. Case 10 and cover plate 11 are provided with bearings 12 and 13 respectively, in which are journalled the ends of shafts 14 and 15 respectively. Shafts 14 and 15 are in end alignment and project into case 10. Each shaft is provided with a splined end portion 16 and 17 respectively, and each carries a bevel gear 18 and 19 respectively having their toothed portions spaced from and facing each other.

The splined portions 16 and 17 of shafts 14 and 15, and bevelled gears 18 and 19 are contained within a cage 20, having one end journalled on shaft 14 as shown at 21, and its opposite end fitting over and splined to a sleeve 22 on shaft 15 as shown at 23.

Cage 20 carries a plurality of bevelled pinions 24 which are arranged so as to operatively engage the opposed bevelled teeth on gears 18 and 19. The pinions 24 may be of any number.

Sleeve 22 is mounted loosely upon shaft 15 and is provided at one end with a clutch member 25 which is adapted to engage a complementary clutch member 26 on gear 19 upon the sliding of the sleeve 22 to the left on shaft 15, as seen in Figure 2. The clutch members 25 and 26 are illustrated in Figure 2 in engaged position.

The opposite end of sleeve 22 is also provided with a clutch member 27 which is adapted to engage a complementary clutch member 28 on cover plate 11 upon the sliding of the sleeve 22 to the right, as shown in Figure 2.

Sleeve 22 is provided with spaced annular ribs 29, which form a groove 30, which is engaged by a fork 31 secured to shaft 32, extending transversely through and journalled in cover plate 11 as shown at 33. Shaft 33 is provided with an operating lever 34 secured thereto as shown at 35.

The operation of the form shown in Figures 1, 2 and 3, is as follows:

Shaft 15 is connected to the source of power. Let it be assumed that shaft 15 turns clockwise when looking at the device from right to left, as seen in Figure 2. To drive shaft 14 clockwise when viewed in a similar manner sleeve 22 is shifted by means of lever 34 to the position shown in Figure 2 so that clutch members 25 and 26 engage each other. Gear 19 which is splined to shaft 15 is driven in a clockwise direction thereby. Sleeve 22 being locked to gear 19 by means of clutch members 25 and 26 is also driven in a clockwise direction. Cage 20 being splined to sleeve 22 as illustrated at 23 is also driven in a clockwise direction. Relative movement between gear 19 and cage 20 is thus prevented, pinions 24 cannot travel over the toothed face of gear 19 and the result is that gear 18 is locked to gear 19 and travels in a clockwise direction therewith. Gear 18 being splined to

shaft 14 drives shaft 14 in a clockwise direction.

To drive shaft 14 counter-clockwise sleeve 22 is shifted to the right, as seen in Figure 2, so as to release clutch members 25 and 26 and engage clutch members 27 and 28. Sleeve 22 is now held stationary as is cage 20 which is splined thereto. There is now relative movement between the gear 19 and the cage 20 for gear 19 turns clockwise, it being splined to the shaft 15. Pinions 24 travel over the toothed face of gear 19 and drive gear 18 in a counter-clockwise direction. Gear 18 being splined to shaft 14 drives said shaft in a like direction.

Either direction of rotation may be the forward direction for the propeller. However, to reduce the number of wearing surfaces, it is preferred to shift the sleeve 22 to the left, in Figure 2, for the forward direction. A reverse direction is obtained by shifting sleeve to the right as seen in Figure 2.

Complementary clutch members 25, 26, and 27, 28 may be of any suitable design. Those illustrated comprise an ordinary dog clutch, but any other type of clutch including the various types of friction clutches may be substituted therefor if desired.

In heavy duty work, the transmission is preferably connected as shown in Figure 7. The flywheel of the engine is illustrated at 38, provided with a clutch 39, operated by means of a fork, not shown, engaging a groove 40 and driving a shaft 41 connected by means of a universal joint 42 to the shaft 15. A second clutch 43 is driven by shaft 14 and is operated by means of a fork, not shown, engaging a groove 44 on the clutch. The clutch drives a shaft 45 connected by means of a universal joint 46 to the propeller shaft 47. Because of the immense relative size of the parts as compared with transmissions ordinarily used with internal combustion engines, clutches 40 and 44 are generally momentarily disengaged when a shift is made in the transmission. The shift is effected very quickly and the result is that the propeller shaft 47 is immediately reversed in direction.

In the form shown in Figures 4, 5 and 6, the cage 120 is provided with an extension 50, providing a brake surface 51 adapted to be engaged by a brake band 52. Brake band 52 may be of any approved design and a common form is shown more in detail in Figures 5 and 6. In these figures brake band 52 is shown connected at 53 in the usual manner at the center of its circumference and having its ends engaged by an operating arm 54 on shaft 55 to which is secured a lever 56. The braking surface 51 and the brake band 52 are intended to reduce partially or completely, as desired, the relative movement between the cage 120 and the case 10. These parts assume the function of the clutch members 27 and 28 of the form shown in Figures 1, 2 and 3.

A friction clutch is substituted in place of the clutch members 25 and 26 of the first form, this friction clutch being adapted to reduce either partially or completely the relative movement between gear 119 and cage 120. Any type of friction clutch may be used for this purpose and I have shown a conventional type of plate clutch to illustrate its function. The driving member of the clutch comprises an extension 58 on gear 119 having a clutch face 59. The driven member of the clutch comprises a sleeve 60 having an expanded end 61 provided with a clutch face 62. Sleeve 60 is movably mounted on a sleeve 122 on shaft 15 and is splined to cage 120 as shown at 68. Sleeve 122 engages the end of spring pressed clutch member 64, having an annular groove 65 engaging clutch fingers 66 which in turn engage plate 67 for pressing the parts together.

Sleeve 122 is provided with spaced annular ribs 69, defining a groove 70 which is engaged by a fork 71 on shaft 72 to which is secured a lever 73.

The clutch is shown in operative position in Figure 4 and is operated by shifting the sleeve 122 by means of lever 73. It is, of course, understood that the clutch mechanism is described merely for the purposes of illustration.

The operation of the form shown in Figures 4, 5 and 6 is as follows:

Assuming that the shaft 15 turns clockwise, as viewed from right to left in Figure 4, it is merely necessary to shift lever 73 to the right to engage the clutch to cause the shaft 14 to turn clockwise. The speed of shaft 14 may be reduced by permitting the clutch to slip if desired.

To cause the shaft 14 to turn counter-clockwise, the clutch remains inoperative and the brake band 52 is brought into operation by means of the lever 56. The reduction, either partially or completely, of the relative movement between cage 120 and case 10 causes the shaft 14 to turn counter-clockwise.

Any other friction devices may be substituted for brake band 52 or the clutch mechanism. In the normal operation, these brake devices will completely reduce the relative movement between the parts for the purposes intended.

The case 10 may be filled with oil or grease if desired, friction devices which will operate in oil being well known.

In view of the heavy duty performed by the device above described, it is highly desirable to synchronize the drive and driven shafts before engaging the clutching mechanism which determines the direction of rotation of the driven shaft. Synchronization can be accomplished in various ways, an example of which is shown in Figures 1 and 2.

Shaft 15, for instance, may be extended as shown and may carry the driven element 80 of clutch 81, the driving element 82 being attached to engine shaft 83. Sleeve 84 of driven element 80 is splined to shaft 15 and carries a groove 85 which is engaged by fork 86 on shaft 87. Shaft 87 extends laterally as shown in Figure 1 and carries a lever 88. Shaft 87 is journaled in brackets 89.

Sleeve 84 carries a disc 90 on one end, which is adapted to frictionally engage a friction face 91 on cover 11 so that when shaft 15 is disconnected from engine shaft 83 by moving lever 88 clockwise to disengage clutch 81, disc 90 engages face 91 to stop shaft 15.

Shaft 14 is simultaneously stopped as follows: A brake drum 92 attached to shaft 14 is adapted to be engaged by brake band 93, which in turn is expanded and contracted by rotating shaft 94 journaled in the overturned end 95 of bracket 96 secured to case 10. A bevel pinion 97 attached to shaft 94 is in mesh with bevel pinion 98 attached to transverse shaft 99. Shaft 99 is journaled at one end in bracket 96, and at its other end in a suitable similar bracket (not shown) so as to extend beyond case 10 as seen in Figure 1. Shaft 99 carries a pinion 100 at its outer end which is engaged by a rack 101 on one end of member 102. The other end of member 102 is pivoted to lever 88.

The operation of the brake on shaft 14 is as

follows: A clockwise movement of shaft 94 contracts brake band 93. It follows that brake band 93 is expanded by a counter-clockwise movement of shaft 94. It can be readily seen that brake 93 is applied when member 102 moves to the right in Figure 2 and is released when member 102 moves to the left.

Therefore shaft 14 is stopped substantially simultaneously with shaft 15 upon disengagement of clutch 81 by a clockwise movement of lever 88. The shafts are now synchronized and the sleeve 22 may be shifted in either direction at will without danger of noise or excessive stresses due to grabbing of the clutching member for connecting shafts 14 and 15. A synchronizing device of this character is highly desirable for heavy duty reversing mechanisms of this type.

After sleeve 22 has been properly shifted, clutch 81 may be reengaged by moving lever 88 counter-clockwise, which in turn releases shafts 14 and 15.

My synchronizing mechanism is equally applicable to the form of the invention shown in Figures 4–6 as well as to other forms.

It is of course understood that any other form of construction may be employed without departing from the spirit of the invention.

My novel transmission is simple in construction, is of relatively low cost compared with similar devices for this purpose, can be readily manufactured, is durable in construction so as to stand the heaviest type of service, and is otherwise highly satisfactory for its intended purpose.

Having described my invention, it is that many modifications may be made in the same within the scope of the claims without departing from the spirit thereof.

This application is a continuation in part of my co-pending application Serial Number 509,392, filed January 17, 1931.

I claim:

1. In a device of the kind described, a drive shaft, a driven shaft, a clutch for connecting said drive shaft to power means, means for engaging and disengaging said clutch, means for controlling the direction of rotation of said driven shaft relative to said drive shaft, said means comprising gear means on each of said shafts, gear means connecting said last mentioned gear means, means directly between said connecting gear means and the gear means on one of said shafts for reducing relative movement therebetween to rotate said driven shaft in one direction, means for reducing the movement of the axis of said connecting gear means to rotate said driven shaft in an opposite direction, and braking means for stopping the rotation of said drive and driven shafts upon disengagement of said clutch.

2. In a device of the kind described, a drive shaft and a driven shaft in end alignment, a clutch for connecting said drive shaft to power means, means for engaging and disengaging said clutch, a gear on each of said shafts, gear means for connecting said shaft gears, means directly between one of said shaft gears and said connecting gear means for reducing relative rotation therebetween to rotate said driven shaft in one direction, means for reducing the movement of the axis of said connecting gear means to rotate said driven shaft in an opposite direction, and braking means for stopping the rotation of said drive and driven shafts upon disengagement of said clutch.

3. In a device of the kind described, a drive shaft, a driven shaft, a clutch for connecting said drive shaft to power means, means for engaging and disengaging said clutch, a gear on each of said shafts, a plurality of gears, each gear connecting said shaft gears, a cage, said plurality of gears mounted in said cage, means directly between said cage and one of said shafts for locking said cage to said shaft to rotate said driven shaft in one direction, means for locking said cage in immovable position to rotate said driven shaft in an opposite direction, and braking means for stopping the rotation of said drive and driven shafts upon disengagement of said clutch.

4. In a device of the kind described, a drive shaft, a driven shaft, a clutch for connecting said drive shaft to power means, means for engaging and disengaging said clutch, a gear on each of said shafts, at least one gear connecting said shaft gears, a rotatable cage, said connecting gear carried by said cage, a sleeve on one of said shafts splined to said cage, clutch means at each end of said sleeve, said sleeve movable in one direction to operate clutch means to reduce relative rotation between one of said shafts and said cage and movable in the opposite direction to reduce rotation of said cage, and breaking means for stopping the rotation of said drive and driven shafts upon disengagement of said clutch.

5. In a device of the kind described, a drive shaft, a driven shaft, a clutch for connecting said drive shaft to power means, means for engaging and disengaging said clutch, a gear on each of said shafts, at least one gear connecting said shaft gears, a rotatable cage, said connecting gear carried by said cage, a sleeve on one of said shafts, said sleeve splined to said cage, clutch means on one of said gears, complementary clutch means on said sleeve, stationary clutch means, complementary clutch means on said sleeve for said stationary clutch means, means for moving said sleeve to operate either of said clutch means, and braking means for stopping the rotation of said drive and driven shafts upon disengagement of said clutch.

6. In a device of the kind described, a drive shaft, a driven shaft, a clutch for connecting said drive shaft to power means, means for engaging and disengaging said clutch, a gear on each of said shafts, at least one gear for connecting said shaft gears, a cage, said connecting gear mounted on said cage, friction means for connecting said cage to one of said shafts to rotate said driven shaft in one direction, friction means for reducing the rotation of said cage to rotate said driven shaft in an opposite direction, and means for synchronizing said drive and driven shafts.

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