

May 27, 1958

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2,836,085

TWO-SPEED OUTPUT GEARMOTOR

Filed June 14, 1955

2 Sheets-Sheet 1

Fig. 1.

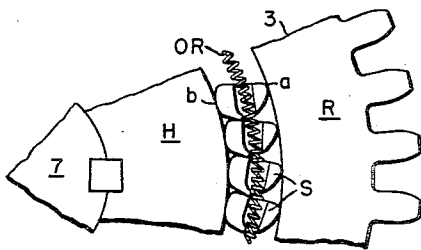
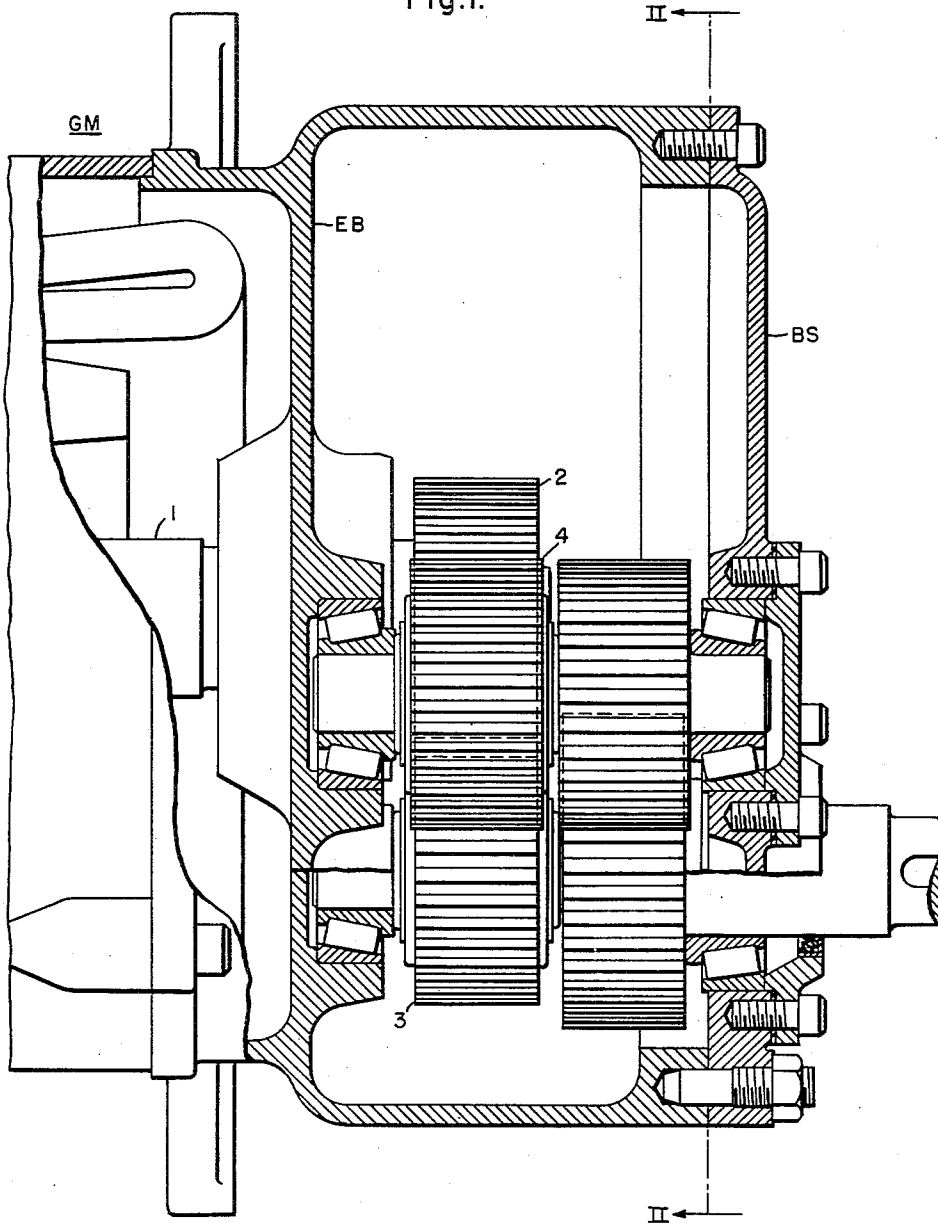


Fig. 4.

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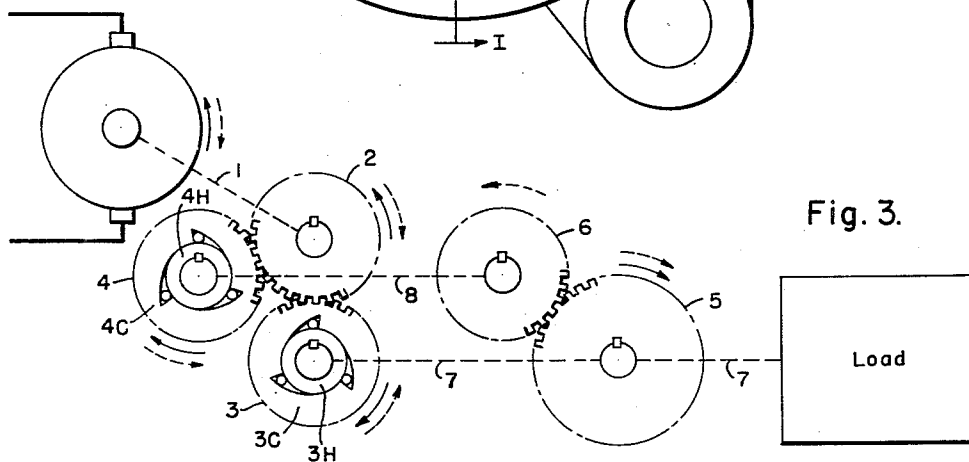
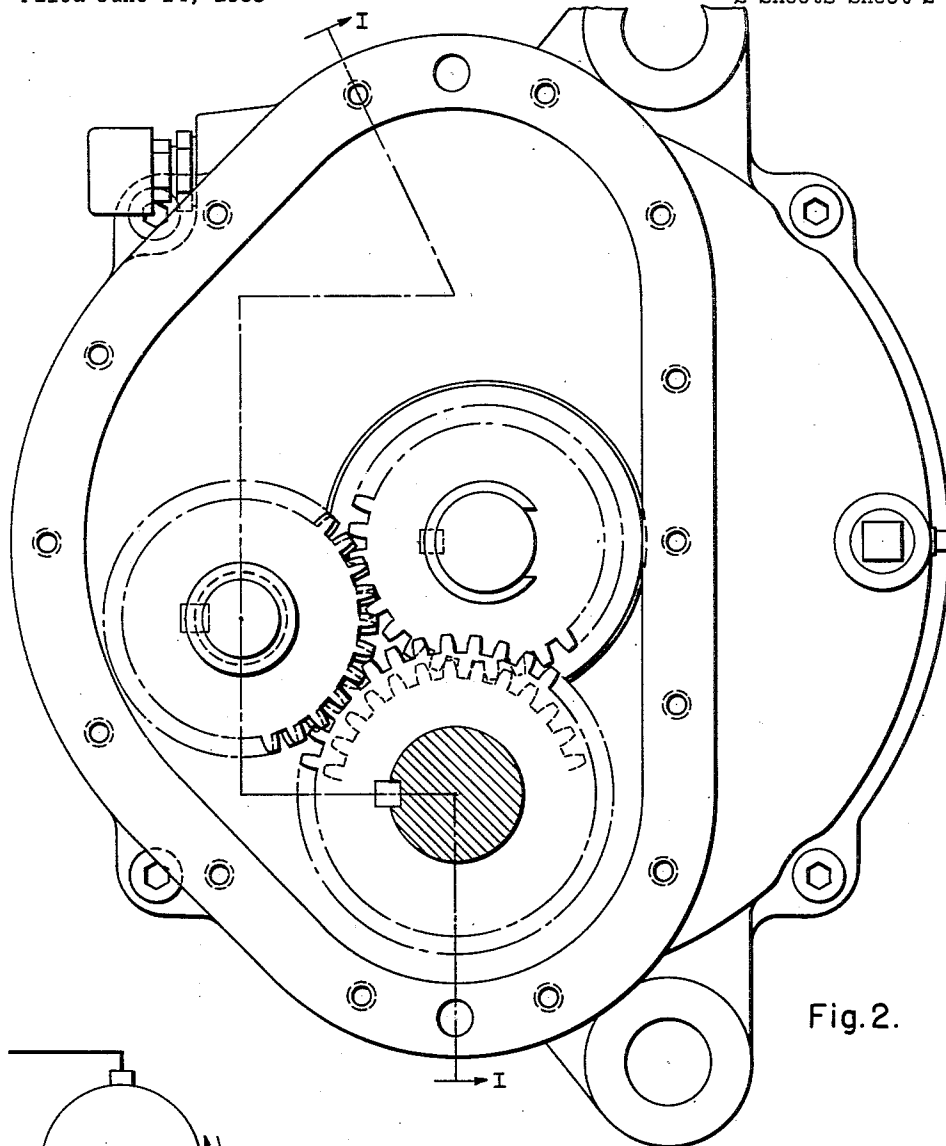
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TWO-SPEED OUTPUT GEARMOTOR

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4 Claims. (Cl. 74—812)

My invention relates to improved transmission mechanisms and more particularly to a gearmotor, namely an electric motor having a special gear transmission built into the motor end bell.

Recently the textile industry has developed a new spinning frame for which two different speeds in the same direction must be available.

In operation of the spinning frame, a slow speed is required at the beginning of a spinning cycle. Some time later, which may be anywhere from 30 minutes to 4 hours later depending on the character of the spinning cycle, the output speed, that is, the spinning frame speed, must automatically change to a higher speed. If the higher speed is chosen to be 1750 R. P. M. then the lower speed will be fixed at from 15% to 20% below the higher speed.

In similar applications of the prior art the drive from the motor to the driven shaft is a V-belt and there is about a 2 to 1 speed reduction. For the particular application in mind, space is at a premium and high accuracy is required. Therefore, some mechanical variable speed transmission as a veri-pitch V-belt drive, or a Reeves drive is not an acceptable solution.

One solution proposed is a scheme using a differential gear. A main motor is used to drive one side of the differential input and a small motor drives the other input to the differential. By reversing the direction of rotation of the small motor, the output of the differential will change its speed. It is apparent that this solution of the problem is both cumbersome and expensive.

One broad object of my invention is the provision of a simple special transmission disposed in the end bell of a motor for obtaining two output speeds, in the same direction, on the output shaft merely by running the motor either in one direction or the other.

An important object of my invention is to provide means in a transmission for a gearmotor for producing two different forward speeds of the load upon operation of the gearmotor at the same speed either forward or reverse.

Another broad object of my invention is the provision of converting the driving power of a reversible motor into two different forward speeds.

The objects recited are merely illustrative. Other objects and advantages will become more apparent from a study of the following specification and the accompanying drawings, in which:

Figure 1 is a side view of the transmission mechanisms of my invention mounted in the end bell of a gearmotor, with some parts of the end bell broken away to show some of the details;

Fig. 2 is an end view of the showing in Fig. 1 with the outer covering and bearing support removed to show some of the details;

Fig. 3 is a schematic showing of the arrangement of the elements of my transmission mechanism and thus illustrates the theory of operation of my invention; and

Fig. 4 shows a sector of the over-running, or one-way,

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clutch gear combination forming an essential part of my invention.

In actual practice the clutch and gear combination may take several forms but the particular combination shown has been found most effective.

My apparatus has special utility in the field of application hereinabove mentioned, but the invention is not limited to the field of use mentioned, but is applicable in any use where two different forward speeds of a machine are needed and the complications of differential two-motor drives, or V-belt drives, are to be avoided.

In Fig. 1 the motor GM is provided with the end bell EB having the outer cover and bearing support BS. The right-hand bearing of the motor shaft 1 is disposed in the end bell EB and to the right of the shaft bearing a pinion 2 is keyed to the motor shaft 1. This pinion 2 meshes with the gears 3 and 4.

Gears 3 and 4 are substantially identical in size and construction and are, in fact, each a combination of a gear and over-running, or one-way, clutch. The type of over-running clutch used is well known in the trade and one reliable type is sold under the trade name of Form-sprag clutches.

This type of over-running clutch comprises a hub portion H and a rim portion R with a full complement of sprags S disposed in the annular space between the outer surface of the hub H and the inner surface of the rim R. The sprags are built so that a spring or other resilient member as an O-ring OR tilts the sprags S so that each sprag at all times engages the hub and rim at points a and b. When the rim R rotates counterclockwise the hub H is not carried along but each sprag has sliding engagement with the rim and hub. The instant the rim R rotates clockwise the sprags all lock against rim and hub to thus carry the hub H along in the clockwise direction. By providing the rim R with gear teeth I provide a combination of a gear and an over-running clutch.

It does not matter whether the hub H is the driven member or is the driving member. When the hub H is the member that is driven from a motor or some other mover then the rim is carried along with the hub when the hub rotates counterclockwise. When the hub H rotates clockwise there is free-wheeling between hub and rim.

The showing in Fig. 4 shows the hub of gear 3 keyed to shaft 7 and driven by gear 2.

The over-running clutch and gear combination for gear 4 has its inner ring, or hub 4H, fixedly mounted on the jack-shaft 8. A gear 6 is keyed to the right-hand end of the jack-shaft 8 and this shaft is mounted in suitable bearings in the end bell EB and bearing support BS. The gear 3 has its inner ring, or hub 3H, fixedly mounted near the left end of the load driving shaft 7. To the right of gear 3 a gear 5 is keyed to the load driving shaft 7. Gears 3 and 5 are disposed between the bearings for the load driving shaft 7 disposed in the end bell EB and bearing support BS.

For the particular application I have in mind the gears, 2, 3, 4 and 6 are all of the same size while gear 5 is somewhat larger, that is, has more teeth. This means for a given speed of gear 6 the output speed of the load driving shaft 7 will be lower than the speed of jack-shaft 8. While the two gears 3 and 4 are identical they are so mounted on their respective shafts that counterclockwise rotation of gear 2 will drive gears 3 and 4 clockwise but no clockwise torque will be transmitted to jack-shaft 3 but clockwise torque will be transmitted to load driving shaft 7.

A better understanding of my invention may be had from a study of Fig. 3 of the drawings. Let the assumption be that motor GM rotates at 1750 R. P. M. in such a direction that pinion 2 rotates clockwise. Gears 3 and 4 will both rotate counterclockwise. The free-wheeling,

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or clutch element 4C will engage and drive the jack-shaft counterclockwise and thus drive gear 6 counterclockwise. The gear 5 will thus be driven clockwise. Since gear 5 is larger than gear 6 the load speed will be at the lower speed, the first speed for the spinning cycle.

From the foregoing operation it is apparent that the inner ring, or hub 3H, of the over-running clutch 3C rotates clockwise but since gear 3 rotates counterclockwise the clutch element 3C does in no way interfere with the low speed transmission from shaft 1 to shaft 7.

When the motor is reversed, pinion 2 is reversed. In other words, when gear 2 is rotating counterclockwise both gears 3 and 4 are rotating clockwise. The clutch element 4C now free-wheels whereas clutch element 3C now drives shaft 7 clockwise at the higher speed. While it is true that gear 6 and shaft 8 rotate counterclockwise, it is apparent that clutch element 4C does not affect the transmission of the higher speed to the shaft 7 driving the load.

While I have shown gears 2, 3, 4 and 6 of the same size such need not be the case at all. The sizes of the gears selected may be made to suit the requirements of each case.

While I have disclosed only one embodiment it is understood that my invention is capable of modifications which fall within the spirit and the scope of my invention.

I claim as my invention:

1. In a mechanical transmission for driving a load shaft at two selected different speeds in the same direction from a reversible motor operating at a selected constant speed either in a forward direction or a reverse direction, in combination, a motor, a gear case mounted on the motor frame and comprising a motor end bell and a bearing support, a jack-shaft mounted in suitable bearings in the end bell and bearing support, a first one-way clutch having a hub portion, clutch elements, and an outer ring, a second similar one-way clutch, a first gear keyed to the jack-shaft and the hub of the first clutch being also keyed to the jack-shaft, gear teeth on each of the outer rings of the clutches, a load shaft mounted in suitable bearings in the end bell and bearing support and projecting from the gear case so that a load may be coupled to the load shaft, a second gear, said second gear being keyed to the load shaft and meshing with the first gear, said second gear being larger than the first gear and thus has more gear teeth than the first gear, said second clutch having its hub keyed to the load shaft, the motor shaft projecting through the end bell and having a pinion keyed thereto, said pinion being disposed to mesh with the gear teeth on the rings of the clutches, the first clutch being so disposed on the jack-shaft that counterclockwise rotation of its ring will transmit torque to its hub and the second clutch being so mounted on the load shaft that clockwise rotation of its ring will transmit torque to the load shaft.

2. In a mechanical transmission, in combination, a gear case having a pair of substantially parallel sides, an input shaft projecting into the case through a side wall and inside the casing having a pinion keyed to the shaft, a jack-shaft parallel to the input shaft mounted in suitable bearings in the sides of the case, a first gear keyed to the jack-shaft and a second gear disposed on the jack-

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shaft and including a free-wheeling clutch for engagement with the jack-shaft, the sense of the free-wheeling clutch is such that counterclockwise rotation of the second gear transmits torque to the jack-shaft, a load shaft projecting into the case and being disposed in parallel relation to the jack-shaft, a third gear, said third gear being larger than the first gear, keyed to the load shaft and meshing with the first gear, a fourth gear, said fourth gear being disposed on the load shaft and including a free-wheeling clutch for engagement with the load shaft, the sense of the free-wheeling clutch is such that clockwise rotation of the fourth gear transmits torque to the load shaft, said pinion on the input shaft being disposed to mesh with the second and fourth gear.

3. In a gear transmission, in combination, a gear case, three shafts, an input shaft, a jack-shaft and a load shaft, disposed in parallel relation to each other and mounted in suitable bearings in the case, a driving gear rigidly connected to the input shaft, a pair of one-way clutch type of gear combinations, both meshing with the driving gear, disposed respectively on the jack-knife and load shaft, the sense of the coupling of the clutch and gear combination on the jack-shaft is such that torque is transmitted to the jack-shaft only when the gear portion rotates counterclockwise and the sense of the coupling of the clutch and gear combination on the load shaft is such that torque is transmitted to the load shaft only when the gear portion rotates clockwise, an intermediate gear rigidly connected to the jack-shaft and a driven gear rigidly connected to the load shaft meshing with the intermediate gear, said driven gear being larger than the intermediate gear to thus in use run at a slower speed than the intermediate gear.

4. In a gear transmission, in combination, an input shaft having a pinion keyed thereto, a first gear and one-way clutch combination with the gear portion meshing with the pinion, a second gear and one-way clutch combination with the gear portion meshing with the pinion, each combination having a hub, a pair of parallel shafts, the hub of the first combination being keyed to one shaft and the one-way clutch portion of the first combination being so disposed between the hub and gear portion for driving the shaft to which the first hub is keyed clockwise, and the hub of the second combination being keyed to the other shaft and the one-way clutch portion of the second combination being so disposed between the hub and gear portion for driving the second shaft to which the second hub is keyed counterclockwise, meshing gears of different size also keyed to the respective shafts, with the larger of the two meshing gears being keyed to the first shaft.

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