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APPARATUS FOR CHANGING SPEED AND DIRECTION OF ROTATION BY REVERSING A CONSTANT SPEED MOTOR

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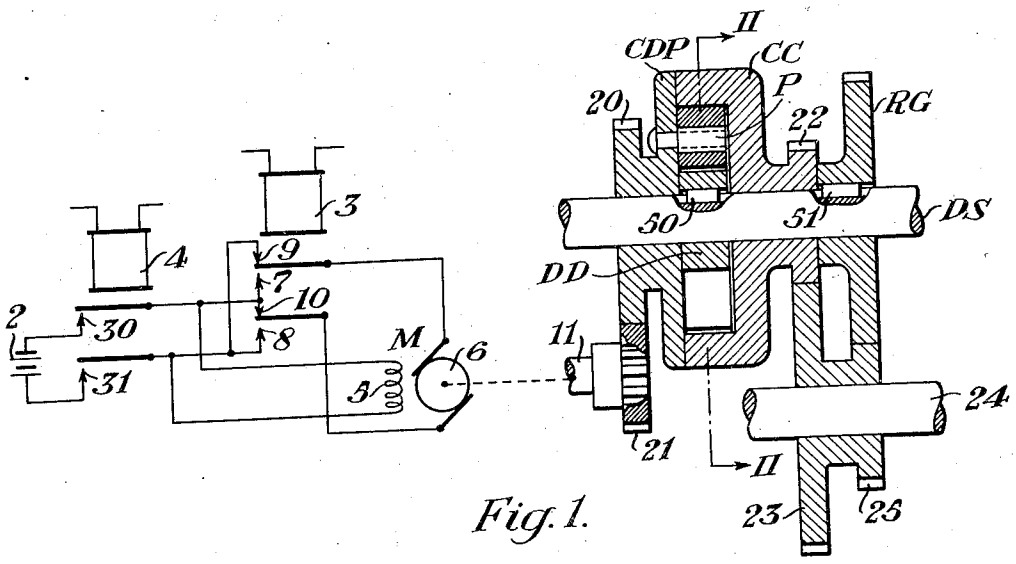

Fig. 1.

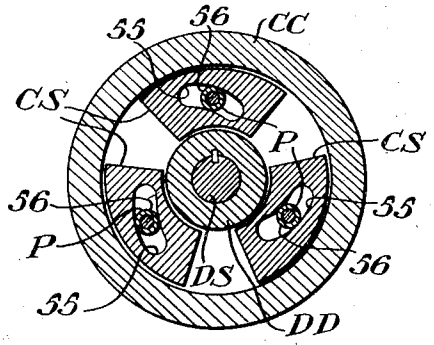

Fig. 2.

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APPARATUS FOR CHANGING SPEED AND DIRECTION OF ROTATION BY REVERSING A CONSTANT SPEED MOTOR

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4 Claims. (Cl. 74—367)

My invention relates to apparatus for changing the speed and direction of rotation of a mechanism, and has for an object the provision of novel and improved apparatus for obtaining a change in the speed of rotation of a mechanism as well as obtaining a change in the direction of rotation in response to reversibly operating a constant speed motor.

The present application is a division of my United States Letters Patent 1,991,756, granted February 19, 1935, for Apparatus for changing speed and direction of rotation by reversing a constant speed motor.

I will describe one form of apparatus embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawing, Fig. 1 is a view partly diagrammatic and partly in section of one form of apparatus embodying my invention. Fig. 2 is a sectional view at the line II—II of Fig. 1. In each of the two views like reference characters designate similar parts.

It has been proposed to control a highway crossing signal located at the intersection of a highway and a railway at grade in such a manner that the signal is operated a constant time interval before a train reaches the intersection regardless of the speed of the train. Such control involves a mechanism for determining the speed of the train as it approaches the intersection and for subsequently starting the operation of the signal in accordance with the measured speed. It is desirable to determine the speed of a train while the train is traversing a relatively short track section, much shorter than the required operating section; and furthermore, it is desirable to operate the mechanism while determining the speed of the train and while determining the time for starting the operation of the signal by a single motor, the motor operating at a constant speed throughout the entire period. Such requirements necessitate not only a change in the direction of operation of the mechanism when a train reaches a fixed point; but also a change in the speed of operating the mechanism, a constant speed reversible electric motor being a reliable and efficient driving unit. A feature of my invention is the provision of novel and reliable means for selecting the speed and direction of rotation of an operating shaft by selecting the direction of operation of a constant speed motor. Other features of my invention will appear as the specification progresses.

Many different applications for the apparatus of my invention will naturally suggest themselves to those skilled in the art, and it will be understood that I do not wish to limit myself to the specific case cited above, this one case will serve, however, to illustrate the many different places the apparatus embodying my invention may be employed.

Referring to Fig. 1, M designates a constant speed motor of any of the many well known types, and in this instance is shown as a direct current motor reversibly supplied with current from a battery 2 through the medium of two controlling relays 3 and 4. Relays 3 and 4 may be controlled in any convenient manner, such for example, as by standard railway track circuits not shown. When both relays 3 and 4 are energized as illustrated in the drawing, current is supplied to neither the field winding 5 nor to the armature 6 of the motor M and the motor is inactive. With relay 4 deenergized and relay 3 energized the field winding 5 of motor M is excited by current from the battery 2 over a circuit easily traced and which includes the two back contacts 30 and 31 of relay 4. The armature 6 of motor M receives current from the battery 2 by a circuit extending from one terminal of battery 2 over back contact 30 of relay 4, front contact 10 of relay 3, armature 6, front contact 9 and back contact 31 to the opposite terminal of the battery 2. Under this condition the direction of the flow of current in the armature 6 is such as to cause the motor M to rotate, say, in a clockwise direction at its given constant speed. Deenergizing both relays 3 and 4 causes the field winding 5 to be excited the same as before, but the circuit for the armature 6 is now from the top terminal of battery 2 over back contact 30, back contact 7 of relay 3, armature 6, and back contacts 8 and 31 to the opposite terminal of battery 2. The direction of the current flow in the armature 6 is reverse to that of the former case and the motor M is operated in a counter-clockwise direction at its given constant speed. It follows that when both relays 3 and 4 are energized, the motor M is inactive; when relay 4 is deenergized and relay 3 is energized, the motor M is rotated clockwise at its given constant speed; and with both relays 3 and 4 deenergized, the motor M is rotated counter-clockwise at its given constant speed. It will be understood, of course, that many other ways may be readily employed to reversibly supply current to the motor M to cause it to rotate clockwise at one time and to rotate counter-clockwise at another time.

As shown schematically in Fig. 1, the motor M is operatively connected with a shaft 11, and thus

it follows that when the motor M is rotated clockwise at its given constant speed, the shaft 11 likewise rotates clockwise at a given constant speed; and when the motor is rotated counter-clockwise at its given constant speed, the shaft 11 likewise rotates counter-clockwise at its given constant speed.

A frictional clutch mechanism comprising a clutch case CC, a drive drum DD, clutch segments CS and a clutch drive plate CDP are mounted upon an operating shaft DS. The drive drum DD is keyed to the shaft DS by a key 50, but the drive plate CDP and the clutch case CC are both free to rotate on the shaft DS. The clutch segments CS are made to fit loosely between the outer face of the drum DD and the inner face of the case CC. Each segment CS is provided with a slot 55 the two extreme ends of which are of unequal radii with respect to the center of the shaft DS, as will be readily understood by an inspection of Fig. 2. The clutch drive plate CDP is provided with three pins P each of which projects into the slot 55 of a mating clutch segment, a roller 56 being fitted to each pin. A drive gear RG, to be referred to later, is also keyed to the operating shaft DS by a key 51. The clutch plate CDP is equipped with a gear 20 which engages a pinion 21 on the motor shaft 11. The clutch case CC is equipped with a gear 22 which engages a gear 23 adapted to freely rotate on an idle shaft 24. A gear 25 on the hub of gear 23 engages the gear RG which as stated above is keyed to the operating shaft DS. The operating shaft DS may be connected to any desired load, such for example, as the constant time warning mechanism for a highway crossing signal referred to hereinbefore.

The operation of this clutch mechanism is such that when the clutch plate CDP is driven in a counter-clockwise direction as viewed in Fig. 2, the pins P move along the slots 55 to force the clutch segments CS toward the center and these segments are made to clutch the outer face of the drive drum DD with the result that the operating shaft DS is driven in a counter-clockwise direction. When the clutch plate CDP is driven in the clockwise direction, the pins P move along the slots 55 to force the clutch segments CS outward, and the segments CS are made to clutch the inner face of the clutch case CC with the result that the clutch case is rotated in a clockwise direction. Under this latter condition, the gear 22 drives the gear 23, and gear 25 on the hub of gear 23, in turn drives the gear RG, with the result that clockwise rotation of the clutch case CC causes a clockwise rotation of the operating shaft DS. Hence, operating the motor M in a direction to rotate the plate CDP in a counter-clockwise direction causes the drum DD and the operating shaft DS to be rotated in a counter-clockwise direction, the speed of rotation of shaft DS being in accordance with the gear ratio between the gear 20 and the pinion 21. Under this condition of operation the clutch segments CS are drawn away from the clutch case CC and it is free to be driven by the shaft DS through the gear train comprising gears RG, 25, 23 and 22 without appreciable load to the motor M. Reversing motor M and thus rotating the plate CDP in a clockwise direction, the clutch case CC is engaged by the segments CS and the shaft DS is rotated in a clockwise direction at a speed of rotation depending upon the gear ratio of the gear train comprising the gears 21, 20, 22, 23, 25 and RG. Under this condition of operation the clutch segments CS are drawn away from the drum DD and it is free to rotate with the shaft DS without appreciable load to the motor M.

It is clear from the foregoing description that two different speeds of rotation as well as a change in the direction of rotation are obtained by reversibly operating the constant speed motor M.

Although I have herein shown and described only one form of apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In combination, an operating shaft, a drive drum keyed to said shaft, a driven gear keyed to said shaft, a clutch case having an inner face concentric with the outer face of the drive drum, a gear train connecting said case with said driven gear and arranged to cause said gear to rotate in the same direction as said case, a clutch segment mounted between said drive drum and said clutch case, said segment having an outer face adapted to engage the inner face of the clutch case and an inner face adapted to engage the outer face of said drum, a drive plate, a gear train to connect said plate to said motor; and means actuated by said plate when rotated in one direction to force said segment into engagement with the clutch case, and actuated by said plate when rotated in the opposite direction to force the segment into engagement with said drum; whereby operation of the motor in one direction at a given speed causes rotation of said operating shaft in one direction at a first speed and operation of the motor in the opposite direction causes rotation of said shaft in the reverse direction at a second speed.

2. In combination, an operating shaft, a drive drum keyed to said shaft, a driven gear keyed to said shaft, a clutch case loosely mounted on said shaft and having a gear formed thereon, said clutch case constructed with an inner surface concentric with the outer surface of said drum, a first gear train including the gear on said case and said driven gear and operative to rotate said shaft in a given direction in response to rotation of said case in said given direction, a clutch segment mounted loosely between the outer surface of said drum and the inner surface of said case, said segment constructed with an outer surface for frictional engagement with the inner surface of said case and with an inner surface for frictional engagement with the outer surface of said drum, a drive plate mounted loosely on said shaft and having a gear formed thereon, a second gear train including the gear on said plate and a driving pinion, means to force said segment into engagement with the clutch case in response to the plate rotated in said given direction by said second gear train and to force said segment into engagement with the drum in response to the plate rotated in the opposite direction.

3. In combination, a drum keyed to an operating shaft, a clutch case mounted loosely on said shaft and having an inner surface concentric with the outer surface of said drum, said case having a gear formed thereon, a drive plate mounted loosely on said shaft adjacent said drum and provided with a plurality of spaced pins projecting between said inner surface of the case and the outer surface of the drum, said plate having

a gear formed thereon, a plurality of clutch segments one mounted on each of said pins and each constructed with an outer surface for frictional engagement with the inner surface of said case and an inner surface for frictional engagement with the outer surface of said drum, said segments each provided with an inclined slot for mounting on its pin whereby rotation of the plate in one direction is effective to drive said case and rotation of the plate in the other direction is effective to drive said drum, a gear train including a gear in mesh with the gear on said case and a driven gear keyed to said shaft, said gear train effective to rotate said shaft in said one direction in response to rotation of said case, and reversible operating means including a pinion in mesh with the gear on said plate.

4. In combination, an operating shaft, a drive drum keyed to said shaft, a clutch case loosely mounted on said shaft and constructed with an inner surface concentric with the outer surface of said drum, a drive plate mounted loosely on said shaft and provided with a pin projecting between said inner surface of the case and outer surface of the drum, a clutch segment constructed with a slot for mounting on said pin, said slot having its opposite ends of different radii with respect to the drum center for causing said segment to frictionally engage the inner surface of the case in response to rotation of the plate in one direction and to frictionally engage the outer surface of the drum in response to rotation of the plate in the other direction, a first gear train including a driving gear fixed with said case and a driven gear keyed to said shaft, a second gear train including a pinion and a driven gear fixed with said plate, and means for reversibly operating said pinion, whereby said shaft is rotated in said other direction through said second gear train and said drum and is rotated in said one direction through said first and second gear trains.

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