

36. **B. E. O'HAGAN**
APPARATUS FOR CHANGING SPEED AND DIRECTION OF
ROTATION BY REVERSING A CONSTANT SPEED MOTOR
Filed Feb. 15, 1935

36. **B. E. O'HAGAN**
APPARATUS FOR CHANGING SPEED AND DIRECTION OF
ROTATION BY REVERSING A CONSTANT SPEED MOTOR
Filed Feb. 15, 1935



By *Arthur*

HIS ATTORNEY.

UNITED STATES PATENT OFFICE

2,036,073

APPARATUS FOR CHANGING SPEED AND
DIRECTION OF ROTATION BY REVERSING
A CONSTANT SPEED MOTORBernard E. O'Hagan, Swissvale, Pa., assignor to
The Union Switch & Signal Company, Swiss-
vale, Pa., a corporation of Pennsylvania

Application February 15, 1935, Serial No. 6,663

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 by reversibly operating a constant speed motor.

The invention of the present application is disclosed, but not claimed, in an application, Serial No. 663,440, filed March 30, 1933, as a joint application by Bernard E. O'Hagan and Branko Lazich and which application has since been changed to a sole application by Branko Lazich.

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.

Loosely mounted on the motor shaft 11 is a gear G1, on the arbor 12 of which is keyed a ratchet R1. On the arbor 12 of gear G1 is loosely mounted a second gear G2 on the arbor 13 of which is keyed a second ratchet R2. The physical arrangement of these parts will be readily understood by an inspection of Fig. 1, the ratchets R1 and R2 being arranged for opposite operation as shown in Fig. 2. An arm 14 is rigidly fastened to the motor shaft 11 by a pin 52, and arm 14 carries a pin 15 which fits into a yoke 16 of a ratchet pawl 17 as is best shown in Fig. 2. The pawl 17 is supported by a pin 18 attached to a collar 19 which fits on the arbor 13 of gear G2 with a slight amount of friction between collar 19 and the arbor 13 so that when the direction of rotation is reversed as will be shortly pointed out, the pawl 17 is driven positively into engagement with the proper ratchet R1 or R2. Gear G1 meshes with a gear G3 pinned to an operating shaft DS by a pin 53, the gear ratio between gears G1 and G3 being arranged as desired. Gear G2 meshes with a gear G4 which is likewise pinned to the operating shaft DS by a pin 54, the gear ratio between gears G2 and G4 being arranged as desired. In Fig. 1, the gears G1 and G3 are selected to produce a reduction in the speed of rotation so that the operating shaft DS is driven at a speed of rotation less than the driving gear G1 when that gear is active. Gears G2 and G4 are selected to produce an increase in the speed of rotation so that the operating shaft DS is driven at a speed of rotation greater than that of the driving gear G2 when that gear is active. 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.

When the motor M is operated in a direction proper for rotating the shaft 11 in a counter-clockwise direction as viewed in Fig. 2, the pin 15 of arm 14 causes the pawl 17 to tilt to the right and engage the ratchet R2 with the result that the gear G4 and the operating shaft DS are rotated in a clockwise direction when viewed from the right-hand end of Fig. 1, the speed of rotation of the shaft DS depending upon the gear ratio between the gears G2 and G4. Under this condition the ratchet R1 and gear G1 are free to be rotated by the operating shaft DS through the gear G3 and offer appreciably no load to the motor M. When the motor M is rotated in the opposite direction to drive the motor shaft 11 in the clockwise direction as viewed in Fig. 2, the pin 15 of the arm 14 causes the pawl 17 to tilt to the left and engage the ratchet R1 with the result that the gear G3 and the operating shaft DS are rotated counter-clockwise as viewed from the right-hand end of Fig. 1, the speed of rotation of the shaft DS depending upon the gear ratio between the gears G1 and G3. Under this condition the ratchet R2 and gear G2 are free to turn so that when they are driven through the gear G4, they offer appreciably no load to the motor M. It is clear from the fore-

going description that the direction of rotation of the motor M selects the ratchet and gear train by which the operating shaft DS is to be operated. The different gear ratios for the two different gear trains cause the operating shaft DS to be operated clockwise at one speed when driven by the constant speed motor M, and to be driven counter-clockwise at a different speed when the motor M is reversed.

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 motor shaft, a first train of gears including a driven gear rigid with the operating shaft and a driving gear loosely mounted on the motor shaft, said driving gear provided with an extending arbor, a second train of gears including a driven gear rigid with the operating shaft and a driving gear loosely mounted on the arbor of the driving gear of said first gear train, said driving gear of the second gear train also provided with an extending arbor, a first ratchet keyed to the arbor of the driving gear of the first gear train, a second ratchet keyed to the arbor of the driving gear of the second gear train, said ratchets reversed to each other, a ratchet pawl, and means governed by the direction of rotation of the motor shaft for causing said ratchet pawl to selectively engage said ratchets.

2. In combination, an operating shaft, a motor shaft, a first train of gears including a driven gear rigid with the operating shaft and a driving gear loosely mounted on the motor shaft, said driving gear provided with an extending arbor, a second train of gears including a driven gear rigid with the operating shaft and a driving gear loosely mounted on the arbor of the driving gear of said first gear train, said driving gear of the second gear train also provided with an extending arbor, a first ratchet keyed to the arbor of the driving gear of the first gear train, a second ratchet keyed to the arbor of the driving gear of the second gear train, said ratchets reversed to each other, a ratchet pawl, an arm secured to the motor shaft, and means mounted on said arm effective to cause said ratchet pawl to engage one or the other of said ratchets according to the direction of rotation of said motor shaft.

3. In combination, an operating shaft, a motor shaft, a first train of gears including a driven gear rigid with the operating shaft and a driving gear loosely mounted on the motor shaft, said driving gear provided with an extending arbor, a second train of gears including a driven gear rigid with the operating shaft and a driving gear loosely mounted on the arbor of the driving gear of said first gear train, said driving gear of the second gear train also provided with an extending arbor, a first ratchet keyed to the arbor of the driving gear of the first gear train, a second ratchet keyed to the arbor of the driving gear of the second gear train, said ratchets reversed to each other, a collar frictionally mounted on the arbor of the driving gear of said second gear train, a pin secured in said collar, a ratchet pawl journaled on said pin, an arm secured to the motor shaft adjacent the arbors of said driving

gears for rotations with the motor shaft, and a pin mounted on said arm effective to tilt said ratchet pawl into engagement with one or the other of said ratchets according to the direction of rotation of the motor shaft.

5 4. In combination, an operating shaft to be operated in one direction at a first given speed and in the other direction at a second given speed, a constant speed motor, a motor shaft
10 operatively connected with said motor, a first train of gears including a driven gear rigid with the operating shaft and a driving gear loosely mounted on the motor shaft, said driving gear provided with an extending arbor and said first
15 train of gears effective to produce said first speed when driven by said motor, a second train of

gears including a driven gear rigid with the operating shaft and a driving gear loosely mounted on the arbor of said driving gear of the first train, said driving gear of said second train also provided with an extending arbor and said second gear train effective to produce said second speed when driven by said motor, a first ratchet keyed to the arbor of the driving gear of the first gear train, a second ratchet keyed to the arbor of the driving gear of the second gear
10 train, said ratchets reversed to each other, a ratchet pawl, and means governed by the direction of rotation of the motor for causing said ratchet pawl to selectively engage said ratchets.

15
BERNARD E. O'HAGAN.