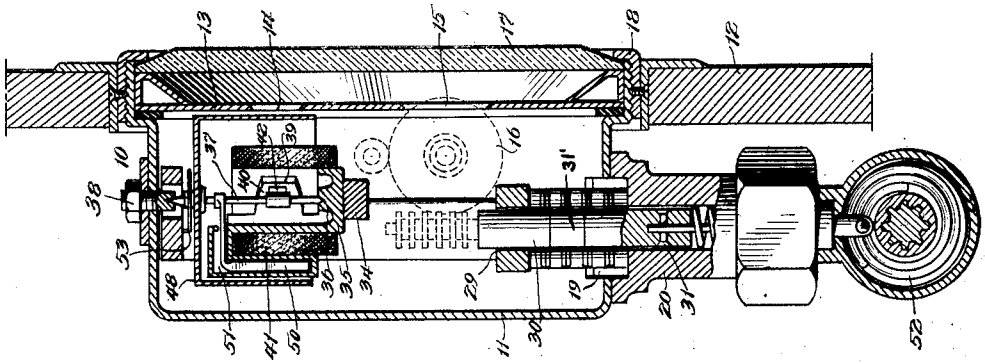
March 13, 1928. 1,662,433

H. J. MURRAY

ELECTRIC SPEEDOMETER

Filed June 20, 1922

Fig. 2.



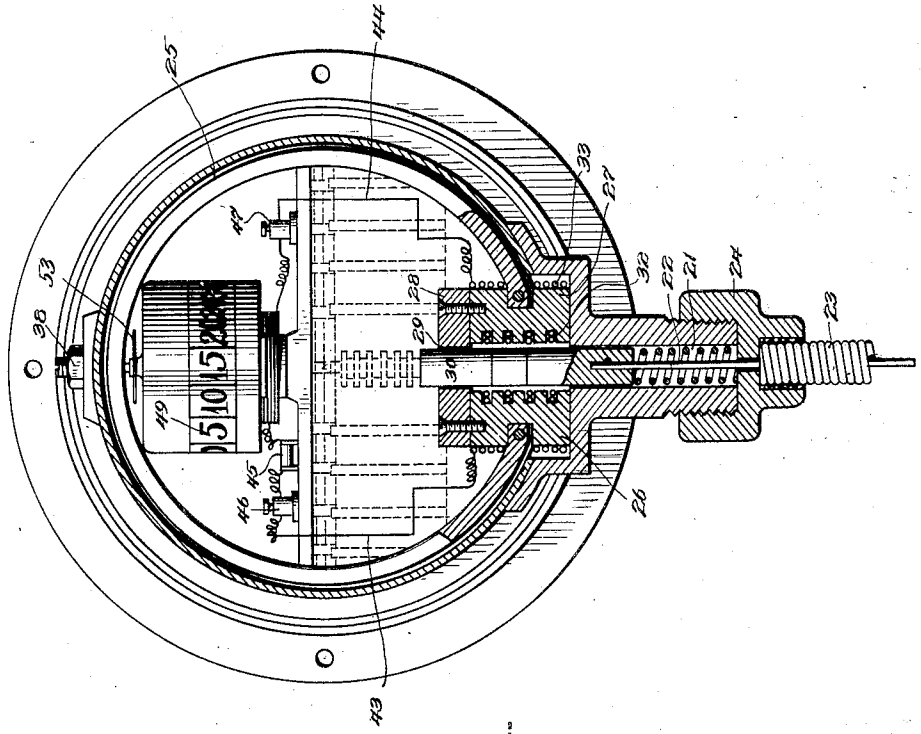


Fig. 1.

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UNITED STATES PATENT OFFICE.

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ELECTRIC SPEEDOMETER.

Application filed June 20, 1922. Serial No. 569,759.

The invention relates to a pulsatory current electric current generator of the type in which the armature reciprocates in the magnetic field and the invention specifically relates to such a generator constituting part of a speed indicator in which the indicating element is controlled by the current developed by such a generator and in which the reciprocating armature of the generator is operatively connected so as to be a function of the speed to be measured.

Magnetic speedometers of the type now generally known are designed so that the action of a speed controlled rotating armature generates an alternating current which in turn controls an indicator responsive to changes in frequency and voltage of the alternating current generated. Indicator actuating mechanism of the type which necessarily employs alternating current is expensive to manufacture and must have a degree of refinement in construction and operation not necessary with speedometers of the type intended for use on automotive vehicles where an error of one or two per cent is negligible.

Accordingly, one of the objects of the invention is to provide a simplified form of electrically actuated speedometer in which it is possible to utilize the usual alternating current instruments and also a form of indicator affecting instrumentalities of the type which are usually found in direct current or rather in unidirectional current types of instrument.

Another object of the invention is to provide in a speedometer of the type outlined, an electric generator certain elements of which may be easily modified so that the device can generate both alternating and in effect, unidirectional currents and to provide a form of indicating mechanism coacting therewith in such manner that it can be actuated from any form of electric current which may be developed by the generator.

Another object of the invention is to provide a form of generator which will not be materially affected by the expansions and contractions of parts thereof due to temperature changes, which will have the parts forming the air gap designed to cause the magnetic reluctance of the air gap to remain constant, which may be substantially free of brushes, contacts, plugs or other spark forming parts, and in which the armature element may be quickly demounted from the remaining part of the mechanism without affecting the remaining parts and without necessity for demounting any other parts or breaking any electrical connections.

Various other objects and advantages of the invention will be in part obvious from an inspection of the accompanying drawings and in part will be more fully set forth in the following particular description of one form of mechanism embodying my invention, and the invention also consists in certain novel features of construction and combination of parts hereinafter set forth and claimed.

In the accompanying drawings:

Figure 1 is a view largely in vertical section taken through an electro-magnetic speedometer constituting a preferred embodiment of the invention.

Figure 2 is a vertical sectional view taken from front to rear and taken in a plane at right angles to the face of the instrument and through the device shown in Figure 1.

In the following description and in the claims, parts will be identified by specific means for convenience of expression but they are intended to be as generic in their application to similar parts as the art will permit.

In the drawings there is shown a speedometer 10 comprising a mechanism containing casing 11 mounted in a support 12. The front of the casing is provided with a dial 13 having a sight opening 14 for reading the speed indicator hereinafter described and a sight opening 15 for reading the odometer mechanism indicated at 16 in dotted outlines, but forming no part of the present disclosure, except to show that the odometer may be driven by the reciprocating armature hereinafter described. A cover glass 17 is held in place by a retaining ring 18 which finishes the front of the instrument.

The bottom of the casing 11 is provided with an opening 19 outlined by an armature supporting casting 20 which depends from the casing and is provided with a bore 21, into the lower open end of which extends one end of a reciprocating rod 22 constituting part of a flexible power transmitting cable 23, secured at one end by the nut 24 threaded to the casting 20, and in other respects corresponding to the speedometer drive illustrated in my Patent No. 1,488,935, April 1, 1924.

A permanent magnet 25 in the form of a split ring provides part of a flux path and is loosely fitted within the casing 11, and has its lower split ends set into and secured into opposite sides of a pair of pole pieces 26 and 27 extending through the opening 19. The pole pieces extend within and to the outside of the magnet and are secured together at their inner ends by means of a yoke 28. The yoke is provided centrally thereof with an opening 29. A pencil-like generator armature 30 in the form of a line of plugs, one of which 31' is of soft iron or other magnetic material and the others of which are made of non-magnetic material arranged in axial alignment to form a long cylinder, is mounted for reciprocatory movement between the pole pieces. One end of the armature is guided in the yoke opening 29 and the opposite end is guided in the bore 21. The armature is secured to the reciprocating rod 22 by means of a pin 31 and it is to be understood that the armature will be reciprocated by the reciprocating rod 22 and will partake of the irregular movement of the rod 22 hereinafter more fully described. The pole pieces 26 and 27 are provided with grooves 32 and a single conductor 33 is wound about both of the pole pieces to form inductors so as to form a stationary armature winding and thus constitute part of an electric circuit. It is obvious however that the pole pieces may be wound in parallel, if desired.

The electric circuit includes an electrically actuated instrument of a type which is influenced by changes in frequency of the current passing through the circuit, and in the device herein disclosed, where the organization is designed to constitute a speedometer, the electrical instrument is of a type which will indicate or record speed characteristics.

Referring to the specific disclosure herein illustrated, there is shown an indicator support in the form of a cross piece 34 extending horizontally across the permanent magnet and secured thereto at opposite ends. The cross piece is provided centrally thereof with a cup 35 providing a lower bearing 36 for an upstanding axle 37 the upper end of which is journalled in an adjusting screw 38, access to which is readily provided from the exterior of the casing so as to adjust the upper bearing. The cup 35 provides a bottom support for an upstanding, hollow, cylindrical field containing piece 39 which has one side cut away to form a curved extension 40 formed of soft cast iron and tapering in the direction of desired rotation of the axle 37. This field piece 39 is surrounded with an instrument field winding 41 to form a cylindrical hollow winding and thus form a field producing member.

A second soft iron pole piece 42 is secured to the axle 37 to rotate therewith concentric to the circular field 39, and thus form a moving or indicator controlling armature. The conductor which constitutes the winding of the pole piece 26 is connected electrically at one end to the instrument field winding 41 by means of a lead 43 and similarly the winding about the pole piece 27 is connected to the field winding 41 by means of a lead 44. In those cases where an approximate direct current is desired, it is proposed to install an indicator of a type which will be affected by the frequency or voltage of the current passing through it and for this purpose there is shown in Figure 1 an impedance winding 45 contained in the lead 43. The impedance winding may be readily changed from its position in the circuit including the lead 43 to the circuit including the lead 44 and for convenience in making the connections, the leads 43 and 44 are interrupted by binding posts 46 and 47 carried by the cross-piece 34.

An indicator 48 is secured to the axle 37 to rotate therewith and in this disclosure the indicator is in the form of an inverted aluminum cup provided with speed designating characters 49 on the outside thereof, and which numerals are caused to pass the sight opening 14 as the axle is rotated under the influence of the current passing through the electrical instrument disclosed.

Under some conditions, it is desirable to dampen the oscillations of the indicator, and for this purpose a vane 50 is secured to the axle 37 and is caused to move in an annular chamber 51 to form in effect a dashpot action.

It is herewith suggested that the generator armature be reciprocated faster while moving in one direction than when moving in the opposite direction, and in so far as the present disclosure is concerned, this may be obtained by any suitable form of cam control 52, indicated diagrammatically in the present disclosure.

A coiled spring 53 engages the axle 57 and tends to restore the indicator to its initial, zero position when free of the magnet influences which cause it to move.

In operation, and assuming first that the movable armature is reciprocated across the faces of the pole pins provided by the wound pole pieces faster in one direction than in the opposite direction it will be obvious that the current generated in the electric circuit will have a voltage and consequently an amperage proportionate to the rate of movement of the reciprocating armature, and the current will have a wave form proportional to said movement. Under this assumption the generator produces an alternating current having a wave curve characteristic in one direction different from the wave form characteristic in the other di-

rection. With the generator designed to produce an alternating current it is possible to use any form of the electrically controlled indicators now used with alternating current.

Again assuming that the armature is caused to move slower in one direction than in the other, due to the construction of the cam control, there will be produced within each cycle a current of two wave form characteristics. Assuming that the relation of the several parts forming the electric indicator and the movement of the armature relative thereto are such that the upward motion induces a positive voltage, then the downward motion will induce a so-called negative voltage. If the upward motion is relatively slow and the downward motion fast within each cycle, then the positive wave will have a different characteristic than the negative wave. In this way, it is possible to generate electric current of a single phase having different frequencies, and the frequencies will vary with the speed of the armature in definite relation and with a resultant change in the voltage and current strength.

By the proper selection of the type of impedance used, it is possible to more positively retard the higher frequency than the lower frequency and thus pass the portion of the cycle having a lower frequency to a larger extent than the higher frequency is passed. In this way it is possible to generate approximately direct current without contacts or commutators. By a proper selection of the type of cam control used, it is possible, by means of the device disclosed to generate either an alternating current or an approximate unidirectional current.

While I have shown and described, and have pointed out in the annexed claims, certain novel features of my invention, it will be understood that various omissions, substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

Having thus described my invention, I claim:

1. In a device of the class described, the combination of a magnetic structure providing a portion of a flux path and including a permanent magnet for a portion of its length adapted to provide flux in the said path, a soft iron pole piece fixed to the said magnet and also forming a portion of said path, a movable armature positioned in a portion of the said path and adapted to contain a portion of the said flux, means for reciprocating the said movable armature in the said path whereby the said contained flux will be caused to move therewith and hence past the said fixed pole piece whereby the total flux of the said path is maintained substantially constant.

2. In a device of the class described, the combination of a magnetic structure providing a portion of a flux path and including a permanent magnet for a portion of its length adapted to provide flux in the said path, a soft iron pole piece fixed to the said magnet and also forming a portion of said path, a movable armature positioned in a portion of the said path and adapted to contain a portion of the said flux, means for reciprocating the said movable armature in the said path whereby the said contained flux will be caused to move therewith and hence adjacent the said fixed pole piece whereby the total flux of the said path is maintained substantially constant, and a system of inductors operatively associated with the said moving flux, whereby alternating electric current is caused to flow in the said inductors.

3. In a device of the class described, the combination of a magnetic structure providing a flux path and consisting of a permanent magnet, having pole pieces, a movable armature, spaced substantially equidistances from the pole pieces so as to form an air gap of substantially constant width in all positions of the movable armature, means for supporting the said permanent magnet and its pole pieces with a freedom of relative movement in such direction that the said movable armature may be moved relative thereto.

4. In an electric instrument, the combination of a permanent magnet in the form of a split ring, pole pieces at the ends of the magnet, an armature mounted for reciprocatory movement between the pole pieces, inductors carried by the pole pieces, and said armature being removable as a unit without affecting the magnet, inductors or indicator.

5. In an electric instrument, the combination of a permanent magnet, pole pieces coacting with said magnet to form inductors, and a reciprocating armature having a movement faster in one direction than in the other, and an electric instrument disposed in circuit with said inductors.

6. In combination, a permanent magnet in the form of a split ring, pole pieces at the ends of the magnet, means forming an electric circuit including an indicator and inductors wound about the pole pieces, and an armature guided for reciprocatory movement between the pole pieces.

7. In combination, a permanent magnet in the form of a split ring, pole pieces at the ends of the magnet, means forming an electric circuit including inductors wound about the pole pieces, a yoke connecting the pole pieces and an armature reciprocating between the pole pieces and guided in the yoke.

8. In a dynamo-electric machine, the com-

bination of a magnetic structure providing a flux path and comprising a plurality of relatively movable portions, means for producing a magnetic flux in said path, one of said portions provided with inductors, said movable portions being operatively associated for irregularly varying the distortion of the flux from its normal inactive position, thereby to induce a current in said inductors having a wave characteristic for half of each cycle different from the wave characteristic of the other half.

9. In a dynamo-electric machine, the combination of a magnetic structure providing a flux path, means for creating flux in said path, conductors inductively associated with said path to be affected by a movement of said flux, and power means having cyclic movement and having a variable speed within each cyclic movement, said means being operatively associated with said structure for causing the flux to link with said inductors at a rate different from the rate at which it unlinks therefrom.

10. In a dynamo-electric machine, the combination of a magnetic structure providing a flux path, means for creating flux in said path, conductors inductively associated with said path to be affected by a movement of said flux, power means having cyclic movement and having a variable speed within each cyclic movement, said means being operatively associated with said structure for causing the flux to link with said inductors at a rate different from the rate at which it unlinks therefrom and means in circuit with said inductors constituting an impedance.

Signed at New York city, in the county of New York and State of New York this 14th day of June, A. D. 1922.

HOWARD J. MURRAY.