Jan. 25, 1938. G. WALL 2,106,582

PREPAYMENT METER FOR ELECTRICITY, GAS, AND LIKE COMMODITIES

Filed March 12, 1936 2 Sheets-Sheet 1

FIG. 1.

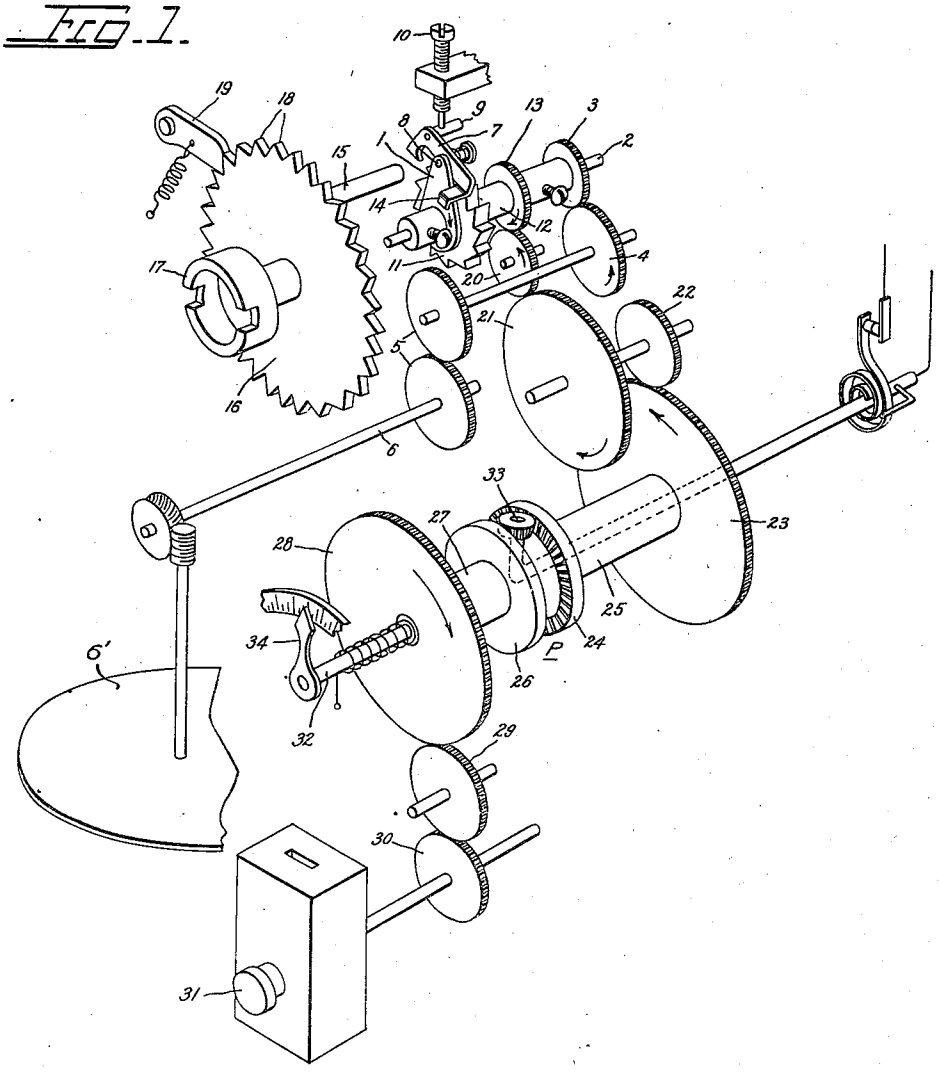

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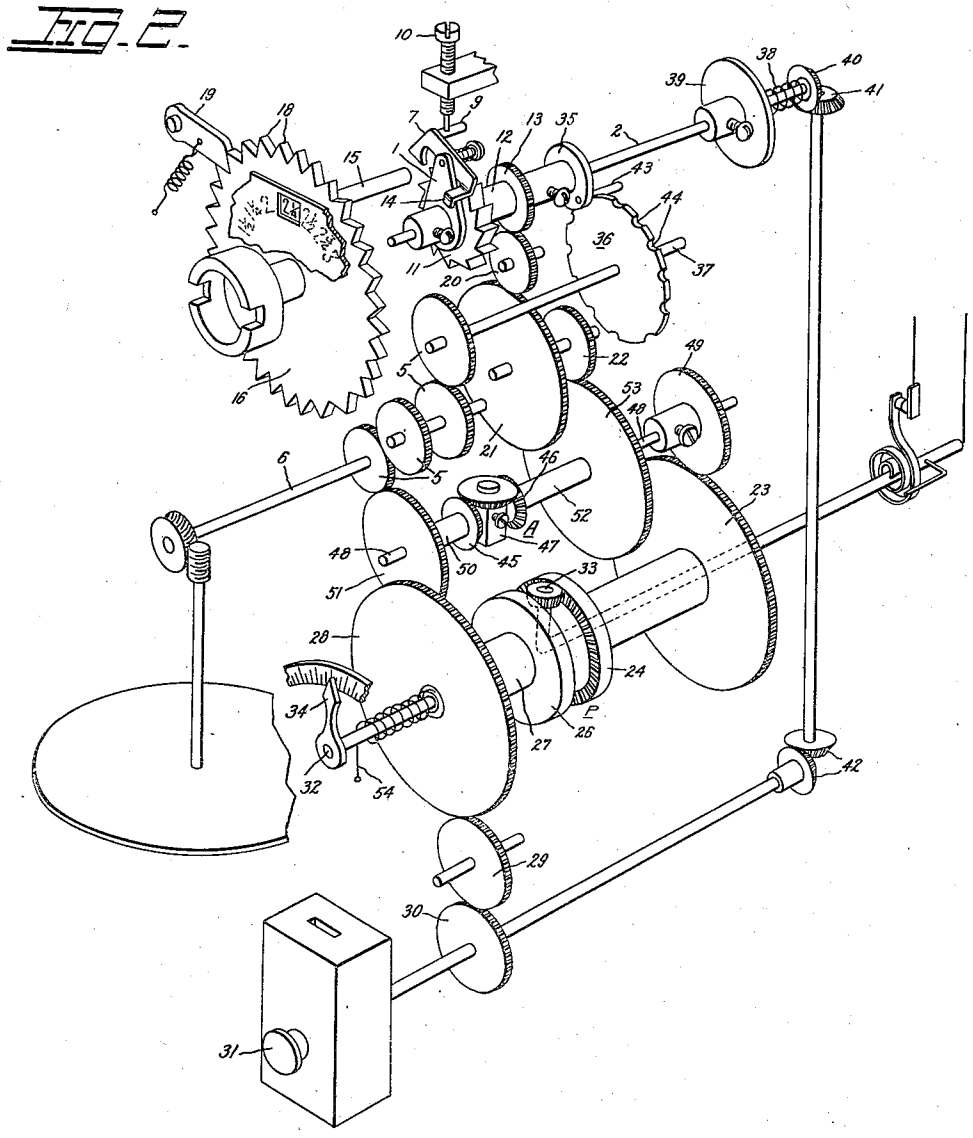
Fig. 2.



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PREPAYMENT METER FOR ELECTRICITY, GAS, AND LIKE COMMODITIES

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7 Claims. (Cl. 74—125.5)

The present invention relates to prepayment meters for electricity, gas, and like commodities.

In prepayment meters of the kind referred to, a device hereinafter called the prepayment mechanism comprises two operable members, one of which, herein referred to as the coin side, is operated by the coin mechanism on the insertion of a coin thereinto and the rotation thereof to discharge the coin therefrom. The coin side of the prepayment mechanism is moved by an amount proportional to the value of the coin inserted into the coin box. The other operable member of the prepayment mechanism, herein referred to as the commodity side, is moved in the "off" direction by or under the control of the meter rotor. The two operable members control a third member, such as tap or switch which controls the supply of the commodity. The prepayment mechanism may be of the epicyclic differential type or the well known catch up mechanism type, or of any other suitable form.

Hitherto, it has been proposed, in order to change the scale of payment for the commodity consumed, to change the amount by which the coin side of the prepayment mechanism is advanced by the operations incidental to passing one coin into the coin collecting box or drawer, so that successive equal changes of the amount of this movement result in equal changes of the amount of commodity allowed per coin, and when it is desired to express the tariff in terms of commodity per unit of money, this system results in a convenient indexing of the price change adjustment. It has also been proposed to include between the meter rotor and the commodity side of the prepayment mechanism a variable gear device whereby a progressive change of gear ratio between the meter rotor, or the equivalent, and herein referred to solely as the meter rotor, and the commodity side of the prepayment mechanism may be readily obtained. This latter arrangement lends itself conveniently to expressing the tariff in terms of the number of coins of a given denomination per unit of commodity.

The present invention more specifically relates to prepayment meters of the kind referred to which have a variable device as last hereinbefore described, and has for its object novel mechanism whereby the progressive change of gear ratio aforementioned may be obtained.

According to the present invention in its preferred form, a pawl and ratchet mechanism is included in a train of gears connected to the commodity side of the prepayment mechanism and is adapted to be made operative through an adjustable part of the rotary path of a member rotated by or under the control of the meter rotor, so as to render operative through that said adjustable part of the rotary path of the said member the said train of gears connected to the commodity side of the prepayment mechanism.

In a preferred method of carrying out the invention the pawl and ratchet mechanism is made operative always at the same fixed point in the rotary path of a member rotated by or under the control of the meter rotor and a device, whose angular position with respect to the said same fixed point is adjustable, is furthermore provided and adapted to cause the said pawl and ratchet mechanism to become inoperative thereby to render the said train of gears inoperative after a predetermined adjustable fraction of the angular movement of the rotor or member controlled thereby. Conveniently, the pawl may be the member rotated by the meter rotor, and fixed and relatively adjustable stops are provided to rock the pawl into and out of engagement with the ratchet wheel.

Such gear mechanism rendered operative by the pawl and ratchet mechanism may be the only gear mechanism between the meter rotor and the prepayment mechanism, or it may be additional to a continuously operative gear mechanism between the meter rotor and the prepayment mechanism, in which case the resultant of the two movements of the two gear mechanisms is obtained by a differential mechanism and transmitted to the commodity side of the prepayment mechanism. The continuously operative gear mechanism may be for the normal price per unit of the commodity and the effect of the additional gear may be added or subtracted from the effect of the continuously operative gear as the price of the commodity varies above or below the normal price.

The accompanying drawings taken in conjunction with the following description give by way of example two embodiments of the invention. The features of the invention which are believed to be novel and patentable are pointed out in the claims appended hereto. In the drawings, Figure 1 shows diagrammatically a prepayment electricity meter in which the variable gear mechanism is inserted between the meter rotor and the commodity side of the prepayment mechanism and is driven directly by the meter rotor, whilst Figure 2 shows diagrammatically

the said mechanism rotated by an auxiliary motor under the control of the meter rotor.

Referring now to Figure 1 of the drawings, an arm 1 is secured to a shaft 2 which is geared through gears 3, 4, 5 to one of the shafts 6 of the meter register which is driven in the usual manner by the meter rotor 6', and the arm 1 is provided at its free end with a pawl 7 which is pivotally attached to the arm by a pivot pin 8 and is spring pressed against the arm so that said pawl will be held by friction in whatever position it is placed. The pawl 7 is provided at one end with a projecting pin 9 which, as the arm rotates, is adapted to come into contact with a fixed stop in the form of an adjustable screw 10 screwed through a suitable stationary member of the meter frame, and the pawl 7 is thereby depressed and caused to engage with the teeth of a ratchet wheel 11 integral with a sleeve 12 and gear wheel 13 loosely mounted on the shaft 2. The pawl 7 is furthermore provided with a tail piece 14 suitably shaped and adapted to come into contact at an adjustable predetermined point in its rotary path due to the rotating arm 1, with an adjustable stop 15 so that the pawl 7 is rocked about its pivot and disengaged from the teeth of the ratchet wheel 11. It will be observed that the end of the screw 10 is at a greater radial distance from the axis of rotation of the shaft 2 than the pivot pin 8, and the stop 15 is at a lesser radial distance than the pivot pin 8. In other words, the stops 10 and 15 are on either side of the pivot pin 8 and the projections 9 and 14 are correspondingly positioned so that the projecting pin 9 is at a greater radial distance than the pivot pin 8 when the pawl 7 is disengaged and the tail piece 14 is at a lesser radial distance when the pawl 7 is engaged. When the projection 9 strikes the stop 10, the projecting pin 9 is driven inward to cause engagement of the pawl with the ratchet 11 and, when the tail piece 14 strikes the stop 15, the tail piece 14 is driven inward to cause disengagement of the pawl 7 from the ratchet 11.

The adjustable stop 15 takes the form of a pin and is carried on a circular plate 16, herein referred to as the locating disk, provided with a knob 17 by which it can be rotated about an axis coaxial with the axis of the shaft 2 and is so located that the projecting pin 15 lies in the circular path of the tail piece 14 of the pawl 7. It will be observed that the position of the adjustable stop 15 will determine the angle through which the arm 1 rotates whilst the pawl 7 is in engagement with the ratchet wheel 11 and this angle may therefore be varied by turning the locating disk 16 to various positions. The locating disk 16 may be provided with a series of circumferential notches 18, the distance between two successive notches representing a suitable variation of price per unit of the commodity, as for instance one farthing per unit of the commodity. A pawl 19 fixed to a stationary part of the meter may be arranged to engage with the notches in the locating disk 16 so that the said disk remains in the position set.

The gear wheel 13 integral with the sleeve 12 and the ratchet wheel 11 is geared through wheels 20, 21, 22, 23 to the commodity side 24 of the prepayment mechanism P, represented in the drawings as an epicyclic differential mechanism. The wheel 23 is integral with a sleeve 25 and sun wheel 24 of the prepayment mechanism. The coin side of the prepayment mechanism is the sun wheel 26 which is integral with a sleeve 27 and wheel 28. This latter wheel gears in well known manner through a suitable gear train represented by wheels 29 and 30 with the coin mechanism represented at 31. The two sun wheels 24 and 26 are mounted loosely on the shaft 32 to which the planetary cage 33 of the prepayment differential is secured and the shaft 32 is provided in the usual way with a "coins unused" pointer 34 and a switch tripping cam (not shown).

In operation the gears between the meter rotor and the shaft 6 are chosen so that the shaft 6 of the meter register makes 10 revolutions for each unit of electricity consumed. The movement of shaft 6 is imparted to shaft 2 and hence pawl 7 is rotated (in a clockwise direction viewed from the left of Fig. 1). As the pin 9 of the pawl passes under the pin or screw 10 the pawl is rocked into engagement with the teeth of the ratchet wheel 11 which is rotated along with the pawl. When the tail 14 of the pawl 7 engages with the adjustable pin 15 the pawl is rocked out of engagement with the teeth of the ratchet wheel 11, the movement of which now ceases until the pawl is again rocked into engagement therewith on passing the fixed stop screw 10. The amount of rotation of the wheel 11 for each revolution of the shaft 2 or the pawl 7 can be adjusted by means of the adjustable stop 15 as hereinbefore described. The movement of the wheel 11 is transmitted through the wheels 13, 20, 21, 22, and 23 to the commodity side of the prepayment differential P. The movement of the planetary cage 33 depends upon the movement of the wheel 11 and consequently may be made to return a greater or smaller distance per each unit of electricity consumed by adjustment of the stop 15, with a consequent greater or smaller charge respectively for a unit of electrical energy.

Referring now to Figure 2 of the drawings, this figure illustrates a modification of the mechanism shown in Figure 1, in which the rotating member is not rotated directly from the meter rotor, but under the control of the meter rotor, in order to relieve the meter rotor of the work of rotating the mechanism described with reference to Figure 1.

In the following description the designations given to parts in Figure 1 will be given to the corresponding parts in Figure 2.

The shaft 2 is driven now by an auxiliary motor shown as a spring and escapement mechanism but it will be understood that any suitable form of auxiliary motor may be used, as for instance a synchronous motor with a slipping device or preferably a shaded pole motor.

The wheel 3 of Figure 1 is dispensed with and one member, the escaping member, 35 of the escapement mechanism is secured to the shaft 2. The escapement mechanism may be of any suitable form, and is shown in Figure 2 only diagrammatically. The other member of the escapement mechanism, the controlling member, 36 is shown as a notched disk secured to the shaft 37 which is geared to the shaft 6 of the meter register through the gear train 5. A helical spring 38 is provided on the shaft 2, one end of the spring being attached to a disk member 39 secured to the said shaft and the other end of the spring being attached to a gear wheel 40 which is geared through suitable gearing 41, 42 to the coin receiver mechanism 31, which, in addition is geared to the sun wheel 26 as described in reference to Figure 1. By rotating the coin receiver mechanism after the insertion of a coin the spring 38 is wound up. A slipping clutch may be inserted at any position between the coin receiver mechanism and

the spring 38 to prevent the spring from being overwound. The escaping member 35 of the escapement mechanism is provided with a projecting pin 43 which is adapted to engage with the notches 44 in the circumference of the notched disk 36 secured to the shaft 37 rotated by the meter rotor as hereinbefore described.

The driving power of the rotating pawl 7 is thus obtained from the wound-up spring 38 which is released step by step by the notched disk 36 which is rotated during consumption of the commodity.

As shown in Figure 2, the meter rotor may also be geared from the shaft 6 of the meter register to one sun wheel 45 of an auxiliary differential mechanism A, the other sun wheel 46 of which is geared to the gear wheel 13 which is integral with the sleeve 12 and ratchet wheel 11 through the gear comprising wheels 20, 21, 22. The sun wheel 45 is integral with a sleeve 50 and wheel 51, loosely mounted on a shaft 48, and the sun wheel 46 is integral with a sleeve 52 and wheel 53 also loosely mounted on the shaft 48. The wheel 53 meshes with wheel 22 and wheel 51 meshes with a wheel of the gear train 5 which wheel is secured to shaft 6. The planetary cage 47 of the auxiliary differential A is secured to the shaft 48 which is suitably geared through wheels 49 and 23 to the commodity side 24 of the prepayment mechanism P. It will be observed that the resultant movements of the gear mechanism directly between the meter rotor or shaft 6 and on the one hand the sun wheel 45 of the auxiliary differential A, and on the other hand through the intermittently operated pawl and ratchet mechanism 7, 11, is obtained by the planetary cage of the differential A and transmitted to the commodity side of the prepayment mechanism. This resultant movement may be, as already explained, the sum or the difference of the movements imparted to the sun wheels 45 and 46.

In order further to relieve the meter rotor of the work of driving the mechanism, a helical spring 54 may be arranged on the shaft 32 to which the planetary cage 33 of the prepayment mechanism is secured and the spring is adapted on rotation of the coin receiver after the insertion of a coin thereinto, to be wound up, so that it tends to return the planetary wheel 33 to its normal or switch tripping position, thereby aiding the meter rotor during the consumption of the commodity.

In operation assuming a coin has been inserted into the coin receiver, the handle 31 is rotated to discharge the coin therefrom in the well known manner, and during such rotation the springs 38 and 54 are wound up. The meter rotor on rotation in accordance with consumption of the commodity rotates the sun wheel 45 of the auxiliary differential A. At the same time the meter rotor rotates shaft 37 and notched wheel 44, which, as it rotates, releases the pin 43 secured to the disk 35 which, together with the shaft 2 is constrained to rotate by the spring 38, and does so rotate quickly when the pin 43 is released through practically a complete revolution until the pin 43 again engages with the next notch of disk 44, after which the movement of the shaft is the same as that of the wheel 36, until the pin is again released. For each release of the pin, it will be observed, the shaft 2 makes one complete revolution. If more than one pin such as 43 be provided, the angle through which the shaft 2 rotates as each pin is released from a notch will depend upon the number of pins. A fractional part of the movement of the shaft 2 as hereinbefore explained with reference to Fig. 1, is transmitted to the sun wheel 46 of the auxiliary differential A. This fractional part of the movement of shaft 2 which is transmitted may be varied by adjustment of the adjustable pin or stop 15, and may be added to or subtracted from the movement of the sun wheel 45 as hereinbefore explained to vary the price of the commodity above or below a normal price represented by the movement of the sun wheel 45. Instead of providing for the winding of the spring 38 from the coin knob 31 via the bevel wheels 40, 41, 42, the spring tension may be sustained by a small shaded pole motor which is connected across the circuit and which is allowed to stall when winding is not needed, or a self-starting motor, for instance of the shaded pole type, may be caused to function in place of the spring, and may run continuously, if provided with a slipping clutch.

The embodiments of the invention hereinbefore described are given as an example of carrying the invention into practice, but many other embodiments will present themselves to those skilled in the art and which fall within the scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a prepayment meter, a variable ratio mechanism for connecting the commodity side of a prepayment mechanism to a meter rotor, said variable ratio mechanism comprising a rotatable ratchet wheel, a rotatable member carrying a pawl adapted to engage said ratchet wheel, and a pair of means for alternately engaging said pawl with said ratchet wheel and disengaging the pawl from the ratchet wheel during each revolution of one of them.

2. In a prepayment meter, a variable ratio mechanism for connecting the commodity side of a prepayment mechanism to a meter rotor, said variable ratio mechanism comprising a rotatable ratchet wheel, a rotatable member carrying a pawl movably mounted upon said rotatable member and adapted to engage or disengage said ratchet wheel according to the position of the pawl upon the rotatable member, a stationary member for deflecting said pawl to the position engaging said ratchet wheel at a given angular position of the rotatable member, a second stationary member angularly displaced from the first for deflecting said pawl to the position disengaging said ratchet wheel at a second angular position of the rotatable member, and means for adjusting the difference between the angular positions of said stationary deflecting members.

3. A variable ratio transmission for connecting two relatively rotatable members comprising in combination with such members, a rotatable ratchet wheel connected to one of said members, a pawl carried by the other of said members, said pawl being movably mounted upon the member carrying it, and being adapted to engage or disengage said ratchet wheel according to the position of the pawl upon the member carrying it, a secondary member for deflecting said pawl to a position engaging said ratchet wheel, a second stationary member for deflecting said pawl to a position disengaging said ratchet wheel, said stationary deflecting members being angularly spaced, and means for adjusting the difference between the angular positions of said stationary deflecting members.

4. A variable ratio transmission for connect-

ing a driving member and a driven member relatively rotatable with respect to each other comprising in combination with such members, a ratchet wheel connected to one of said members, said pawl being movably mounted upon the member carrying it, and being adapted to engage or disengage said ratchet wheel according to the position of the pawl upon the member carrying it, a member for deflecting said pawl to a position engaging said ratchet wheel at a predetermined angular position of the driving member, and a second member for deflecting the pawl to the position disengaging said ratchet at a predetermined angular position of the pawl carrying member.

5. A variable ratio transmission for connecting a driving and a driven member relatively rotatable with respect to each other comprising in combination with such members, a rotatable ratchet wheel connected to one of said members, a pawl carried by the other of said members, movably mounted upon the member carrying it and adapted to engage or disengage said ratchet wheel according to the position of the pawl upon the member carrying it, a member for deflecting the pawl to a position engaging said ratchet wheel at a predetermined angular position of the driving member, a second stationary member for deflecting the pawl to the position disengaging said ratchet at a predetermined angular position of the pawl carrying member, and means for adjusting the angular pawl operating positions of the said deflecting members to vary the ratio of the transmission.

6. A variable ratio transmission for connecting a driving member and a driven member relatively rotatable with respect to each other comprising in combination with such members, a ratchet wheel connected to one of said members, a pawl, a pivot pin pivotally attaching said pawl to the other of said members in such a position as to make the pawl engageable with said ratchet, said pawl having a pair of projections on either side of said pivot pin, a stationary stop located in the path of one of the projections of said pawl when the pawl is in the disengaged position, whereby said pawl is moved into engagement with said ratchet wheel at a predetermined angular position of said pawl-carrying member, and a second stationary stop angularly spaced from said first stop and located in the path of the other projection of said pawl when the pawl is in its engaged position, whereby said pawl is moved out of engagement with said ratchet wheel in another angular position of said pawl-carrying member.

7. A variable ratio transmission for connecting a controlling member and a driven member relatively rotatable with respect to each other comprising in combination with such members, an intermediate rotatable member, a ratchet mechanism interposed between said driven member and said intermediate member, an escapement device interposed between said controlling member and said intermediate member, an auxiliary motor supplying torque to said intermediate member, said ratchet mechanism comprising a rotatable ratchet wheel, a rotatable arm and a pawl movably mounted upon the said rotatable arm and adapted to engage or disengage the said ratchet wheel according to the position of the pawl upon the arm, a stationary member for deflecting the said pawl to the position engaging said ratchet wheel at a predetermined angular position of the rotatable arm, and a second stationary member for deflecting the pawl to a position disengaging said ratchet wheel at a second angular position of the ratchet arm.

GEORGE WALL.

CERTIFICATE OF CORRECTION.

Patent No. 2,106,582. January 25, 1938.

GEORGE WALL.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, first column, line 4, claim 4, after "members," insert the words and comma a pawl carried by the other of said members,; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 8th day of March, A. D. 1938.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.