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RELAY MOVEMENT.

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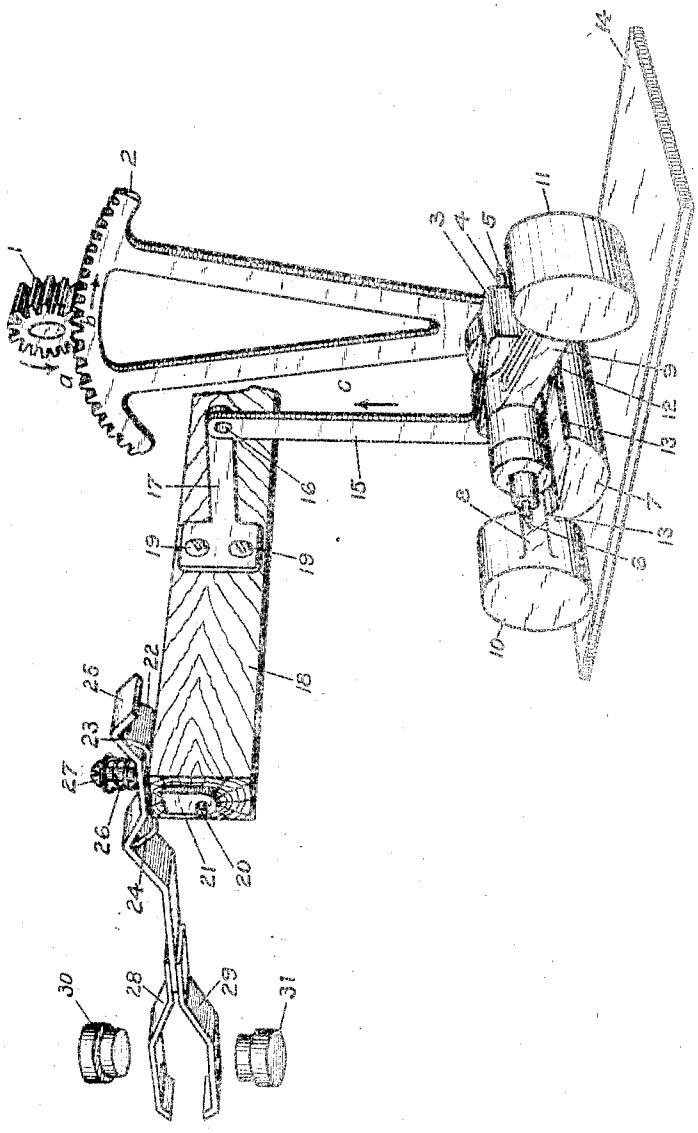
1,019,047.

Patented Mar. 5, 1912.



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RELAY-MOVEMENT.

1,019,047. Specification of Letters Patent. Patented Mar. 5, 1912.

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To all whom it may concern:

Be it known that I, WINTHROP K. HOWE, a citizen of the United States, and resident of the city of Rochester, in the county of Monroe and State of New York, have invented a new and useful Relay-Movement, of which the following is a specification.

This invention relates to a relay movement.

The object of this invention is to so construct a relay movement that it may be used in a three position relay, that is, so that with no force acting upon it, it will assume a neutral position, but with force acting upon it in one direction, it will assume a position to one side of the center and with force acting upon it in the other direction it will assume a position to the other side of the center.

A further object of the invention is to so arrange the mechanism of a relay movement that it may be easily transformed into a two position relay movement, that is, it will normally have a bias in one direction which will be overcome when force is exerted upon the relay movement to move it to another position.

It is further an object of this invention to construct a three position relay which will be dependent upon gravity for its return to the normal or neutral position.

Heretofore three position relays have been constructed in which the armature was held in the central or neutral position by the action of opposed springs. Such a construction is, however, objectionable as it has been found particularly in railway signaling in which absolute certainty of action must be obtained that no reliance can be placed upon springs where it is necessary to absolutely insure the return of a part to a certain position, for in railway signaling devices the failure of a part to return to a certain predetermined position may result in the loss of many lives. It will be later pointed out, however, that the mode of operation and the functions performed by applicant's device cannot be obtained by the use of springs without undue complication.

A further object of the invention is to produce a relay in which movement will take place either to or from a normal position upon the slightest change of the value of the current from a predetermined value, that is to produce a relay in which the "pick-up" and "drop-away" values are practically equal.

In order to render the invention readily intelligible applicant has shown a preferred embodiment of the invention by a single figure upon the accompanying sheet of drawing in which like reference characters denote like parts.

1, designates a pinion which may be attached in any suitable manner to the armature shaft of a relay motor, such, for instance as is shown by the patent to Willis B. Rice, granted February 28th, 1911, #985,705. The pinion 1 of applicant's device could be preferably attached in the same manner and to the same part as the pinion 19 of the above mentioned patent. Pinion 1 meshes with a sector 2, which is fastened to a block 3 through which passes the shaft 4, the ends of which, 5 and 6, are cone shaped and may be inserted in any suitable fixed bearings so that the sector 2 may, with the shaft 4, oscillate thereon. The member 3 has an outstanding portion 7. Upon the shaft 4 are placed the arms 8 and 9 so as to be freely movable about the axis of the shaft 4 and which bear upon their outer ends the weights 10 and 11 respectively; the arms have a projecting portion 12, adapted when the arm is in normal position to rest against the edges 13 of the member 7. When in normal position the weights 10 and 11 are just clear of the plate 14, but a slight movement downward of either of the weights 10 or 11 brings them in contact with the fixed plate 14 so that they rest thereon.

Attached to member 3 is the upstanding arm 15, which by means of the pivot pin 16 connects with the arm 17 which is attached to the wooden insulating member 18 by means of the screws 19. The insulating member 18 is pivoted at either end as by means of the pivot pin 20, the support for the pivot pin being member 21, a fragment of which is shown. The member 22 is fastened to the upper face of the member 18 and has two knife edge bearings 23 and 24 against which rests the rigid member 25 spring pressed there against by means of the spring 26 which is tensioned by means

of screw 27, which is screw threaded into the member 18. The member 25 bears upon its outer end the rigid contact fingers 28 and 29. The contact finger 28 is adapted to touch contact 30 when moved upwardly and the contact finger 29 is adapted to touch contact 31 when moved downwardly.

If the pinion 1 is revolved in the direction of the arrow *a*, the sector 2 will move in the direction of the arrow *b*, consequently the link 15 will move in the direction of the arrow *c*, and the finger 29 will touch contact 31. The extent of movement of the pinion 1 is such, that the contact finger 29 is not only caused to touch contact 31, but is caused to bear quite firmly against contact 31 and to slide thereon. This effect is produced by the continued motion of the pinion 1 after the contact finger 29 touches contact 31, which causes the knife edge bearing 24 to move downwardly from in contact with the member 25, so that the member 25 bears only upon the knife edge bearing 23 and at the same time the spring 26 is compressed. After the finger 29 is moved so as to touch contact 31, if the turning torque exerted upon the pinion 1 is withdrawn, the contact finger 29 will be brought back to the position as shown in the figure by the action of the weight 10, for when the sector 2 moved in the direction of the arrow *b*, about the shaft 4, as a pivot, the member 3 carrying with it the projection 7 contacted with arm 8 carrying the weight 10 so that when the turning torque exerted upon pinion 1 is withdrawn, the weight 10 acting through the projection 7, brings the member 3 together with the link 15 and the operated parts back to the central position. As the contact finger 29 was pressed firmly and resiliently against contact 31, as soon as the turning torque exerted upon the pinion 1 is withdrawn, there is a tendency caused by the force of spring 26 to return the parts toward normal position.

The weights 10 and 11, when in normal position, have their center of gravity below the horizontal axis of the shaft, consequently, when the sector 2 is moved, thereby oscillating the projection 7 and either the weight 10 or 11, the torque exerted by the particular weight moved, gradually increases as the weight is moved upwardly, for the effective lever arm is increased by the upward movement so that it becomes a maximum when either the arm 8 or 9, according to the direction in which the sector moves, is in a horizontal position. In the full reverse position of the sector, however, arm 8 or 9, according to which weight is moved, is above the horizontal position, consequently, the torque exerted by the weight 10 or 11, as the case may be, is decreased from its maximum value in proportion to the sine of the angle that the arm rises above the horizontal position. The counter-torque tending to move the sector back to the normal position, is, however, the same, for as soon as either arm 8 or 9, according to the direction of the movement of sector 2, reaches the horizontal position, the contact finger 28 or 29 touches the contacts 30 or 31 and any further movement causes a compression of spring 26, thus increasing the returning torque by the same amount that it is decreased by the raising of the arm of the weight above its horizontal position. The effect of such a construction is to maintain a nearly uniform returning torque upon the sector 2. As is well known, the torque curve of a moved weight such as 10 or 11 is a sine curve, which reaches its greatest value when the lever arm is at a maximum, which in this particular case, is when the arms 8 or 9 assume a horizontal position, so that if the weight is moved through such an angle that the torque reaches a maximum and then decreases, some other means must then be used to increase the torque as the torque of the weight decreases, which in this case is done by the use of spring 26, thus the counter torque of the device as constructed, would be approximately a straight line having its maximum value when the parts are in the extreme moved position, and having its minimum value when the parts are in the neutral or central position. The difference between the maximum and minimum value of the torque, however, is very slight, so that in a relay movement constructed as herein shown and described, the amount of current needed to start the relay is approximately the same as the value below which the current must fall in order to have the parts return to normal position. Such a construction, therefore, gives an almost ideal relay and one which is responsive to the slightest changes in current strength. It must be readily seen that the use of a spring would not allow one to obtain the mode of operation and the functions described, for the torque curve of a spring is a straight line, consequently, if a spring were attached to sector 2, the tension exerted by the spring would uniformly increase with the arc of movement of the sector 2, so that, after a contact finger touched a contact, and further movement took place, the counter-torque tending to return the sector to normal position would increase very rapidly with further movement, so that, when the parts are in the moved position a slight drop in the current needed to move the relay would cause it to start to return to normal position, but as soon as the contact finger left the contact, the returning torque would suddenly drop whereupon the current then being of sufficient strength to move the sector against the returning torque, the contact finger would again be moved so as to touch the con-

tact which would immediately raise the returning torque so that the sector would again fall back and the result would be that considerable arcing would take place between the contact finger and the contact.

If the pinion 1 is turned in a direction opposite to the arrow *a*, then the sector 2 will move in the direction opposite to the arrow *b*, about the shaft 4 as a pivot and in so doing will move link 15 downwardly, that is, in a direction opposite to the arrow *c*, and will cause the finger 28 to touch the contact 30 and in so doing the weight 11 will be raised so that when the torque exerted upon pinion 1 is withdrawn, the weight 11 will return the parts to the normal or central position.

As is well understood by those conversant with the relay art, the contact 30 may be connected to one end of a circuit and the member 25 may be connected to the other end of the circuit, so that when member 25 through the contact finger 28 touches contact 30, the broken circuit will be completed. The same holds true of contact finger 29 and contact 31. It must be seen, therefore, that one circuit may be closed by the operation of a relay in one direction and another circuit by the operation in another direction and when no turning torque is exerted upon the pinion 1, both circuits will be broken. It is to be further observed that at all times while the member 25 is out of normal position it is acted upon by either the weight 10 or 11 to return it to the normal central position. It is to be further observed that when one weight is acting, the other weight is resting upon the plate 14 and takes no part in the movement excepting that when the sector 2 returns to its normal position from a moved position by means of either the weight 10 or 11, the sector goes but very little beyond the central position, for if it is being acted upon by the weight 11 as soon as the member 25 reaches the central position the edge of the projecting member 7 strikes the arm of the weight 10 and so absorbs the momentum imparted by weight 11 to the sector and so quickly brings the sector to rest. For it must be readily seen that as soon as the sector 2 has reached the normal position any further movement toward the other reverse position is prevented by a weight and a slight movement only beyond the normal suffices to allow a weight to rest upon the plate 14 so that after the sector 2 has been returned to the normal position by weight 11, it is no longer acted upon by weight 11 if it passes beyond the normal position toward the other reverse position, and as the sector 2 and the member 3, together with the projection 7 are very much lighter than the weight 10, they are quickly brought to rest.

In some cases it would be desirable to use the sector shown for a two position relay, in which it would merely be necessary to remove one of the weights and to so adjust the contact arm 25 that when in normal position it would rest against either the contact 30 or 31. In such case the contacts would be held firmly together by the action of the weight which was retained, as the parts would be so adjusted that the weight would not rest upon the plate 14 until after suitable pressure had been exerted by the weight in bringing the two normally closed contacts together.

It is to be observed that applicant has constructed a three position relay movement in which the contacts are brought to the central position from either reverse position by the action of gravity and that entire dependence has not been placed upon springs or such other mechanical returning devices which are liable to break and so cause a false operation. Furthermore, it is to be observed that when springs are used there is great likelihood, on account of the difficulty of making two springs exactly alike, that after springs have been used for some little time one will lose much more of its elasticity than the other, so that with no turning torque exerted upon pinion 1, the contacts on either one side or the other of the center might be closed. In applicant's device no such contingency is likely for the mass of the weights 10 and 11 after being placed in the mechanism is fixed and unvariable.

Applicant's invention as embodied in the concrete form herein shown, makes possible the employment of weights instead of springs, thereby overcoming the serious objection heretofore noted. Applicant's construction, however, allows one to obtain advantages not to be obtained by the use of springs. This is due to the fact that by employing the construction as herein shown, and making use of a weight to return the parts to normal, a much more rapid movement may be obtained without introducing so much resistance to the actuation of the relay by the operating means to which it is connected. A spring exerts its greatest pulling force when fully distended and when returning to normal position at which time there should be no appreciable force exerted by it, it rapidly loses its pulling force, but when a weight is used, gravity acts as a uniformly accelerating force to return the weight displaced to the normal position so that the final part of a movement to normal position is at a more rapid rate than the initial part of a movement, although the turning torque exerted by the weight as constructed by the applicant is greater at the initial part of the movement than at the final portion of the movement due to the fact that the weight, when in normal position, is below the horizontal axis upon which

it is pivoted. Applicant, is, therefore, by his construction enabled to obtain practically the same torque when the relay contact is in either extreme position or in a neutral position, and to obtain a more rapid return of the parts to normal position than could be obtained by the use of a spring without unduly strengthening the spring.

Having thus described my invention and explained the principle thereof and illustrated the preferred physical embodiment thereof, what I claim as new and desire to secure by Letters Patent, is:

1. In a relay movement, a pinion adapted for oscillation, a sector engaging with said pinion, a shaft for pivoting said sector for oscillation, arms extending in opposite directions from said shaft loosely mounted thereon and making an angle less than one hundred and eighty degrees with each other, both arms lying below a horizontal line through the said shaft, weights attached to the arms, a member oscillating with the sector disposed below the arms against which they are adapted to rest in normal position, a plate below the weights against which they are adapted to rest when free, a link connected to said member oscillating with the sector, and means for closing a circuit connected to the link.

2. In a relay movement, a member adapted to be oscillated, circuit closing means operated by said member, means for creating equal counter torque upon said member, when moved in either direction, said means consisting of two weights acting in opposite directions, and one resilient means having one line of action only.

3. A relay movement, a member adapted to be oscillated, circuit closing means operated by said member, a weight acting to prevent oscillation of said member in one direction, another weight acting to prevent oscillation of said member in the other direction, and means to prevent one of said weights acting while the other acts.

4. In a relay movement, a pinion adapted for rotation, a sector engaging with said pinion, means for pivoting said sector for oscillation, a weight raised by the sector upon oscillation in one direction, a weight raised by the sector upon oscillation in the other direction, and means connected to said sector to close a circuit upon movement in either direction.

5. In a relay movement, a member adapted to be oscillated, a weight attached to said member with its center of gravity below its axis of oscillation when in normal position, and adapted to be moved so that the center of gravity is above said shaft, a movable contact connected to said member, a fixed contact in the path of movement of said movable contact, resilient means interposed between said movable contact and said member, whereby the counter-torque upon said member increases approximately uniformly.

WINTHROP K. HOWE

Witnesses:
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