L. V. LEWIS.

RELAY.

APPLICATION FILED NOV. 17, 1916.

1,310,626. Patented July 22, 1919.

3 SHEETS—SHEET 1.

FIG. 1

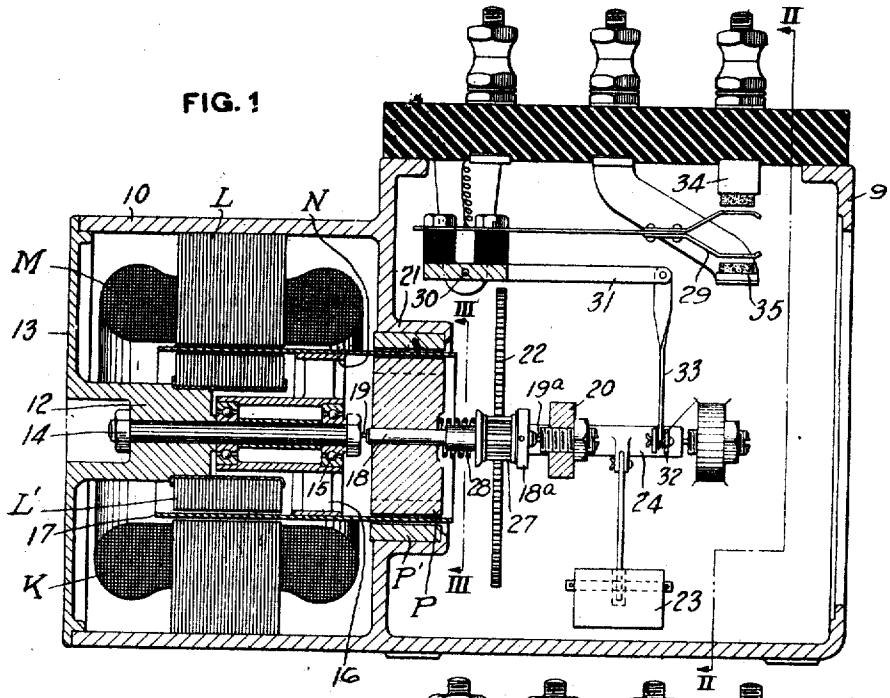
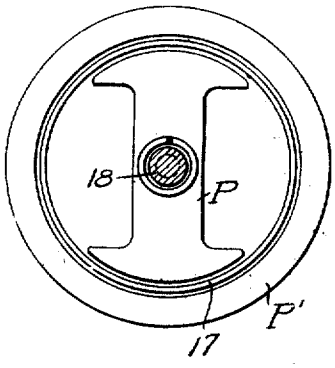


FIG. 3



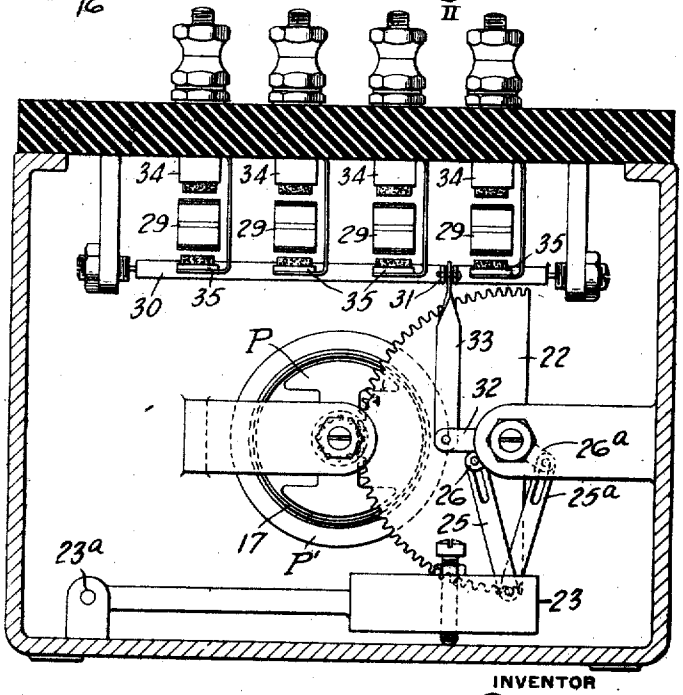


FIG. 2

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3 SHEETS—SHEET 2.

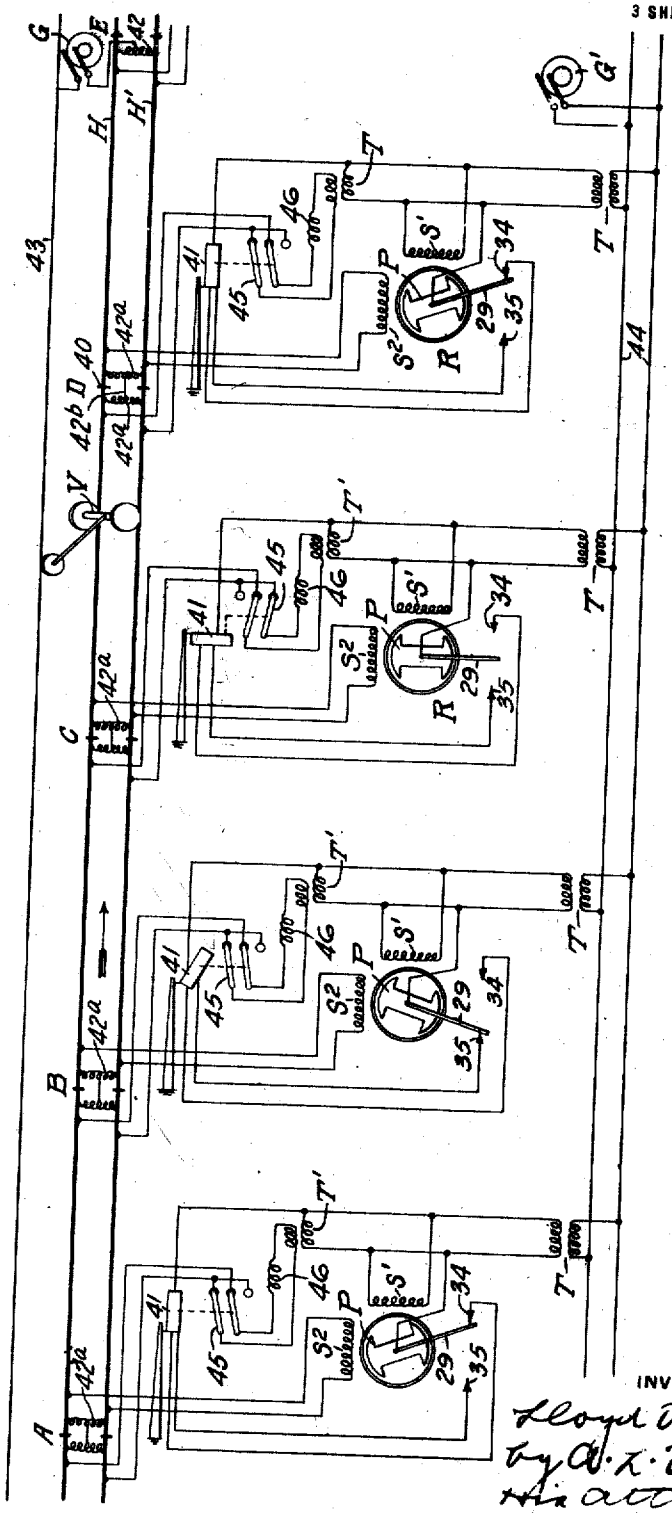


FIG. 4

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3 SHEETS—SHEET 3.

FIG. 5

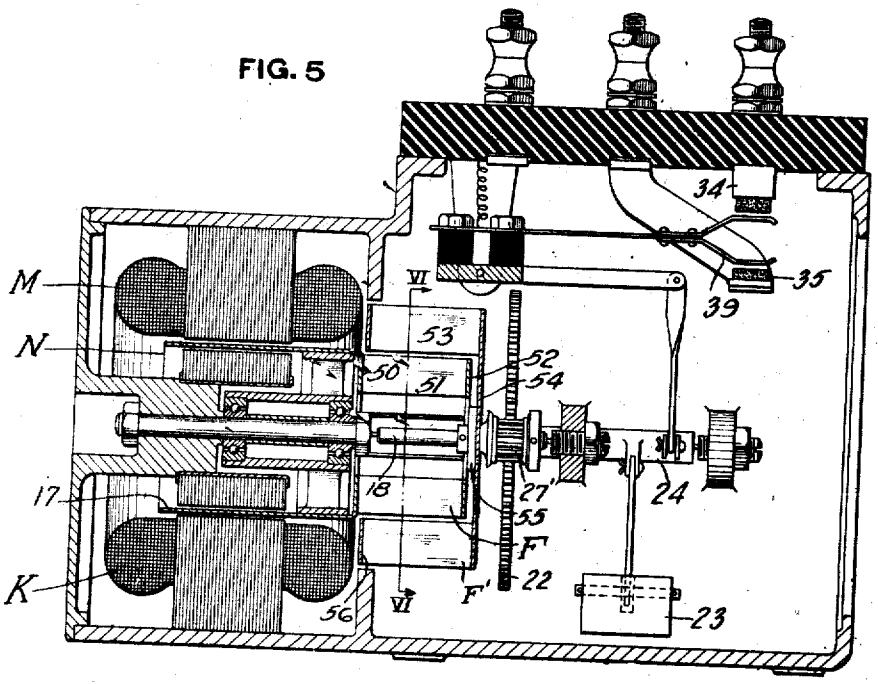
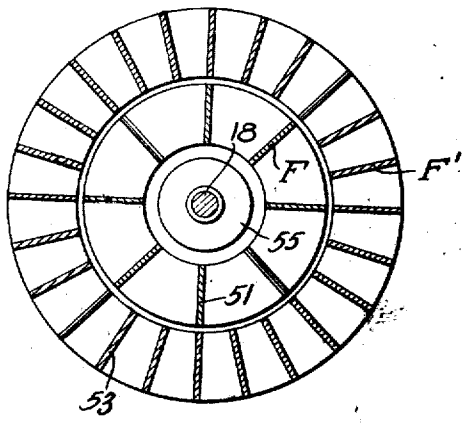


FIG. 6



WITNESSES

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UNITED STATES PATENT OFFICE.

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RELAY.

1,310,626. Specification of Letters Patent. Patented July 22, 1919.

Application filed November 17, 1916. Serial No. 131,866.

To all whom it may concern:

Be it known that I, LLOYD V. LEWIS, a citizen of the United States, residing at Edgewood borough, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Relays, of which the following is a specification.

This invention relates to alternating current relays, more especially adapted to railway signaling as applied to electric railways wherein the propulsion and signaling currents are alternating in character but of different frequencies, the propulsion current being of a lower frequency than the signaling current; the relay is selectively responsive for contact operation only at a frequency higher than that of the propulsion current. The chief characteristic of this invention resides in the provision of a relay of this character which is selective as to frequency by means of torque, that is to say, a relay in which the motor varies in speed substantially in accordance with variations in frequency, and has associated therewith a biased member which is moved by the motor to close the contact or contacts only when the motor is supplied with current at or above a predetermined frequency.

Another feature of my invention is the provision of a relay of this character which is capable of movement to two positions from its intermediate or biased position, depending on the direction of the operating motor.

Other characteristics of this invention are to provide a relay of this character which is so constructed as to provide maximum reliability, to minimize the number of frictional surfaces, and to reduce the danger of sticking of the relay to a minimum.

Other characteristics will appear from a consideration of the following detailed description, taken in connection with the accompanying drawings forming a part of this specification, with the understanding, however, that the embodiments illustrated, though practical, are by no means the only embodiments which the invention may assume, wherefore the invention is not confined to any strict conformity with the showing of the drawings, but may be changed and modified in various particulars, so long as such changes and modifications make no material departure from the salient features of the invention.

While the present invention is not of necessity confined to use in railway signaling systems, it is particularly adapted to such use, wherefore in the following description it will be considered that the invention is applied to a railway signaling system, thus avoiding complexity of description, without, however, confining the use of the invention to the particular associations described.

In the drawings, Figure 1 is a central longitudinal sectional view showing one form of relay embodying my invention.

Fig. 2 is a transverse sectional view taken on the line II—II of Fig. 1, looking in the direction of the arrows, and showing in elevation a portion of the mechanism for actuating the contacts.

Fig. 3 is a vertical sectional view taken on the line III—III of Fig. 1, showing in elevation the relative arrangement of magnet, core, and armature of the relay.

Fig. 4 is a diagrammatical view of the relay, shown in the preceding figures, as applied to a railway signaling system.

Fig. 5 is a vertical longitudinal sectional view showing another form of relay embodying my invention.

Fig. 6 is a transverse sectional view of Fig. 5 taken on the line VI—VI thereof looking in the direction of the arrows, and showing the relative arrangement of the blades.

Similar reference characters designate similar parts throughout the several views.

Referring to the drawings, my first form of relay is designated generally by the letter R and comprises in this instance a substantially rectangular casing 9, formed of any non-magnetic material, such as aluminum, and having one side thereof provided with a laterally disposed compartment 10 which communicates with casing 9, as shown. The compartment has arranged therein a prime mover M which is, in this instance, a reversible induction motor having a stator K comprising two separate windings S′ and S², wound, however, on the same laminated outer iron core L. The stator further comprises a central laminated core L′, which is spaced from the outer core L to receive the drum of rotor N, as will be described. The central core L′ is mounted

on a stud 12 formed on a plate 13, the latter providing a closure for the compartment 10, as shown. Removably mounted on the stud 12 is a stub shaft 14 upon which is rotatably mounted, by means of the ball bearings 15, a spider 16. The spider has secured to its periphery a drum or annular member 17 formed of conducting material, and which is of such a length to have one end thereof extending through the air gap formed between the outer and central cores of the stator K while its opposite end extends through an air gap between a permanent magnet P and a soft iron ring P'. The magnet P is rotatably mounted within the drum 17 by means of a shaft 18, one end of which is pivoted in a jeweled bearing formed on the end of the stub shaft 14 as at 19, while its opposite end is similarly mounted in an arm 20 formed on the inner wall of the casing 9 as at 19a. The ring P' is secured to a flange 21 formed on the adjacent wall of the compartment 10, said ring encircling the drum 17 at a point opposite the magnet P, thus disposing the drum in the magnetic field of the magnet. It will be evident, therefore, that when the motor M is energized, drum 17 will be rotated in the magnetic field of magnet P to induce magnetic lines of force therein whereby a torque will be transmitted to the magnet. This torque transmitted to the magnet is proportional to the speed of rotation of the rotor N, as the greater the speed of the rotor, the greater are the number of lines of force cut by the drum to cause a corresponding increase in the torque. As motor M is of the induction type, it is obvious that the speed of rotation of the rotor is substantially proportional to the frequency of the current, therefore, in order to allow the relay to respond to the frequency of the signaling current but not to the frequency of the propulsion current, it is necessary to provide some means for preventing the magnet responding to the influence of the drum 17 until the drum exceeds a speed corresponding to the frequency of the propulsion current. Such means comprises in this instance a segmental gear 22 biased to an intermediate or neutral position by means of a weight 23 pivotally mounted in the casing at 23a. The gear 22 is attached to a crank shaft 24, while the weight 23 is eccentrically connected to such shaft by means of links 25 and 25a connected respectively to arms 26 and 26a on shaft 24. The arms 25 and 25a are slotted to permit the gear to oscillate in either direction from its intermediate position without interference. The gear is driven by a small pinion 27 which is freely mounted upon the shaft 18 and is driven thereby by the friction between the pinion 27 and collar 18a attached to the shaft. Pinion 27 is pressed against collar 18a by spring 28. The purpose of the frictional connection between pinion 27 and shaft 18 is to eliminate any shock which might be caused by the sudden stoppage of magnet P. It will be obvious from the foregoing that the biasing action of the weight 23 upon the segmental gear 22 prevents movement of the gear and consequently rotation of the magnet P until the torque created by the drum 17 is of such a strength as to overcome the biasing action of the weight, whereby the magnet and gear will be permitted to move. As the torque is proportional to the speed of the drum, it is obvious that the magnet will be rotated only when the frequency of the current supplied to the motor is sufficient to drive the motor at the speed required to create the desired torque. This frequency corresponds to the frequency of the signaling current or any frequency above the maximum propulsion frequency but not to the propulsion frequency or any lower frequency.

The magnet P is designed to operate contact fingers 29 through the segmental gear 22, the fingers being pivoted upon a shaft 30 and adapted to be simultaneously rocked by an eccentric connection with the crank shaft 24, said connection including arms 31 and 32 and a link 33 pivotally connecting the two. The contact fingers 29 are interposed between an upper and lower set of fixed contacts 34 and 35 respectively, said fingers being normally held in disengaging or neutral position, with respect to the contacts 34 and 35, under the biasing action of the weight 23.

In operation, when the motor is energized to rotate the drum say in a counter-clockwise direction as viewed in Fig. 2, and at a sufficient speed to overcome the biasing action of the weight 23, magnet P will be caused to rotate with the drum. Hence, pinion 27 will drive the gear 22 upwardly to cause a partial rotation of the shaft 24 against the action of the weight 23, thus rocking the shaft 30 to move the contact fingers 29 upwardly to engage the contacts 34. When the motor is deënergized, however, magnet P will be free to rotate in an opposite direction under the influence of the weight 23, hence, gear 22 and consequently the contact fingers 29 will return to their normal or neutral position. If, however, the motor is energized to rotate in a clockwise direction, a reverse movement of the magnet, gears, etc., will occur to cause the fingers to engage the lower contacts 35.

Referring now to Fig. 4, I have here shown one form of railway signaling system including a relay of the type shown in the preceding views. H and H' designate the track rails of a railway over which traffic normally moves in the direction indicated by

the arrow. These track rails are divided into block sections A—B, B—C, etc. by means of insulated joints 40. G designates a generator of propulsion current, one terminal of which is connected with the track rails through an impedance bond 42 and the other terminal of which is connected with a third rail or trolley 43. The propulsion current is conducted from block to block by means of impedance bonds 42^a connected across the rails adjacent the ends of the block, the middle points of each pair of adjacent bonds being connected by conductors 42^b. Located adjacent the entrance end of each section is a signal 41, each of which is here shown as of the semaphore type capable of three positions of indication, namely, "danger", "caution" and "clear". Alternating signaling current of a frequency higher than that of the propulsion current is supplied to the rails of each block section from the generator G', the terminals of which are connected with transmission mains 44 and to which transmission mains are connected the primaries of transformers T, the secondary of each of which supplies the primary of the corresponding track transformer T'. The secondary of each track transformer T' is connected across the rails of the corresponding section through an impedance coil 46 and through a pole-changer 45 operatively connected with the semaphore of the adjacent signal. Located adjacent the entrance end of each section is a relay R, the winding S' of which is connected directly across the secondary of the adjacent transformer T and the winding S^2 of which is connected with the track rails of the section for which the relay is provided. Each signal 41 is provided with a caution indication circuit which is closed when the contact 29 of the corresponding relay engages with fixed contact 35 and with a clear indication circuit which is closed when contact 29 of the corresponding relay engages fixed contact 34, both of these circuits being supplied with energy from the secondary of the adjacent transformer T. The circuit for the control of a signal in this manner are so well understood by those skilled in the art that it is deemed unnecessary to trace the circuits in detail herein.

It will be understood that the direction of rotation of the magnet P of each relay is dependent upon the phase relation of the current in the two windings of the relay; that is to say, if the phase of the current in the track winding lags behind the phase of the current in the local winding, the magnet P will rotate in one direction, whereas if the phase in the track winding is caused to lead the phase in the local winding, the magnet P will rotate in the other direction. The relation of the phases of the two windings of each motor is determined by the pole-changer 45 operated by the signal for the section next in advance.

In Fig. 4, section C—D is occupied by vehicle V, so that winding S^2 of the relay R for this section is deënergized, whereby contact 29 of that relay occupies its neutral position and signal 41 therefore indicates danger. Pole-changer 45 operated by the signal for section C—D then supplies current to the track rails of section B—C in such direction that contact 29 of the relay for section B—C is swung to the left, thereby closing the caution indication circuit for signal 41. With signal 41 of section B—C in the caution position, the pole-changer 45 for this signal supplies current to the track rails of section A—B in such direction that contact 29 of the relay for section A—B is swung to the right, thereby closing the clear indication circuit for signal 41 at this section. When the car or train V proceeds into section D—E, it will deënergize the track winding S^2 of the relay for this section so that signal 41 for this section will change to danger. The track winding S^2 of relay R for section C—D is now energized and the phase relation of the current in this winding to that of the current in winding S' is such as to cause contact 29 to swing to the left, thereby closing the caution indication circuit for signal 41 of section C—D, which signal thereupon moves to the caution position. This movement of the signal reverses pole-changer 45 connected therewith, thereby reversing the phase relation of the current in winding S^2 of relay for section B—C with respect to the current in winding S' of that relay, so that contact 29 swings to the right, thereby causing signal 41 for section B—C to move to its clear position.

I have said that the frequency of the signaling current produced by generator G' is higher than that of the propulsion current produced by generator G. For example, the frequency of the signaling current may be 60 cycles per second and that of the propulsion current 25 cycles per second, in which case each relay R will be so adjusted that its contacts will not be closed when the relay rotor rotates at a speed corresponding to 25 cycle current in the relay windings, but that they will be closed when the relay rotor operates at a speed corresponding to 60 cycle current in the windings. It will be clear, therefore, that in the event of a difference of potential of propulsion current across the rails of any given block section, the presence of this propulsion current in the windings S' and S^2 of the relay for that block section cannot of itself cause operation of such relay to close one or another of its contacts. For example, considering block section C—D, which, as shown in Fig. 4, is occupied by a car or train V, if the propul-

sion current should be unbalanced at the entrance end of this section and also in some other section, it is obvious that both windings S′ and S² of relay R for section C—D would be energized by propulsion current; whatever the value of this current in the windings of this relay, however, it could merely cause operation of the rotor R of this relay at a speed too low to cause movement of the contact member 29, hence the relay would not be actuated by such propulsion current to cause a false caution or clear signal in the rear of the car or train V.

In Figs. 5 and 6, I have shown a modified means for obtaining the desired torque to move the biased gear 22 after the rotor reaches or exceeds a speed proportional to the signaling frequency. In this embodiment of my invention the torque is created pneumatically, that is, revolving fan blades act pneumatically on normally stationary fan blades to cause movement thereof. In carrying out my invention, I provide a motor M identical to that shown in my first form, with the exception, however, that the drum 17 has its inner or right hand marginal edge bent inwardly to provide an annular flange 50. Secured to the flange 50 at regular spaced intervals and extending laterally therefrom, in circular series, are the blades 51 of a fan F. These blades 51 are arranged radially with respect to the axis of the rotor N and have their right hand ends secured together by means of an annular disk 52. Fixed to the shaft 18 is a second fan F′ which is of such a diameter as to surround the fan F with the proper intervening space to permit rotation of the fans independently of each other. Fan F′ comprises a circular series of blades 53 which are co-extensive with the blades 51 of fan F and are similarly arranged with respect to the axis of the rotor. These blades 53 are secured together at one end and to the shaft 18 by means of a disk 54 riveted to a collar 55, while the opposite ends are connected by an annular disk 56. It will be noted that the number of blades constituting the fan F′ is greater than that of fan F, wherefore the required amount of torque will be produced in fan F′, as will be hereinafter described.

It will be apparent from this construction and arrangement of fans F and F′, that they do not mechanically contact with each other and that they may be readily and conveniently separated.

In operation, it is to be understood that gear 27′ in Fig. 5 is the equivalent of gear 27 in Fig. 1, and that the biased gear 22 meshes with gear 27 to normally prevent rotation of shaft 18 and fan F′. When motor M is supplied with alternating current of a frequency corresponding to the signaling frequency, rotor N and consequently fan F will be caused to rotate at a predetermined speed. When fan F rotates at this speed, the blades thereof will agitate the surrounding air to produce a torque upon the blades of fan F′ which is of sufficient strength to overcome the biasing action imposed upon the shaft 18 whereby fan F′ will be dragged around with fan F to cause rotation thereof against the biasing action of weight 23 as in the first form of my invention. It will now be seen that gears 27′ and 22 are actuated to move the contacts 29 from their neutral position to engage either of the contacts 34 or 35, depending upon the direction in which the motor M is rotated. It is understood that the biasing action of weight 23 upon the fan F prevents movement of such fan when the motor M only receives current of the frequency corresponding to the propulsion current or any frequency lower than the signaling frequency.

From the foregoing description, taken in conjunction with the accompanying drawings, it will be evident that I have provided three position relays which are selective as to frequency for contact operation and that the torque produced in either of the relays is obtained without mechanical contact.

Having thus described my invention, what I claim is:

1. A relay comprising a motor, a magnet inductively associated with the rotor of said motor for movement therewith, means for preventing said magnet from moving with said rotor until the rotor has reached a predetermined speed, and a contact governed by said magnet.

2. A relay comprising a prime mover, a conductor adapted to be moved by said prime mover, a movable magnetized member for creating a magnetic field through which said conductor moves whereby torque is exerted on said member, means for exerting a reverse torque on said member independently, and contacts controlled by said member.

3. A relay comprising an electrical generator having a rotatable field and rotatable armature, means for rotating said armature, whereby torque is exerted on the field, means for exerting a fixed torque on said field in opposition to the torque of said armature, and contacts controlled by said field.

4. A relay comprising an electrical generator having a movable field and a movable armature, means for moving said armature to effect a torque on said field, means for controlling said field for permitting movement thereof only after said armature has attained a predetermined speed, and contacts controlled by said field.

5. A relay comprising a motor, a movable member biased to one position, means actuated inductively by said motor for moving said member away from its biased position, and contacts controlled by said member.

6. A relay comprising a motor, a movable member biased to one position, means actuated inductively by said motor for moving said member away from said position, said means being effective only at or above a predetermined speed of said motor, and contacts controlled by said member.

7. A relay comprising a motor, a member adapted to be moved by said motor, electrical means interposed between said motor and member and responsive at or above a predetermined speed of said motor to move said member, and contacts controlled by said member.

8. A relay comprising a reversible motor, a movable member biased to a neutral position, means actuated inductively by said motor to move said member away from the neutral position in one direction or the other in accordance with the direction of rotation of said motor, said means being effective only at or above a predetermined speed of said motor, and contacts closed by said member when out of neutral position.

9. A relay comprising a motor, an extension formed on the rotor of said motor, a permanent magnet mounted for rotary movement independently of said extension, a magnetizable ring surrounding said magnet and arranged in spaced relation thereto, said extension being arranged for movement between said ring and magnet, a biased member connected to said magnet and effective to prevent movement of said member and said magnet until said extension has attained a predetermined speed or better, and contacts controlled by said member.

10. A relay comprising an induction motor, a contact controlling member, and means interposed between said motor and member for operatively connecting the two to cause movement of the member, said means being effective at or above a predetermined frequency of the current supplied to said motor.

11. A relay comprising an electric motor, a contact controlling member, and means interposed between the motor and the member for operatively connecting the two at a predetermined speed of the motor but not at lower speeds.

In testimony whereof I affix my signature in presence of two witnesses.

LLOYD V. LEWIS.

Witnesses:
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HELEN KERSHAW.