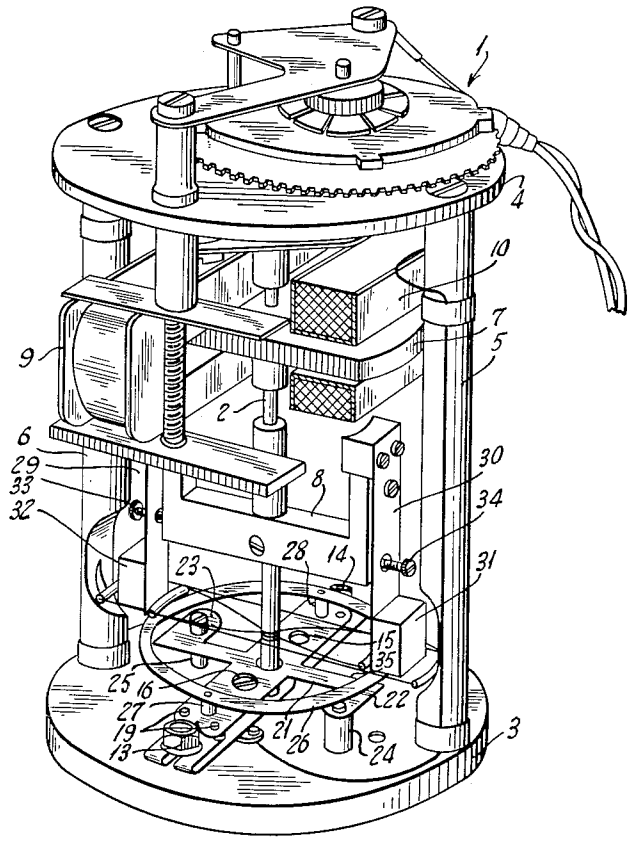
March 18, 1952 CARL-ERIK GRANQUIST 2,589,369

ADJUSTING ARRANGEMENT

Filed July 14, 1948 2 SHEETS—SHEET 1

Fig. 1.



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Fig. 2.

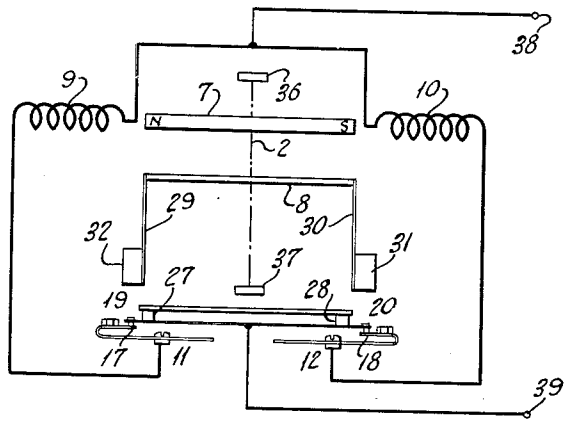
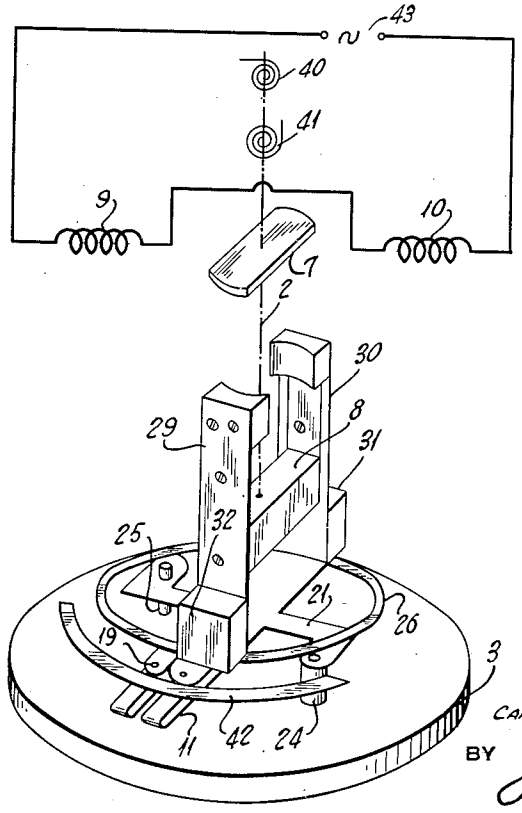


Fig. 3.



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ADJUSTING ARRANGEMENT

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3 Claims. (Cl. 318—325)

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The present invention relates to arrangements for the breaking and making contacts and more especially to such arrangements which use magnetic forces therefore.

The majority of the arrangements heretofore known, which use magnetic forces for the above mentioned purpose, generally contain an electromagnet with corresponding armature. When a current is led to the coil of the electromagnet, the electromagnet attracts the armature whereby it moves sufficiently for breaking or making contacts. The most typical exponent for an arrangement of this kind is a relay in its general construction. In such arrangements, both the attracted element, i. e. the armature and the attracting element, i. e. the core of the electromagnet contact directly with each other when they are in attracted condition. The present invention utilizes the force of attraction between an attracted element and an attracting element, in such a way that there is always a considerable air gap between the elements. In the invention one of the contacts in a pair of contacts is arranged with an element of magnetic material or with an element which is permanently magnetic, or with an element which consists of an electromagnet, and another element, dependent upon the character of last named elements, consists of magnetic or permanently magnetic material or of an electromagnet, approaches said one contact and that at a determined distance between both kinds of elements the first named element approaches the last named over a distance which is sufficient to obtain a desired change of the mutual position of the contacts of the pair of contacts. This change of position of the contacts may also be obtained by means of repulsion whereby both kinds of elements consist of permanent or electro-magnets with like poles facing each other. In the following, the invention will be described applied to two different arrangements.

For easier understanding of the invention one of the different arrangements will be described in connection with the accompanying drawings, in which Fig. 1 is a perspective view of a motor with a contact arrangement according to the invention, Fig. 2 is a schematic diagram showing the contact arrangement, and Fig. 3 is a schematic diagram of a frequency relay embodying the present invention.

In Fig. 1 a motor is shown which is provided with a movable shaft 2, which is journalled in two fixed discs 3 and 4. These two discs are connected with each other by means of two rods 5 and 6. On the shaft 2 a permanent magnet 7 and a U-shaped member 8 are fixed. The permanent magnet 7 will—dependent on the position of the shaft 2—be located inside both coils 9 and 10. Two bent metal strips 11 and 12, fixedly

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arranged by means of screw devices 13, 14, 15 and 16 and electrically insulated from the disc 3, are arranged diametrically opposite each other on the disc 3. The top surfaces of the bent parts 17 and 18 of the metal strip 11, 12 constitute one of the contacts of the pairs of contacts 17, 19 and 18, 20. Over these metal strips 11 and 12 a thin metal plate 21 is arranged, stamped in the form of a cross. One pair of the diametrically opposite arms of the cross is formed at its outer ends with lugs 22 and 23, turned each in its own direction and perpendicularly to the arms. The cross 21 is fixed to the disc 3 by means of these lugs and a pair of distance pieces 24 and 25. The two other arms are provided with contact pins 19 and 20 and placed above the bent metal strips 11 and 12. The metal cross 21 is electrically connected with the disc 3. Because there are no outer forces which influence the arms provided with the contact pins, the contact devices which are formed by the pairs of contacts 17, 19 and 18, 20 will be open. By means of two spacers 27 and 28 a ring of magnetic material, the function of which will be explained hereinafter, is fixed on these arms. Metal strips are fixed with one of its ends on the legs of the U-shaped element 8. At the other end of the metal strips parallelepiped-shaped metal pieces 31 and 32 of about even weight are arranged. In the present invention one of them is constituted of a permanent magnet. These metal strips with attached metal pieces form pendulums, which swing out when the shaft 2 rotates. The deviation of the pendulums is regulated partly by the screws 33 and 34 and partly by the frame 35.

The permanent magnet above mentioned is so dimensioned that when it is in its position of repose, i. e. when the shaft 2 does not rotate, the force of attraction between this magnet and the ring is so great that that part of the ring which is near the magnet rises slightly simultaneously with the lowering of the opposite part due to a certain stiffness of the ring. This rising and lowering of the ring will decrease during the rotation of the shaft 2 as the magnet, due to the centrifugal force, is removed from the ring. When the magnet for instance is found at that part of the ring where the spacer 27 is arranged, then that part will rise and the diametrically opposite part will be lowered and thereby close the contact arrangement containing the contacts 18 and 20. The contact arrangement containing contacts 17 and 19 will be closed in the same way when the magnet is at that part of the ring where the spacer 28 is located. When the magnet rotates, it is able up to a certain deviation therefrom to influence the ring so that the contact arrangements are periodically closed. When this deviation is exceeded however, the force influencing the ring is too little.

In Fig. 2 a coupling diagram for the motor 1 is shown. Elements in this figure, which correspond with like elements in Fig. 1, are provided with the same reference numerals. 2 is a shaft arranged in two bearings 36 and 37. On the shaft are fixedly arranged a permanent magnet 7 and a yoke 8 in the ends of which are arranged the metal strips 30 and 29 with the parallelepiped metal pieces 31 and 32. One of the pieces is a permanent magnet. The units 30, 31 and 29, 32 serve as pendulums. The iron ring 26 is by means of two distance pieces 27 and 28 fixed at the cross 21 which has two contacts 19 and 20. The two bent metal strips 11 and 12 are each provided with a contact 17 and 18, respectively.

It appears from the coupling diagram in Fig. 2 that the contact system of the present invention functions as a commutator. The current, which flows alternately through the coils 9 and 10, when the terminals 38 and 39 are connected to a current source, will cause the motor to rotate. The motor will run with a constant velocity partly due to the counterbalancing by the units 30, 31 and 29, 32 and partly due thereto that the piece which is a permanent magnet and which did not touch the ring, is not able to influence the contact arrangements containing the contact pairs 17, 19 respectively 18, 20 over a certain distance from the ring. The load on the motor, will be constant at constant velocity due to the fact that the permanent magnet rotates along the closed iron ring and that the force between the ring and the magnet has approximately the same magnitude along the whole ring. The friction losses in the motor are decreased thereby that the commutation takes place without friction losses.

Hereinafter contact arrangement according to the invention used in a frequency relay will be described. Such a relay may, with certain changes, substantially be the same as the arrangement shown in Fig. 1. These changes consist thereof that both metal pieces 31 and 32 by means of two torsion springs 40 and 41 are made to take up such a position of repose that both pieces are found over the contact pairs 17, 19 and 18, 20 and that both coils 9 and 10 are coupled in series, have cooperating fields and are coupled to an alternating potential source 43, the frequency of which may vary. The contact arrangement positioned at the permanent magnet has no mission to fill while it continuously remains open. The contact arrangement diametrically opposite this contact arrangement may be connected to an arbitrary circuit or the like. This contact arrangement is, when the metal pieces are in repose, always closed. When these metal pieces oscillate, this contact arrangement is broken when the distance between the permanent-magnetic pieces and the ring pass a certain value. In case it is desired that the last named contact arrangement will be open when the metal pieces are in repose, it is so arranged that the distance between the magnetic piece and the ring is exactly so great that said contact arrangement is not influenced but that it is influenced due to the decrease of this distance during the oscillation of the metal pieces. The above described frequency relays may also be arranged with only "a pendulum" i. e. with that one of the metal pieces 29 and 30 which is provided with the permanent magnet. The increase of the moment of inertia in the oscillatory system in relays of the last named kind, which ensues during oscillation of the system may be compensated by arrangement of e. g. a further iron ring outside the magnet. This ring will have a radius which is greater than the radius of the path which the magnet describes.

A shaft 2 (Fig. 3) carries the two torsion springs 40 and 41, a permanent magnet 7 and a yoke 8. Said yoke is provided with two metal strips 29 and 30 with each a parallelepiped metal piece 32 respectively 31. The piece 32 is a permanent magnet. The ring 26, the cross 21 and the contact pairs are arranged in the same manner as in Fig. 1. 42 is a part of a metal ring arranged outside the ring 26. When the system is at rest, that is when no current flows through the coils, the shaft is held in such a position by the two torsion springs that the magnet is perpendicular to the magnetic field from the coils 9 and 10 and that the piece 32 is situated directly above the contact pair 19 and 17. The contacts 18 and 20 are then closed. When current flows through the coils the magnet 7 and the yoke 8 with the strips 29 and 30 with the pieces 31 and 32 will oscillate. When the current has a predetermined frequency the pieces 31 and 32 will swing out so much that the contacts 18 and 20 are separated from each other. The ring piece 42 is for the purpose of decreasing the moment of inertia of the oscillatory system of the relay.

Although in the above a number of embodiments or modifications of the invention have been described, the invention is not restricted to only those. It ought to be clear that further embodiments or modifications may be possible which fall within the scope of the invention.

I claim:

1. A device of the class described comprising a rotatable vertical shaft, a bracket carried by said shaft, a pair of pendulus members depending from the ends of said bracket and adapted to swing outwardly due to centrifugal force as the shaft is rotated, a flexible ring disposed beneath the path of travel of said members, said ring being of magnetic material and one of said members constituting a permanent magnet and being disposed to magnetically attract and flex said ring as it passes thereover in its path of movement, said magnet being mounted to swing out of the zone of attraction for said ring by centrifugal force as the shaft is rotated, and contacts actuated by the flexing of said ring.

2. In a device as set forth in claim 1, a driving motor for said shaft comprising an armature carried by said shaft and stationary field coils, said contacts being connected in circuit with said field coils to control the energization thereof.

3. A device as set forth in claim 1 in which said contacts are mounted below said ring and pins connect said ring and said contacts to actuate said contacts in response to the flexing of said ring.

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