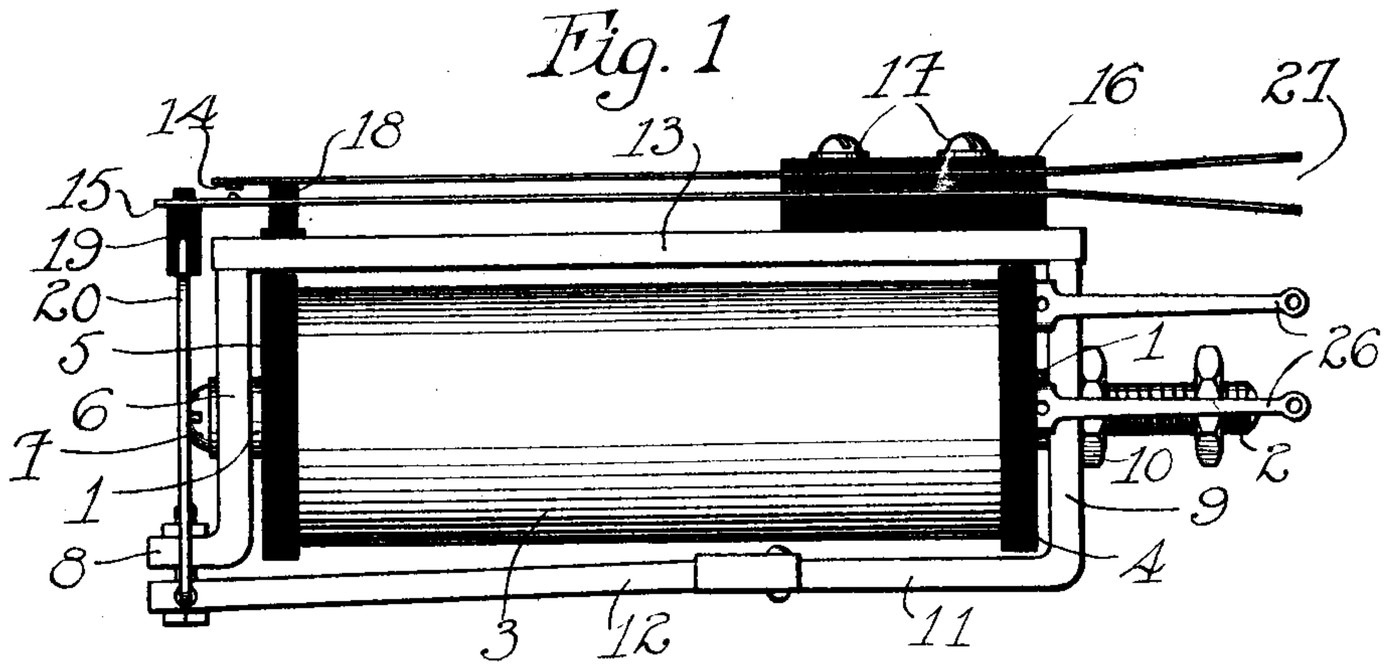
E. A. REINKE.

ELECTROMAGNETIC RELAY.

APPLICATION FILED MAY 10, 1915.

1,170,670. **Patented Feb. 8, 1916.**

Fig. 1



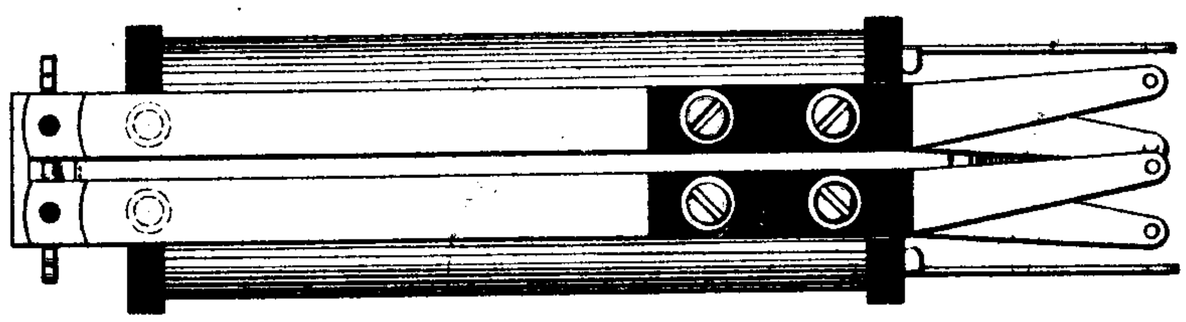


Fig. 2

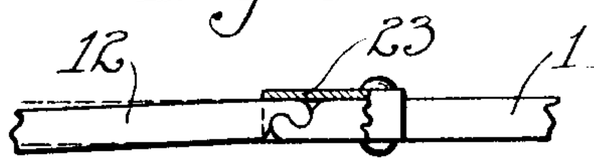


Fig. 5

Fig. 4a

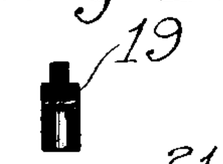


Fig. 3

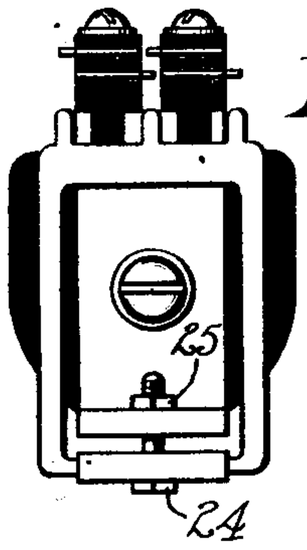
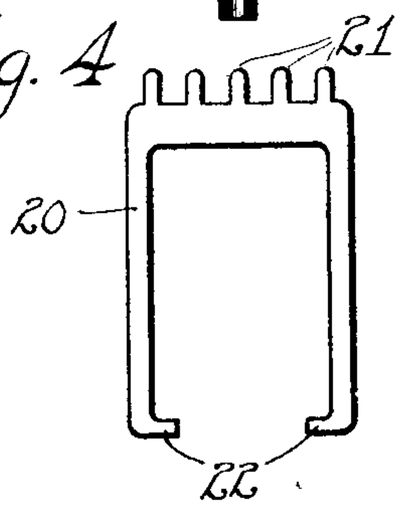


Fig. 4



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UNITED STATES PATENT OFFICE.

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ELECTROMAGNETIC RELAY.

1,170,670. Specification of Letters Patent. Patented Feb. 8, 1916.

Application filed May 10, 1915. Serial No. 27,192.

To all whom it may concern:

Be it known that I, EUGENE A. REINKE, a citizen of the United States, residing at Rochester, in the county of Monroe and State of New York, have invented a certain new and useful Improvement in Electromagnetic Relays, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings forming a part of this specification.

The present invention provides an improved electro-magnetic relay. In most cases where a current impulse or current change is to be transferred from one circuit to another, it is desired that the transfer be made with maximum celerity and minimum expenditure of energy. It is also desirable in such connection that the responsive or transferring device be made of maximum sensitiveness in order to function properly even though the actuating impulse of current be abnormally brief or weak. The demand for such a relay has been brought about largely by increase in the number and rapidity of operations incidental to the use of modern signaling systems. Especially in the operation of automatic circuit selecting apparatus in telephones and similar signaling systems has there been a demand for a relay of the type above specified.

Where a very brief time is allowed for the relay to operate as in rapidly moving step-by-step or wiping switches or the like, the production of a relay which will operate under conditions of increased speed, sensitiveness and efficiency becomes a matter of the greatest importance. It is well known by engineers skilled in the art that the speed of automatic telephone switches is at present limited by the speed and sensitiveness of the relays controlling the circuit. Hence any improvement in the operation of the relay entrains a very large and beneficial result in general operation of the system.

It is the object of the present invention to provide an improved electro-magnetic relay which will embody to as great a degree as possible the above qualities.

In the acompanying drawings, I have illustrated one specific embodiment in which my invention may appear.

Figure 1 is a side elevation of a relay embodying my invention. Fig. 2 is a plan view of the same. Fig. 3 is a front elevation. Fig. 4 is an elevation of the frame or yoke which forms the connecting link between the armature and the contact springs. Fig. 4ª is a fragmentary view of an insulating pin forming the connection between the yoke shown in Fig. 4 and the contact spring, and Fig. 5 is a fragmentary elevation of the joint between the rear pole piece and the movable armature.

The relay shown in Fig. 1 is provided with the central core 1 of magnetic material which is extended as a stud or bolt 2 at the rear of the relay for providing mounting means for the relay structure upon a suitable mount or rack. Upon the core 1 are placed the windings 3 which may be of any desired resistance to suit individual conditions. The windings 3 are held in place between the heads 4 and 5 which are preferably made of insulating material. The pole piece 6 preferably formed out of rectangular bar iron is bolted to the front end of the core 1 as by means of the screw-bolt 7. The lower end of the pole piece 6 is bent outwardly at 8 forming a short extension generally parallel to the axis of the core 1. The rear end of the core 1 is provided with a pole piece 9 which is bolted to the pole piece by means of the nut 10 which coöperates with a threaded stud 2 to hold this pole piece in position. The rear pole piece 9 is bent forward in the same general direction as the pole piece 6 to form a portion 11 generally parallel to the core 1. This parallel portion 11 extends along a considerable length of the core 1 so as to allow the employment of an armature 12 which will be short and will therefore have very small inertia. The armature 12 when attracted to the pole piece 6 closes the magnetic path completely. The pole pieces 6 and 9 are extended above the heads 4 and 5 to form a support for the plate or bar 13 which is made of non-magnetic material. The circuit changing mechanism which in this case comprises two similar spring pairs 14 and 15 is supported upon the plate or bar 13 by means of the block of insulation 16 and the screw-bolt 17. The springs 14 are supported at a predetermined distance from the plate 13 by means of the insulating pins 18 which have their lower ends seated in recesses in the plate 13 and which pass

through holes in the springs 15. The outer end of each spring 15 is perforated to receive the reduced end of a pin of insulation 19 mounted upon the yoke or frame 20 which frame or yoke is pivoted to the armature 12. The insulating pin 19, shown more clearly in Fig. 4ª, is hollow for a part of its length and is adapted to slip over one of the projections 21, formed on the top part of the frame or yoke 20, sufficient projections 21 being formed on this yoke to allow for operation of five pairs of springs. Obviously a greater number could be provided if desired. The odd number of projections 21 is provided so that the resistance of the springs will always be balanced on the yoke 20. The lower end of the yoke is provided with projections 22 turning inwardly so as to seat in holes in the side of the armature 12.

The pole piece 11 and the armature 12 are joined together in the manner shown in Fig. 5. These two parts are conformed to secure what I term an open knuckle joint or clasp joint, the ends of the two bars being provided at their extremities with small hook-shaped projections which interlock and prevent endwise movement. A metal clip 23 which surrounds three sides of the bars 11 and 12 prevents the hooks or ends from being disengaged. The metal clip 23 is secured to the bar 11 so as to minimize the weight and inertia of the movable parts. The outer end of the armature 12 which is adjacent the end 8 of the front pole piece is perforated to allow a small adjusting bolt 24 to pass therethrough and into the end 8 of the pole piece. The bolt 24 is provided with a set-nut 25 to maintain the adjustment of the air-gap formed between the pole piece 6 and the armature 12. The windings 3 are provided with terminals 26 which project outwardly to about the same distance as the end 27 of the springs 14 and 15, thus providing suitable means for attaching the circuit wires.

The armature 12 may be made much shorter than the core 1 without causing excessive leakage. The advantage obtained by making the armature 12 short is a reduction of the weight of the moving parts. The inertia is less and the sensitiveness will therefore be materially increased.

Attention is also called to the fact that the only point at which the magnetic circuit is broken is at the air-gap between the armature and the front pole piece. The open knuckle joint between the pole piece 11 and the armature 12 always preserves a closed path for magnetic lines of force, the intimate relation between the ends of the two bars offering very slight reluctance to the lines of force. By employing the open frame 20 to actuate the springs 14 and 15 I am enabled to shorten the relay structure by a considerable amount, at the same time securing ample surfaces between which the air-gap is formed. The springs 14 and 15 are carried to the full length of the relay in order to obtain maximum sensitiveness with a minimum of resistance to movement. The relay, as constructed, is formed of the least possible number of parts, all of which can conveniently be manufactured without the employment of expensive machinery. The cost of assembling and adjusting the parts may also be very low.

The springs may be disengaged from the yoke 20 by raising the lower spring 15 above the top of the insulating pins 19 whereby the yoke 20 may be swung outwardly exposing the contacts for inspection or repair.

I do not wish to be limited to the precise construction above described, as changes may readily be made in the structure without departing from the scope of the invention.

What I claim as new and desire to secure by Letters Patent is the following:

1. In a device of the class described, a magnetic core having pole pieces, one of said pole pieces extending parallel to said core and having its end formed into one-half of an overlapping rocking joint, an armature of shorter length than the length of the core, said armature having its one end formed into a coöperating half of an overlapping rocking joint and having its other end held adjacent said other pole piece and a winding upon said core.

2. In a device of the class described, a magnetic core having pole pieces, one of said pole pieces extending parallel to said core and having its end formed into one-half of an overlapping rocking joint, an armature of shorter length than the length of the core, said armature having its one end formed into a coöperating half of an overlapping rocking joint and having its other end held adjacent said other pole piece and a clip for holding said halves of said overlapping joint in coöperating relation.

3. In combination, a magnetic core, an L-shaped pole piece having one arm secured to one end of said core, the other arm of said pole piece extending substantially parallel with said core and having on its end one part of a rocking joint, an armature having a corresponding part of a rocking joint engaging the part on said pole piece, said rocking parts overlapping to form a joint of low magnetic reluctance, a clip for holding said halves in coöperating relation, and a pole piece secured to the opposite end of said core, said pole piece having a flattened extremity adjacent the free end of said armature.

4. In combination, a magnetic core, an L-shaped pole piece having one arm secured to one end of said core, the other end of said

pole piece extending substantially parallel with said core and having one part of an overlapping rocking joint upon the end thereof, an armature having a corresponding part of an overlapping rocking joint engaging the part on said pole piece, a clip for holding said halves in coöperating relation, said clip being secured to said pole piece, a pole piece secured to the opposite end of said core and having a flattened extremity adjacent the free end of said armature, and means for determining the air-gap between said armature and pole pieces.

5. In combination, a magnetic core having L-shaped pole pieces, one of said pole pieces having an arm secured to one end of said core, the other end of said pole piece extending substantially parallel with said core and having one part of an overlapping rocking joint thereupon, an armature having a corresponding part of said joint engaging the part on said pole piece, a clip for holding said halves in coöperating relation, said clip being secured to said pole piece, the other end of said armature extending adjacent the end of the other pole piece, a bridge of non-magnetic material secured to said pole pieces, contact mechanism mounted on said bridge, said contact mechanism being adapted to be operated by said armature and a light rectangular frame pivoted on said armature and connected to said contact mechanism.

6. In combination, a magnetic core having L-shaped pole pieces, one of said pole pieces having an arm lying substantially parallel with said core, one part of an overlapping rocking joint being formed on the end of said arm, an armature bar having a corresponding part of said joint engaging the part on said arm, means for holding said halves in contact, the other end of said armature extending adjacent the other pole piece, a bridge of non-magnetic material secured to said pole pieces, spring contact mechanism mounted on said bridge, said contact mechanism comprising springs extending the full length of said bridge piece and a light rectangular frame pivoted to said armature, said frame embracing said adjacent pole piece and having insulated pins connected to said contact springs.

7. In combination a magnetic core, pole pieces for said core, and an armature connecting said pole pieces, one of said pole pieces having coöperating curved surfaces formed thereupon to form an overlapping rocking joint, the area of contact between said curved surfaces being relatively large to form a joint of low magnetic reluctance.

8. In a relay, a core, a pole piece having a reduced portion at the end thereof, said reduced portion comprising a rounded end and a groove just back of said rounded end, an armature having a similar end forming a rocking or sliding joint therewith, and a second pole piece on said core coöperating with said armature, said armature and said pole piece having their reduced ends overlapping each other.

In witness whereof, I hereunto subscribe my name this 1st day of May A. D. 1915.

EUGENE A. REINKE.

Witnesses:
W. W. Van Vleet,
J. S. Gibson.