Feb. 28, 1939.

F. A. ZUPA

2,148,598

RELAY

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FIG. 1

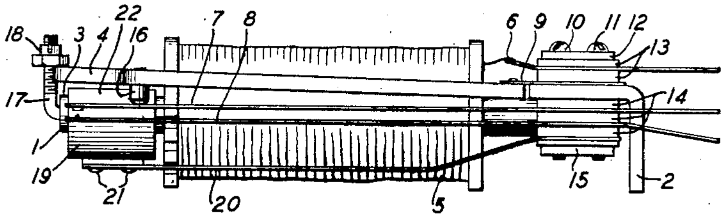
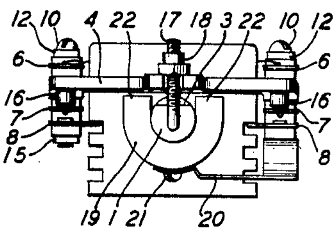


FIG. 2



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RELAY

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6 Claims. (Cl. 175—336)

This invention relates to electromagnetic relays and more particularly to relays for use in the circuits of telephone systems.

In electric circuits generally and in telephone circuits particularly, electromagnetic relays are employed in large numbers for performing numerous and varied circuit switching functions. It is often very essential that relays employed in such circuits shall positively make and break the circuits controlled over their contacts. If the contacts of a relay do not make firmly or break cleanly, or in other words, if the contacts have a tendency to chatter when they make or break, false operation in the circuits controlled thereover will result.

It has been found that one of the factors which contributes to the tendency of relay contacts to chatter is the vibration or bouncing of the relay armature when it strikes the back stop structure at the end of its releasing movement, or when it strikes the pole face of the relay core at the end of its operating movement. The kinetic energy of the armature motion must in some manner be dissipated before the armature and the contacts controlled thereby may come to rest. If the kinetic energy is made low, then the energy dissipation required at the time of impact of the armature is lessened and the rebound is reduced. It is therefore an object of the present invention to reduce the rebound tendency of a relay armature by reducing its speed of movement and thereby reducing its kinetic energy.

In accordance with the invention this object is attained by the provision of a movable member of comparatively large mass with which the relay armature engages before it strikes the end of the core. By thus first engaging the movable mass, the speed of the movement of the armature is reduced before the armature strikes the core. The movable member may be made of non-magnetic material such as lead in the form of a yoke partially surrounding the end of the core, with its arms normally extending above the pole face of the core and supported upon the end of a resilient reed spring.

As an alternative construction, the yoke may be in the form of a permanent magnet and normally held in position against the underside of the core by a reed spring. With this construction since the core exerts a magnetic pull on the yoke, the movement of the armature toward the core will be retarded momentarily after the armature engages the end of the yoke until the yoke is separated from the core and the releasing movement of the armature will be retarded since the magnetic yoke will adhere to the armature thus adding its mass to that of the armature until the armature breaks away from it at the time the yoke engages the underside of the core.

The invention will be more readily understood from the following description taken in connection with the accompanying drawing in which:

Fig. 1 is a side elevational view of a well-known type of relay modified in accordance with the invention; and

Fig. 2 is a front end elevational view of the relay disclosed in Fig. 1.

The relay is in general of a well-known type having a core 1 secured at its rear end to a mounting bracket or heel piece 2 and having a pole face 3 upon its forward end with which the forward end of the armature 4 cooperates. An energizing coil 5 surrounds the core 1, the terminals of which are connected to terminal lugs 6. A spring pile-up is positioned on each side of the coil 5, each spring pile-up comprising any desired combination of contact springs. For convenience of illustration each spring pile-up has been disclosed as comprising an armature spring 7 and a mate spring 8. The armature 4 is hinged at its rear end to the bracket 2 by reed springs 9 which are riveted to the rearwardly extending side arms of the armature. The terminal lugs 6, reed springs 9 and the contact springs 7 and 8 are clamped to the bracket 2 by screws 10 and 11 which extend through the clamping strip 12, lugs 6, insulating strips 13, reed springs 9, bracket 2, insulating strips 14 and contact springs 7 and 8 into threaded holes in clamping strip 15. The terminal lugs 6 and contact springs 7 and 8 are insulated from each other and from the bracket 2 by the interposed insulating strips 13 and 14.

For engaging the armature springs 7 with their mate springs 8 upon the attraction of the armature 4 toward the core 1 in response to the energization of the coil 5, the armature is provided with operating studs 16 of insulating material which engage the armature springs 7.

To limit the releasing movement of the armature away from the core and to adjust the normal air-gap between the armature and the pole face 3 of the core, a back stop screw 17 having a back stop nut 18 threaded thereon is attached to the end of the core 1. In its normal position the forward end of the armature engages beneath the back stop nut 18.

Positioned beneath the forward end of the core 1 and partially surrounding the end of the core is a yoke 19. The yoke is of substantially U-shape and is normally held against the underside of the core by a spring 20 secured at its forward end to the underside of the yoke by screws 21 and secured at its rearward end to the bracket 2 by the screws 10 and 11. The arms 22 of the yoke 19 normally extend slightly above the pole face 3 of the core 1, as most clearly shown in Fig. 2.

In accordance with one embodiment of the invention, the yoke 19 is made of non-magnetic material and has a comparatively large mass. To secure as large a mass as is desirable without unduly increasing the size thereof, the yoke may be made of lead. The relay as constructed in accordance with this embodiment, functions in the following manner: With the yoke normally positioned by its supporting spring 20 against the underside of the relay core with the ends of its arms 22 extending above the pole face 3 of the core, when the coil 5 is energized the armature 4 will be attracted toward the pole face 3 of the core and by the operating studs 16 carried thereby, will engage the armature springs 7 with their mate springs 8. However, before the armature has attained any appreciable speed of movement, it will engage with the projecting arms 22 of the yoke 19 and the speed of its movement will be retarded in accelerating the mass of the yoke so that by the time the armature has depressed the yoke away from the underside of the core and has engaged the pole face 3 of the core, its speed of movement will be so retarded that its impact with the core will be very slight. As a consequence the core and the support for the contact springs will not be displaced as far from normal position and will not therefore impart such vibration to the contact springs as to cause them to chatter.

In accordance with a further embodiment of the invention, the yoke 19 may be made U-shaped either as a permanent magnet or of magnetic material which will become magnetized as a part of the magnetic circuit of the relay. With this construction the relay functions substantially in the manner previously described upon the attraction of its armature except that the yoke being of magnetic material is held magnetically to the underside of the core and the speed of movement of the armature toward the core is not only retarded in accelerating the mass of the yoke, but also due to the magnetic attraction of the yoke to the underside of the core. As the relay armature continues to move toward the core and depresses the yoke, this attraction is overcome and finally the armature strikes the pole face 3 of the core. However, its speed of movement has been so retarded by the yoke that the impact of the armature with the core is not sufficient to cause any appreciable vibration of the core and the contact springs.

When the relay coil 5 is subsequently deenergized, the relay armature will, under the influence of the armature springs 7, tend to move toward the back stop nut 18. The speed of its releasing movement will, however, be retarded since the magnetic yoke 19 will be magnetically attached to the armature during the first part of its releasing movement and will thus add its mass to that of the armature. However, when the yoke again engages with the underside of the core and can no longer follow the movement of the armature, the armature will break away from the ends of the yoke and will continue its releasing movement. The speed of the releasing movement of the armature will, however, have been so retarded that it will not make such an impact with the stop nut 18 as to cause any appreciable rebound of the armature therefrom and therefore will not cause the relay contacts to chatter upon breaking contact.

What is claimed is:

1. In an electromagnetic structure comprising a cylindrical core having the forward end of its cylindrical surface flattened to form a pole face, an armature cooperating with said pole face and an energizing coil on said core, a movable U-shaped yoke partially surrounding the end of said core and normally positioned with the ends of its arms extending beyond the plane of the pole face of said core for engagement by said armature, and spring means for yieldingly supporting said yoke, said armature upon its attraction toward the pole face of said core in response to the energization of said coil first engaging the arms of said yoke to move said yoke whereby the speed of movement of said armature is retarded.

2. In an electromagnetic structure comprising a cylindrical core having the forward end of its cylindrical surface flattened to form a pole face, an armature cooperating with said pole face and an energizing coil on said core, a movable U-shaped yoke partially surrounding the end of said core and normally positioned with the ends of its arms extending beyond the plane of the pole face of said core for engagement by said armature, and a reed spring secured at one end to said yoke and at its other end to the rear end of said core for yieldingly supporting said yoke, said armature upon its attraction toward the pole face of said core in response to the energization of said coil first engaging the arms of said yoke to move said yoke whereby the speed of movement of said armature is retarded.

3. In an electromagnetic structure comprising a cylindrical core having the forward end of its cylindrical surface flattened to form a pole face, an armature cooperating with said pole face and an energizing coil on said core, a movable U-shaped yoke of comparatively large mass partially surrounding the end of said core and normally positioned with the ends of its arms extending beyond the plane of the pole face of said core for engagement by said armature, and a reed spring secured at one end to said yoke and at its other end to the rear end of said core for yieldingly supporting said yoke, said armature upon its attraction toward the pole face of said core in response to the energization of said coil first engaging the arms of said yoke to move said yoke whereby the speed of movement of said armature is retarded in accelerating the mass of said yoke.

4. In an electromagnetic structure having a core, an armature cooperating therewith and an energizing coil, a movable lead yoke partially surrounding the end of said core and normally positioned with its arms extending beyond the pole face of said core for engagement by said armature, and a spring for yieldingly supporting said yoke, said armature upon its attraction toward said core in response to the energization of said coil first engaging the arms of said yoke to move said yoke whereby the speed of movement of said armature is retarded in accelerating the mass of said yoke.

5. In an electromagnetic structure comprising a cylindrical core having the forward end of its cylindrical surface flattened to form a pole face, an armature cooperating with said pole face, and an energizing coil on said core, a movable

U-shaped yoke of magnetic material partially surrounding the end of said core and normally positioned with the ends of its arms extending beyond the plane of the pole face of said core for engagement by said armature and a spring for yieldingly supporting said yoke, said armature upon its attraction toward the pole face of said core in response to the energization of said coil first engaging the arms of said yoke to move said yoke whereby the speed of movement of said armature is retarded in overcoming the attraction between said yoke and said core and in accelerating the mass of said yoke.

6. In an electromagnetic structure having a core, an armature cooperating therewith and an energizing coil, a U-shaped magnet normally positioned in engagement with the underside of said core with its pole-pieces extending beyond the pole face on the upper side of said core, and a spring for yieldingly supporting said magnet, said armature upon its attraction toward said core in response to the energization of said coil first engaging the pole-pieces of said magnet to move said magnet whereby the speed of movement of said armature is retarded in overcoming the attraction between said magnet and said core and whereby upon the release of said armature the speed of movement is retarded in overcoming the attraction between said magnet and said armature.

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