E. E. CLEMENT.

ELECTRICAL RELAY.

APPLICATION FILED JUNE 6, 1906.

991,829.

Patented May 9, 1911.

3 SHEETS—SHEET 1.

Fig. 1.

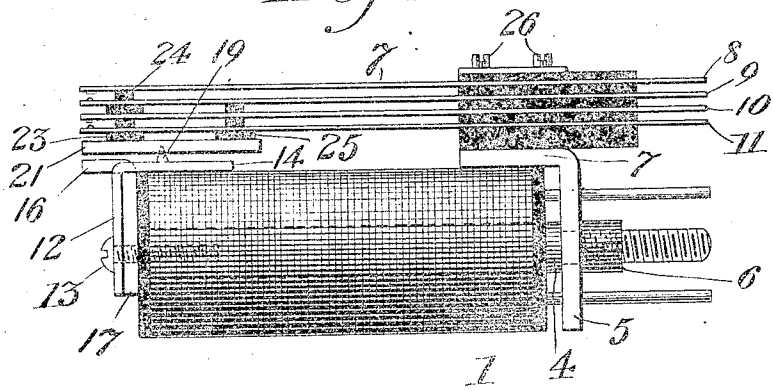
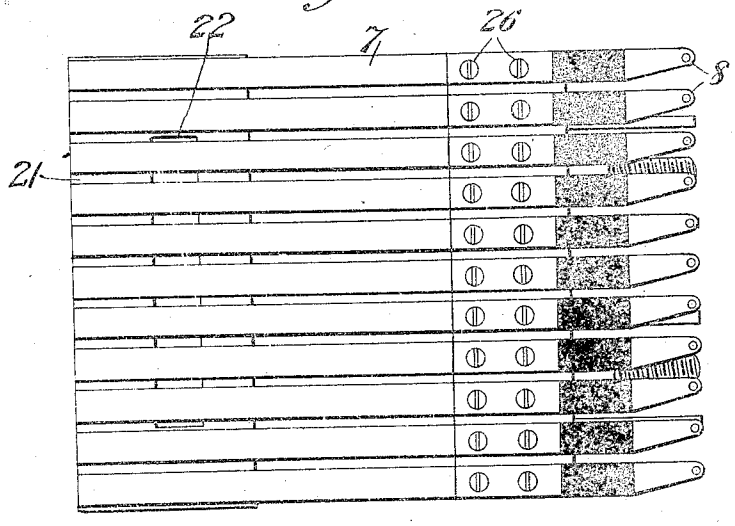


Fig. 2.



Witnesses

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3 SHEETS—SHEET 2.

Fig. 3.

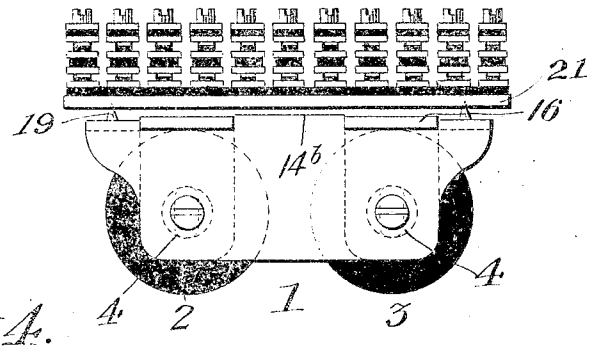

Fig. 4.

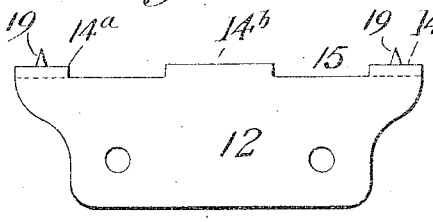

Fig. 5.

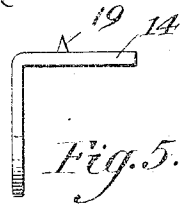

Fig. 6.

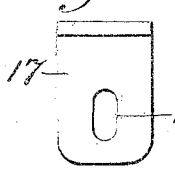

Fig. 7.

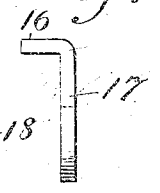

Fig. 8.

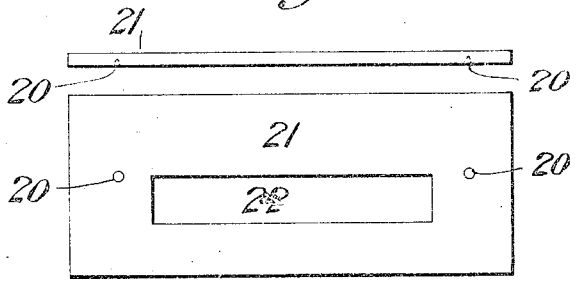

Fig. 9.

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3 SHEETS—SHEET 3.

Fig. 11.

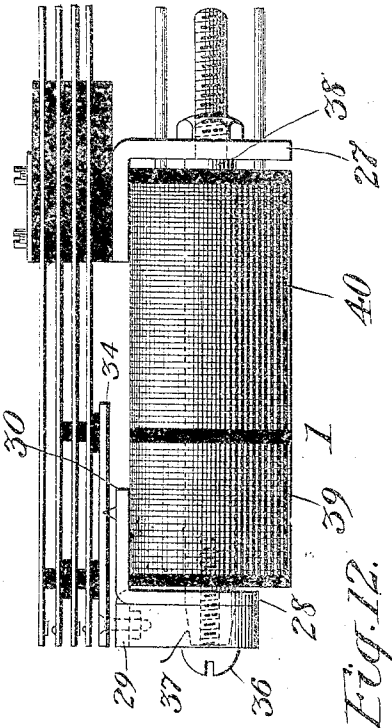


Fig. 13.

Fig. 12.

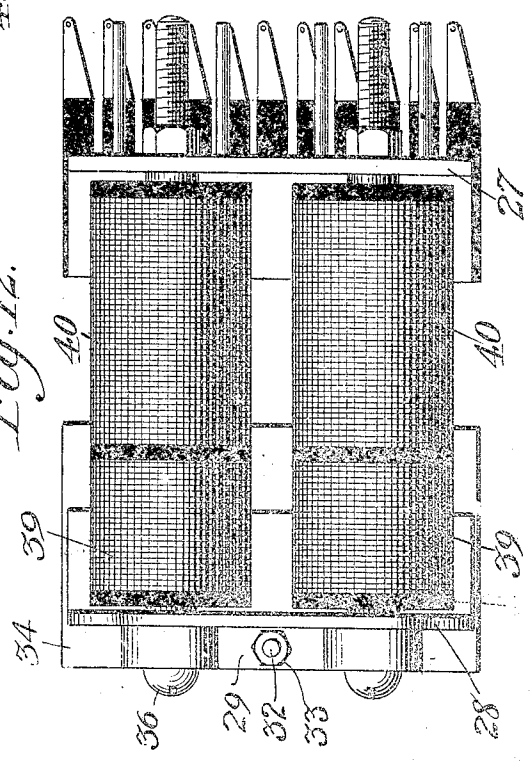
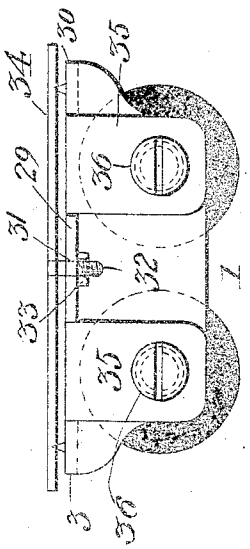


Fig. 10.



Witnesses

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UNITED STATES PATENT OFFICE.

EDWARD E. CLEMENT, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO THE NORTH ELECTRIC COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

ELECTRICAL RELAY.

991,829. Specification of Letters Patent. Patented May 9, 1911.

Application filed June 6, 1906. Serial No. 320,457.

To all whom it may concern:

Be it known that I, EDWARD E. CLEMENT, a citizen of the United States, residing at Washington, in the District of Columbia, have invented a certain new and useful Improvement in Electrical Relays, of which the following is a specification, reference being had therein to the accompanying drawing.

My invention relates to electrical relays and especially to relays for use in certain types of telephone exchange systems and other systems requiring a multiplicity of contacts to be made and broken.

The object of the invention is to provide a relay which will operate satisfactorily more than two pairs of contact springs. This has been difficult to do heretofore owing to the fact that there has been considerable trouble in adjusting the many contacts so that one movement of a common part would make or break them all satisfactorily. Again it has been difficult to obtain proper leverage and sufficient power without making cores and windings large and cumbersome.

Further objects of the invention will be apparent to those versed in the art when the specification is read in connection with the accompanying drawings, in which—

Figure 1 is a side elevation of the complete relay. Fig. 2 is a top plan Fig. 3 is a front end view thereof Figs. 4 and 5 are front and side elevations of the armature supporting frame Figs. 6 and 7 are respectively front and side elevations of the front pole pieces Figs. 8 and 9 are respectively side and front elevations of the armature Fig. 10 is a front elevation of a modified form with the contact springs omitted. Fig. 11 is a side elevation thereof with the contact springs shown, and Fig. 12 is a bottom plan view thereof. Fig. 13 is an enlarged detail of one of the spring operating and supporting studs.

Referring to the drawings, 1 represents an electro-magnet comprising a pair of spools 2 and 3 whose cores 4 are secured to the rear yoke 5 by means of nuts 6 or in any other suitable manner. This yoke piece 5 extends across both spools and is provided with a return portion or flange 7 bent at right angles to the body so as to support the contact springs 8, 9, 10, and 11 parallel with the cores 4.

Extending across the front of the electro-magnet is a second yoke piece 12 secured to the cores 4 by screws 13 and having a return portion or flange 14 extending across the front end and on top of the electro-magnet. This yoke piece and flange is of non-magnetic material and preferably of brass stamped out of sheet metal so as to leave openings 15 for the reception of the feet 16 of the front pole pieces 17 each of which is apertured at 18 to receive the screw 13. This aperture 18 may be a closed vertical slot so that the pole pieces can be adjusted to prevent the armature from engaging one prior to its engagement with the other, but I preferably make the aperture 18 of such size that it will just admit the passage of the screw 13 and thereby hold the pole piece so as to prevent it from moving in a vertical direction and then grind the top of the pole pieces so as to insure the same distance between each pole piece and the armature. The upper edge or flange 14 of the armature supporting yoke is divided into three parts, 14^a, 14^b, and 14^c, the middle one of which extends straight up from the body portion 12 preferably slightly higher than the pole pieces so as to prevent the armature from directly engaging them. This however is not absolutely necessary as the tension of the springs is such that when the current is taken off they will return the armature to normal position instantaneously. Each outside leg of the return flange 14 is provided with a sharp pivot pin 19 which is preferably made of hardened steel. These pivot pins are adapted to engage conical depressions 20 on the underside and at each end of the armature 21 which is cut away at 22 so as to lighten it and to concentrate the flux directly over the pole pieces, not only making the action stronger but preventing any eddy currents.

In the use to which I apply this relay at present, that of cutting on a metallic circuit to its extensions, it is requisite to have two pairs of contacts, one pair for each side of the metallic circuit in each set. Both of these are made and broken at once, and there may be as many sets as there are circuits. In each set the springs 9 and 11 are the working springs and the springs 8 and 10 are the fixed or anvil springs. As shown in Fig. 1, I make these springs self-adjusting,

that is, by the use of two little studs, 23 and 24, one for each pair. The stud 23 rests with its base upon the forward end of the armature 21 and the spring 11 rests upon the shouldered portion thereof. The reduced portion or stem extends through the spring 11 and the fixed or anvil spring 10 rests thereon. The stud 24 has its base resting upon the spring 10 and the spring 9 rests upon the shoulder portion thereof, its reduced portion or stem extends through the pin 9 and the spring 8 rests upon the top thereof. A stud 25 removably seated upon the rear end of the armature back of the pivot pins 19 supports the spring 11 on its shoulder portion and the spring 9 upon its stem or reduced portion. The armature is thus held in place parallel with the core and with the return flanges 14 of the front yoke until the magnet is energized. All the studs 23, 24, and 25 have conical bases, with the points down resting on the armature and contact springs. All the springs of the sets are separated by insulation and each set is held upon the return flange 7 by screws 26. It will be noticed that the pole pieces 17 directly abut the ends of the core and are secured behind the front yoke piece 12 and have their ends 16 projecting out of the cut-away portions 15 of said yoke piece so that they are prevented from having any lateral movement. The yoke piece holds the two spools in proper relation and forms a support for the armature.

In Figs. 10, 11, and 12 I have shown a modified form in which the yoke piece 27 is secured to the magnet 1 in the same manner as that shown in Fig. 1. The front yoke piece 28 is similar in all respects to the yoke piece 12 with the exception that the middle part 29 corresponding to the part 14^b in Fig. 1 is bent forward while the outer legs 30 are bent backward. It is provided with an aperture 31 for the passage of a bolt 32 riveted to the armature and provided with a nut 33 for adjusting the air gap between the armature 34 and the pole pieces 35. These poles pieces are secured by screws 36 to the tapered ends 37 of the cores 38 and have their upper ends flush with the part 29 and in engagement therewith so as to prevent lateral movement thereof. The arrangement of contact springs and armature is the same as that shown in Fig. 1. In Figs. 10, 11 and 12 I have shown two windings upon the cores 38, the forward one, 39, composed of coarse wire and acting to pull up the armature, while the other winding 40 is of relatively fine wire and acts to hold the armature against the core.

Having thus described my invention what I claim is new and desire to secure by Letters Patent is:—

1. In a relay, the combination with an electro-magnet, of a pole piece therefor, a yoke piece holding said pole piece against the core of said electro-magnet, and an armature pivoted on said yoke piece together with contact springs overlying and worked by said armature.

2. In a relay, the combination of an electro-magnet comprising two spools, pole pieces, a yoke adapted to engage said pole pieces to hold them against the core together with an armature, and contact springs operated therethrough by said pole pieces.

3. In a relay, the combination with an electro-magnet, of pole pieces therefor, a yoke piece holding said pole pieces against the cores of said electro-magnet, and an armature pivoted on said yoke piece together with contact springs overlying and operated thereby.

4. In a relay, the combination with an electro-magnet, comprising a plurality of spools having cores, of pole pieces therefor, a yoke piece extending across said spools and engaging said pole pieces to prevent their turning, means for securing said yoke piece and said pole pieces to said cores, an armature pivoted on said yoke piece, and contact springs overlying the armature so as to hold it in position and to be operated thereby.

5. In a relay, the combination with an electro-magnet comprising a plurality of spools having cores, of a pole piece for each core, a yoke piece extending across said cores and formed to engage said pole pieces to hold them from turning, means for securing the pole pieces and said yoke piece to the core, said yoke piece having a return or flange, pivotal means secured to said flange, an armature mounted on said pivotal means, and contact springs overlapping the armature holding it on the pivotal means.

6. In a relay, the combination of an electro-magnet comprising a plurality of spools having cores, a pole piece for each core, a yoke piece having rearwardly extending legs and a projection, said rearwardly extending legs and said projection defining depressions, said pole pieces seated in said depressions between said rearwardly extending legs and the projection, means for securing the pole pieces and the yoke piece to the cores, an armature lying across the legs of said yoke piece and pivoted thereon, and contact springs operated by said armature.

7. In a relay, the combination with an electro-magnet comprising a plurality of spools having cores, of pole pieces having forwardly extending flanges, a yoke piece having rearwardly extending legs or flanges and an upright projection, said pole pieces having their flanges seated between the projection and the rearwardly extending legs so as to prevent them from turning, pivotal points formed on said rearwardly extending

flanges and a flat armature having bearing upon said pivotal points together with contact springs overlying and operated thereby.

8. In a relay, the combination with an electro-magnet comprising a plurality of spools having cores, of pole pieces for the cores, a yoke piece engaging the pole pieces to prevent them from turning, means for securing the pole pieces and the yoke piece to the cores, an armature pivoted on the yoke piece, and means coöperating with the yoke piece and the armature for adjusting the air gap together with contact springs overlying and operated thereby.

9. In a relay, the combination with an electro-magnet, of pole pieces therefor, a yoke piece having a rearwardly extending flange, an armature pivoted on said yoke piece and extending parallel with the flange of said yoke piece to a point over the pole pieces, an extension carried by said yoke piece, and means coöperating with said extension and the armature to adjust the air gap together with contact springs overlying and operated thereby.

10. In a relay, the combination with an electro-magnet, of pole pieces therefor, a yoke piece coöperating with said pole pieces to prevent them from turning, said yoke piece having a rearwardly extending flange, an armature pivoted upon said rearwardly extending flange and lying parallel therewith, an extension formed upon said yoke piece, and a stud carried by said armature and having a nut in engagement with the extension of the yoke piece to adjust the air gap between said armature and the pole pieces together with contact springs overlying and operated thereby.

11. In a relay, the combination with an electro-magnet comprising a plurality of spools having cores, of pole pieces secured to each core, a yoke piece extending across the spools and secured to each core, said yoke piece having a rearwardly extending flange and a forwardly projecting extension, pivotal points on said flange, contact springs, an armature held on said pivotal points and extending parallel with said springs to a point over the pole pieces, a depending stud carried by the forward end of the armature and projecting through an aperture in the forward extension of said yoke piece and a nut on the stud for adjusting the air gap between said pole pieces and the armature.

12. In a relay, the combination with an electro-magnet, armature supporting means carried thereby, an armature carried by said supporting means in substantially parallel relation with the core of the electro-magnet, a set of contact springs supported parallel with the armature, a stud adapted to engage and actuate certain of said springs said stud being supported on the rear end of the armature, a plurality of studs carried by the front end of the armature and adapted to normally support certain of said springs, but to withdraw such support when the armature is attracted, and a pole piece secured to the core of said electro-magnet and extending up approximately flush with the supporting means.

13. The combination with a core having a tapered end, and its winding, of a pair of yoke pieces one secured to each end thereof, an armature pivoted upon one of said yoke pieces, contact springs operated thereby, and a pole piece adapted to engage the tapered end of the core of said magnet, and means for securing said pole piece thereon.

14. In a relay, the combination with an electro-magnet, comprising a plurality of spools provided with cores having tapered ends, of yoke pieces at each end and extending across the spools, an armature pivoted upon said yoke piece and extending across the spools, contact springs operated by said armature, pole pieces mounted upon the tapered ends of the cores of said spools and means for securing said pole pieces thereon.

15. In a relay, the combination with an electro-magnet comprising a plurality of spools having cores, of yoke pieces for the front and rear end of said spools, said yoke pieces extending across said spools and holding them in proper relation, an armature pivoted upon said front yoke piece, contact springs operated thereby, pole pieces having tapered apertures mounted upon the cores of said electro-magnet in front of said front yoke piece and projecting up approximately flush with the top of said front yoke piece, and means for securing the front yoke piece and the pole pieces upon the core, said front yoke piece having means for preventing lateral movement of the pole pieces.

16. In a relay, the combination with an electro-magnet, of a pole piece therefor having an upper lateral extension, a yoke holding said pole piece on the core of said electro-magnet, contact springs, and an armature pivoted on said yoke piece and normally lying parallel to the contact springs, the lateral extension of said pole piece and the supporting part of the yoke.

17. In a relay, the combination with an electro-magnet, of a pole piece therefor having an upper lateral extension, a yoke holding said pole piece on the core of said electro-magnet and having an armature supporting extension parallel with the electro-magnet, an armature pivoted on said yoke extension, contact springs, and connections between the armature and said contact springs which hold the armature normally parallel with the lateral extension of said pole piece, the yoke extension, and the contact springs.

18. In a relay, the combination with an electro-magnet, of a pole piece therefor, a front yoke piece having an armature supporting extension parallel with the electro-magnet, a rear yoke piece, contact springs supported on said rear yoke piece and extending over said front yoke piece parallel with the electro-magnet, an armature pivoted on said extension intermediate the springs and the front yoke extension, and connections between the armature and said springs such as to hold the armature balanced on its pivotal point with both ends free.

19. A relay comprising an electromagnet having a pole piece at one end, an armature support at the same end, an armature centrally fulcrumed upon said support so as to be controlled by said pole piece, and contact springs overlying the magnet and armature, with working connections normally transmitting balanced pressures from the springs to the armature on both sides of the fulcrum.

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

EDWARD E. CLEMENT.

Witnesses:

G. E. RUFF,

H. M. STERLING.