

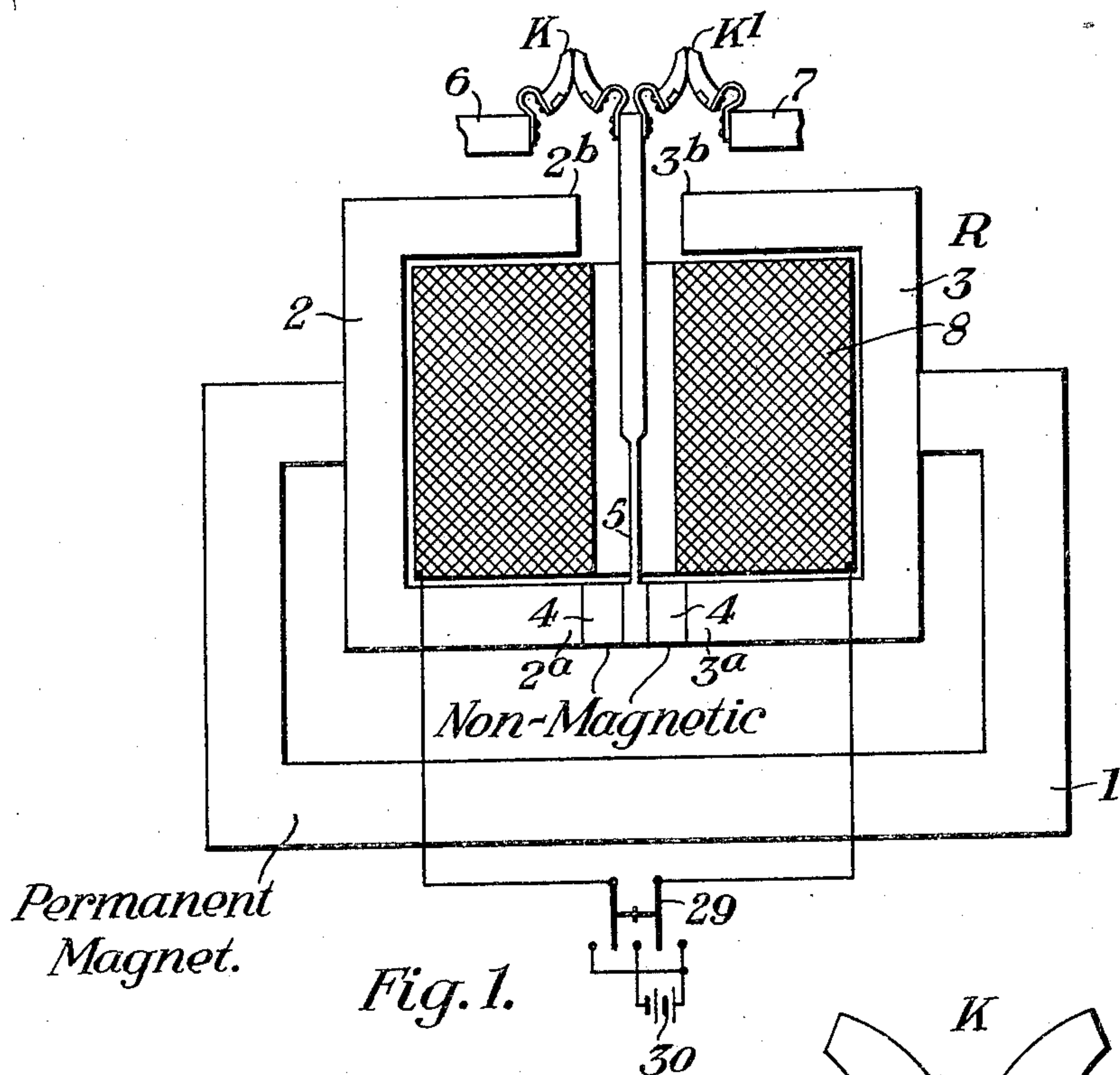
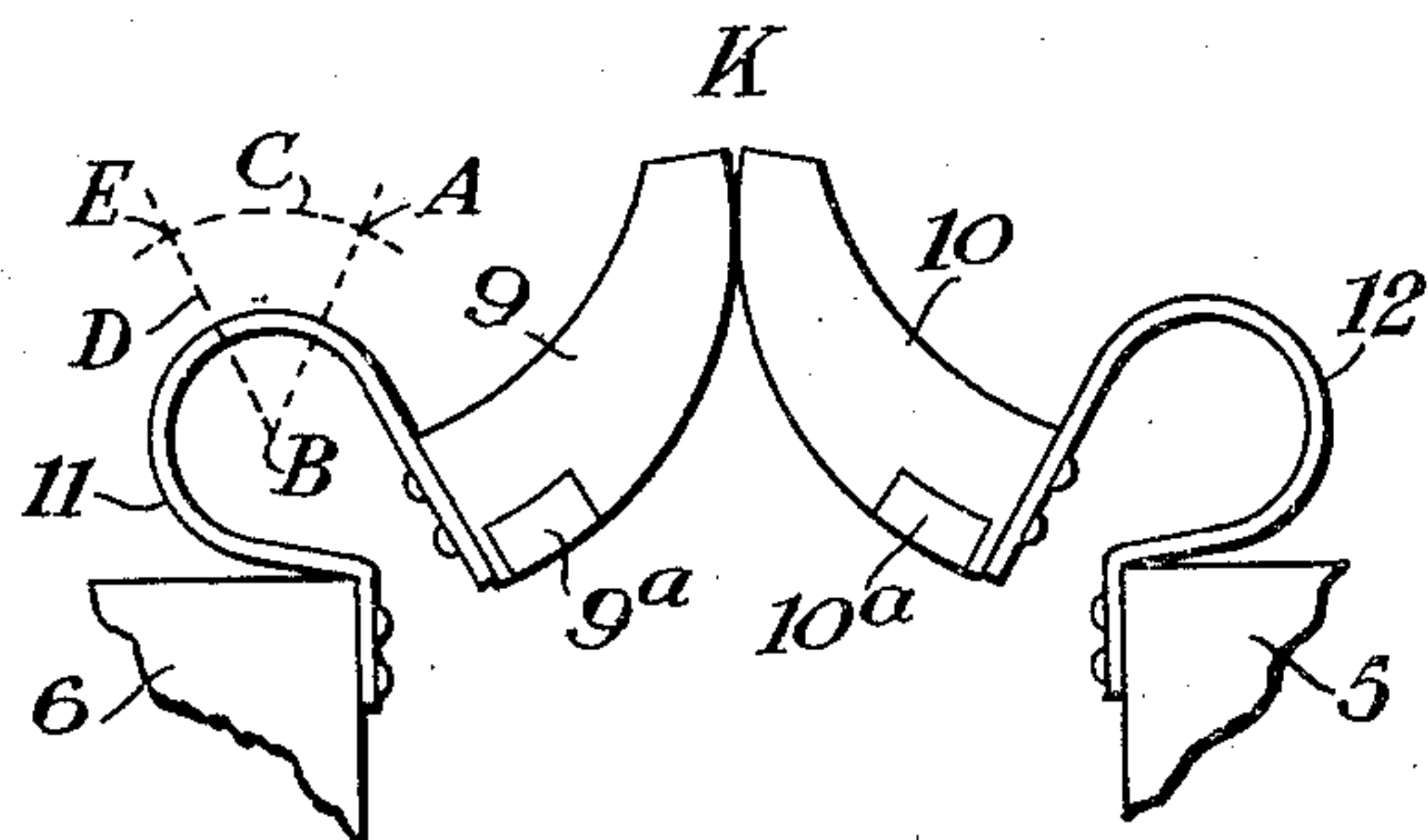
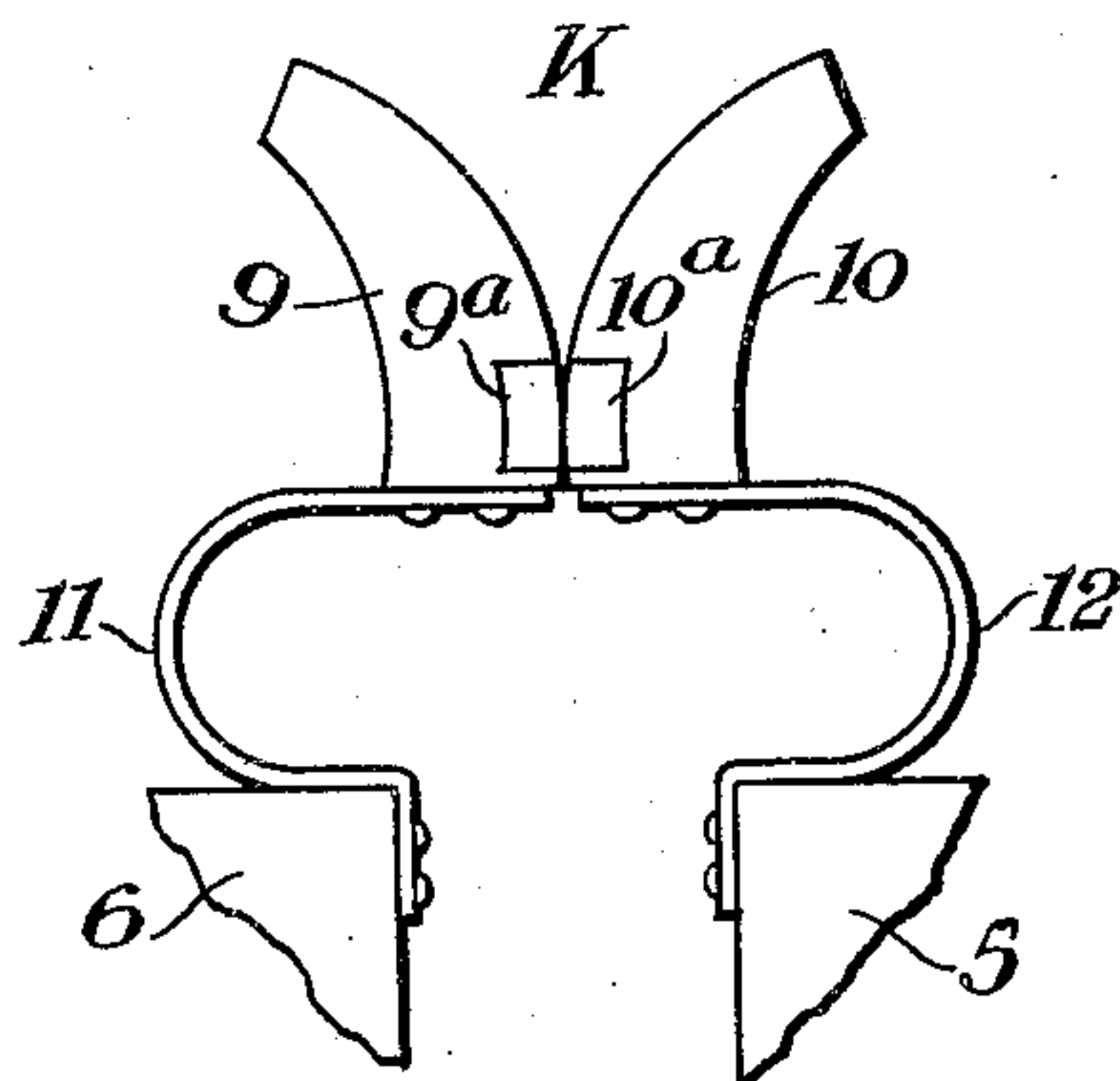
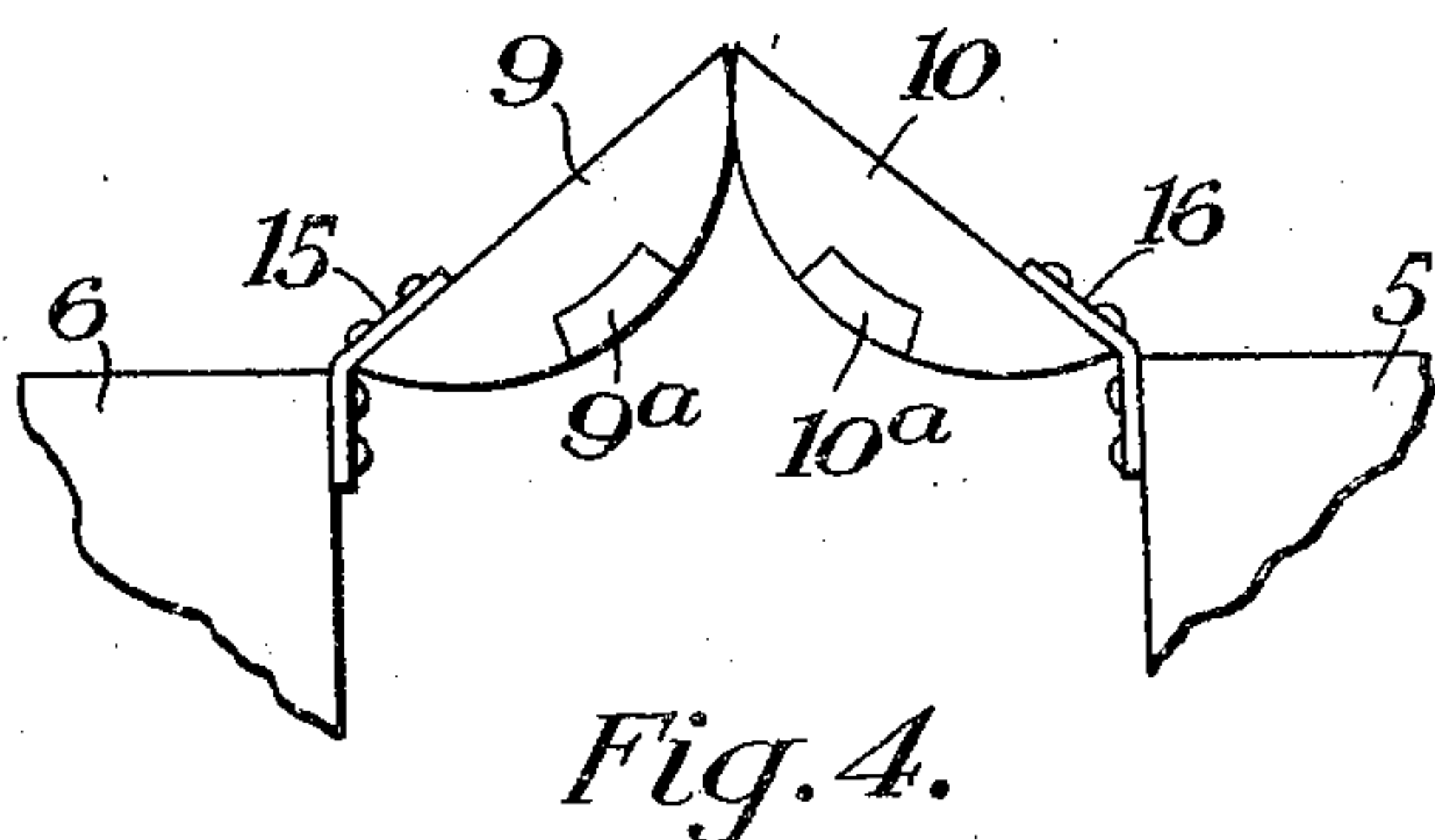
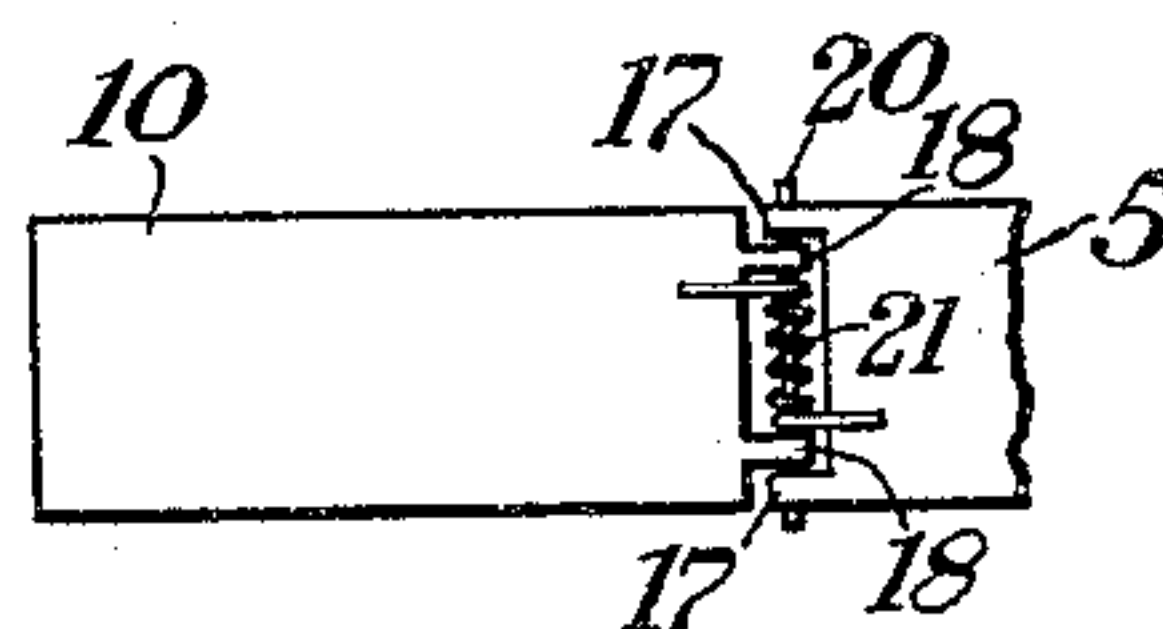
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P. N. BOSSART

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ELECTRICAL RELAY

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ELECTRICAL RELAY

Application filed November 27, 1928. Serial No. 322,242.

My invention relates to electrical relays of the type comprising a movable armature and a contact mechanism controlled thereby. My present invention relates particularly to the contact mechanisms for such relays.

I will describe several forms of contact mechanisms embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawing, Fig. 1 is a view, partly diagrammatic, showing one form of relay embodying my invention. Fig. 2 is a detailed view on a larger scale, illustrating a portion of the relay shown in Fig. 1 and also embodying my invention. Fig. 3 is a view similar to Fig. 2 and illustrating the same parts in different positions. Fig. 4 is a view showing a modified form of a portion of the relay shown in Fig. 1, and also embodying my invention. Fig. 5 is a view showing a modification of the apparatus shown in Fig. 4, and also embodying my invention.

Similar reference characters refer to similar parts in each of the several views.

Referring first to Fig. 1, I have illustrated a relay designated in general by the reference character R and comprising a permanent magnet 1 terminating in U-shaped pole pieces 2 and 3. The reference character 5 designates an armature which, as here shown, comprises a strip of magnetizable material having its lower end interposed between the confronting pole faces 2^a and 3^a of pole pieces 2 and 3, but insulated therefrom by blocks of non-magnetic material 4, 4, by means of which the armature is securely clamped in place. It should be noted that this construction forms a cantilever support for armature 5 which permits the upper end of the armature to move in the air gap between pole faces 2^b and 3^b of pole pieces 2 and 3.

Surrounding the armature 5 is an operating winding 8 which is at times supplied with current of one polarity or the other from battery 30 over a pole-changer 29. Pole-changer 29 may be controlled by any suitable means, not shown in the drawing. For example, if relay R is used in railway traffic controlling apparatus or automatic train control, the pole-changer 29 might be controlled by means

responsive to traffic conditions. When winding 8 is deenergized, the armature 5 occupies its normal or central position in which it is shown in the drawing, and the flux supplied by the permanent magnet 1 divides in two paths, part flowing through the upper legs of pole pieces 2 and 3, and part flowing through the lower legs of these pole pieces. It should be noted that under these conditions, the magnetic forces are balanced and there is no tendency to move the armature away from its normal position. If pole-changer 29 is moved to the left, current of one polarity is supplied to winding 8, and the flux created thereby cooperates with the flux supplied by the permanent magnet 1, to move the armature 5 in one direction, which I will assume to be toward the left as shown in Fig. 1. If pole-changer 29 is moved to the right, current of the other polarity is supplied to winding 8, and armature 5 is then deflected in the opposite direction, or toward the right. With relays of the type described, when the armature is moved away from its normal position toward one of the pole faces 2^b or 3^b, the balance in the magnetic fluxes supplied by the permanent magnet 1 is destroyed and there is then applied to the armature an additional force which tends to move the armature in the same direction as the original armature displacement. This additional force is independent of the input to winding 8 and increases as the armature approaches one of the pole faces 2^b or 3^b substantially in proportion to the armature displacement.

The armature 5 operates two contact mechanisms designated in general by the reference characters K and K¹, portions of which are attached to two fixed members 6 and 7, respectively. Referring now also to Fig. 2, the mechanism K comprises two segments 9 and 10 of insulating material which have their confronting faces shaped as portions of cylinders, the axes of which are parallel. The segment 9 is supported by a semi-circular spring 11, one end of which is attached to the segment and the other end of which is attached to the fixed member 6. In similar manner, segment 10 is supported by a semi-

circular spring 12, one end of which is attached to the segment 10 and the other end of which is attached to armature 5. The parts are so proportioned that when the armature occupies its normal position, as shown in Fig. 2, the springs 11 and 12 are substantially unstressed and the segments 9 and 10 engage along a line which is somewhat above the line joining the centers of deformation of the springs 11 and 12. With this arrangement of apparatus, when the armature 5 approaches the fixed member 6, the segments 9 and 10 roll upwardly on each other, so that the line of contact of these segments remain substantially fixed in position. During this rolling movement of the segments the center of curvature of the rolling surface of segment 9, designated at A in Fig. 2 moves toward the left along the dotted arc C about the center of deformation B of spring 11. When armature 5 has moved to its full left-hand position, the center of curvature of segment 9 will occupy the position indicated in the drawing at E, and since segment 10 has been similarly displaced, the parts will then occupy the positions in which they are shown in Fig. 3. Segment 9 is provided with a contact 9^a and segment 10 is provided with a contact 10^a, the segments 9 and 10 being so located that when the armature occupies its normal position, the contacts are widely separated. When the armature approaches the fixed member 6, however, as shown in Fig. 3, the contacts 9^a and 10^a roll into engagement. The contacts 9^a and 10^a may be utilized to control electrical circuits, not shown in the drawing, in any suitable manner. It should be observed that during the movement of armature 5 toward the position illustrated in Fig. 3, the rolling of segments 9 and 10 is opposed by springs 11 and 12 in accordance with Hooke's law, so that the torque exerted by these springs is directly proportional to the angle through which these springs turn. It should be noted, however, that the moment arms through which these torques are applied to the segments 9 and 10 are substantially constant and it follows that the force which is available to urge the segments 9 and 10 into engagement is substantially proportional to the armature displacement. I prefer to proportion the parts so that the torque exerted by springs 11 and 12 is nearly equal to the additional force which is applied to the armature as a result of the unbalance in the permanent magnet flux. With the parts constructed in this manner, it will be manifest that the current necessary in winding 8 to move armature 5 to its full stroke is only slightly larger than the current necessary to commence the movement of the armature toward member 6.

The contact mechanism K¹ is similar to mechanism K and is operated when the armature is travelling toward the right, as shown

in Fig. 1. It will be plain from the foregoing that the two contact mechanisms K and K¹ assist the natural resiliency of the armature 5 to bias this armature to its normal position.

Referring now to Fig. 4, the contact mechanism here illustrated is similar to that shown in Figs. 1, 2 and 3, except that the segments 9 and 10 are attached to the fixed member 6 and the armature 5 respectively, by flat leaf springs 15 and 16. The operation of the apparatus is similar to that described in connection with Figs. 1, 2 and 3 and will be understood from the drawing without further explanation.

In Fig. 5, I have illustrated an alternative arrangement for supporting the rolling segments of the contact mechanisms. In this modification, the armature 5 is provided with two outstanding lugs 17 which carry a spindle 20. The segment 10 is also provided with two lugs 18 which are pivoted on the spindle 20. A helical spring 21 is placed upon spindle 20 and serves when the segment 10 rolls upon a complementary segment as shown in Figs. 2 and 3, to oppose the rolling movement by a force which varies with the armature displacement. The operation of the apparatus illustrated in Fig. 5 is therefore similar to the operation of the modification shown in Figs. 2 and 4 and will be readily understood from the drawing.

One important feature of the contact mechanism embodying my invention is the absence of friction between the parts. Since the segments 9 and 10 roll upon each other without friction, no power is consumed in the rolling movement of these parts. When the contacts carried by the segments separate, there is no sudden change in the rate of variation of either the deflecting magnetic forces or the opposing spring forces. It follows that the current in winding 8 necessary for full stroke of the armature 5 is nearly the same as the value of the current at which the contacts will separate.

Another advantage possessed by relays embodying my invention is that comparatively heavy contact pressures may be obtained without requiring excessive operating currents, since substantially all of the forces acting upon the relay armature as a result of its displacement may be utilized to urge the contacts into engagement.

Under some conditions, it may be desirable to make the two contacts 9^a and 10^a slightly unsymmetrical, so that a small amount of slide will result, thereby causing a wiping action between these contacts for the purpose of keeping the contacts clean and bright.

In the form of relay here shown, the force acting upon the armature as a result of its displacement, varies directly as the displacement of the armature but this particular arrangement is not essential and my invention

could equally well be used with relays in which variation of this force is not directly proportional to the displacement. By properly shaping the rolling surfaces of segments 9 and 10, the moment arms of the torques exerted by the springs that support these segments may be made to vary with the armature movement.

Although I have herein shown and described only a few forms of electrical relays embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. In a relay having a fixed member and an armature biased to a normal position but movable at times toward said member, a contact mechanism comprising two segments having cylindrical engaging surfaces, means including a spring for attaching one segment to said armature, means including a spring for attaching the other segment to said fixed member, said springs being constructed in such manner that when the armature approaches said fixed member said segments roll upon each other in opposition to forces exerted by said springs upon said segments through substantially constant moment arms, and co-operating contacts carried by said two segments, respectively.

2. A relay comprising a fixed member and an armature biased to a normal position, means for at times moving said armature toward said member, means effective when said armature approaches said member for urging the armature toward the member by an additional force which increases as the armature approaches the member, two curved segments, and means for attaching said segments to said armature and said member, respectively, in such manner that said segments roll upon each other when the armature approaches said member but that such rolling is opposed by forces which are substantially equal to said additional force for every position of the armature, and two co-operating contacts carried by said two segments respectively.

3. A relay comprising a fixed member and a movable armature having a normal position, two cylindrical segments, two springs connecting said segments with said armature and said fixed member respectively in such manner that the segments are in engagement when the armature occupies its normal position and also in such manner that the center of curvature of each segment is spaced from the axis of deformation of the associated spring, and two co-operating contacts carried by said two segments respectively.

4. A relay comprising a fixed member and a movable armature having a normal posi-

tion, two cylindrical segments, two springs connecting said segments with said armature and said fixed member respectively in such manner that the segments are in engagement when the armature occupies its normal position and also in such manner that the plane of the axes of curvature of the segments is parallel with the plane of the axes of deformation of said springs, and two co-operating contacts carried by said two segments respectively.

5. A relay comprising a fixed member and a movable armature having a normal position, two curved segments, two semi-circular springs connecting said segments with said armature and said fixed member, respectively, in such manner that said segments engage along a line parallel with the plane of the axes of deformation of said springs, and two co-operating contacts carried by said two segments respectively.

6. A relay comprising a fixed member and a movable armature having a normal position, two curved segments, two flat leaf springs connecting said segments with said armature and said fixed member respectively in such manner that movement of said armature toward said fixed member causes rolling engagement of said segments along a line parallel with the plane through the axes of bending of said springs, and two co-operating contacts carried by said two segments respectively.

7. A relay comprising a fixed member and a movable armature having a normal position, two complementary curved segments pivotally attached to said armature and said fixed member respectively, two springs one associated with each segment for urging the segments into rolling engagement, and two co-operating contacts carried by said two segments respectively.

In testimony whereof I affix my signature.
PAUL N. BOSSART.