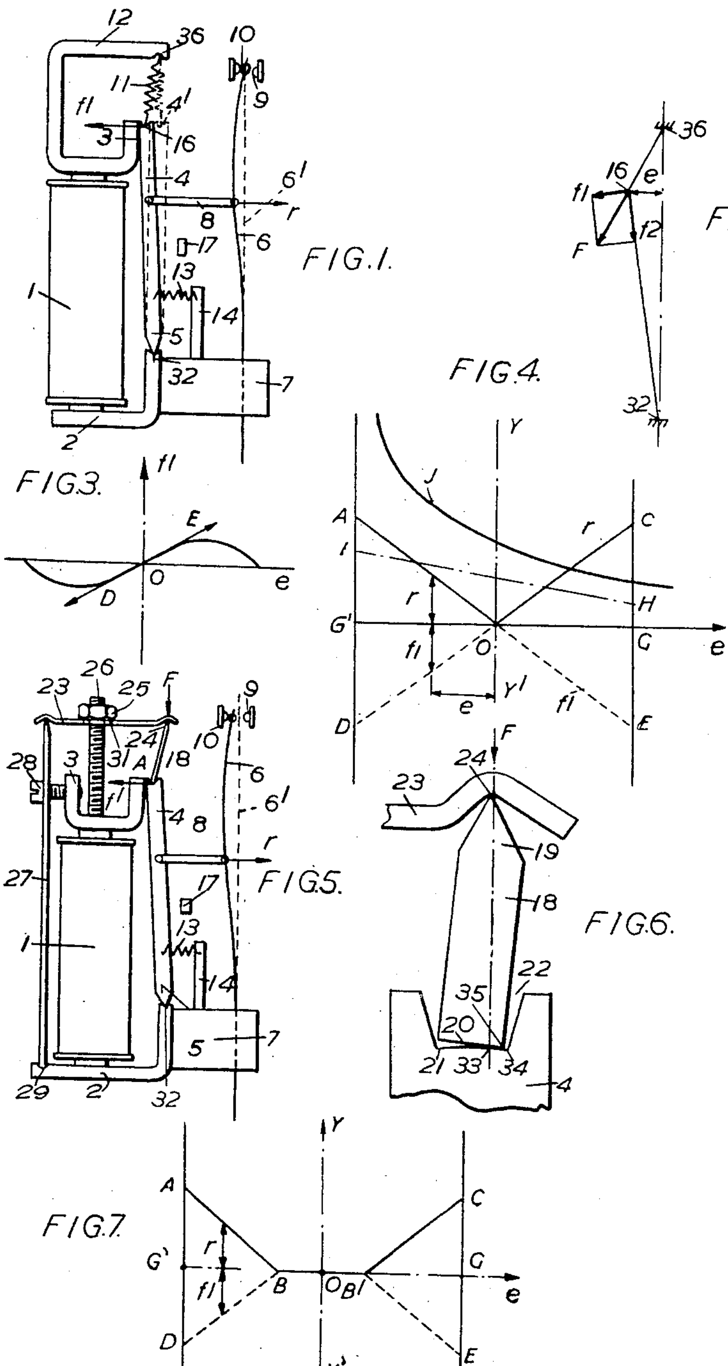
Dec. 9, 1952 Y. J. G. JUILLARD 2,621,269

ELECTROMAGNETIC RELAY WITH COMPENSATED CONTACT PRESSURE

Filed Dec. 30, 1948 4 Sheets-Sheet 1



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ELECTROMAGNETIC RELAY WITH COMPENSATED CONTACT PRESSURE

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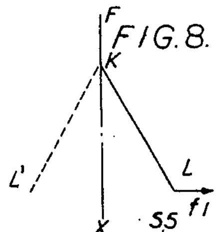

FIG. 8.

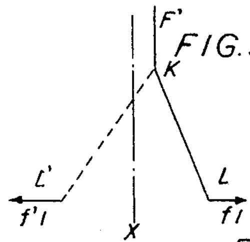

FIG. 9.

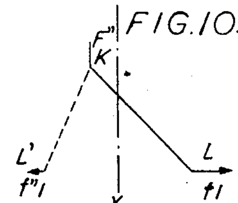

FIG. 10.

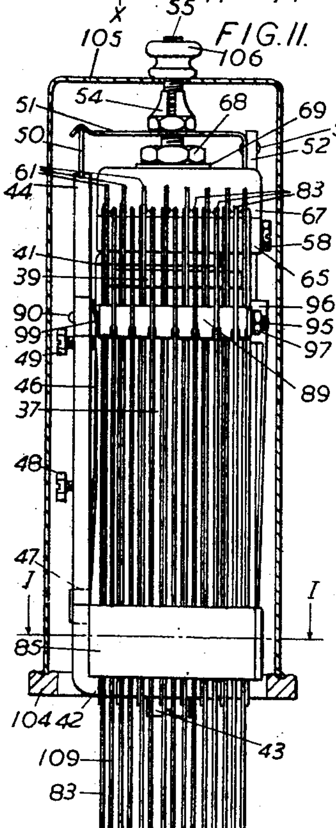

FIG. 11.

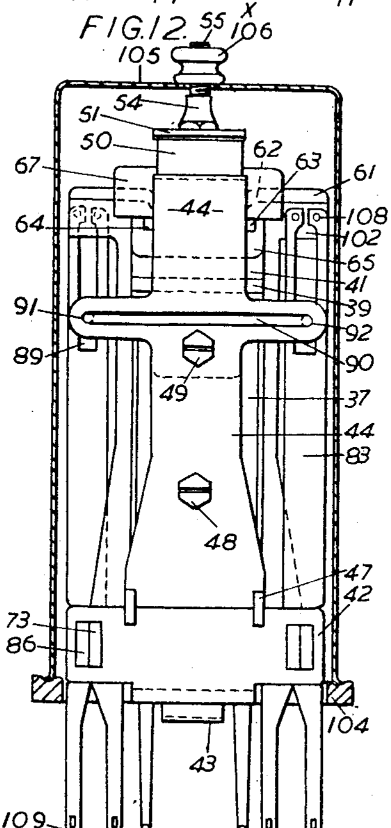

FIG. 12.

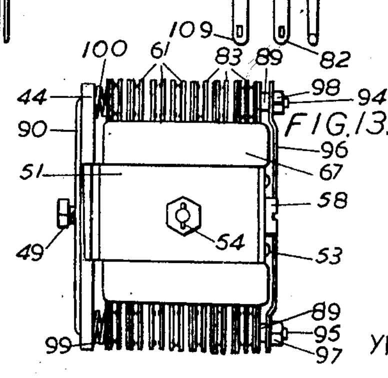

FIG. 13.

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FIG. 14.

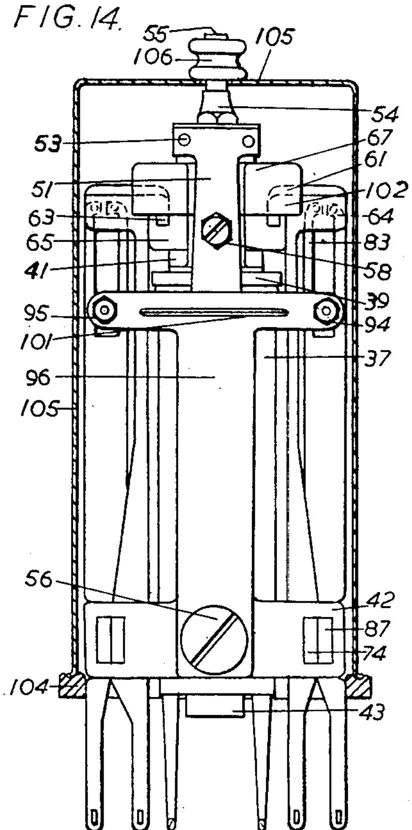

FIG. 15.

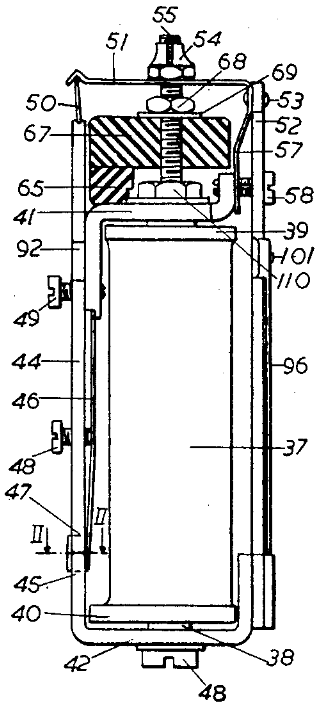

FIG. 16.

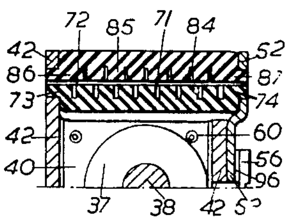

FIG. 17.

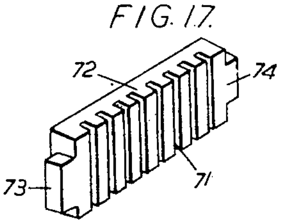

FIG. 18.

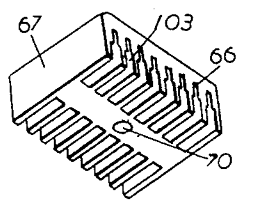

FIG. 19.

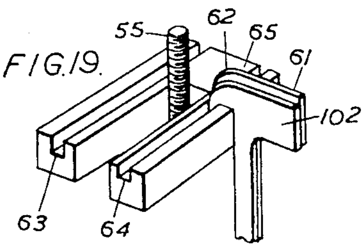

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FIG.20.

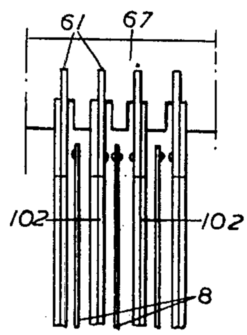


FIG.21.

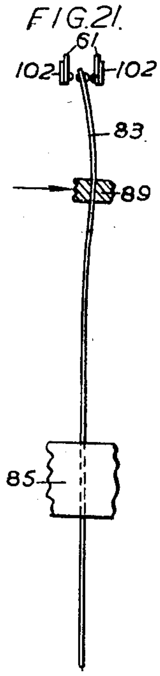


FIG.22.

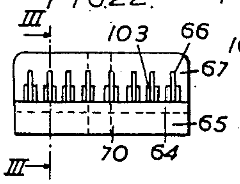


FIG.23.

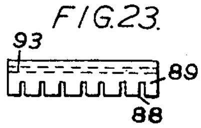


FIG.24.

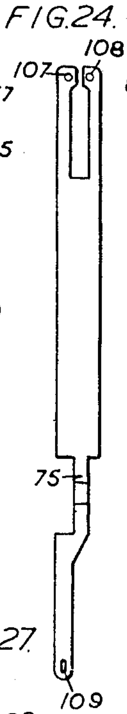


FIG.26.

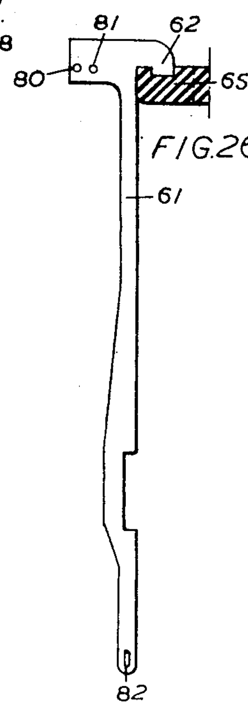


FIG.27.

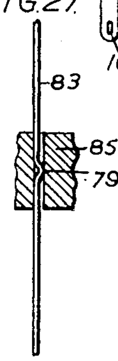


FIG.25.

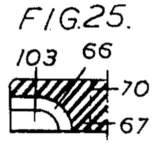
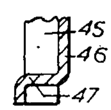


FIG.28.



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UNITED STATES PATENT OFFICE

2,621,269

ELECTROMAGNETIC RELAY WITH COMPENSATED CONTACT PRESSURE

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Application December 30, 1948, Serial No. 68,228
In France December 31, 1947

9 Claims. (Cl. 200—87)

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In the electromagnetic relays used at the present time, a blade operates a group of mobile springs the number of which depends on the use for which the relay is intended. When the said springs come into contact with the stationary springs, they must exert a certain pressure on these springs in order that the corresponding electric circuits may be properly established. Because of this they undergo a certain amount of deformation and thus exert on the blade certain forces which, compounded with the electromagnetic forces, produce resultants which must be taken into account in the design of the various coil members. It is, therefore, necessary to design a special spring for a given spring set-up which will meet the various operating conditions required in each particular case, and this makes their manufacture more complicated and costly.

Furthermore, an adjusting screw is frequently employed which is screwed into the blade and which permits adjustment of the airgap when the said blade is attracted. It is thus possible to change at will certain characteristics of the relay, such as its attraction and release characteristics. The use of gages in the adjustment of the various contact springs is also obviated. In spite of their many advantages, the use of these screws has a certain number of drawbacks; they are generally associated with a braking device which substantially increases the cost of the relay; they must be very carefully ground so as to give the desired accuracy, and they wear rapidly. Finally the results obtained with them depend on the group of spring contacts. For example, a heavily loaded relay will always release rapidly irrespective of the size of the airgap adjusted by the screw.

This invention relates to a relay whose coil has electrical characteristics practically indedependent of the spring assembly and which does not require any device for adjusting the airgap when in the operating position.

One of the features of the invention is based on the fact that a compensating force or a force equal but opposite in direction to the mobile spring assembly is exerted on the blade in each of its positions, so that in the absence of any other force the mobile part of the relay is in a position of neutral equilibrium.

In some relays the blade must be in the operated position when the coil circuit is closed, and in the unoperated position when the coil circuit is open.

Another feature of the invention is based, in

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combination with the preceding feature, on means for restoring the mobile assembly to the unoperated position of the relay when the coil circuit is not closed; the attraction and release characteristics of the relay will be a function only of a restoring device, and thus the use of a member, such as an adjusting screw will no longer be necessary.

During the motion of the mobile contacts between the normal positions of the back and front contacts, or vice versa, the said back or front contacts do not react on the mobile contacts. It is therefore necessary to provide arrangements whereby the compensating action becomes inoperative during this motion.

Another feature of the invention is based on a method whereby the compensating action is obtained by a force applied to an intermediate part which acts on the blade in such a manner that the intermediate part produces a compensating action only when the mobile contacts press either on the front contact or on the back contacts.

In order to meet the requirements of certain operating conditions, it may be necessary to counteract the action of the mobile springs on the blade with a compensating force that is less or greater than the said action. Such is the case for a example of relays wherein the required holding and release characteristics must be independent of the attraction characteristics.

Another feature of the invention is based on a method whereby the point of application of the force acting on the blade moves in such a way that the component that produces the compensation is greater during the establishing of the front contacts than during the establishing of the back contacts, or vice versa.

Since the compensating action is a function of the number of spring contacts, a device for adjusting the value of the said compensating action must be provided.

Another feature of the invention is based on a blade-pressure spring one end of which presses against the intermediate part that acts on the blade, it being possible to adjust the tension of the said spring by any suitable means, and the other end of the spring being rigidly attached to an adjusting part which permits displacing the point of application of the force exerted by the said spring.

Various other features will become apparent from the following description, which is given as a non-limitative example. Reference is had to the attached figures, in which:

Figure 1 is a compensated contact pressure relay.

Figures 2 to 4 are diagrams showing the operation of the relay of Fig. 1.

Figure 5 is a variant of Figure 1 wherein it is possible to increase the spacing between the back contacts and the front contacts.

Figure 6 is a large scale view of the compensating device of Figure 5.

Figure 7 is a diagram showing the operation of Figure 5.

Figures 8 to 10 are diagrams showing the operation of a partially compensated contact pressure relay.

Figure 11 is a side view of one embodiment of a compensated contact pressure relay.

Figure 12 is a profile view of the relay of Fig. 11, showing the blade side.

Figure 13 is a top view of Figure 11, without cover.

Figure 14 is a profile view of the relay of Fig. 11, showing the contact side.

Figure 15 is a view of the relay of Figure 11, from which the cover and contact springs are assumed to have been removed.

Figure 16 is a plan view in half section along I—I of Figure 11.

Figure 17 is a perspective of the attaching part of the lower part of the stationary contact springs.

Figures 18 and 19 are perspectives of the two attaching parts of the upper part of the stationary springs.

Figure 20 is a detail view showing the spring contact assembly and the associated insulating parts.

Figure 21 is a detail view showing the deformation of the mobile contact springs in the operated position.

Figure 22 is a side view of the attaching parts of Figures 18 and 19.

Figure 23 is a view of the plunger.

Figure 24 is a view of a mobile spring contact.

Figure 25 is a profile view in half section along III—III of Figure 22.

Figure 26 is a view of a stationary contact spring and of the associated attaching part.

Figure 27 is a view of the attaching device of the mobile contact springs.

Figure 28 is a sectioned view along II—II of Figure 15, showing the shape of the springs which permits the hinging of the blade to the yoke.

Figure 1 shows a relay comprising a coil 1, a yoke 2 and a pole piece 3. Moving blade 4 has a knife-edge part 4 which is supported on yoke 2. The mobile contact springs 6, only one of which is shown in order not to complicate the figure, are inserted in a part 7 attached to the yoke, and operated by blade 4 by means of a plunger 8. The springs 6 press against either back contacts 9 or front contacts 10, depending on the position of the blade. A spring 11, operating under compression, is attached on the one hand to the upper end 16 of the blade and on the other hand to a point 36 on the extension 12 of the pole piece. A restoring spring 13 is attached on the one hand to the blade and on the other hand to a stationary part 14. A stop 17 limits the motion of the blade when the blade is not attracted.

It will be assumed that the dimensions of the plunger 8 are such, that, when pivot 32 of the blade is in the extension of the axis of the compensating spring 11, the mobile spring 6 is equidistant from back contact 9 and front contact 10. This position of the blade, or "mean position," is shown on the figure in dotted lines at 4'.

When the blade is in the position shown in full lines, spring 11 exerts a force F (Fig. 2) on the said blade. This force may be resolved into two other forces $f1$ and $f2$. The $f2$ component, directed toward the axis of rotation of the blade produces no useful effect; the $f1$ component, normal to the preceding one, tends to move the said blade away from its mean position. This component is a function of the distance e which separates the position occupied by the mean position from the end 16 of the blade.

The manner in which F1 varies with e is shown in Figure 3. In practice, $f1$ is a linear function of e for small values of e, and accordingly the curve may be assumed to be the same as tangent DOE at the origin, without appreciable error. In what follows, only the straight portion of the curve will be used.

When the mobile contact springs 6 are in the mean position 6', they do not exert any pressure on the blade of the relay; but when they come against back contact 9 or front contact 10 and exert a certain pressure on the said contacts, they are deformed and thus apply a force r to the blade, this force being directed in a direction opposite that of component $f1$ due to the compensating spring. If the distance the mobile springs move is small, then it is permissible to assume that this force r is a linear function of the displacement e of the blade.

Figure 4 is a diagram of the various forces involved. The displacements e of the end of the blade from its mean position are plotted as abscissas, and the mechanical stresses, as ordinates. Let OG and OG' be the two extreme values of e. Since the force r due to the deformation of the mobile springs and the component $f1$ due to the compensating spring always act in opposite directions, the former was considered positive and the latter negative in this diagram. In order to facilitate comparison of the effects produced, since the forces $f1$ and r do not act on the blade with the same lever arm, two scales were used for the said forces, these scales being proportional to the said lever arms.

The portion AO of the curve shows the manner in which r varies during the establishing of the front contacts, and OC the manner in which r varies during the establishing of the back contacts. AO and OC are symmetrical with respect to the axis of ordinates YY'.

The portion DO of the curve shows the manner in which the component $f1$ of the compensating spring varies when the blade is between the attracted position and the mean position; OE shows the manner in which the component $f1$ varies when the blade is between the mean position and the release position.

By a suitable choice of the pressure of spring 11 the slopes of the portions OD and OE of the curves may be made equal and of opposite sign to those of OA and OC. For each position of the blade, the component $f1$ due to the compensating spring is then equal and opposite in sign to the reaction r of the mobile springs on the blade. If restoring spring 13 is eliminated, the blade is then in a state of neutral equilibrium, irrespective of the construction of the spring assembly.

When spring 13, which exerts a tensile effect, is in place, it holds blade 4 in its unoperated position, when the coil circuit is not completed. On the other hand, when current flows in the said coil, blade **4** is attracted by pole piece **3** since the force caused by the electromagnetic effect is greater than the tension of spring **13**. It is seen, therefore, that the electrical characteristics of the coil are independent of the contact spring assembly; they depend only on the characteristics of restoring spring **13**.

The curve J of Figure 4 shows the manner in which the electromagnetic forces vary as a function of the distance traveled, and HI, the manner in which the tension of the restoring spring **13** varies. In practice, the curve HI is substantially rectilinear. In order for the relay to operate properly it is necessary and sufficient that the electromagnetic forces be greater than the action produced by the restoring spring for each position of the blade, i. e., that the curve J be located completely above curve HI.

The attractive force to be provided is small, if the restoring spring **13** is suitably chosen, and it is not necessary to have a magnetic circuit with low reluctance when the relay is attracted.

In the system described above the mobile springs must pass from the front contacts to the back contacts practically instantaneously, and therefore the distance between the said contacts is small, a situation which, in practice, presents many difficulties in the manufacture and use of the relay.

If it is desired to increase this distance, the device shown in Figures 5 and 6 is used.

In this device, a part **18** (side view), comprises a knife-shaped part **19** and a curved part **20** which can roll without slipping on a surface **21** of a groove **22** cut in the upper part of blade **4**. Part **18** is held in place by a pressure spring **23** one end of which bears against the knife point **19**, and the other end, on a part **27** supported in a groove **29** in yoke **2**. A nut **25**, screwed on a threaded rod **26**, permits adjustment of the spring tension. A screw **28**, screwed in pole piece **3**, permits, through part **27**, the displacing of spring **23** in order to change the position of the point of application **24** of the force F exerted by the spring. So that this motion may occur spring **23** is provided with an elongated opening **31** for the passage of rod **26**.

The point of application of force F is adjusted in such a manner that part **18** and the blade are in the extension of each other when the said blade is in the mean position. The position of part **18** is so adjusted that, when the blade is in its mean position, the midpoints of the two profiles **20** and **21** coincide.

When the blade **4** moves to the left from its mean position, it carries along in its rolling motion without slipping part **18** which then rotates around point of application **24** of force F. The position of front contact **10** is such that, during this motion, spring **6** does not touch the said contact. The said spring is therefore not deformed in any respect and hence does not exert any action on the blade.

Point **33** of the blade, which is in contact with part **18**, is subjected to a force directed toward the pivot of the said blade; this force does not have therefore any useful component permitting motion of the blade in either direction. Since there are no forces present due to electromagnetic effects or to the restoring spring, the mobile assembly of the relay is in a state of neutral equilibrium.

The instant mobile spring **6** presses against front contact **10**, the end points **34** and **35** of profiles **21** and **20** are brought into coincidence. If the blade continues to move toward the left, profiles **20** and **21** cease to be tangent; the blade carries along part **18** at point of contact **34**, and the point of application **24** of force F approaches the pivot of the armature. Spring **6**, whose deformation is continuously increased, applies a force r to the blade, as shown in Figure 5, and this force increases with the displacement of the blade. Moreover, the force exerted on the point **34** of the blade is no longer directed toward the pivot of the blade; consequently, it has a component $f1$ which tends to cause the blade to pivot toward the left. This component counteracts the force r produced by the deformation of mobile spring **6**.

The device operates in exactly the same manner when the blade moves to the right from its mean position.

The curve ABB'C (Fig. 7) shows the manner in which the force r varies with the distance e of the end of the blade from its mean position, and DBB'E, the manner in which the useful component $f1$ of force F varies with this distance. As long as the point of contact of parts **4** and **18** is in line with the point of application of the force and the hinged joint of the blade, i. e., as long as the distance e does not exceed one of the values OB or OB', the forces r and $f1$ are zero, and both curves lie along the axis of abscissas. On either side of the values OB, OB' the forces $f1$ and r vary linearly with e, if it is assumed that the displacements of the blade remain small. By suitably adjusting the tension of spring **23**, it is possible to make the slopes of the straight lines BA and BD, on the one side, and B'C and B'E on the other side, equal. If this is done, irrespective of the position of the blade, the forces r and $f1$ cancel each other, and, since there is no other force present, the relay assembly is in a state of neutral equilibrium. The distance separating contacts **9** and **10** may be increased or decreased by changing the length of contact surfaces **20** and **21**.

As shown in Figure 5, a restoring spring **13** has been provided in order to keep the relay in its unoperated position when the coil circuit is not closed.

It was assumed in the foregoing description that the point of application **24** of the force F was adjusted in such a manner that part **18** and the blade were in the extension of each other, when the blade was in the mean position. When this is the case, and when the relay is in the unoperated position, there is obtained a certain component $f1$ which balances, as has been seen, the action of the mobile contact springs **6**. Force F, component $f1$ when the relay is in the unoperated position, and the straight line X along which the force F is directed are shown in Figure 8. Part **18** has been shown diagrammatically by the straight line KL, when the blade is assumed applied to the stop **17**, and by KL', when the blade is assumed attracted.

If, by means of screw **28**, the point of application of the force F is displaced toward the right, the point of contact between the two profiles **20** and **21** will be on the straight line joining the point of application of force F to the armature pivot only when the blade moves a certain amount around a position different from the mean position; the curve DBB'E (Fig. 7) is also subjected to translational motion toward the right; component $f1$ is smaller when the relay is in the unoperated position than in the preceding case. In order for it to retain its value, it is necessary to replace force F with a greater force F', as shown on Figure 9. As has already been explained, this is obtained by changing the pressure of spring 23 by means of nut 25. The reaction exerted by the mobile contact springs is accordingly exactly compensated when the relay is in the unoperated position. On the other hand, when the relay is attracted, i. e., when the knife-shaped part occupies position KL', force F' will give rise to a component $f'1$ which is greater than $f1$, and therefore greater than the reaction r of the mobile contact springs. The blade is held in its attracted position independently of the electromagnetic forces or the forces due to the restoring spring, so that, for one and the same attraction adjustment, the relay may remain attracted with a very small number of ampere-turns.

On the other hand, if the point of application of force F is displaced toward the left when the relay is in the unoperated position, it is possible to obtain the same component $f1$ as in the preceding cases by giving to this force F a suitable value F'' smaller than F. When the relay is in the attracted position, the said force F'' will give rise to a component $f''1$ less than $f1$. The reaction of the mobile contact springs on the blade will be only partially compensated for, and the number of ampere-turns necessary for holding the relay will be greater.

It is seen therefore that, generally by changing both the point of application and the value of force F, it is possible, for each position of the blade, to compensate only partially the forces due to the mobile contact springs or else to counteract them with greater forces. It is thus possible to change the various operating conditions of the relay, such as the number of ampere-turns necessary for attraction or holding, the speed of operation, etc. . . . . It is particularly possible to make the attraction and release characteristics independent.

It is possible to obtain more particularly certain advantages in connection with slow attraction or release operation. This retarded action is, in general, obtained by associating with the relay a ring, made of copper or another metal which is a good conductor, the purpose of which is to retard the building up or collapse of the flux in the relay. If the relay has a certain number of contact springs, however, the flux necessary for holding the relay in the attracted position is high, and even if it decreases only slowly, the relay will release quite quickly. It is, therefore, quite difficult to obtain a long retarded release with a large spring assembly. It is likewise clear that it is difficult to obtain a long retarded attraction with a small spring assembly. On the other hand, with the device described above, the flux necessary for the operation of the relay is independent of the spring assembly, and it is possible to obtain a quite substantial degree of retardation, regardless of the number of springs to be operated.

The system considered has a great advantage as regards adjustment. Because of the compensating device, it is easy to obtain with a small number of ampere-turns large displacement and high contact spring pressures; the corresponding electric circuits will always be closed securely, and it will not be necessary to adjust each contact in order to have it close at a given airgap size.

With reference to Figures 11 to 28, one embodiment example of a compensated contact pressure relay will not be described.

The coil of the relay comprises a winding 37 (Fig. 15), wound on core 38, and two spool ends 39 and 40. Pole piece 41 is attached to core 38 by means of nut 110, screwed on threaded rod 55. The said rod is itself screwed into or rigidly attached to the said core with any suitable means. The other end of the core is attached to yoke 42 through screw 43. Blade 44 is hinged to the end 45 of the yoke by means of a spring 46 which seats on the pole piece 41, has a curved portion 47 (Fig. 28), which traverses the yoke and blade, and terminates at the outside faces of the said yokes and blades. The said spring exerts a certain pressure on screw 48, screwed in the blade, and this pressure brings the blade into the unoperated position when the circuit of the coil is open. By turning screw 48 it is possible to change the tension of spring 46. The travel of the blade is limited, on the one side, by pole piece 41 and, on the other side, by a screw 49 screwed into the said pole piece. Part 50, which may roll without slipping on the end of the blade when the blade moves, is held in place by a spring 51, attached to a part 52 by means of two rivets, such as 53. The pressure of spring 51 on part 50 is adjusted by a split nut 54, screwed on threaded rod 55. Part 50, spring 51 and threaded rod 55 are made of a suitable metal, such as brass, in order to prevent the insertion of a shunt in the magnetic circuit of the relay. Part 52 is screwed into the yoke by a screw 56, shown in Figures 14 and 16. Spring 51 has a part 57 which seats on the pole piece 41, and exerts a pressure on part 52 which causes the said piece, because of its flexibility, to press against the head of screw 58, screwed in the pole piece. By turning screw 58, and hence acting on part 52, spring 51, mentioned in the first part of this description, is caused to move laterally. Terminals, like those shown at 59 and 60 lead the current to the coil.

Each stationary contact spring 61 (Figures 19 and 26) comprises a bent-back portion 62 which is inserted, on the one hand, in one of the two grooves 63, 64 made in part 65, and on the other hand, in one of the grooves 66, made in part 67. Part 65 is kept in place, on the pole piece, by stationary springs 61, and part 67 is held in place on threaded rod 55, already mentioned (Fig. 15) by means of a nut 68 and a washer 69. A hole 70 is made in part 67 for passage of the threaded rod. The other ends of the stationary springs are inserted in grooves 71 (Figs. 16 and 17), made in two parts, such as 72. Each part 72 comprises two projecting parts 73 and 74 which are inserted in openings made in yoke 42 and part 52 (Fig. 16). The twin contacts of the stationary spring 61 are shown at 80, 81 (Fig. 26) and the terminal at 82.

Parts 75 of the mobile contact springs 83 (Fig. 24) are inserted in grooves 84 (Fig. 16) of parts, such as 85; the said parts have projecting parts 86 and 87 which are installed in openings made in the yoke and part 52, side by side with the projecting portions of parts 72. Since it is quite difficult to make sufficiently narrow grooves in parts 85 for the insertion of the thin mobile springs, the said springs have a curved portion 79 (seen in profile, Fig. 27) this curved portion being so dimensioned that the springs are held in place in the grooves in such a way that they cannot move. The grooves in parts 72 and those of part 85 are staggered, as shown in the figure, so that a mobile spring may be placed between two stationary springs. The mobile springs occupy grooves 88 of two plungers 89 (Fig. 23). The plungers 89 are supported by a thin rod 90 having the shape of a U, shown in Figures 12 and 13, which enters two holes 91 and 92 made in the blade 44, and in holes 93 of the said plungers. Rod 90 ends in two threaded parts 94 and 95. A flexible T-shaped part 96 (Figures 13 and 14), reinforced by a rib 101, and attached to the yoke by means of screw 56, holds rigidly the U-shaped rod and prevents it from pivoting around its middle branch. This part is held by two nuts 97 and 98, screwed to the threaded parts of the U-shaped rod 90. Two springs 99 and 100, installed between blade 44 and plungers 89, keep part 96 against nuts 97 and 98. By turning the said nuts, it is possible to adjust the position of the mobile contact springs with respect to the stationary springs. The flexible portion of part 96 has been provided in order to facilitate displacement of the mobile contact springs. The twin contacts associated with the mobile springs are shown at 107, 108 (Fig. 24) and the terminal at 109.

The right-hand part of Figure 12 shows the first stationary contact spring removed, in order to show the associated mobile spring.

In the first part of the description it was assumed that the resultant of the forces exerted by the mobile springs on the blade had the same value for two positions of the said blade, these positions being symmetric with respect to the mean position. This condition is realized if the number of back contacts is equal to the number of front contacts. If this is not true, the procedure is as follows:

Insulating parts 102 (Figs. 19 and 20) are applied to the faces of the stationary springs that do not have any contact. The thickness of the said parts is the same as that of the contacts they replace. These parts are inserted in grooves 63 and 64, of part 65, and in portions 103 of the grooves of part 67, on the one hand, and in grooves 71 of parts 72, on the other hand. When the displacement of the blade on either side of its mean position is such that one of the mobile springs comes in contact with the corresponding stationary springs, the mobile springs that do not have to establish any electrical contact press, respectively, on the insulating parts associated with the corresponding stationary springs; they are deformed, and accordingly exert on the blade a mechanical effect identical with that they would have exerted if they had pressed on a contact associated with a stationary spring.

Insulating parts 102 enter, just as stationary springs 61, into grooves 71 of parts 72. In order that grooves having uniform dimensions may be used, the contact spring assembly is so arranged that each stationary spring is associated with an insulating part, in the manner shown in Figure 20. The width of a groove is then equal to the sum of the thicknesses of a spring and an insulating part.

The relay is attached to a part 104 (Fig. 11). A cover 105 is placed on the said part, thus forming a dust-proof enclosure for the various electrical contacts. The said cover is held in place by a nut 106 screwed on threaded rod 55.

I claim:

1. A switch device comprising a support, an electromagnet mounted on said support, an armature pivotally mounted on said support and adapted to be moved in one direction about its pivot by the action of said electromagnet, means

for normally moving said armature about its pivot in the other direction, a compensating member pivotally associated with the other end of said armature and substantially in line therewith, means for pivotally mounting the other end of said member on said support, means for urging said compensating member towards said armature so as to produce a toggle action between said member and said armature, a pair of spaced contacts insulatedly mounted on said support, a spring strip insulatedly mounted on said support and having one end between said contacts so as to engage said contacts alternately as the spring strip is moved in first one direction and then the other, a plunger for connecting said spring strip with said armature so as to cause it to move when said armature is moved, and means for adjusting the pressure of said member against the end of said armature so that the toggle effect of said armature and said member will compensate for the pressure of the spring strip against the contacts.

2. A switch device comprising a support, a pair of spaced contacts individually mounted on said support, a conductive element insulatedly mounted on said support and having one end between said contacts so as to engage said contacts alternately as the conductive element is moved in first one direction and then the other, a lever pivotally mounted on one end on said support, a plunger member connecting said conductive element with said lever so as to cause it to move when said lever is moved, compression means pivotally engaging said lever at the other end thereof and secured to said support, said compression means being normally in alignment with said lever and operable to urge said lever out of alignment therewith when said lever is moved so as to produce a toggle action between the lever and the compression means, means connected to said lever for normally moving said conductive element towards one of said contacts, and power means for moving said conductive element towards the other of said contacts against the action of said last named means.

3. The switch device as claimed in claim 2 in which said compression means is in rocking engagement with said end of said lever, such that the point of contact therewith shifts in the opposite direction to the movement of said lever.

4. The switch device as claimed in claim 3 and further comprising means for angularly adjusting the axis of alignment of said lever with said compression means.

5. The switch device as claimed in claim 4 and further comprising means for adjusting the compression of said compression means.

6. The switch device as claimed in claim 5 in which said means for normally moving said conductive element towards one of said members comprises a biasing spring connected at one end to said lever and at its other end to an extension of said support and wherein said power means for moving said element towards the other of said members comprises an electromagnet positioned on said support adjacent said lever for controlling said lever.

7. The switch device as claimed in claim 6 and further comprising a plurality of pairs of spaced members, a plurality of spring strips each having conductive element thereon positioned between respective spaced members and means

linking each of said springs to said toggle mechanism.

8. A switch device comprising a support, a toggle mechanism including a compression link and an armature pivotally mounted on said support, means connecting a conductive element to said armature so that it is movable therewith, a pair of spaced members mounted on said support adjacent said conductive element on opposite sides thereof, whereby said spaced members act as stops for the movement of said conductive element, first means including said toggle mechanism for applying a motive force normally urging said conductive element towards one of said members, power driven means connected to said armature for applying a motive force for moving said element towards the other of said members against the action of said first means, means including a compensating member for compensating the pressure of said conductive element against said members, said compensating member being connected to the compression link so as to produce toggle action between said compression link and said armature, and means for shifting the center of movement of said toggle mechanism with respect to said members.

9. A switch device according to claim 8 in which means is provided for adjusting the effective action of the said compensating member.

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