

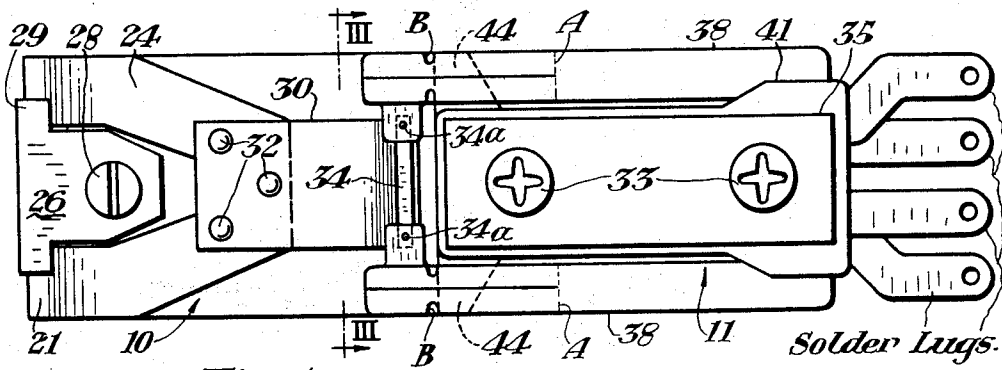
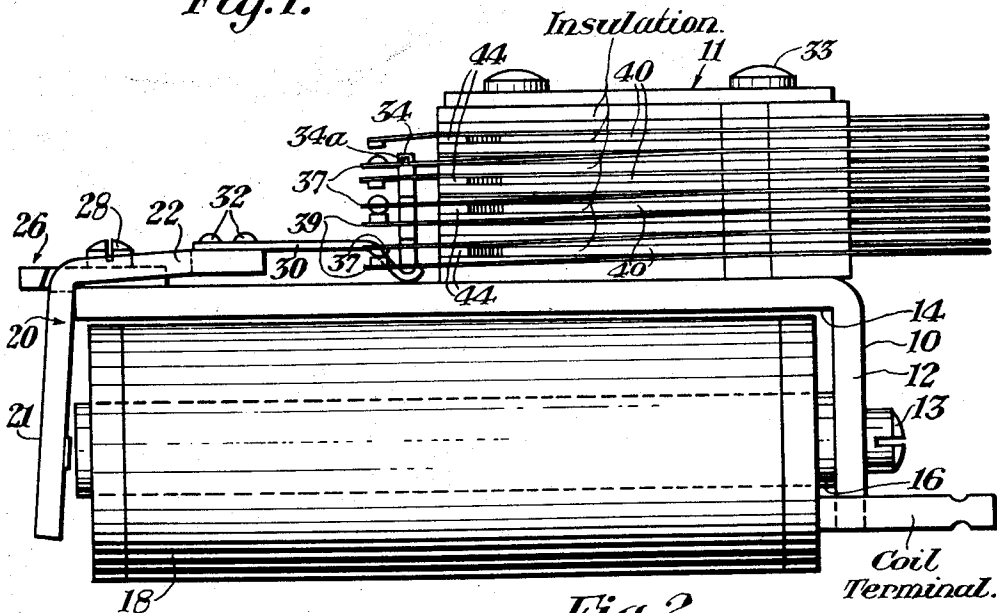
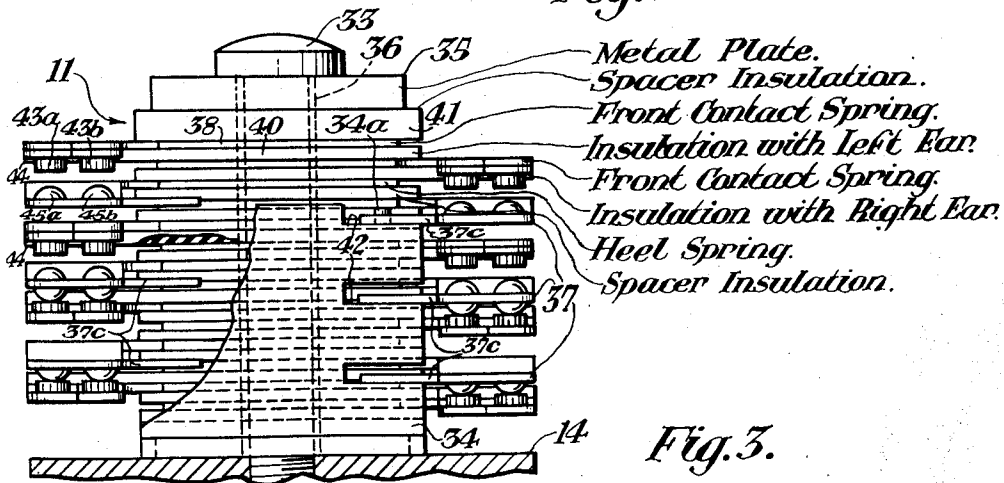
July 12, 1960

A. HUFNAGEL
ELECTRICAL RELAYS

2,945,107

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

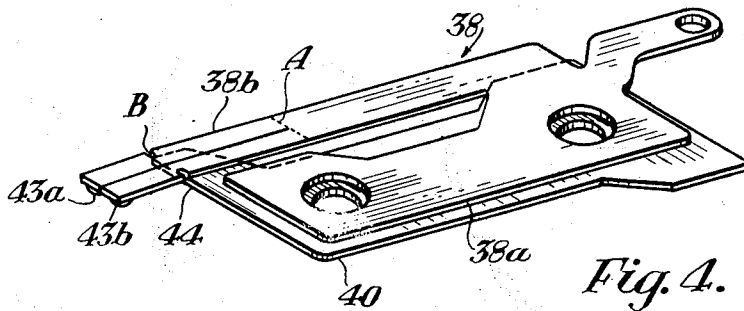


Fig. 4.

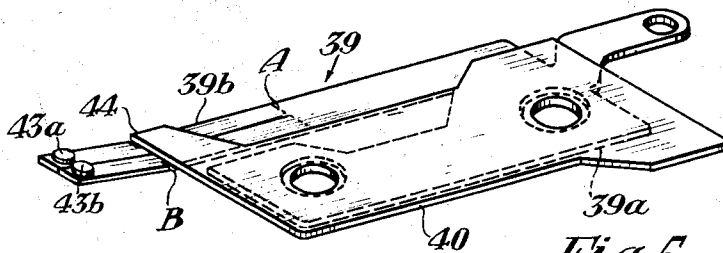


Fig. 5.

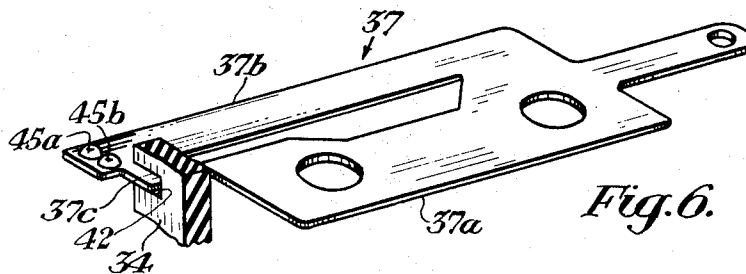


Fig. 6.

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2,945,107

ELECTRICAL RELAYS

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3 Claims. (Cl. 200—104)

My invention relates to electrical relays, and more particularly to an improved contact spring stack for general purpose or telephone type relays.

One type of prior art telephone relay includes a single contact stack structure comprising a plurality of fixed and movable contact springs clamped between insulating wafers. The movable contact springs are operated by a contact actuator connected to the armature. Generally, short thick metal strips which act as "stops" or "buffers" are positioned adjacent the fixed contact springs for minimizing contact vibration and bounce, and for establishing the adjustment of the spring contact tip.

Other forms of prior art relays utilize two or more columns of contact springs and a separate contact stack for each column of springs. A block of insulating material is positioned between adjacent stacks. Shoulders formed on the block engage the ends of the fixed springs to provide stops therefor.

Accordingly, it is a principal object of my invention to provide spring stops which are an integral part of the insulative wafers in a contact stack.

It is another object of my invention to provide inexpensive spring stops for a relay with no loss of compactness in the relay.

It is another object of my invention to provide contact spring stacks having a minimum of components.

In the attainment of the foregoing objects, I provide a relay having a contact stack structure in vertical stacked relation which includes a single contact stack comprising a plurality of fixed and movable contact springs, and wafer insulators interposed between adjacent springs. The contact springs extend forwardly from the contact stack in approximate parallel relation and form a vertical row of springs on each side of the stack. A metal pressure plate and two suitably insulated screws hold the stacked springs together. Designated ones of the wafer insulators are each formed with an ear projecting from one side of the stack. A forward portion of each fixed contact spring is bent and prestressed to overlappingly engage an associated projecting ear. A change in the operating condition of the relay causes the movable contact springs to disengage from the fixed contact springs. Any movement of the fixed contact springs is stopped almost instantly due to the restraining action of the ear projecting from each wafer insulator.

I shall describe one form of a relay embodying my invention, and shall then point out the novel features thereof in the appended claims.

Other objects and advantages of my invention will become apparent from the following description and from the accompanying drawings in which like reference characters refer to like elements throughout and in which:

Fig. 1 is a plan view of a relay including a contact stack according to my invention;

Fig. 2 is a side view of the relay of Fig. 1;

Fig. 3 is a view partly in cross section taken along the line III—III of Fig. 1;

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Fig. 4 is an isometric view showing the relation of a front contact spring with the projecting ear of an insulative wafer;

Fig. 5 is an isometric view showing the relation of a back contact spring with the projecting ear of an insulative wafer; and

Fig. 6 is an isometric view showing the relation of a movable heel spring and the spring actuating member.

Referring to Figs. 1 and 2, the relay may comprise an L-shaped backstrap 10 of magnetizable material, including a relatively short vertical leg 12 and a relatively long horizontal leg 14. A magnetizable core 16 is affixed to the vertical leg 12 as by a screw 13. The core 16 is parallel to the horizontal leg 14 and has secured thereon an operating coil winding 18. Pivotaly mounted on the forward end of the horizontal leg 14 of the backstrap 10 is an L-shaped armature 20 having legs 21 and 22 of about equal length. The armature 20 includes an opening in leg 22 near the bend thereof for receiving a plate 26 by which the armature is affixed to backstrap 10. Plate 26 is affixed to leg 14 by a screw 28 and a portion of plate 26 projects beyond the forward end of leg 14. The projecting portion of the plate 26 is provided with oppositely disposed tabs 29, which overlappingly engage the sides of leg 22, to provide a pivotal hinge for the armature 20. Leg 21 of the armature is disposed vertically to cooperate with one end of core 16, while the other leg 22 is connected to an insulative contact actuating member 34 by means of an arm 30. One end of arm 30 is connected to armature 20 as by rivets 32, and the other end of arm 30 is cupped and positioned beneath contact actuating member 34 to provide a lifting means therefor.

A contact stack 11 is supported by the horizontal leg 14 of the backstrap 10. The stack 11 is held together and secured to the leg 14 by a metal pressure plate 35 and two screws 33 which extend through the stack and make threaded engagement with the leg 14. Screws 33 have the usual insulating sleeves 36 thereon, see Fig. 3. A relatively thick spacer insulation 41 is inserted between the metal pressure plate 35 and the top contact spring in the stack 11. The contact stack 11 includes movable heel springs 37, front contact springs 38, back contact springs 39, and spring insulation wafers 40 interposed between adjacent contact springs. As best seen from Fig. 3, the contact stack 11 includes two columns of spring contacts. It will be noted that the contact springs are turned alternately left and right in the stack, their mounting portions being interleaved and spaced by insulation wafers. The uppermost series of elements in the contact stack 11 have been labeled in Fig. 3 for easy identification.

Referring now also to Figs. 4 to 6, each contact spring comprises a supporting portion referred to generally by letter *a* having openings therethrough for receiving the screws 33; and a cantilever portion or finger, referred to generally by letter *b*, which extends beyond one side of the stack parallel to the supporting portion of the spring. The front and back springs 38 and 39 are bifurcated at their forward portions. Contact elements or buttons 43 on each of these bifurcated segments of springs 38 and 39 are arranged to be engaged by contact elements or buttons 45 on the movable springs 37. The front and back springs 38 and 39 are bifurcated to reduce the possibility of an open circuit condition due to foreign particles becoming lodged between a pair of mating contact buttons. Because of the bifurcation in springs 38 and 39, each pair of mating contact buttons, say 43*a* and 45*a* make good contact independently of the condition existing between the other pair of mating contact buttons 43*b* and 45*b*, see Fig. 3. Thus, the possibil-

ity that an open circuit condition will occur is decreased.

The contact actuating member 34, of any suitable insulative material, is notched to receive forward portions of the heel springs 37, see Figs. 3 and 6. Shoulders 42, formed by notching contact actuating member 34, cooperate with tab portion 37c of heel springs 37 to lift said heel spring when the armature 20 is actuated due to energization of the relay winding 18. The heel springs 37 are prestressed or pretensioned so as to be biased downwardly against the surfaces of shoulders 42 on the contact actuating member 34. Upon deenergization of the coil winding 18, tab portion 37c of heel springs 37 will bias contact actuating member 34 downward and cause the armature 20 to return to its deenergized position with leg 21 spaced from the core 16, as shown in Fig. 2. Circular projections 34a on the top surface of contact actuating member project into associated holes in the uppermost heel spring 37 to prevent lateral movement of member 34.

In the contact stack, designated ones of the spring insulators 40 are formed with ears 44 which project from the side of the spring insulator at the forward end of the stack, see Fig. 4. A same insulation wafer may be employed for the contact springs on either side of the stack merely by placing the wafer so that its ear projects in the desired direction.

The ears 44 of the insulators 40 are positioned to cooperate with the cantilever portions or fingers 38b and 39b of the front and back contact springs 38 and 39, respectively. The forward part of cantilever portions 38b of front contact springs 38 are bent slightly downwardly at approximately point A to rest on an upper surface of the ears 44 when the relay winding 18 is deenergized. Similarly, the forward part of cantilever portions 39b of back contact springs 39 are bent slightly upwardly at approximately point A to engage the lower surfaces of the ears 44 upon upward movement of the contact actuating member 34 due to energization of relay winding 18. The bend in the cantilever portions 38b and 39b is desirably toward the front or free end rather than near the base of each cantilever portion. Bending at a forward point causes the cantilever portions 38b and 39b to rest against the front edges of the projecting ears 44 rather than against the rear edges to provide a more accurate positioning of the contact buttons 43 on the fixed contact springs 38 and 39 with respect to the contact buttons 45 on the movable contact springs 37.

The position of a given front contact spring 38 or a back contact spring 39 is determined mainly by the location of the associated insulating ear 44. For more accurate adjustment and also to correct for any contact wear that may occur in service the front and back contact springs 38 and 39 may be bent at a second point B. It will be appreciated that bending at point B does not affect the contact spring pressure against its associated ear 44. In order to localize the bend at point B and to facilitate bending, the front and back contact fingers are notched, see Fig. 4, sufficiently to reduce the cross sectional area at this point.

In the deenergized condition of the relay winding the movable heel contact springs 37 engage the back contact springs 39. Upon energization of the relay winding 18, the outwardly inclined leg 21 of the armature 20 moves in a counterclockwise direction into engagement with the extending end of the core 16. The other leg 22 of the armature moves upwardly to cause the arm 30 to impart upward motion to the contact actuating member 34. As the contact actuating member 34 moves upward, the heel springs 37 engage and slightly raise the front contact springs 38. Back contact springs 39 are restricted from excessive upward movement and caused to stop by the lower surfaces of ears 44. Heel springs 37 are thus separated in an almost instantaneous manner from the back contact springs 39. Upon deenergization of the

relay winding 18, the downwardly biased heel springs 37 return to their normal position and move the contact actuating member 34 downward. The front contact springs 38, which are also biased downward, are restricted from excessive downward movement and caused to stop by the upper surfaces of the ears 44. The heel springs 37 are thus separated in an almost instantaneous manner from the front contact springs 38.

In my relay the momentary chattering of relay contacts when they break is avoided since, as noted above, the projecting ear of each insulator almost instantaneously separates either a back or a front contact finger from a heel contact finger, the ears serving to dampen spring vibration.

From Fig. 3, it can be seen that the electrical creepage distance, that is, the distance between contact springs measured over the surface of the insulation around the outside edges of the insulation, is greater than the actual insulation thickness. This feature is obtained by horizontally displacing the spring edges with respect to the insulation edges. To make the electrical creepage distance through the screw holes large, the holes in the support portions b of the contact springs may be of larger diameter than the diameter of the holes in the insulation wafers 40, see Fig. 4.

It will be appreciated that a principal advantage of a relay according to my invention is that as a result of employing the spring insulating wafers in a dual capacity, as insulators as well as spring stops, the number of component parts necessary to the relay is reduced. The number of contact springs and interspring insulations is the same as though the spring contacts were in two separate blocks. However, the number of screws, screw insulating tubes and top and bottom insulations is halved.

Another advantage of a relay according to my invention is that since the spring stops are an integral part of the wafers, the need for adjusting the spring stops is eliminated. If fine adjustment of the contacts is desired, this adjustment can be obtained by bending the front and back contact springs at point B.

Although I have herein shown and described only one form of electrical relay embodying my invention, it is to be 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. A contact stack comprising at least one fixed contact spring and at least one movable contact spring, an insulating wafer disposed between said springs, said insulating wafer having a laterally projecting ear at one end thereof, each of said contact springs including a support portion and a cantilever portion offset from said support portion and extending laterally beyond one side of said wafer, said cantilever portion having an end affixed to said support portion and a free end extending past said ear of said wafer, the free end of said cantilever portions of said fixed contact spring bearing on said ear of said wafer and said ear providing a stop therefor, and contact buttons on said free ends, said cantilever portion of said fixed contact spring being bent at a point intermediate said affixed end and the point where said cantilever portion bears on said ear for prestressing said cantilever portion to engage the edge of said ear adjacent said contact buttons whereby precise adjustment can be made between the contact buttons on said movable contact spring and the contact buttons of said fixed contact spring.

2. A contact stack comprising at least one fixed contact spring and at least one movable contact spring, an insulating wafer disposed between said springs, said wafer including a laterally projecting ear at one end thereof, each of said contact springs including a support portion and a cantilever portion offset from said support portion and extending laterally beyond one side of said wafer,

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each said cantilever portion having an end affixed to said supporting portion and a free end extending past said ear of said wafer, the free end of said cantilever portion of said fixed contact spring bearing on said ear and said ear providing a stop to limit movement of said cantilever portion of said fixed contact spring toward said movable contact spring, contact buttons on said free ends, said cantilever portion of said fixed contact spring being bent to engage a part of said projecting ear adjacent said contact buttons for obtaining an accurate adjustment of said contact buttons on said fixed contact springs with respect to the contact buttons on said movable contact springs, said cantilever portion of said fixed contact spring being bent at a second point intermediate said contact buttons and the point where said cantilever portion bears on said ear for obtaining a second and relatively finer adjustment between the contact buttons on said fixed contact spring and the contact buttons on said movable contact spring.

3. A contact stack comprising at least one fixed contact spring and at least one movable contact spring, an insulating wafer disposed between said springs, said wafer including a laterally projecting ear at one end thereof, each of said contact springs including a support portion and a cantilever portion offset from said support portion and extending laterally beyond one side of said wafer, each said cantilever portion having an end affixed to said supporting portion and a free end extending past

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said ear of said wafer, the free end of said cantilever portion of said fixed contact spring bearing on said ear and said ear providing a stop to limit movement of said cantilever portion of said fixed contact spring toward said movable contact spring, contact buttons on said free ends, said cantilever portion of said fixed contact spring being bent to engage a part of said projecting ear adjacent said contact buttons for obtaining an accurate adjustment of said contact buttons on said fixed contact spring with respect to the contact buttons on said movable contact spring, said cantilever portion of said fixed contact spring being notched at a point along the edge of said ear adjacent said contact buttons, to reduce the cross section of said cantilever portion, said cantilever portion of said fixed contact being bent at said notched section for obtaining a second and relatively finer adjustment between the contact buttons on said fixed contact spring and the contact buttons on said movable contact spring.

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