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ELECTROMAGNETIC RELAYS AND TO APPARATUS INCORPORATING SUCH RELAYS

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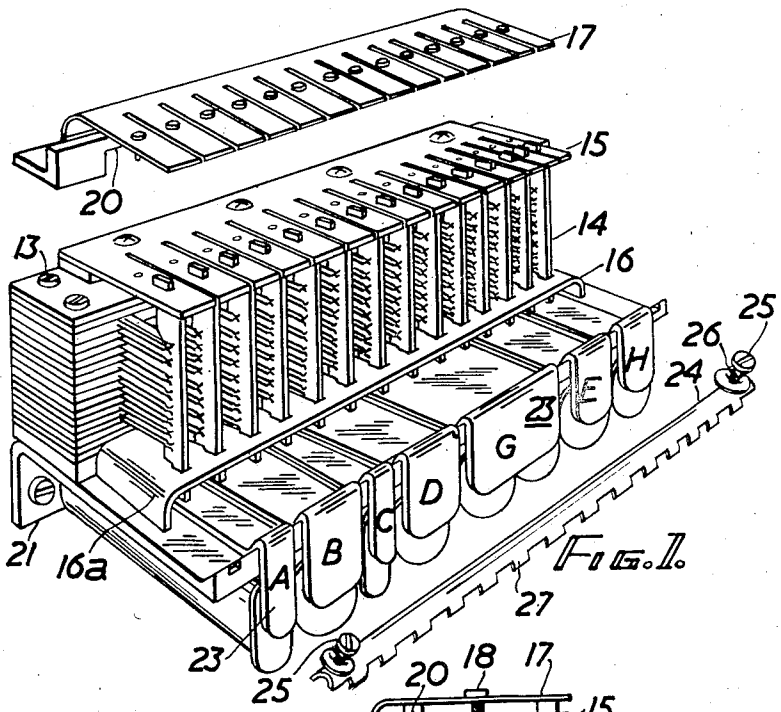

FIG. 1.

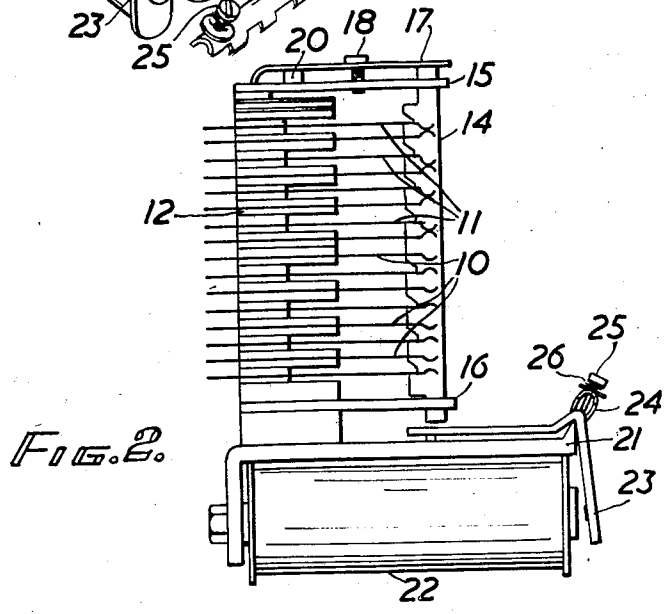

FIG. 2.

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ELECTROMAGNET RELAYS AND TO APPARATUS INCORPORATING SUCH RELAYS

Frederick Emil Rommel, Ilford, England, assignor to The Telephone Manufacturing Company, Limited, Hollingsworth Works, England

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6 Claims. (Cl. 200—98)

This invention relates to electromagnetic relays and to apparatus or systems incorporating such relays.

The invention in one aspect is concerned with a construction of relay having at least one contact set having a plurality of co-operating contacts in each set, and the invention accordingly includes an electromagnetic relay comprising an insulating support, a series of resilient fixed contact carriers held rigidly in, and extending in substantially parallel, free and aligned arrangement from, said support, contacts carried on said carriers adjacent the free ends thereof, said contacts being held by said carriers in substantially regular and predetermined spacing from each other, a series of moving contact carriers also extending from said support, contacts carried on said moving carriers near the free ends thereof and so as to co-operate with said fixed contacts, a member of insulating material having thereon a series of surfaces adapted to be engaged by said moving carriers, whereby the spacing of the moving contacts is determined, an armature arranged to move said member and thereby the moving contacts the said moving contacts being spaced at distances different from those between the fixed contacts, whereby actuation of different co-operating fixed and moving contacts is effected at different times in the movement of said member.

The invention is also concerned with a construction of relay having a plurality of operating coils and armatures, and a plurality of associated contacts sets, which are structurally combined, and the invention also includes an electromagnetic relay comprising an insulating support, a plurality of series of resilient fixed contact carriers held rigidly in said support, the carriers of each series of carriers extending in substantially parallel, free and aligned arrangement from said support, the aligned carriers of each series of carriers being generally parallel to those of the other series, contacts carried on said carriers adjacent the free ends thereof, a plurality of series of moving contact carriers also extending from said support, contacts carried on said moving contact carriers near the free ends thereof, the moving contacts of one series being adapted to co-operate with the fixed contacts of one series, a member of insulating material associated with the moving contacts of each series, each such member having thereon a series of surfaces adapted to be engaged by the moving contact carriers of the associated series, and whereby the spacing of moving contacts on those carriers is determined, a plurality of armatures each arranged to move at least one but not all of said members, means for applying pressure to said members in a direction oposite that in which the members are moved by the armatures in the contact-actuation direction, and means for independently adjusting the pressure on at least some of said members, and thereby to adjust the actuating time of the contacts.

The invention further includes an electromagnetic relay comprising an insulating support, a plurality of series of resilient fixed contact carriers held rigidly in said support, the carriers of each series of carriers extending

in substantially parallel, free and aligned arrangement from said support, the aligned carriers of each series of carriers being generally parallel to those of the other series, contacts carried on said carriers adjacent the free ends thereof, said contacts being held by said carriers in substantially regular and predetermined spacing from each other, a plurality of series of moving contact carriers also extending from said support, contacts carried on said moving carriers near the free ends thereof, the moving contacts of one series being adapted to co-operate with the fixed contacts of one series, a member of insulating material associated with the moving contact carriers of each series, each such member having thereon a series of surfaces adapted to be engaged by the moving contact carriers of the associated series, and whereby the spacing of those moving contacts is determined, a plurality of armatures each arranged to move at least one but not all of said members and thereby the associated moving contacts, the said moving contacts being spaced at intervals differing from the spacing intervals between the co-operating fixed contacts, whereby actuation of different co-operating fixed and moving contacts is effected at different times in the movement of said member.

Other features and advantages of the invention will appear from the following description of one embodiment thereof, given by way of example, in conjunction with the accompanying drawings, in which:

Figure 1 is a partly exploded perspective view of a multiple relay and

Figure 2 is an end view of the relay of Figure 1.

The relay shown in the drawings makes use of a contact set which is described in U. S. Patent #2,630,500 issued to Frederick E. Rommel and the pending application of the same inventor Ser. No. 451,374 filed August 23, 1954, now Patent No. 2,821,598, dated January 28, 1958.

While reference to these copending applications is directed for a fuller description of a contact set of this type and for the method of assembling and adjusting it, for the purpose of the present invention it is sufficient to point out that such a contact set comprises fixed and moving contact carriers, which for convenience can be referred to as springs, carried from a common support member. The fixed springs are held rigidly in the support member; the moving springs are mounted in the support member in such a way that they can be attached to it after the fixed springs, and without releasing the fixed springs. Thereby it is possible to attach the fixed springs to the support member and adjust them positionally with regard to some datum on the support member without interference or hindrance from the moving springs which can be attached subsequently without altering the adjustment of the fixed springs. Moreover, the spacing of the moving contacts is determined not by the springs, but by insulating members, or cards, which engage the moving springs near the contacts. In this way the need for individual adjustment of the springs, necessary with the conventional type of spring sets is obviated.

In the drawings the fixed contact springs are shown at **10**, and the moving springs at **11**. The fixed springs are clamped between insulating spacing strips **12** by means of bolts **13**. The strips are shaped to provide recesses to receive the moving springs, and the recesses are such that the flexing length of the moving springs is greater than that of the fixed springs. Each contact set has its associated card **14**, the edge of which is slotted to receive the moving springs, the card being guided at its upper end by passing through a slot in a plate **15** and at its lower end by a passing through a slot in another plate **16**. Both plates **15** and **16** are secured to the stack of

spacers, and it will be seen from the drawing that the turned over ends 16*a* of the lower plate 16 are provided to determine accurately the spacing of the plate 16 from the yoke member 21. The surface of the contact assembly which engages the yoke can be the datum surface for the adjustment of the contacts, so that a common datum can then be used for the contacts and the plate 16.

The construction of card adopted in the present construction differs from previously known devices in that the slots are not parallel sided. As appears from Figure 2 the slots have the edge at right angles to the vertical edge of the card, but the upper edge is at an angle. The necessary location of the moving contacts in this construction is obtained by ensuring that the moving springs rest upon the horizontal lower edge of the slot in the card. This requirement can be met by suitable design without the need for a separate individual tensioning adjustment of the moving springs.

A tongued plate 17 of spring metal, having a tongue for each card, is fastened to the top of the contact assembly by a series of screws 18, each passing through one of the tongues of the plate 17 and entering the plate 15. A bar or the like 20 engages the rear part of the spring plate 17, and so each tongue of plate 17 can be tensioned against one of the cards 14. The contact assembly is arranged to form a unitary structure.

The contact assembly is secured to a yoke structure 21. This is of generally L shape, and a series of operating coils 22 are secured to the short arm of the L. The extremity of the long arm is formed with a knife edge which acts as a pivot for a series of armatures 23. The armatures are held on knife edges by a resilient bridge 24; this bridge is held on the yoke by screws 25 under tension of springs 26, and the bridge is formed with projecting teeth 27. As shown in Figure 2 the teeth bear against the respective armatures one on each side, and the number of pairs of teeth is the same as the number of contact sets. The ends of the armatures lie beneath the lower ends of the cards so that when an armature is moved one or more cards will be lifted and the related contacts actuated. There is a slight clearance between the ends of the cards and the armatures when the latter is in its unactuated position, so that the contact separation is not in any way dependent upon the armature rest position.

The construction thus far described provides a series of relays which are structurally combined and which, so far as circumstances of use permit, can be electrically combined also. In general, however, and especially in telecommunication and like switching circuits it is necessary for a variety of contact operations to be provided. The relay described can be arranged to give a variety of such operations, but at the same time preserving a large degree of uniformity in the construction of the contact springs and in particular without the need for individual adjustment of the springs.

In the first place, one of the features by which the desired variety of operations can be obtained is by the use of armatures of different sizes. Thus, one armature can be associated with one, two or more cards. Accordingly the lateral extent of the armatures along the line of the knife edge varies, and it follows also that the power required to operate the armatures will vary. The different powers can be attained in different ways; the operating coils can have different sizes so as to produce different ampere-turns when energized from the same voltage, and more than one operating coil can be used with a single armature. Examples of both methods are shown in the embodiment illustrated.

Secondly, the operating characteristics of the cards and associated contacts are susceptible of adjustment by means of the corresponding screw 18, by which the effective armature load can be varied, and hence the operate and release times of the associated contact sets. For example, if the tension due to the spring finger 17 on one

of the cards is entirely removed, the operate time of the associated contacts might be of the order of a few milliseconds. By increasing the tension of the finger 17 the card will not move until the force generated by the armature when energized has built up to a value sufficient to overcome the tension. A delay of 20 to 30 milliseconds can easily be achieved in this way, and substantially higher values are attainable if desired.

The relay will normally release quickly, but the release time can be increased by the use of copper slugs, short circuited turns or nickel iron sleeves on the windings.

Further, if it is desired to secure sequential contact actions, as in first to act, or so-called X contact, or last to act or Y contacts, this can be effected by modifying the positioning of the slots in the cards, by which the moving contacts are located, with respect to each other and to the bottom, operating, edge of the card.

It has already been mentioned that one of the main advantages of the contact construction used in the present application is the fact that all the fixed springs can be adjusted easily. With the multiple relay construction described all the fixed springs can be adjusted simultaneously; it may therefore be arranged to provide in each contact set half of the fixed contacts appropriate for "make" contact operations and half for "break" operations and to insert in each set only as many moving springs as are required for a particular operation. Thus, a typical impulse relay, having two make-before-break change-over sets could have a full set of fixed springs, but only four moving springs in appropriate slots in the one card.

Further the variety of contact operations can be obtained without the use of individually shaped or adjusted armatures, since the desired operations can be obtained with uniform travel for the different armatures.

It will be seen that with the construction described the multiple relay can be broken down in two parts; the contact assembly and the yoke assembly, including the coils and armatures. Moreover, contact adjustment can be carried out, in the manner indicated in our prior specifications, before these two main parts are assembled.

In telecommunication switching systems use is made of various functional circuit units or stages e. g. Pre-, Group-, Final-Selectors, Registers etc. which generally employ a number of relays in association with a switching mechanism. In such applications the number of relays is largely determined by the circuit function and the individual contact arrangement and energizing winding by the type of system and switching mechanism. The present invention greatly facilitates the manufacture of diverse systems by providing a unitary structure which may contain all the relays of a circuit, unit or stage and in which the contact arrangement and energizing windings of the individual relays can be varied, at will. Such a unit can readily be provided with a plug or jack in mounting to facilitate maintenance.

The embodiment illustrated for example could be employed as the relay structure for a final selector stage provided with the following relays:

A—Impulse Feed Supervision ------ Functions—Caller
B—Impulse Guard Unit Hold ------ Functions—Caller
C—Impulse Off-Normals ---------- Functions—Caller
D—Feed Supervision ------------- Functions—Called
G—Unit Off-Normal
E—Ring Trip ------------------- Functions—Called
H—Test ------------------------ Functions—Called

I claim:

1. An electromagnetic relay including a contact assembly comprising a plurality of series of fixed contact carriers and a plurality of series of moving contact carriers arranged to co-act with said fixed carriers, an actuating member associated with the moving contact carriers of each series, each actuating member having surfaces thereon serving to determine the positions of the contact

ends of at least some of the moving contact carriers of the associated series relative to the fixed contact carriers of such series, a plurality of armatures each having an individual operating magnet and being arranged to move at least one but not all of said actuating members to effect co-action between different ones of said moving and fixed contact carriers, the operating magnets of the individual magnets having coils producing different ampere-turns when energized by the same voltage, spring means for applying pressure to the actuating members tending to move them in a direction opposite that in which the members are moved by the armatures when the relay is operated, and means for individually adjusting the spring pressure applied to at least some of said members.

2. A relay as defined in claim 1, in which at least one of said series of fixed contact carriers includes a plurality of uniformly-spaced contact carriers and the actuating member associated with such series has a plurality of non-uniformly spaced surfaces determining the positions of the co-acting moving contact carriers relative to the uniformly-spaced fixed contact carriers whereby co-action between different co-acting fixed and moving carriers is effected at different times in the movement of such member.

3. A relay as defined in claim 1, and further including means for limiting the movement of at least one of said actuating members in response to the pressure applied thereto by said spring means whereby the limited position of said member is dependent of the rest position of the associated armature.

4. A relay as defined in claim 1, wherein said spring means comprise a plurality of resilient fingers each engaging an actuating member.

5. A relay as defined in claim 1, wherein the armatures are substantially L-shaped and are pivotally mounted at the junction point of the legs of the L on a continuous knife edge formed by a common magnetic member.

6. An electromagnetic relay comprising a horizontal magnetic yoke, a plurality of horizontally-spaced units of fixed and movable contact carriers secured to said yoke adjacent the upper side thereof, each of said units having a vertical actuating member associated therewith for operating the movable contact carriers thereof, said actuators being guided for vertical longitudinal movement in spaced fixed guide means, a plurality of operating magnets secured beneath said yoke, some of said magnets having coils designed to pproduce different ampere-turns when energized by the same voltage, L-shaped armature members associated with each of said operating magnets, means for pivotally connecting the armature members at the junction points of the legs of the L to said yoke so that one leg of the L extends across the upper surface of the yoke intermediate the yoke and the lower extremity of at least one of the vertical actuators and the other leg is directed downwardly adjacent the associated operating coil, and spring means biasing said actuators downwardly toward said armature members so that said actuators will be moved upwardly upon energization of the associated armatures, said spring means comprising a plate extending above said contact carrier units and having a plurality of resilient tongues projecting laterally therefrom, each of said tongues being associated with a separate one of said actuators respectively, and screw means associated with each of the tongues for individually adjusting the spring pressure applied thereby.

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