Oct. 24, 1950 R. E. H. CARPENTER 2,526,804

ELECTRICAL CONTACT ASSEMBLY

Filed Feb. 27, 1946 4 Sheets-Sheet 1

FIG. 1.

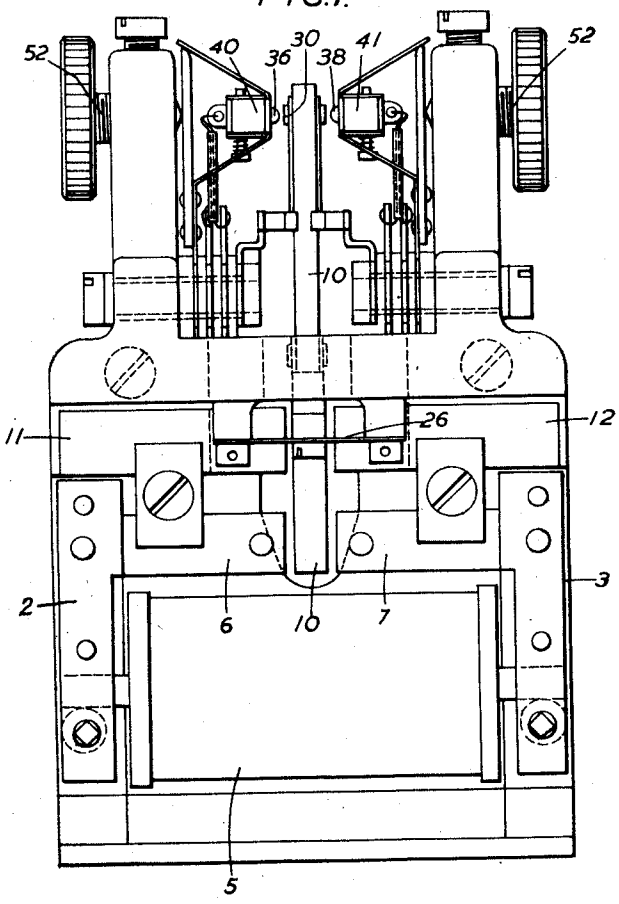
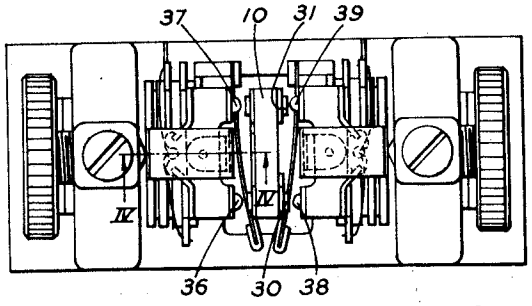



FIG. 2.




Inventor
Rupert E. H. Carpenter
By
Ralph B. Stewart
Attorney

Oct. 24, 1950 R. E. H. CARPENTER 2,526,804

ELECTRICAL CONTACT ASSEMBLY

Filed Feb. 27, 1946 4 Sheets-Sheet 2

FIG. 3.

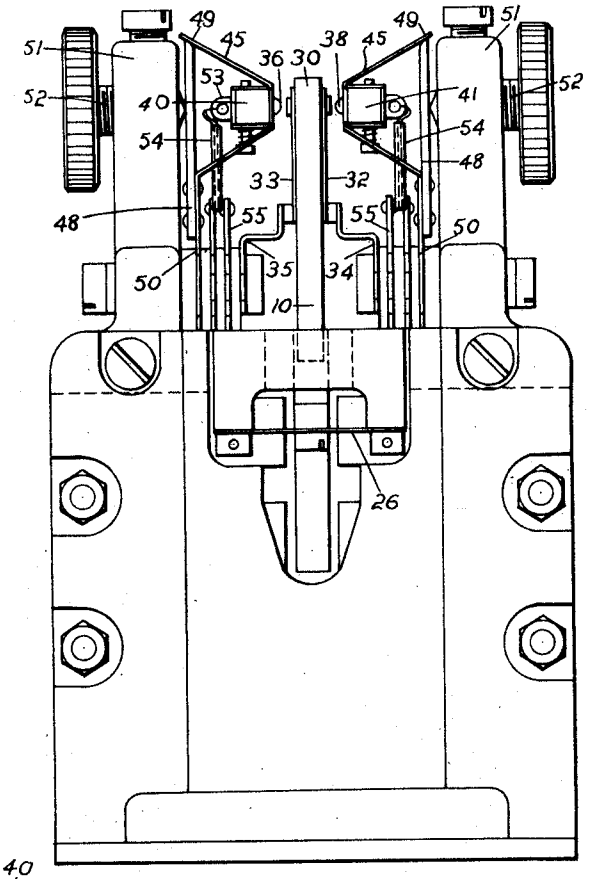



FIG. 5

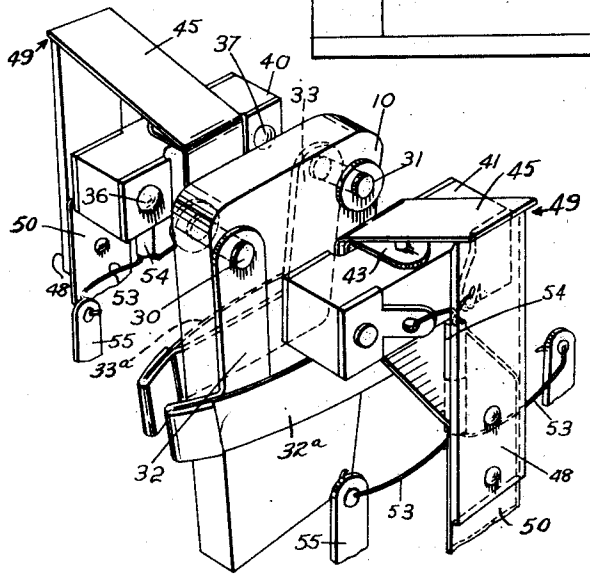
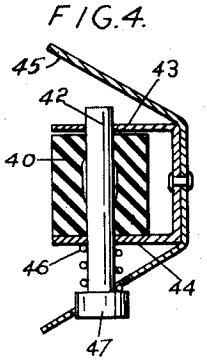



FIG. 4.




Inventor
Rupert E. H. Carpenter
By
Ralph B. Stewart
Attorney

Oct. 24, 1950 R. E. H. CARPENTER 2,526,804

ELECTRICAL CONTACT ASSEMBLY

Filed Feb. 27, 1946 4 Sheets-Sheet 3

FIG. 6.

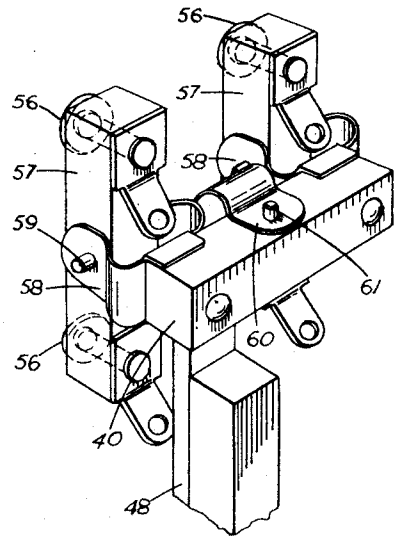
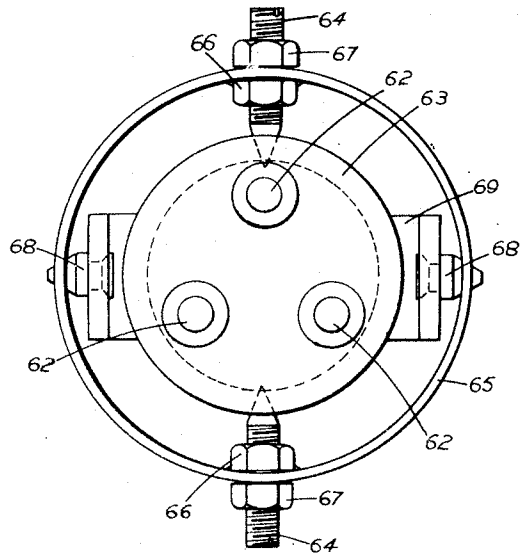



FIG. 7.




Inventor
Rupert E. H. Carpenter
By
Ralph B. Stewart
Attorney

Oct. 24, 1950 R. E. H. CARPENTER 2,526,804

ELECTRICAL CONTACT ASSEMBLY

Filed Feb. 27, 1946 4 Sheets-Sheet 4

FIG. 8.

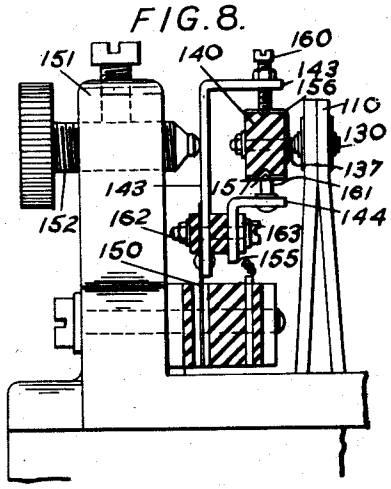



FIG. 9.

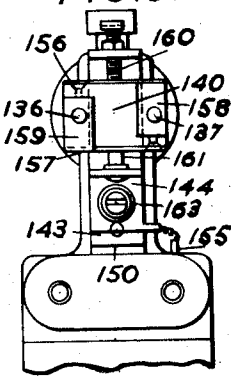
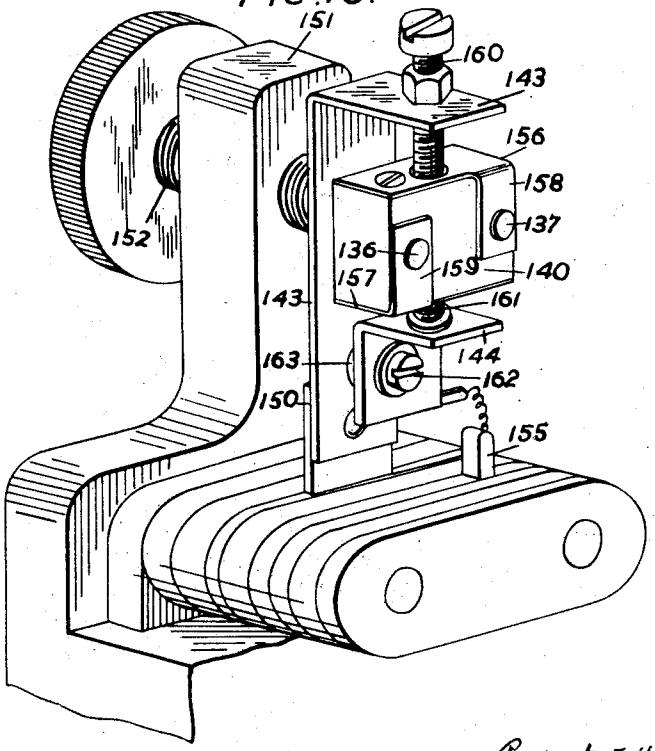



FIG. 10.




Inventor
Rupert E. H. Carpenter
By Ralph B. Stewart
Attorney

Patented Oct. 24, 1950 2,526,804

# UNITED STATES PATENT OFFICE

2,526,804

## ELECTRICAL CONTACT ASSEMBLY

Rupert Evan Howard Carpenter,
South Croydon, England

Application February 27, 1946, Serial No. 650,617
In Great Britain March 6, 1945

4 Claims. (Cl. 200—166)

1

This invention relates to the mounting of electrical contacts and its chief object is to secure the simultaneous opening or closing or both of two or more pairs of electrical contacts, such as those used in polarised or other relays. The invention is particularly suitable for use in relays having a pair of moving contacts which alternatively engage one or other of two pairs of contacts which can be regarded as relatively fixed contacts and which therefore effect the same operation as a double pole change-over switch. The invention, however, is also applicable to other relays with multiple contacts, such as, for example, those required to open or close a number of circuits simultaneously.

According to the present invention, one of each pair of co-operating contacts is so mounted that movement imparted to the one contact of a pair upon closing of the contacts results or tends to result in a movement in the opposite sense of another contact of the same kind, or of more than one such contact in the apparatus, and the relative position of these moved contacts is then maintained frictionally.

For clearness of description, any two contacts which are brought into or out of engagement, such as the movable armature contact and a side contact of a polarised relay, will be referred to respectively as an active and a passive contact. Thus, on the first operation of the device, after setting up, one passive contact will normally be reached by its co-operating active contact earlier than the other or others, and consequently this co-operating pair of contacts will close first. The motion thus imparted to that passive contact, however, causes the other passive contact of a pair, or the other passive contacts to move towards their corresponding active contacts, and this motion will only cease in each case on the meeting of each pair of active and passive contacts. Then all the passive contacts will be aligned with respect to their co-operating active contacts, and all pairs of active and passive contacts will be pressed together with approximately the same force. On the active contacts, which are all assumed to move together, being moved in the opposite direction, all pairs of active and passive contacts tend to separate at the same instant of time. Moreover, since the relative positions of the passive contacts are maintained by friction, the second and succeeding closures of the contacts will be nearly simultaneous also, and the pressures between the passive contacts and the co-operating active contacts will remain equalised which is a state of affairs which cannot be attained by independent mounting of the individual contacts on springs.

2

In order that the invention may be readily understood and easily carried into effect, some forms of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 is a front elevation of a polarised telegraph type of relay to which the invention is applied;

Figure 2 is a plan of the same;

Figure 3 is a rear elevation;

Figure 4 is a vertical section to an enlarged scale taken on the line IV—IV in Figure 2; and

Figure 5 is an enlarged perspective view of the contact arrangements with the passive contacts spread from the armature which bears the active contacts;

Figure 6 is a perspective view of a modified arrangement in which the invention is applied to the mounting of four passive contacts;

Figure 7 is an elevation looking on the face of a mounting for three passive contacts.

Figure 8 is a view in elevation of the left terminal pillar of a form of relay using a contact supporting bar formed of insulating material, the insulating bar and certain other parts being shown in vertical section;

Figure 9 is a view to the right of Figure 8 with the armature removed; and

Figure 10 is a perspective view of Figure 8 with the armature removed.

Referring to Figures 1 to 5, the contacts are those of a double pole change-over or double throw relay which is a polarised relay having the magnetic circuits and the mounting of the armature arranged as in applicant's U. S. Patent 2,412,123. The coil for the reversals current **5**, the magnets **11**, **12**, the magnetic limbs **2**, **3**, the pole pieces **6**, **7**, the armature **10**, and the armature mounting springs **26**, correspond to the same parts in the said Patent 2,412,123, in which those parts are similarly numbered. Near one end the armature **10** carries a pair of contacts **30**, **31** which project from its two opposite flat faces; they are insulated from one another, and as best seen in Figure 5, are connected by angle strips **32** **33** and flexible connector strips **32***a* and **33***a* to terminal strips or tags **34**, **35**, which are mounted on the frame of the instrument. It can be seen that the contacts **30**, **31** are spaced a short distance apart and are placed side by side so that they are equidistant from the pivotal axis of the armature **10**. These form the active contacts and they engage a pair of side contacts **36**, **37** when the upper end of the armature moves to the

left, as seen in Figure 1, and they engage a pair of contacts 38, 39 when the upper end of the armature moves to the right in Figure 1. The pair of passive contacts 36, 37, or 38, 39 on each side are mounted near opposite ends of a short bar 40, 41 of rigid insulating material, and pivoted at its centre about a vertical axis which is therefore parallel to the contact bearing faces of the armature 10. The pivotal arrangement is shown in Figure 4 where one of the bars 40 has a pin 42 forced into a vertical bore in the bar 40, and passes through holes in tongues 43, 44 secured to the sheet metal pieces 45 to engage frictionally the upper and lower surfaces of the bar 40. A coiled compression spring 46 is introduced around the pin 42 between its head 47 and the lower tongue 44. Thus, as the pin 42 is tight in the bar 40, this spring forces the bar 40 down into contact with the tongue 44, and while the bar 40 and the pin 42 can turn about the vertical axis of the pin, friction is exerted by the tongue 44 to hold the bar 40 in any angular position into which it may be pushed.

The sheet metal pieces 45 are in effect flat springs riveted at their lower ends to contact supporting plates 48, and at their upper ends at 49, rubbing on the top edges of the plates 48, thereby providing compliant members with damping means for vibrations of the armature in accordance with applicant's U. S. Patent No. 2,219,222. The plates 48 are resiliently mounted at their lower ends on tags 50 and the adjustment of the passive contacts 36, 38 is effected by resiliently springing the plates 48 inwards from the pillars 51. For that purpose, the plates 48 are engaged by the points of the adjustment screws 52.

The passive contacts 36, 37, and 38, 39 are, therefore, mounted so that they can move through small angles about the axes of the pins 42, but this angular movement is controlled by the friction between the bars 40, 41 and the tongues 44. These contacts 36 and 37 or 38 and 39, are mounted with the members of each pair spaced apart by the same distance as the active contacts 30, 31 so as to co-operate with the latter.

In an alternative construction the bars 40, 41 may be made of insulating material with metal foils on opposite faces, and the contacts 36 and 37 or 38 and 39 connected each to one of the foils so that connection may be made to them through the frictional joints between the bar 40 or 41 and the tongues 43, 44 which would then be insulated from one another. This alternative construction is illustrated in Figures 8 to 10 and will be described in greater detail hereinafter. In either arrangement the bar 40 or 41 constitutes a rocker bar bearing contacts 36, 37 or 38, 39, which if one of a pair moves, the other is caused to move in the opposite sense so that when the passive contacts, for example, 36, 37, are engaged by the armature or active contacts 30, 31, the passive contacts are self-aligned with respect to the active contacts.

The connections to the contacts 36, 37, and 38, 39 are made by flexible insulated wires 53 which on either side of the armature are taken down through short lengths of insulating sleeving 54 and are secured to terminal tags 55 which are carried in the same insulating mounting as the tags 50.

In Figure 6, an arrangement is shown where there are four passive contacts 56 mounted in pairs on separate rocker bars 57 which in this instance are shown to be vertical. The bars 57 are gripped in spring fingers 58 through which horizontal pivot pins 59 pass, the pins 59 being fixed in the bars 57. The rocker bars 57 can yield in the spring fingers 58 and turn through small angles about the pivot pins 59 so that the passive contacts 56 of each pair simultaneously move in opposite senses. The spring fingers 58 are formed in two pairs each constituted by a loop of spring metal such as copper beryllium, and these loops are secured to a horizontal rocker bar 40 which corresponds exactly to the bar 40 in Figures 1 to 5. In this case, however, the rocker bar 40 is gripped by the spring fingers of a sheet metal loop 60 through which a pin 61 fixed in the rocker bar 40 passes, so that as in Figures 1 to 5, the rocker bar 40 can turn about the vertical axis of the pin 61. The rocker bar 40 is mounted at the upper end of a plate 48 which corresponds to the supporting plate 48 in Figures 1 to 5, and except that the armature must have four contacts, the rest of the relay may be constructed as in Figures 1 to 5 and consequently functions as a four-pole change-over relay.

In Figure 7, a triple pole arrangement is illustrated, the passive contacts 62 being mounted at the corners of an equilateral triangle on the face of a cylindrical member 63 of insulating material mounted parallel to the contact carrying face of the armature of the relay and which is made hollow with an annular wall for the sake of lightness. The disc 63 is adjustably gripped by the points of two screws 64 which pass through a gimbal ring 65 which can yield slightly. The screws 64 are threaded in nuts 66 welded to the inside of the ring 65, and the screws are provided with lock nuts 67. The gimbal ring 65 is also engaged by the points of pivots 68 which project outwardly from the arms of a forked bracket 69. This bracket may be a continuation of a plate such as the plate 48 in Figures 1 to 5, or may be fixed to the upper end of such a plate. The pivots 68 are not in themselves adjustable, but the frictional action of them can be adjusted by adjustment of the screws 64 because the adjustment of the screws 64 slightly distorts the gimbal ring 65 and modifies the frictional engagement of the pivots 68 with that ring.

Figures 8 to 10 illustrate the alternative construction referred to above in which the bar for supporting the passive contacts is formed of insulating material. In this arrangement, the bar 140 (corresponding to the bar 40 in Figures 1 to 5) is formed of insulating material and is provided with sheet metal pieces 156 and 157 on the upper and lower faces. These metal sheets have extensions 158 and 159 bent against the front face of the bar 140 and are connected to the passive terminals 136 and 137, respectively. The frictional joint for supporting the bar and for effecting electrical connections to the passive contacts are formed by pivot pins 160 and 161 supported in horizontal portions of tongues 143 and 144 which are insulated from one another. The pointed ends of pivot screws 160 and 161 are seated in bearing sockets formed in metal sheets 156 and 157 so that the bar 140 can turn on the pivots under the friction due to the pressure of the adjustable pivot screw 160. The bracket 143 is resiliently supported on a terminal strip 150 and the contacts are set, as in the case of Figures 1 to 5, by the screw 152 threaded in the upper end of pillar 151 and bearing on the bracket 143. The bracket 144 has a flexible connection to a terminal strip 155 so that connection to the contacts 136 and 137 is completed through the pivotal joints and the pins 160 and 161. The bracket

144 is supported from the bracket 143 by means of a screw 162 passing through clearance holes in the brackets and in insulating washers or spacer disks 163.

In the above examples, the equalising system has been described as applied to the passive contacts, but clearly the roles of the active and passive contacts in this connection may be reversed; however, it is usually preferable to avoid the extra mass involved in such means on the moving parts.

It will be appreciated that the friction provided for maintaining the adjustable contacts in the adjusted position should be as great as possible subject to the fact that the adjustment must occur under the smallest operating forces exerted by the moving contacts. Any connecting wires from the contacts must be sufficiently flexible to ensure that the adjustable contacts will not be prevented from remaining in the position in which they are set. The adjustable contacts and the rocker bar or other member carrying them should have a minimum moment of inertia and if mounted with compliance and provided with damping means according to my U. S. Patent 2,219,222 dated October 22, 1940, should be as light as possible. It will also be apparent that an outstanding advantage of the invention is that a single adjusting means only need be used for advancing and retracting all the adjustable contacts which will usually be the passive contacts; thus, the adjustment of such a relay or other apparatus is rendered no more difficult than that of an apparatus having a single side contact on each side of the armature.

I claim:

1. A mounting assembly for electrical contacts, comprising two pairs of contacts mounted for relative movement to permit of opening and closing of said contacts, a rocker member carrying one of said pairs of contacts and pivotally mounted about an axis to permit of movement of the contacts carried thereby in opposite senses to and from the respective contacts of said other pair, frictional means engaging said rocker member to maintain same and the contacts carried thereby in positions determined by the engagement of said two pairs of contacts, and a pair of conductive mounting means carried on opposite sides of said rocker member, said pair of mounting means being insulated from each other and forming the pivotal mounting for said rocker member for connecting the contacts on said rocker member with a pair of fixed terminals.



2. In a double-throw switch, the combination of an armature mounted to move between two positions, a pair of active contacts carried by said armature on one side thereof, a second pair of active contacts carried by said armature on the opposite side thereof, two pairs of passive contacts arranged on opposite sides of said armature and in positions to be engaged respectively by said pairs of active contacts carried by said armature, a rocker member arranged on one side of said armature and carrying in insulated relation the contacts of one pair of said pairs of contacts and being adjustable in position by engagement with the cooperating pair of contacts, frictional means operative to maintain said rocker member in adjusted position, a second rocker member arranged on the opposite side of said armature and carrying in insulated relation the contacts of another pair of contacts and being adjustable in position by engagement with the cooperating pair of contacts, frictional means to maintain the second rocker member in adjusted position, a pair of metallic pivotal joints pivotally supporting each rocker member and being insulated from each other, a pair of fixed terminals for each rocker member, and means forming separate connections from the contacts on each rocker member through said joints to the respective fixed terminals.

3. A contact assembly according to claim 1 wherein said rocker member is formed of insulating material.

4. A switch according to claim 2 wherein said rocker members are formed of insulating material.

RUPERT EVAN HOWARD CARPENTER.


## REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

| Number | Name | Date |
|---|---|---|
| 547,537 | Biddle et al. | Oct. 8, 1895 |
| 2,059,702 | Matthias | Nov. 3, 1936 |
| 2,092,478 | Sommermeyer | Sept. 7, 1937 |
| 2,219,222 | Carpenter | Oct. 22, 1940 |
| 2,339,996 | Kight | Jan. 25, 1944 |