

Sept. 27, 1966

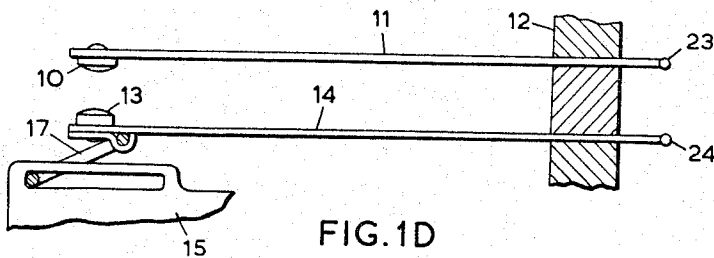
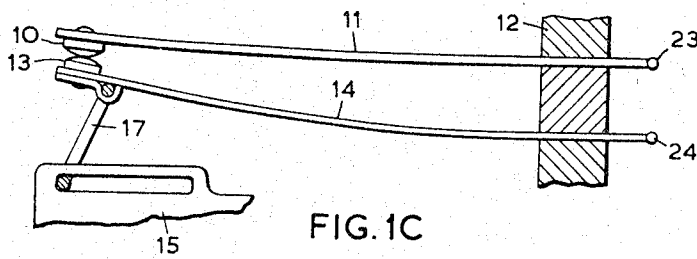
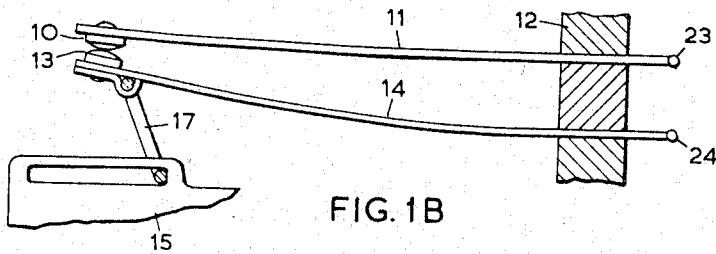
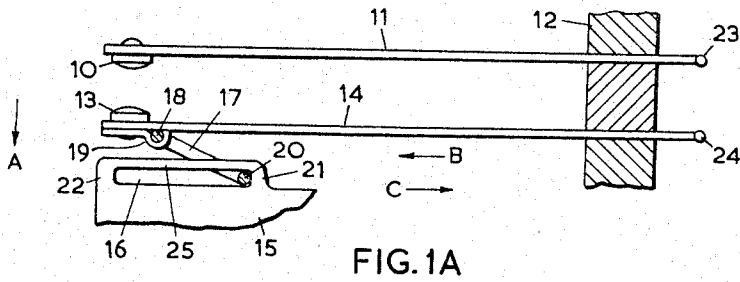
H. HOEL

3,275,963

ELECTRICAL CONTACT ARRANGEMENT SETTABLE AT WILL TO BE  
NORMALLY OPENED OR NORMALLY CLOSED

Filed July 31, 1964

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

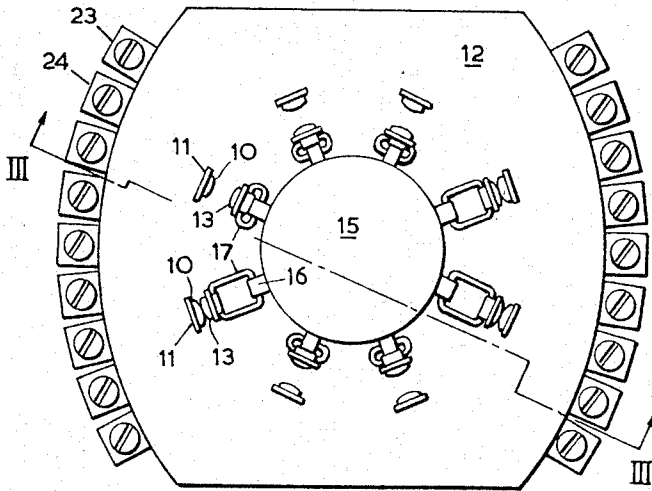


FIG. 2

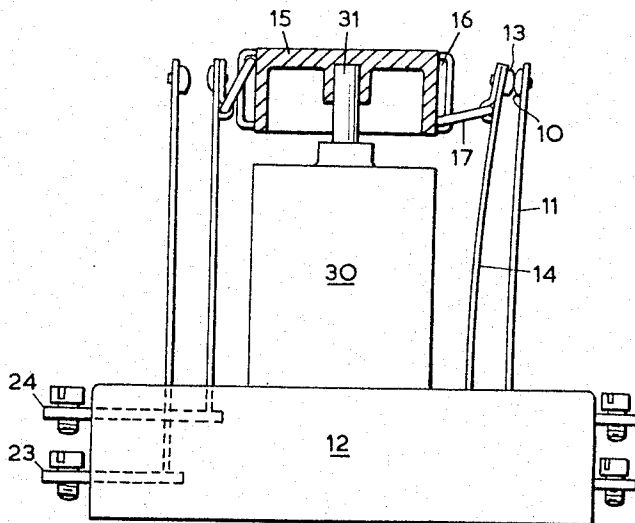


FIG. 3

1

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**ELECTRICAL CONTACT ARRANGEMENT SETTABLE AT WILL TO BE NORMALLY OPENED OR NORMALLY CLOSED**

Hans Hoel, Oslo, Norway, assignor to The English Electric Company Limited, London, England, a British company

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6 Claims. (Cl. 335—121)

The invention relates to electrical contact arrangements operable to complete an electrical circuit.

According to the invention, such an electrical contact arrangement comprises a body portion, a contact member constrained for movement relative to the body portion along a first predetermined line between an engaged position in which it completes the said electrical circuit and a disengaged position, an operating member movable along a second predetermined line approximately normal to the first line, two stops on one of the members spaced apart in a direction parallel to the second line, an operating link with one of its ends pivotally attached to the one of the members not carrying the stops and with the other of its ends settable at will to abut against either stop, whereby, when the link abuts against one stop, movement of the operating member in one direction along the second line moves the contact member into the engaged position, and when the link abuts against the other stop, movement of the operating member in the same direction moves the contact member into the disengaged position, the link lying at a small angle to the operating member when the contact member is in one of the said positions and at a greater angle not more than about 90° thereto when the contact member is in the other position, the contact arrangement also comprising releasable holding means for holding the link in abutment with either of the stops.

Advantageously, the member carrying the two stops is formed with a slot which is engaged by the said other of the ends of the link, the two ends of the slot constituting the two said stops.

The contact member may comprise a leaf-spring anchored at one end to the body portion and carrying an electrical contact, the leaf-spring extending in a direction approximately parallel to the said second predetermined line, but being displaced therefrom in the direction of the said first predetermined line, and being biased towards the operating member so as to constitute the said holding means.

In an embodiment of the invention, the holding means may comprise releasable clamping means for holding the link in abutment with either of the stops. In such a case, the contact member may comprise a leaf-spring anchored at one end to the body portion, and carrying an electrical contact, the leaf-spring extending in a direction approximately parallel to the said second predetermined line, but being displaced therefrom in the direction of the said first predetermined line, and being biased away from the operating member.

A contact assembly embodying the invention comprises a plurality of electrical contact arrangements each as described above, the contact arrangements being mounted so that the said first predetermined lines of movement of the contact members are all approximately parallel to one another, the said operating member of each contact arrangement being constituted by a single member which is common to all the contact arrangements and which is interconnected with the contact member of each contact arrangement by a separate operating link.

Advantageously, each contact member comprises a leaf-spring anchored at one end to the body portion of the

2

arrangement and carrying a contact at the other end, each leaf-spring providing a bias force acting along the said second predetermined line and the links of the contact arrangements being so set with respect to the said stops that when the said single member moves so as to cause the contact members to move from one said position to the other position, some of the leaf-springs oppose the movement of the single member and some assist it, the net force required to move the single member being substantially zero.

Two embodiments of the invention will now be described by way of example and with reference to the accompanying drawings in which:

FIGS. 1A to 1D show an electrical contact arrangement and illustrate its operation;

FIG. 2 is a diagrammatic plan view of a contact assembly incorporating several arrangements as shown in FIGS. 1A to 1D; and

FIG. 3 is a diagrammatic sectional elevation on the line III—III of FIG. 2.

Referring to FIG. 1A, the contact arrangement comprises a contact 10 mounted on an electrically conductive arm 11 which is anchored in a fixed electrically insulating body portion 12. The arm 11 is made slightly resilient. A contact member comprises a contact 13 mounted on an electrically conductive longitudinal member 14 also anchored in the body portion 12. The longitudinal member is in the form of a leaf-spring and is biased in the direction of the arrow A. An operating member 15, of which only part is shown, is constrained for movement in the direction of the arrows B and C and has one edge portion formed into a slot 16. An operating link 17 interconnects the longitudinal member 14 and the operating member 15. The link is pivotally attached to the longitudinal member 14 by means of a pin 18 which pivots in a clamp 19 mounted on the member 14. The other end of the link 17 carries a further pin 20 which engages the slot 16. In FIG. 1A, the pin 20 is shown abutting against a stop formed by the end 21 of the slot 16 and the contact 13 is in a disengaged position in which it is not engaging the contact 10. If now the operating member 15 is moved in the direction of the arrow B, the operating link 17 will cause the contact 13 to move into its engaged position in which it engages the contact 10 as shown in FIG. 1B, the angle between the link and the operating member increasing to nearly 90°. FIGS. 1A and 1B therefore illustrate the contacts in a normally open configuration in which movement of the operating member in the direction of the arrow B is necessary to bring the two contacts into engagement.

In FIG. 1C, the operating member 15 is in the same position relative to the fixed body portion 12 as in FIG. 1A. However, the operating link 17 has been reset so that its pin 20 is abutting against a stop formed by the end 22 of the slot 16. This resetting of the link 17 has caused the contact 13 to move into its engaged position in which it engages the contact 10 and thus the configuration illustrated is a normally-closed configuration. If now the operating member 15 is moved in the direction of the arrow B, the contact 13 moves into its disengaged position.

The contact arrangement illustrated in FIGS. 1A to 1D may therefore have a normally-closed or normally-opened configuration depending on the setting of the operating link 17, and in each case movement of the operating member 15 in the same direction, and for the same distance, serves to operate the contacts, that is, to move the contact 13 into its disengaged position or into its engaged position respectively. Terminals 23 and 24 respectively attached to the ends of the arm 11 and the longitudinal member 14 enable electrical connections to be made to the contacts 10 and 13 so that movement

of the contact 13 into its engaged position completes a circuit between the terminals. The top portion 25 of the slot 16 may be removed if desired, the link 17 then being settable to abut against either of two stops formed by the ends 21 and 22 of the now-open slot. Means (not shown) may be provided for temporarily locking the pin 20 against either of the stops, in which case the member 14 may be biased in the opposite direction to the arrow A.

The operating member 15 may be moved by electromagnetically or manually operated means according to the type of device in which the contact arrangement is incorporated.

It will be observed that as the operating member 15 moves the contact 13 into the engaged position (with the contacts arranged in either the normally-open or the normally-closed configuration), the angle between the link 17 and the operating member 15 increases. Thus, as the contact 13 moves into the engaged position, an increasing force is applied to it by the longitudinal member 14, thus ensuring firm and reliable contact operation. The speed of movement of the contact 13 is reduced as it approaches the engaged position, thus reducing any tendency to "contact bounce." The smaller angle between the link and the operating member when the contact 13 is not in the engaged position ensures rapid movement of the contact 13 towards or away from the contact 10. The force exerted by the operating member 15 remains relatively constant during movement of the contact 13 thus simplifying the design of a relay in which the contact arrangement is incorporated and reducing the liability of the contacts to "chatter" as they engage, if the arrangement is being operated by an A.C. electromagnet.

In FIGS. 2 and 3, a plurality of pairs of contacts similar to those shown in FIGS. 1A to 1D are illustrated grouped around a central solenoid coil 30. Items in FIGS. 2 and 3 performing functions similar to those of items shown in FIGS. 1A to 1D are similarly referenced. The operating member 15 is of circular form and is clamped to a plunger 31 movable in a vertical direction by means of the solenoid coil 30. The operating member carries around its periphery a number of slots 16 engaged by the ends of the operating links 17. By appropriately setting the respective links 17 as described with reference to FIGS. 1A to 1D, some of the contact pairs can be arranged to have a normally-open configuration and some a normally-closed configuration. The configuration of any particular pair of contacts can be easily altered. If approximately equivalent numbers of contact pairs have normally-closed and normally-open configurations, the force necessary for moving the plunger 31 is very small, the force exerted in engaging contact pairs having a normally-open configuration being balanced by the spring force produced by the disengagement of contact pairs having a normally-closed configuration.

What I claim as my invention and desire to secure by Letters Patent is:

1. An electrical contact arrangement comprising a body portion, first and second contact members, means mounting first and second contact members on the said body portion and constraining movement thereof relative to the body portion along a first predetermined line between mutually engaged and mutually disengaged positions, an operating member movable along a second predetermined line approximately normal to the first line, first and second stops in one of the second contact members and the operating member spaced apart in a direction parallel to said second line, pivot holding means in the other of the second contact member and the operating member, a rigid operating link, first and second pivot means at the two ends of the said rigid operating link, the rigid operating link being pivoted at one end about said pivot holding means and settable at will to pivot

about one of the said first and second stops, whereby, when the link pivots about the first stop, movement of the operating member in one direction along the second line moves the second contact member from the disengaged to the engaged position, and, when the link pivots about the second stop, movement of the operating member in the same direction moves the second contact member from the engaged to the disengaged position.

2. An electrical contact arrangement according to claim 1, in which the member carrying the two stops is formed with a slot which is engaged by the said other of the ends of the link, the two ends of the slot constituting the two said stops.

3. An electrical contact arrangement comprising a body portion, first and second contact members, means mounting first and second contact members on the said body portion and constraining movement thereof relative to the body portion along a first predetermined line between mutually engaged and mutually disengaged positions, an operating member movable along a second predetermined line approximately normal to the first line, first and second stops in the operating member spaced apart in a direction parallel to said second line, pivot holding means in the second contact member, a rigid operating link, first and second pivot means at the two ends of the said rigid operating link, the rigid operating link being pivoted at one end about said pivot holding means and settable at will to pivot about one of the said first and second stops, whereby, when the link pivots about the first stop, movement of the operating member in one direction along the second line moves the second contact member from the disengaged to the engaged position, and, when the link pivots about the second stop, movement of the operating member in the same direction moves the second contact member from the engaged to the disengaged position.

4. An electrical contact arrangement according to claim 1, including an electromagnetically operated actuator connected to move the operating member along the said second predetermined line.

5. A contact assembly, comprising a plurality of electrical contact arrangements each according to claim 1, the contact arrangements being mounted so that the said first predetermined lines of movement of the contact members are all approximately parallel to one another, the said operating member of each contact arrangement being constituted by a single operating member which is common to all the contact arrangements and which is interconnected with the second contact member of each contact arrangement by a separate rigid operating link.

6. A contact assembly according to claim 5, in which each contact member comprises a leaf-spring anchored at one end to the body portion of the arrangement and carrying a contact at the other end, each leaf-spring providing a bias force acting along the said second predetermined line and the rigid operating links of the contact arrangements being so set with respect to the said stops that when the said single member moves so as to cause the second contact members to move between engaged and disengaged positions, some of the leaf-springs oppose the movement of the single operating member and some assist it.

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BERNARD A. GILHEANY, *Primary Examiner.*

ROBERT K. SCHAEFER, *Examiner.*

R. N. ENVALL, Jr., *Assistant Examiner.*