

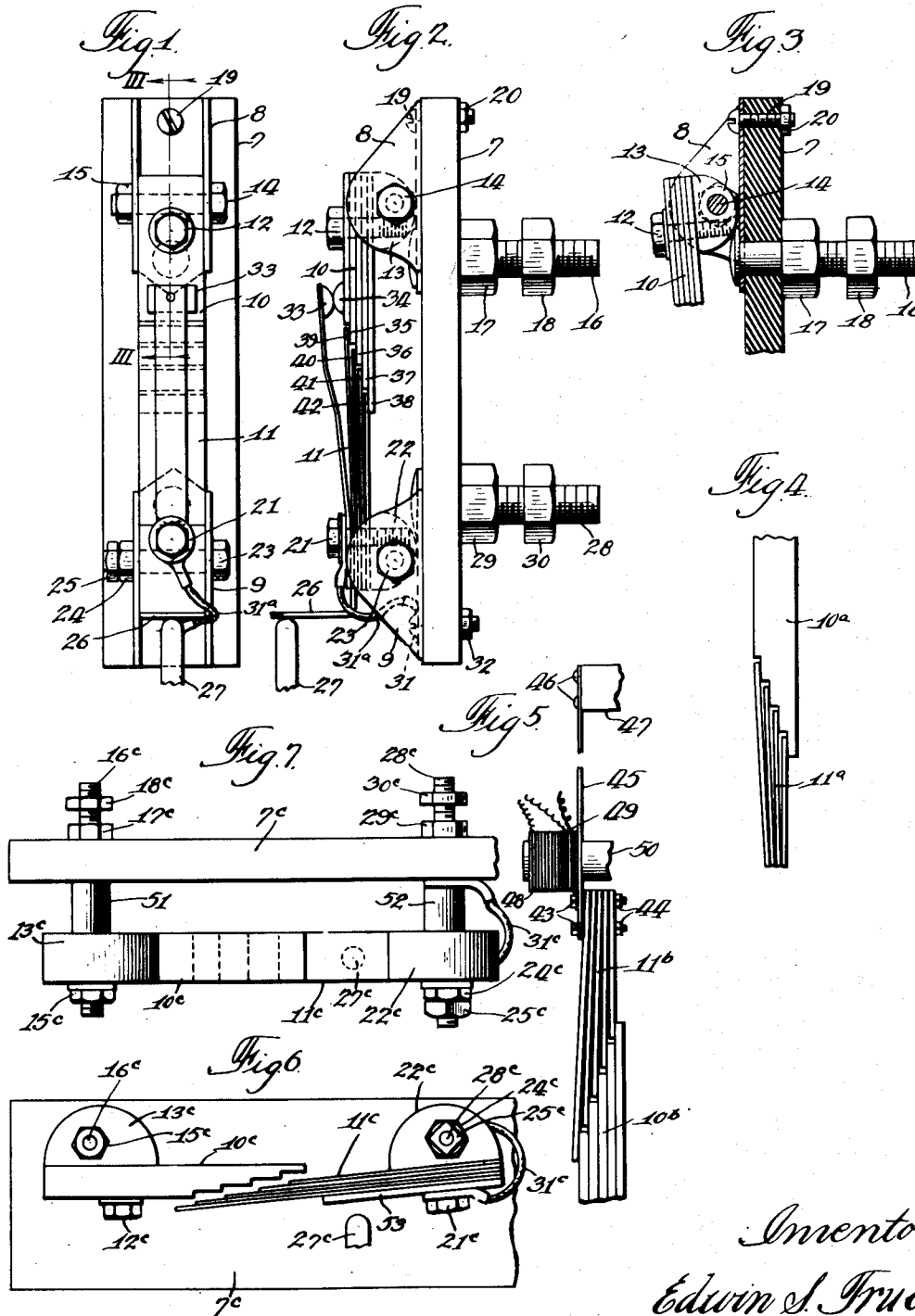
July 1, 1930.

E. S. TRUE

1,769,279

ELECTRICAL CONTACTING DEVICE

Filed Aug. 5, 1927



Witness:
Dorel Magnusson.

Inventor:
Edwin S. True.
By Jones, Addington, Ames, & Seibold.
Attys.

UNITED STATES PATENT OFFICE

EDWIN S. TRUE, OF OAK PARK, ILLINOIS

ELECTRICAL CONTACTING DEVICE

Application filed August 5, 1927. Serial No. 210,774.

My invention relates to electrical contacting devices and has particular relation to such devices wherein laminated contact members are utilized.

5 Contacting devices comprising laminated contact members have been utilized in the electrical art for various purposes, but such devices have been so constructed that the laminated contact members are adapted to engage
10 co-operating contact members on a plane surface thereof. Each of the laminations in such a device makes contact with the plane surface of the co-operating contact member only along an edge of the lamination, or, at
15 best, along a very narrow inclined surface at the extremity of the lamination. The area of the contact surface between the co-operating contact members is therefore very small and the current carrying capacity of the contacting device is greatly limited thereby.

20 The principal object of my invention is to provide an electrical contacting device embodying a laminated contact member and a co-operating contact member having a stepped
25 contact surface, whereby sensitive contact over a relatively small area may be effected with a slight operating pressure and contact of greater current carrying capacity is automatically obtained over a relatively large area
30 as the operating pressure is increased.

Other objects and advantages of my invention will appear from a consideration of the following detailed description, taken in connection with the accompanying drawings, in
35 which:

Figure 1 is a front elevational view of an electrical contacting device embodying my invention;

40 Fig. 2 is a side elevational view of the device shown in Fig. 1;

Fig. 3 is a fragmentary sectional view taken along the line III—III of Fig. 1;

Fig. 4 is a fragmentary elevational view showing a modification of my invention;

45 Fig. 5 is a fragmentary elevational view

showing my invention as applied to a relay of the moving coil type;

Fig. 6 is an elevational view showing a different method of mounting an electrical contacting device embodying my invention; and

50 Fig. 7 is a top plan view of the device shown in Fig. 6.

Referring to the drawings, and particularly to Figs. 1, 2, and 3, a base member 7 of
55 insulating material supports two bracket members 8 and 9, which, in turn, support two laminated contact members 10 and 11, respectively. The contact member 10 is composed of a plurality of relatively thick and rigid laminations of suitable electrical conducting
60 material, such as copper, bronze, or the like. These laminations are secured by a bolt or cap-screw 12 to a rocker member 13 of substantially semi-cylindrical form. The rocker member 13 is pivotally supported with respect
65 to the bracket 8 by means of a bolt 14 and is adapted to be secured in position with respect to the bracket 8 by means of a nut 15 co-operating with the bolt 14. The contact member 10 and the rocker member 13 may
70 be adjusted in any desired position with respect to the base member 7 by turning these members about the pivotal mounting provided by the bolt 14. When the desired position
75 is obtained, the nut 15 may be tightened on the bolt 14 to clamp the side walls of the bracket 8 tightly against the ends of the rocker portion 13, thereby fixing the contact member 10 securely in position.

80 Electrical circuit connection may be made to the contact member 10 through a stud 16 which extends through an aperture in the base portion of the bracket 8 and the base member 7 and is provided with a nut 17 which serves
85 to secure the bracket 8 in fixed position with respect to the base member 7. An additional nut 18 may be provided to facilitate the connection of suitable conductors to the stud 16. A bolt 19 and co-operating nut 20 are also
90

provided to maintain the bracket 8 in proper relation to the base member 7.

The laminations of the contact member 11 are secured by means of a bolt or cap-screw 21 to a rocker member 22, which is similar to the rocker member 13 that is associated with the contact member 10. A bolt 23 extends through the side walls of the bracket 9 and a suitable aperture in the rocker member 22 to provide a pivotal mounting for the contact member 11. Since this contact member is to be movable with respect to the bracket 9, about the pivotal mounting of the bolt 23, it is not desired that the side walls of the bracket 9 be clamped in tight relation to the sides of the rocker member 22. Therefore, a nut 24 and a lock-nut 25 are provided for the bolt 23 whereby said bolt may be maintained in position with respect to the bracket 9 without producing a clamping effect upon the member 22.

A lever member 26 is secured in fixed relation to the contact member 11 and the rocker member 22 by means of a bolt 21. The lever member 26 extends outwardly from the base member 7 to provide means for actuating the contact member 11 about the pivotal mounting to the bolt 23. A suitable actuating member 27, which may be an extension of a solenoid core, a manually operable member, or any other desired device, is adapted to engage the lever arm 26 near the outer extremity thereof to actuate the contact member 11 into engagement with the contact member 10. When the contact members 10 and 11 are vertically mounted as shown in Figs. 1, 2, and 3, a counterweight, spring, or other suitable means may be provided for actuating the contact member 11 out of engagement with the contact member 10 when the lever member 26 is disengaged by the actuating member 27. Ordinarily, however, the weight of the movable parts is such that the contact member 11 will be actuated out of engagement with the contact member 10 by the action of gravity when the actuating member 27 disengages the lever member 26.

The bracket 9 is secured to the base member 7 by means of a terminal stud 28 and co-operating nut 29 corresponding to the stud 16 and nut 17 that are associated with the bracket 8. Electric circuit connection to the contact member 11 is facilitated by the provision of an additional nut 30 for the stud 28, corresponding to the nut 18 that is provided for the stud 16. An auxiliary bolt 31 and co-operating nut 32, corresponding to the bolt 19 and nut 20 that are associated with the bracket 8, are also provided to secure the bracket 9 in fixed relation to the base member 7 and to secure one terminal of a flexible conductor 31^a in electrical conducting relation to the bracket 9. The other terminal of the conductor 31^a is secured in elec-

trical conducting relation to the contact member 11 by the bolt 21.

The movable contact member 11 is composed of a plurality of relatively thin laminations of resilient conducting material, such as copper, bronze, or the like. The outer lamination of this contact member may be provided with an arcing tip 33 that is adapted to engage a similar arcing tip 34 mounted on the outer lamination of the fixed contact member 10. The arcing tips 33 and 34 may be made of carbon or any other suitable arc-withstanding, conducting material and are so disposed that the arcing tip 33 will make contact with the arcing tip 34 before the metallic laminations of the contact member 11 make contact with the metallic laminations of the contact member 10 in response to the actuation of the contact member 11 by the actuating member 27. Similarly, the arcing tip 33 will disengage the arcing tip 34 only after all of the metallic laminations of the contact member 11 have disengaged the corresponding metallic laminations of the contact member 10 in response to actuation of the actuating member 27 out of engagement with the lever member 26. Thus, initial contact is always made and final contact always broken between the contact members 10 and 11 by the arcing tips 33 and 34 to prevent injury to the metallic laminations of the contact members by reason of arcing therebetween.

If desired, the laminations of the contact members 10 and 11 may be made of some suitable arc-withstanding material, such, for example, as metallic alloys having suitable electrical conducting characteristics and containing a relatively large proportion of carbon. In the event that such laminations are utilized, the separate arcing tips 33 and 34 may be omitted.

The relatively rigid laminations of the contact member 10 comprise uniformly overlapping portions 35, 36, 37, and 38 that are adapted to be engaged, respectively, by corresponding overlapping portions 39, 40, 41 and 42 of the resilient laminations of the contact member 11. The contact members are so mounted and adjusted that the overlapping portion 39 of the outer lamination of the contact member 11 will make contact with the overlapping portion 35 of the other lamination of the contact member 10 immediately after contact is made between the arcing tips 33 and 34 in response to actuation of the contact member 11 by the actuating member 27. As such actuation is continued, contact is made successively between the portions 36 and 40, 37 and 41, and 38 and 42. As each overlapping portion of the resilient laminations of the contact member 11 is actuated into engagement with the overlapping portion of the corresponding lamination of the contact member 10, a large area of contact surface is secured between the corre-

sponding laminations and the resilient laminations of the contact member 11 engage the rigid laminations of the contact member 10 with a wiping action, which insures firm, clean contact therebetween.

Since the laminations of the contact member 11 are thinner than those of the contact member 10, they will be separated from each other when the contact member 11 is actuated to its final position, in which contact is made between the overlapping portions 38 and 42. The separation of the laminations of the contact member 11 provides ventilating space therebetween, which greatly facilitates cooling of the contact members when they are traversed by currents of relatively high values. The provision of this ventilating space and the large area of contact surface between corresponding laminations of the contact members 10 and 11 increases the current-carrying capacity of the contacting device far beyond that of a contacting device of substantially the same size utilizing a single laminated contact member and a co-operating contact member having a plane contact surface.

While the laminations of the contact member 10 have been referred to as being relatively rigid, it will be seen that they must be resilient to a certain degree, which may be varied by selecting laminations of various mechanical characteristics, as desired. It is only necessary that the laminations of the contact member 10 be substantially more rigid than those of the contact member 11 to insure separation of the laminations of the contact member 11 when it is actuated into engagement with the contact member 10. A relatively slight degree of resiliency in the laminations of the contact member 10 will be found to be advantageous under certain circumstances, as this will facilitate the making of clean, positive contact between the two contact members.

A contacting device constructed in accordance with my invention is peculiarly adapted to be utilized in conjunction with an electrical system wherein initial contact at relatively slight pressure between one or two laminations of each of the contact members is effected in response to the energization of a very sensitive operating electromagnet. When such initial contact is made, a circuit may be completed therethrough for energizing a stronger electromagnet which may be arranged to complete the actuation of the movable contact member to bring all of the laminations thereof successively into contact-making relation with the corresponding laminations of the fixed contact member. As more laminations are brought into engagement, the area of the contact surface is increased, and the current-carrying capacity of the device is likewise increased, thus effecting stronger energization of the elec-

tromagnet to bring all of the laminations into engagement with strong and positive contact pressure. The operating pressure is thus automatically increased from the time that initial contact is made, and the increased current is automatically taken care of. The numerous advantages obtained by the construction of contact members in accordance with my invention, however, render contacting devices so constructed adaptable for application to many other types of electrical devices.

A modified form of my invention that may be utilized for certain applications is shown in Fig. 4. The modification over the form shown in Figs. 1, 2, and 3 consists simply in making one of the contact members, which would usually be the stationary contact member, of solid rather than laminated construction. Such a contact member 10^a comprises a stepped contact surface, each step of which is adapted to be engaged by the overlapping portion of one of the resilient laminations of the cooperating contact member 11^a. The steps are of the same thickness as the laminations would be if the rigid contact member were of laminated rather than solid construction, so that substantially all of the advantages obtained with the relatively rigid laminated contact member are obtained with the solid contact member. Each lamination of the resilient contact member makes contact over a relatively large surface and the several laminations are separated to obtain the same degree of ventilation that would be obtained if a rigid laminated contact member were utilized. The construction of a contacting device utilizing a solid stepped contact member instead of a rigid laminated member would be otherwise the same as shown in Figs. 1, 2, and 3.

Fig. 5 shows contact members constructed in accordance with my invention adapted to be utilized in a relay of the moving coil type. In such a relay a movable contact member 11^b constructed of resilient laminations of conducting material is secured by bolts or screws 43 and co-operating nuts 44 to a resilient armature member 45. The armature member 45 is secured, at the upper extremity thereof, by rivets 46 or other suitable means to a supporting member 47. Two solenoid coils 48 and 49 are secured to the armature member 45 near the lower extremity thereof and a core member 50 of magnetic material extends through these coils. The coil 48 may be made of a relatively large number of turns of fine wire and may be so connected with respect to the electrical system with which the relay is associated as to provide very sensitive means for initiating operation of the relay. The coil 49 may be composed of a relatively small number of turns of heavy wire and so connected that the energizing circuit of this coil will be completed when the

movable contact member 11^b of the relay engages the co-operating stationary contact member 10^b. In this manner, the relay may be caused to initiate contact between the members 10^b and 11^b in response to a comparatively feeble energization of the solenoid coil 48. When contact is made between the first lamination of the movable contact and the co-operating portion of the stationary contact member, the solenoid coil 49 may be energized through such contact to cause the contact member 11^b to be actuated into complete contact with the contact member 10^b. Thus, the coil 49 constitutes a sealing and holding coil for the relay. The structure of my contact members is such as to render them peculiarly adapted to this common form of circuit connection.

It will be apparent to those skilled in the art that my invention may be embodied in a device similar in all essential respects to the device shown in Fig. 5, but utilizing a fixed coil or coils co-operating with a magnetizable portion of the armature member 45. It will be seen also that the number of magnet coils, either movable or fixed, utilized in a device of this character is immaterial in so far as the application of my invention is concerned, and that such number may be one, two or more, depending upon the nature of the electrical system in which the device is to be embodied.

The device shown in Figs. 6 and 7 is similar to that shown in Figs. 1, 2 and 3 in all essential respects, except that it is adapted for horizontal rather than vertical mounting. Such a device comprises a stationary contact member 10^c and a movable contact member 11^c that are mounted by means of terminal and mounting studs 16^c and 28^c, respectively, upon a base member 7^c, which may be a switchboard panel, or the like. The studs 16^c and 28^c comprise shoulder or enlarged diameter portions 51 and 52, respectively, which serve to space the contact member 10^c and 11^c outwardly from the base member 7^c. Nuts 17^c and 29^c are provided to secure the studs 16^c and 28^c to the base member 7^c, and nuts 18^c and 30^c are provided to facilitate the making of electrical circuit connections to the studs 16^c and 28^c, and thence to the contact members 10^c and 11^c.

Outwardly extending portions of the studs 16^c and 28^c extend through suitable apertures in rocker members 13^c and 22^c, to which the contact members 10^c and 11^c are secured by bolts or cap-screws 12^c and 21^c, respectively. The stud 16^c is provided, at the outer extremity thereof, with a nut 15^c to permit clamping the rocker member 13^c in fixed position and electrical conducting relation to the stud 16^c. The position of the contact member 10^c may be adjusted by loosening the nut 15^c and turning the contact member 10^c and rocker member 13^c about the stud 16^c

until the desired position is attained, when the nut 15^c may be again tightened.

A nut 24^c and a lock-nut 25^c are provided for the outer extremity of the stud 28^c to maintain the contact member 11^c and the rocker member 22^c in proper position with respect to the stud 28^c without producing a clamping effect. The stud 28^c thus constitutes a pivotal mounting for the contact member 11^c, and a suitable actuating member 27^c is adapted to engage a relatively rigid strip 53 that is secured in fixed relation to the contact member 11^c by the bolt or cap-screw 21^c to actuate the contact member 11^c into engagement with the contact member 10^c. It will be understood that the actuating member 27^c may be an extension of the armature member of any suitable electrical device, or a manually operable device, as desired.

When the contact member 11^c is pivotally mounted with respect to the stud 28^c, as described, a flexible conductor 31^c, having one terminal connected to the contact member 11^c by the bolt or cap-screw 21^c and the other terminal connected to the stud 28^c between the shoulder portion 52 and the base member 7, is provided to secure proper electrical circuit connection to the contact member 11^c. A spring or counter-weight (not shown) may be provided to actuate the contact member 11^c out of engagement with the contact member 10^c when the actuating member 27^c is released. Ordinarily, however, the weight of the contact member 11^c will be such that the action of gravity will suffice to accomplish this result.

In certain devices the resiliency of the laminations of the contact member 11^c may be sufficient to permit the rocker member 22^c to be securely clamped in position with respect to the stud 28^c by means of the nut 24^c. In such devices the lock-nut 25^c and the flexible conductor 31^c may be omitted, and the actuating member 27 may be utilized to flex the contact member 11^c into proper contact-making relation with the contact member 10^c. This structure is referred to simply to illustrate one of the many modifications to which my invention is adaptable.

From the foregoing description, it will be seen that I have provided a novel method of completing an electrical circuit through a contacting device, which permits such a device of a given size to be so constructed as to have a much greater current-carrying capacity than such devices have formerly had. Clean, positive contact is insured under all conditions by reason of the wiping action between the contact members when they are engaged, and the device is, therefore, very reliable in its operation.

While I have shown and described only certain specific embodiments of my invention, it will be understood that various changes and modifications may be made in

the details of construction and in the application to various types of electrical apparatus, without departing from the spirit and scope of my invention, as set forth in the appended claims.

I claim as my invention:

1. An electrical contacting device comprising a fixed contact member having a stepped contact surface and a movable laminated contact member adapted, when moved substantially normally with respect to the planes of the laminations thereof, to engage the stepped surface of said fixed contact member.

2. An electrical contacting device comprising an adjustable contact member having a stepped surface and a movable laminated contact member adapted, when moved substantially normally with respect to the planes of the laminations thereof, to engage the stepped surface of said adjustable contact member.

3. An electrical contacting device comprising a contact member having a stepped surface, a laminated contact member and means for effecting engagement between said contact members by movement of one of said contact members substantially normally with respect to the planes of the laminations of said laminated contact member.

4. An electrical contacting device comprising a contact member having a stepped surface, a contact member composed of laminations so arranged as to produce a stepped surface and means for effecting engagement between said contact members along said stepped surface by movement of one of said contact members substantially normally with respect to the planes of the laminations of said laminated contact member.

5. An electrical contacting device comprising a relatively rigid contact member having a stepped surface, a co-operating contact member composed of resilient laminations so arranged as to produce a stepped surface and means for effecting engagement between said contact members to cause the laminations of said co-operating contact member successively to make contact with corresponding steps of the stepped surface of said relatively rigid contact member.

6. An electrical contacting device comprising a relatively rigid contact member having a surface composed of step portions, a co-operating contact member composed of resilient laminations the thickness of which is less than that of the step portions of said relatively rigid contact member, and means for effecting engagement between said contact members to cause the laminations of said co-operating contact member successively to make contact with corresponding step portions of said relatively rigid contact member.

7. An electrical contacting device comprising a relatively rigid contact member

having a surface composed of step portions, a co-operating contact member composed of resilient laminations the thickness of which is less than that of the step portions of said relatively rigid contact member, and means for effecting engagement between said contact members to cause the laminations of said co-operating contact member successively to make contact with corresponding step portions of said relatively rigid contact member, and, in so doing, to cause said laminations to separate from each other.

8. An electrical contacting device comprising a contact member composed of relatively rigid laminations so arranged as to produce a stepped surface, a co-operating contact member composed of resilient laminations also arranged to produce a stepped surface, and means for effecting engagement between said contact members to cause the resilient laminations of said co-operating contact member successively to make surface contact with corresponding relatively rigid laminations of said first-mentioned contact member.

9. An electrical contacting device comprising a contact member composed of relatively thick overlapping laminations, a co-operating contact member composed of relatively thin overlapping laminations and means for effecting engagement between said contact members to cause the overlapping portions of the relatively thin laminations of said co-operating contact member successively to make surface contact with corresponding overlapping portions of the relatively thick laminations of said first-mentioned contact member.

10. An electrical contacting device comprising a contact member having a stepped surface, a laminated contact member, co-operating portions of said contact members being composed of electrical conducting and arc-withstanding material, and means for moving one of said contact members substantially normally with respect to the planes of the laminations of said laminated contact member to cause initial contact to be made between said conducting and arc-withstanding portions.

11. An electrical contacting device comprising a contact member having a stepped surface, a laminated contact member, co-operating portions of said contact members being composed of electrical conducting and arc-withstanding material, and means for effecting engagement between said contact members to cause initial contact to be made between said conducting and arc-withstanding portions, and subsequent contact to be made between the stepped surface of said first-mentioned contact member and successive laminations of said second-mentioned contact member.

12. An electrical contacting device com-

- prising a fixed contact member having a stepped surface, a member of electrical conducting and arc-withstanding material secured to said fixed contact member, a movable laminated contact member normally biased out of engagement with said fixed contact member, means for actuating said movable contact member into engagement with said fixed contact member by movement of said movable contact member substantially normally with respect to the planes of the laminations thereof, and a member of electrical conducting and arc-withstanding material so resiliently mounted with respect to said movable contact member as to engage said first-mentioned arc-withstanding member before engagement is effected between said contact members and to disengage said first-mentioned arc-withstanding member after said contact members are disengaged.
13. An electrical contacting device comprising a relatively rigid contact member having a stepped surface, a co-operating contact member composed of resilient laminations so arranged as to produce a stepped surface and operating means for effecting engagement between said contact members, said contact members being so disposed that a relatively slight pressure on said operating means will effect engagement between one of the laminations of the co-operating contact member and a corresponding portion of the stepped surface contact member and increasing pressure on said operating means will effect engagement between successive laminations of the co-operating contact member and corresponding portion of the stepped surface contact member to increase the total area of contact surface between said contact members.
14. An electrical contacting device comprising a relatively rigid contact member having a stepped surface, a co-operating contact member composed of resilient laminations so arranged as to produce a stepped surface and operating means for effecting engagement between successive laminations of said co-operating contact member and corresponding portions of said stepped surface contact member as increasing pressure is applied to said operating means.
15. An electrical contacting device comprising a relatively rigid contact member having a stepped surface, a co-operating contact member composed of resilient laminations so arranged as to produce a stepped surface and operating means for effecting engagement between successive laminations of said co-operating contact member and corresponding portions of said stepped surface contact member to increase the area of contact surface between said contact members as increasing pressure is applied to said operating means.
16. An electrical contacting device comprising a relatively rigid contact member having a stepped surface, a co-operating contact member composed of resilient laminations so arranged as to produce a stepped surface and operating means for effecting wiping engagement between successive laminations of said co-operating contact member and corresponding portions of the stepped surface of said relatively rigid contact member.

In witness whereof, I have hereunto subscribed my name.

EDWIN S. TRUE.