Aug. 25, 1953 B. VOLGOVSKOY 2,650,284

ELECTRICAL CONTACT ASSEMBLY

Filed Dec. 21, 1951 2 Sheets-Sheet 1

Fig. 1.

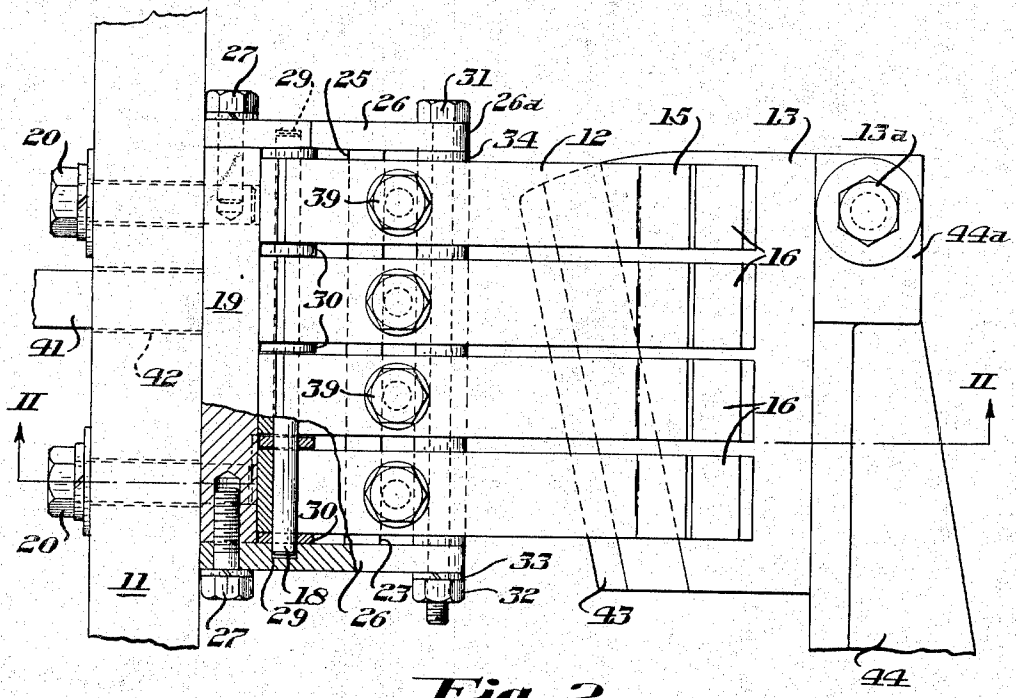


Fig. 2.

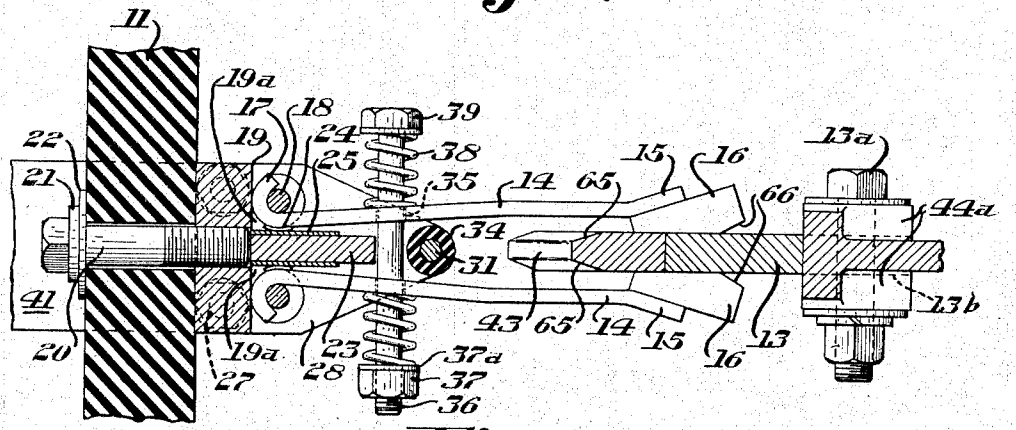
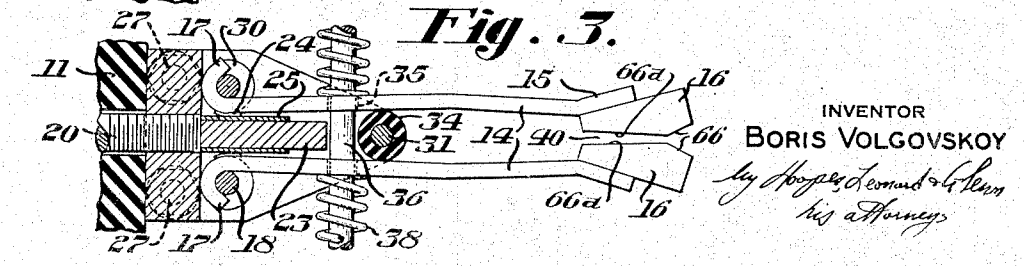


Fig. 3.



INVENTOR
BORIS VOLGOVSKOY
by Hopgood, Leonard & Glenn
his Attorneys

Aug. 25, 1953 B. VOLGOVSKOY 2,650,284

ELECTRICAL CONTACT ASSEMBLY

Filed Dec. 21, 1951

2 Sheets-Sheet 2

Fig. 6.

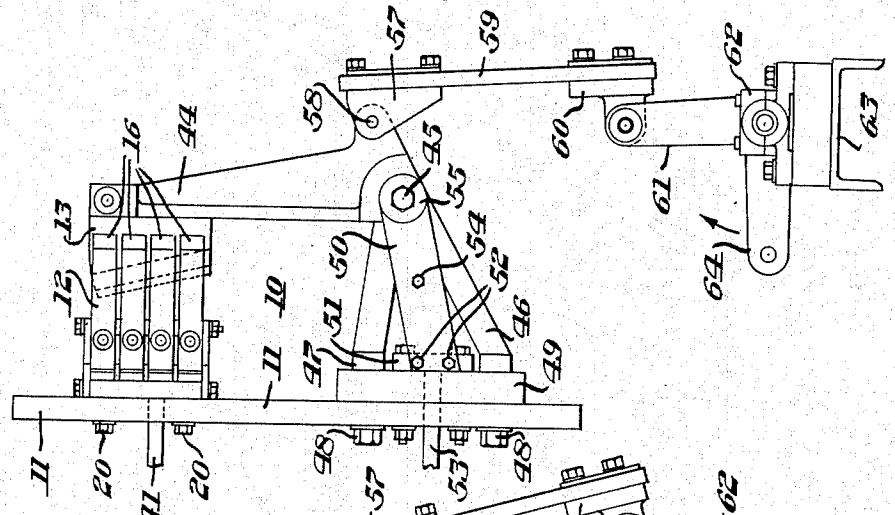


Fig. 5.

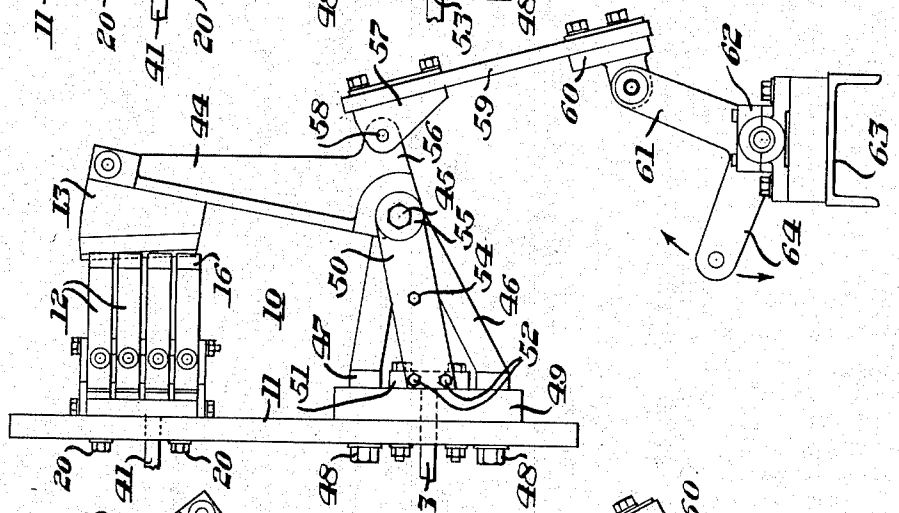
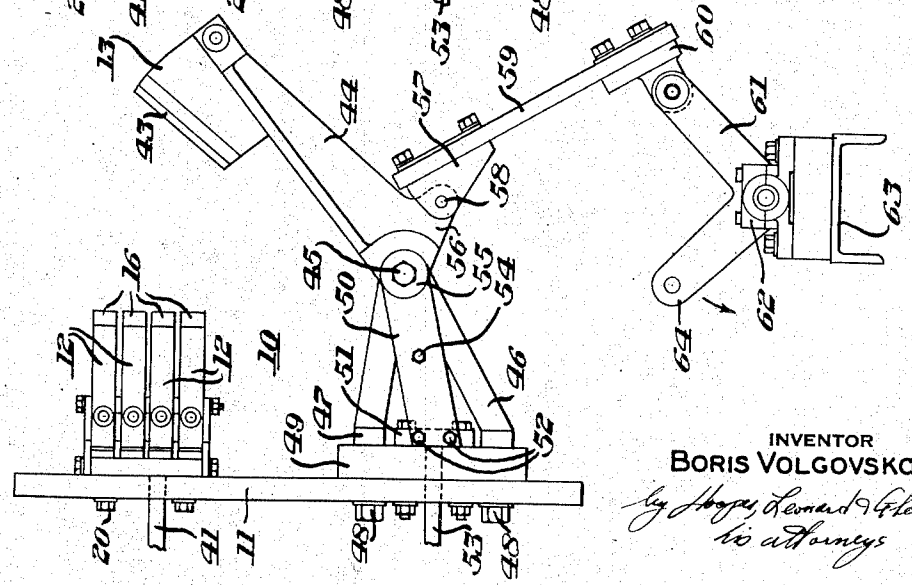


Fig. 4.



INVENTOR
BORIS VOLGOVSKOY
by Hoopes, Leonard & Glenn
his attorneys

Patented Aug. 25, 1953

2,650,284

UNITED STATES PATENT OFFICE

2,650,284

ELECTRICAL CONTACT ASSEMBLY

Boris Volgovskoy, Mount Lebanon Township, Allegheny County, Pa., assignor, by mesne assignments, to McGraw Electric Company, a corporation of Delaware

Application December 21, 1951, Serial No. 262,700

3 Claims. (Cl. 200—162)

1

This invention relates to a new electrical contact assembly for current-interrupting service. More particularly, it pertains to a novel contact construction of the knife-edge and laterally separable blade type in which there is material localizing of any arcing and pitting in service and in which any part affected is readily adjustable and/or replaceable as occasion demands.

One form of electrical contact assembly heretofore used had laterally separable contacts which in use, regardless of how quickly the contacts were opened or closed, had a tendency to arc and pit not only at the outer ends but also intermediate the ends of the separable contacts. The supporting bar for the separable contacts was similarly affected. On the other hand, without such a supporting bar, there would have been no practicable way to mount the separable contacts and hold them in proper position regardless of whether the switch were opened or closed. In many such constructions, also, the assembly was so integrated that the removal of even a part thereof was a relatively difficult task and sometimes had the result that the pitting of only a portion of the assembly might cause the entire assembly to have to be discarded. Further, in other cases, the construction was such that the arcing and pitting described adversely affected not a removable portion only of the entire assembly but so much of it that, again, the entire unit might have to be wholly discarded.

In the new combination of this invention, the foregoing difficulties have been overcome. Regardless of the magnitude of the current flow to be started or interrupted by the new contact assembly disclosed herein, arcing and pitting are materially localized and confined to the part especially designed for such phenomena. At the same time, that part is affected only in the prescribed portion thereof adapted for it and there is no arcing or pitting intermediate the ends of the laterally separable contacts. In this new construction provision is made for a plurality of separable contacts in a tiered arrangement and novelly hinged and connected for the ready disassembly of any part of the entire assembly affected by any arcing and/or pitting. Means are also provided in this new case for confining any arcing and pitting which does occur in the use of the new switch mechanism to generally not more than one of the contacts in the tiers. As a consequence, the new construction is relatively trouble-free and inexpensive to maintain and will provide longer life and more effective service than prior devices of the same general type.

2

Other objects and advantages will be apparent from the following description and from the drawings, which are illustrative only, in which:

Figure 1 is a view in elevation, partly in section, of one embodiment of the new construction of this invention;

Figure 2 is a view taken along line II—II of Figure 1;

Figure 3 is a view similar to the view shown in Figure 2 with, however, the movable contact out of engagement with the elongated contacts thereby placing the new assembly in open circuit condition;

Figure 4 is a view in elevation of the new assembly with the circuit in circuit open condition, the elongated tier contacts being in position as shown in Figure 3;

Figure 5 is a view in elevation of the new assembly shown in Figure 4 with the movable contact in the intermediate position of initial circuit closing or final circuit opening position relative to the elongated tier contacts; and

Figure 6 shows the new assembly in circuit closed condition corresponding to the position shown in part in Figure 1.

Referring to the drawings, a new assembly 10 made in accordance with one embodiment of this invention may be used, for example, in a transformer circuit switch for interrupting electric current flow in the course of tap-changing under load. A panel 11 of suitable insulating material and sufficient structural strength may be used for the mounting of the relatively fixed elongated tier contacts 12 and their cooperating relatively movable knife-edge contact 13. Elongated contacts 12 are in a tiered arrangement as shown in Figures 1 and 4 to 6. Each tier has one contact 12 therein which comprises elongated opposed sides 14, the outer ends 15 of which may be outwardly flared and may be provided with arc-resisting electrically conductive tips 16. The sides 14 may be constructed of a highly electrically conductive metal or metal alloy. The inner ends 17 of the respective sides 14 in each contact 12 are outwardly bent so as to partially surround a hinge pin 18 for hinging action therewith.

A conductive contact block 19 is rigidly bolted to panel 11 by bolts 20, a lock washer 21 and a positioning washer 22 being also provided. In horizontal section block 19 is generally T-shaped, the bent ends 17 fitting into the respective corners 19a between the head of the T and the stem 23 to retain the respective ends 17 of each side of each contact 12 in hinging relation rela-

tive to the respective pins 18 on the two sides of the stem 23 integral with block 19. A pad 24 may be bonded to the insides of the respective sides 14 adjacent ends 17 and may be made of a high conductivity silver alloy for rubbing engagement against a collector plate 25 of similar metal bonded to block 19 along each side of stem 23. Thus, regardless of whether a contact 12 is in its opened or separated position as shown in Figure 2, or, in its closed position as shown in Figure 3, the pads 24 bear against the respective collector plates 25. Each collector plate 25 may extend the entire height of block 19 thereby making engagement with all of the pads 24 of all the contacts 12 in the respective tiers. The pads 24 may be affixed to the respective sides 14 by soldering or other surface-to-surface bond and similar surface-to-surface contact may be provided between the respective plates 25 and block 19.

A pair of cap plates 26 extend in the same general direction as elongated contacts 12 and are secured to the assembly by bolts 27 engaging aligned and correspondingly tapped holes in block 19. The opposed faces 28 of cap plates 26 have countersunk openings 29 therein on each side of stem 23 to serve as aligned sockets on each side of stem 23 for the respective ends of each hinge pin 18. Vertical spacing of the contacts 12 along the height of the hinged pin 18 is obtained by means of washers 30 interposed between sides 14 of adjoining contacts 12 and between cap plates 26 and contacts 12 as the case may be.

The outer ends of the respective cap plates 26 are drilled for the passage of a bolt 31 therethrough, a nut 32 and lock washer 33 being used to hold bolt 31 tightly in place. A tubular sleeve 34 of Bakelite or fiber electrical insulation fits over the shank of bolt 31 between the opposed faces 28 of plates 26. By making sleeve 34 to relatively close dimensions, and tightening up on nut 32, the outer ends 26*a* of the plates 26 can be made very rigid in the course of assembling the new device.

Intermediate the ends of each contact 12, the sides 14 thereof are provided with openings 35 therethrough, the said openings being in alignment. Through those openings in each tier, a bolt 36 is passed to serve in conjunction with a nut 37 as a retainer for the springs 38. The springs 38 are positioned between the outside of the respective sides 14 and the head 39 of the bolt on the one hand and nut 37 on the other hand. In general, the springs 38 will be of equal strength to exert similar force on the respective sides 14 of each contact 12. In addition, a lock washer 37*a* or other means such as a cotter pin may be used to prevent any change in the distance between head 39 and nut 37. By the same token, the force exerted by the respective springs 38 on each bolt 36 can be adjusted as required by changing the distance between the head 39 and the nut 37 in assembling the new device. Since the diameter of the springs 38 is greater than that of the holes 35, the springs 38 act to push the sides 14 of each contact 12 in each tier into the closed or unseparated position shown in Figure 3.

The height of the sides 14 at each end 17 in each contact 12, the proportions of the washers 30, the relative fit of inner ends 17 around the hinge pins 18 and, the fit of the aforesaid corners 19*a* in holding ends 17 in hinging relation relative to the pins 18, are such that each side

14 in each of the tiers extends outwardly in a firm manner so that no side of any contact 12 will droop. Instead, all contacts 12 will remain parallel, as shown in the drawings, throughout their period of service. In their position the inner sides of sides 14 of each contact 12 bear against sleeve 34, the exterior diameter of which is selected to maintain a gap 40 between the respective tips 16 of each pair of contacts 12 when in the position shown in Figure 3. The gap 40 lies one-half on each side of a median plane passing through the axis of bolt 31 and midway between the sides 14 of the respective tiers 12. A bus-bar 41 is welded to block 19 and passes through an opening 42 in panel 11 for connection with whatever circuit the new contact assembly of this invention may be used.

The relatively movable contact 13 is in the form of a knife blade of a conductive metal and is provided with a tapered nose 43 which may also be made of an arc-resisting refractory conductive material welded or otherwise bonded to the back of knife edge 13. Contact 13 is bolted by a bolt 13*a* to a metal arm 44 which swings in an arc about a pivot bolt 45. Contact 13 is readily removable and is provided with a rearwardly extending tenon 13*b* which fits in a slot between lugs 44*a* integral with arm 44. The tenon 13*b* and lugs 44*a* are drilled through an alignment for receipt of the bolt and nut assembly 13*a* which holds contact 13 rigidly in place on arm 44 so as to form a rigid integral part thereof during movement and service.

Pivot bolt 45 passes through drilled openings in the sides of the lower clevised end of arm 44 and may be mounted in any suitable manner. In the assembly 10, pivot bolt 45 passes through an aligned drilled opening through the outer end of a V-shaped bracket 46 of metal having its respective bases 47 rigidly held in place by bolts 48 extending through panel 11 and an insulating mounting block 49 into correspondingly drilled and tapped openings in bases 47. The bracket 46 fits between the sides of the drilled and bushed lower clevis end of arm 44 through which bolt 45 also passes.

Outwardly of the sides of arm 44 are a pair of metal conductor bars 50 extending between pivot 45 and a lower conductive block 51. Bolts 52 fasten the ends of bars 50 adjacent block 51 to the respective sides thereof. A bus-bar 53 is welded to block 51 and extends through registering openings in insulation members 49 and 11 to be connected to another part of the aforesaid circuit in connection with which the new device may be used so as to permit electric current to flow through said circuit when the parts of the new device are in the position shown in Figure 6 and to interrupt the flow of such current when the parts are in position shown in Figure 4.

A bolt and nut assembly 54 connects the bars 50 on opposite sides of arm 44 to assist in holding the relative members surrounding pivot bolt 45 in position without undue play. Suitable washers may be placed on pivot 45 between the sides of the bracket member 46 and the inside of the clevis of arm 44. Belleville washers 55 may be employed between the head and nut respectively of the pivot bolt and nut subassembly 45 to provide locking and good contact during the arcuate swinging of arm 44 and contact 13 in the aforesaid median plane in the course of service as shown in the positions illustrated in Figures 4 to 6.

The lower end of arm 44 is also provided with an extension 56 which fits between the sides of a

clevis 57 to which it is hingedly connected by a pin 58. Clevis 57 is bolted to a connecting member 59 which may be of suitable laminated Bakelite or insulated fiber material. The lower end of connecting member 59 may be bolted in turn to a bracket 60 pivotally connected to a bell crank 61. Bell crank 61 may be arcuately rotated in a conventional bearing block 62 fastened to a structural frame member 63, forming a part, for example, of the transformer tap-changer or other structure with which the new device is to be used. The ends 64 of crank 61 may be connected to a conventional toggle mechanism or other device for moving arm 44 through an arc of the magnitude depicted by the extreme positions shown in Figures 4 and 6 in response to the demands of the circuit in which the new device is connected to make and break the circuit respectively by the engagement and disengagement of contacts 12 and 13.

The acute angle defined by and between the surfaces 65 of the nose 43 corresponds generally to the angle formed by the provisional engagement surfaces 66 of tips 16 when in the unseparated position as shown in Figure 3. Further, in the embodiment shown, a line joining either the tips 16 or the surfaces 66 of the contacts 12 in the respective tiers, is a vertical line. On the other hand, there is no coincidence between that vertical line and the line of direction in which nose 43 extends in the median plane midway between the surfaces 65 and parallel thereto. Hence, in making initial engagement as in the case of contact 13 being swung from a position as shown in Figure 4 to a position as shown in Figure 5, the uppermost contact 12 would have its tips slidably engaged first by the uppermost part of nose 43. Further movement of contact 13 into full engagement position, fully closing the circuit through the bus-bars 41 and 53, will successively provide contact with each of the other contacts 12 in turn moving from top to bottom thereof as shown in Figures 5 and 6. In such full engagement, the engagement surfaces 66a bear against contact 13.

Conversely, in interrupting the current flowing through the new assembly 10, the lowermost contact 12 will return to the position shown in Figure 3 to be followed in turn by the successive disengagement of the contacts 12 immediately above from any bearing against contact 13, while contact 13 is returning from a position as shown in Figure 6 to a position as shown in Figure 4. In this way, whatever arcing occurs will substantially be entirely at the tips 16 of the uppermost contact 12 and at the uppermost part of nose 43. As and when those tips 16 as a consequence might warrant resurfacing or replacement, the upper cap plate 26 may readily be removed enabling the sides 14 of uppermost contact 12 to be lifted off the hinge pins 18 for such resurfacing or replacement by another contact 12 without affecting the contacts 12 on the lower tiers. On the other hand, the ends 17 of sides 14 may be made short enough while still providing suitable hinging contact to enable any side 14 of any tier 12 to be withdrawn from the assembly by first removing the parts 36—37—38 engaging the side 14 to be removed and then swinging that side 14 outwardly until the end 17 thereof can be slid out in the space between its hinge pin 18 and its collector plate 25 and in a direction toward and normal to the axis of bolt 31.

Moreover, even if the arcing that does occur in connection with the uppermost tier 12 should

eventually offer undue resistance to the flow of current through the uppermost contact 12 when the switch is closed, the lower tiers 12 will readily provide a conductive path for any resulting augmented flow of electric current therethrough. Thereby, the new electrical contact assembly of this invention may be continued in service with assurance that at all times there will be effective load carrying capacity in the new assembly and that there can be no intermediate arcing along any of the sides 14 because of the insulating nature of the sleeve 34 at the time of relative movement of the sides 14 in any contact 12 due to the swinging of movable contact 13 in the median plane. At the same time whenever any contact part of the relatively fixed contacts 12 or the movable contact 13 does require redressing or replacement, its removal and/or replacement may readily be performed. If desired, conventional arc chutes may be used to enclose the fixed contact assembly comprising the contacts 12, suitable openings being provided in the chute for the engagement and disengagement of contact 13 relative to the contacts 12.

The new construction of this invention may be variously embodied without departing from the spirit of the invention as defined by the appended claims.

I claim:

1. In an electrical contact assembly, in combination, a contact having a pair of generally elongated oppositely disposed sides, a hinge pin adjacent one end of said sides, at least one of said sides having its adjacent end fitting around said hinge pin to hinge said side, a non-conductive stop positioned between said sides intermediate the respective ends thereof including a cross bolt and an insulating sleeve surrounding said bolt, means for relatively pressing said sides toward each other and against said stop when said assembly is in open circuit condition, and a contact movable relative to said first-mentioned contact into and out of engagement with and between the other ends of said first mentioned contact to make and break an electrical circuit and an arc resisting electrically conductive tip at the outer end of each contact side member.

2. An electrical contact assembly, in combination, a plurality of generally elongated contacts in tiered arrangement, each of said contacts having a pair of oppositely disposed spaced sides, means for hinging all of said contacts adjacent a corresponding end of each thereof, means for relatively pressing said sides toward each other, an insulating stop positioned between the respective sides of each contact intermediate the ends thereof including a cross bolt and an insulating sleeve surrounding said bolt, and a contact movable relative to said first-mentioned contacts generally in a median plane between the respective sides of said first-mentioned contacts to make and break an electrical circuit and an arc resisting electrically conductive tip at the outer end of each contact side member.

3. In an electric current making-and-breaking contact assembly, in combination, a plurality of generally elongated parallel contacts, each contact comprising a pair of separable sides, a T-shaped contact block, the stem of said block extending between the inner ends of said sides respectively of said contacts, cap plates in opposed relation fastened to the ends of said block, hinge pins extending between said cap plates adjacent said stem, a collector plate bonded to said block along each side of the stem thereof, the

inner ends of said respective sides of each of said contacts partially surrounding the adjacent hinge pin and extending between it and the corner of said contact block adjacent thereto, said sides being in continuous engagement with said collector plate, adjustable resilient means engaging the respective sides outwardly of the respective block, an insulating stop extending between and connected to said cap plates outwardly of said block, said stop having a diameter sufficient to provide a gap between the outer ends of said sides of said contacts when said sides are pressed against said stop by said means.

BORIS VOLGOVSKOY.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,978,246	Bauerschmidt	Oct. 23, 1934