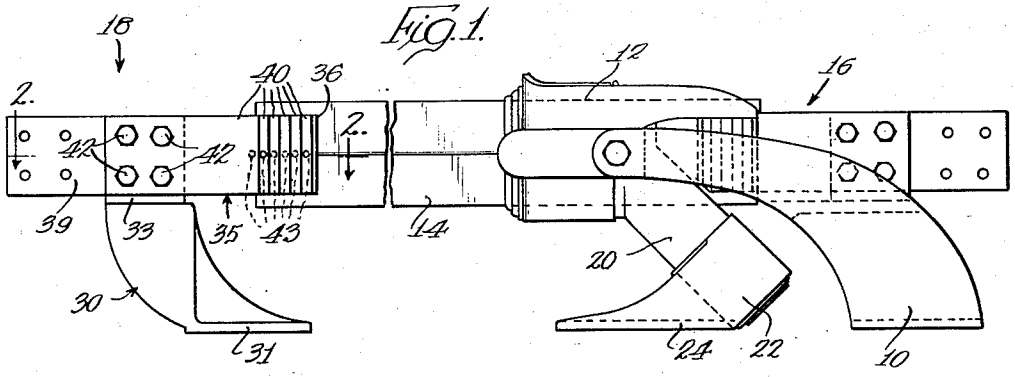
March 26, 1957 C. H. STUMPFHAUS 2,786,922

HIGH CAPACITY CONTACT ASSEMBLY

Filed Dec. 14, 1955

Fig. 1.



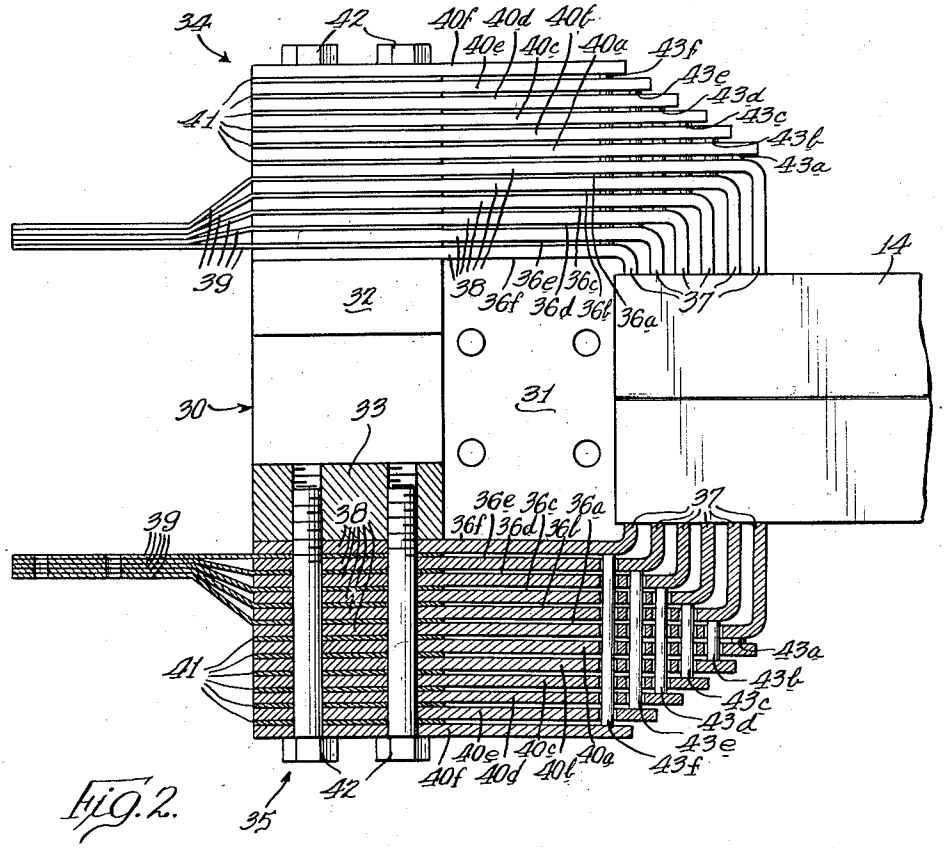


Fig. 2.

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HIGH CAPACITY CONTACT ASSEMBLY

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The present invention relates to high capacity electric switches, and particularly to an improved high pressure contact assembly therefor.

In the high capacity switch art, it has long been known that high pressure contact is vastly preferable to low pressure contact in insuring good electrical connection between a switch blade and contact structure, that high pressure contact is accommodated by maintaining the area of contact small, and that a small area of contact is efficient to carry load if contact pressure is adequate. In accordance with these principles, a large number of small area, high pressure contact structures for high capacity switches has heretofore been proposed.

It is the object of the present invention to provide an improved contact assembly for high capacity switches.

More particularly, it is an object of the invention to provide an improved small area, high pressure contact assembly for switches characterized by one or more contact plates engaging at their edge surfaces only against the switch blade.

Another object of the invention is to provide an improved high capacity contact assembly comprising a plurality of parallel contact plates disposed transversely of the switch blade to engage the blade only at the outer edge surface thereof.

A further object of the invention is the provision of an improved high capacity contact assembly comprising a plurality of contact plates as above defined and an individual spring for each plate biasing the edge surface of the respective plate into high pressure contact with the switch blade, thus to accommodate formation of the contact plates from the best suited conductor material and formation of the springs from the best suited spring material to insure high pressure, high conductivity contact engagement between the switch blade and the contact assembly.

A still further object of the invention is the provision of an improved high capacity contact structure comprising a compact laminated assembly of a plurality of superposed L-shaped contact plates each presenting an edge for engagement with a switch blade, a plurality of superposed leaf springs of the same number as the contact plates superposed on the contact plates, and means extending between respective ones of said springs and plates to transmit spring force to each contact plate, the contact plates and spring leaves being secured together at the ends thereof remote from the switch blade contacting edges of said plates.

An additional object of the invention is to provide an improved high capacity contact assembly of economical, yet sturdy construction insuring continued high pressure, high conductivity contact engagement over exceedingly long periods of time and use.

Other objects and advantages of the present invention will become apparent in the following detailed description of a preferred embodiment of the invention.

Now, in order to acquaint those skilled in the art with

the manner of making and using my high capacity contact assembly, I shall describe, in connection with the accompanying drawing, a preferred embodiment of the invention and a preferred manner of making and using the same.

In the drawing, wherein like reference numerals indicate like parts:

Figure 1 is a side elevation of a high capacity switch including the contact assembly of the present invention; and

Figure 2 is an enlarged view, partly in plan and partly in horizontal cross-section, of the contact, the sectional part of the view being taken substantially on line 2—2 of Figure 1.

Referring now to the drawings, and particularly to Figure 1, I have shown, by way of example and for purposes of thorough explanation, my improved contact assembly embodied in a high capacity air break switch of a type well known in the art. As shown, the switch includes a stationary mounting frame 10, a blade guide or hinge 12 pivotally mounted on the frame 10, and a switch blade 14 journalled in the blade guide for rotation about its own axis. The switch blade 14 extends to the opposite sides of the blade guide 12, and in its closed position, as shown in Figure 1, engages at its rearward end in a contact assembly 16 mounted on the frame 10 and at its forward end in a spaced stationary contact assembly 18 which is similar to or identical with the assembly 16. The operating mechanism of the switch comprises an arm 20 fixed to the blade 14 and extending downwardly therefrom at an angle of approximately 45° to the blade axis, the arm being rotatably received at its lower end within a complementary socket 22 provided on a rotatable operating crank 24. In a preferred embodiment of the switch, the pivot axis of the guide 12, the axis of the switch blade 14 and the axis of rotation of the operating crank 24 are disposed perpendicular to one another in the closed position of the blade, and these three axes and the axis of the arm 20 intersect in a common point. In use, as the crank 24 is rotated, the switch blade 14 is simultaneously rotated about its axis and swung in an arc about the pivot axis of the blade guide in a known manner.

To provide high pressure contact engagement, the switch blade 14 may be flattened at its ends, or may comprise a square tube, as is shown. In the closed position of the switch, the major cross-sectional dimension of the blade end, i. e., a diagonal of the square tube, is disposed perpendicular to the contact member in high pressure engagement therewith. As rotation of the operating crank in the direction to open the switch commences, the movement imparted to the blade by the crank arm 20 is predominantly a rotary movement of the blade about its own axis to rotate the major dimension of the blade out of perpendicular relationship to the contact members and to rotate the minor cross-sectional dimension of the blade toward perpendicular relationship with the contact members, thus to alleviate or reduce the engaging pressure between the contacts and the blade. As contact pressure is relieved, resistance to arcuate movement of the blade is decreased and the blade is readily swung in an arcuate path about the pivot axis of the blade guide or hinge 12 to move the forward end of the blade upwardly out of the contact assembly 18 and to move the rearward end of the blade downwardly out of contact assembly 16, thus to open the switch, the switch blade in open position being disposed substantially in a vertical position and aligned with the axis of rotation of the operating crank 24. Upon rotation of the crank 24 in the direction to close the switch, the sequence of operation is generally reversed, with the blade being moved

into the contacts with relatively low contact pressure and then being rotated to move the portion of major cross-sectional dimension thereof into final high pressure engagement in the contact assemblies.

Switches of this general nature are well known and have proven highly successful in the art, and several embodiments thereof are disclosed and claimed in United States Letters Patent No. 2,231,992, No. 2,316,844 and No. 2,527,924.

The contact assemblies 16 and 18 of the switch shown in Figure 1 are constructed and embodied in the switch in accordance with the present invention and are preferably identical. Referring now to Figure 2, one contact assembly of the invention is shown as comprising a generally U-shaped base 30 including a bight portion 31, adapted to be bolted or otherwise secured to the upper end of an insulator stack (not shown), and a pair of upstanding spaced parallel legs 32 and 33. The legs 32 and 33 of the base support a pair of contact subassemblies 34 and 35 of identical form which are mounted on the base in opposed relation to one another. Each of the contact subassemblies 34 and 35 comprises a laminated assembly of contact plates and springs, including a plurality of contact plates or members 36 having portions 37 extending in spaced parallel relation to one another and terminating at their free outer ends substantially in a common plane parallel to the switch blade. While the portions 37 may extend at various angles to the axis of the blade, I prefer that the same extend perpendicular to the blade 14 when the switch is closed, and that the same terminate at their outer ends in a common plane at right angles to the portions. As thus disposed, the free outer edges of the portions 37, being of thin plate form, comprise small area contact surfaces for engagement with the blade. Due to the fact that substantially only a line i. e., a corner edge of the square tube, is exposed on the blade for engagement with the contact members, the free outer edges of the members actually define contact points, as will be explained in greater detail hereinafter.

To facilitate mounting thereof, the contact plates 36 each include a mounting portion 38 extending at an angle from the inner ends of the contacting portions 37. As thus formed, a compact assembly of a plurality of the contact members is effected by forming the angularly shaped members of progressively increasing size from the inner one to the outer one thereof, and nesting the same together so that the contacting portions 37 extend in spaced parallel relation to one another, and the mounting portions 38 are superposed on one another. In the preferred embodiment of the invention, the contact members are L-shaped, the contacting portion 37 comprising the base leg of each L and extending perpendicular to the blade, and the mounting portion 38 comprising the main leg of the L and extending in spaced parallel relation to the switch blade in the closed position of the blade.

The contact subassemblies in the completed switch must afford good electrical contact with the line terminal, and while this may be accomplished through the contact base 30, I prefer to incorporate terminal leads 39 in each subassembly. As shown, the leads 39 are preferably one less in number than the contact members 36 and are interleaved at one end thereof with the free outer end portions of the main legs 38 of the contact members in intimate contacting engagement therewith. As thus mounted, the leads 39 also serve to separate the main legs 38 of the contact plates or members to accommodate independent movement of the plates. Adjacent their outer ends, the terminal leads 39 are brought together in intimately engaging superposed relation and are provided with bolt holes to facilitate attachment thereto of a line terminal.

As is known in the art, copper is the preferred material for the contact members 36 and terminal leads 39 because of its excellent conductivity. If desired, of course, silver contacts could be provided at the outer edges of the portions 37 of the contact members 36. However, copper has exceedingly little inherent resiliency, and is not in and of itself suitable for effecting high pressure engagement with the switch blade. Therefore, spring means are required. Various alloys have been suggested for switch contacts to afford both relatively high conductivity and resiliency, but it is obvious that some sacrifice in both conductivity and resiliency must be made to accommodate the combination of both characteristics in one material. For these reasons, I prefer to employ contact members made of copper and to provide separate spring means therefor, the spring means being formed of spring steel or the like affording optimum resiliency. More particularly, I provide a separate spring for each of the contact members 36 to bias each of the members into high pressure engagement with the switch blade irrespective of irregularities or the like in the blade or the contact edges or points of the contact members.

As shown in the drawings, the contact members 36 comprise a nested assembly of a given number of angular members of progressively increasing size from the inner to the outer sides thereof. To cooperate with such assembly, I provide an equal number of leaf springs 40 of progressively decreasing size superposed on one another and superposed in turn on the main legs 38 of the contact members 36 to the side of the legs 38 opposite the side to which the legs 37 extend. To separate the springs from one another, and to accommodate independent movement thereof, separators 41 are provided between the outer contact 36 and the adjacent spring 40 and between adjacent springs. The springs 40, from the inner to the outer ones thereof, are of the same length, respectively, as the main legs 38 of the contact members 36 from the outer to the inner ones thereof, so that the longest contact plate and the longest spring are disposed adjacent one another at the center of the resulting laminated stack of contacts and springs. To maintain the relationship defined, the springs 40, main legs 38, terminal leads 39 and separators 41 are clamped together adjacent the free ends of the legs 38 by means of bolts 42 or the like. The springs 40 are paired with the contact members 36 of corresponding length; that is, the outer contact member 36*a* is paired with the inner leaf spring 40*a*, the next inward contact 36*b* is paired with the next outward spring 40*b* and so on in the pairs 36*c*—40*c*, 36*d*—40*d*, 36*e*—40*e* and 36*f*—40*f*, as shown in the drawings, according to the number of contacts employed in a given assembly.

To establish operative engagement between the paired springs and contacts, pins 43*a*, 43*b*, 43*c*, 43*d*, 43*e* and 43*f*, respectively, are provided, the pins extending perpendicularly between the respective spring and contact member adjacent the ends thereof opposite the ends at which the springs, contacts, terminal leads and separators are secured together. Specifically, pin 43*a* is provided between and adjacent the ends of the longest leaf spring 40*a* and the main leg 38 of the longest contact member 36*a*, the pin 43*a* being suitably secured to one or the other of the spring 40*a* and the contact 36*a*. In the case of the remaining pairs of springs and contacts, the springs and contact plates or members intermediate or between a given pair are apertured along a line extending transversely of the springs and contact plates adjacent the outer ends of the corresponding spring and plate to define a passage therebetween within which the respective pin is slidably received, thus operatively to connect the spring and contact plate and at the same time retain the pin in place. By way of specific example, the shortest or outermost spring 40*f* is connected to the shortest or innermost contact plate 36*f* by means of the pin 43*f* which extends slidably through aligned apertures provided in the plates 36*e*, 36*d*, 36*c*, 36*b* and 36*a*, and the springs 40*a*, 40*b*, 40*c*, 40*d* and 40*e*, adjacent the ends of the members 36*f* and 40*f*. The length of the respective pin is preferably such

as to maintain spring force on the respective contact at all times.

As thus constituted, the respective contact subassemblies **34** and **35** are secured to the legs **32** and **33** of the contact base **30**, suitably by means of the bolts **42**, in the relationship previously described, and shown in the drawings.

In use, as the square tube switch blade **14**, or an equivalent blade, is moved arcuately downward into the contact assembly **18**, or upward into the contact assembly **16**, the major cross-sectional dimension of the blade is inclined to the contact subassemblies **34** and **35** so that the blade may be moved relatively easily between the juxtaposed outer contact edges of the portions **37** of the contact plates. However, the normal spacing of the contact edges of the two subassemblies **34** and **35** is such that the blade engages in electrical contact with the contact members. Thereafter, as the switch blade is rotated about its own axis, the major cross-sectional dimension of the blade is rotated into position perpendicular to the contact subassemblies, during which rotation the outer free ends of the contact plates **36** of each subassembly are moved outwardly to bias the free end of the springs **40** outwardly by means of the pins **43** thus to increase the spring force exerted on the contact plates or members. Finally, when the blade is stopped in its closed position, substantially only longitudinal lines on diametrically opposite sides of the switch blade, i. e., opposite corners of the square tube, engage the free outer edges of the portions **37** of the contact plates so that electrical contact between the blade and contact assembly is limited to a plurality of points on each side of the blade, each point of contact being a high pressure contact by virtue of the springs **40**. Thus, extremely high pressure engagement over a very small area is accommodated between the blade and its contact to improve upon the known, desirable characteristics of high pressure, small area contacts. Moreover, such high pressure small area contact is established, according to the invention, in an optimum manner, utilizing optimum materials of construction in a compact, economical and highly efficient assembly.

While I have described and shown what I regard to be a preferred embodiment of my invention, it will be appreciated that various changes, rearrangements and modifications may be made therein without departing from the scope of the invention, as defined by the appended claims.

I claim:

1. A contact assembly for high capacity switches having a switch blade movable into and out of the contact to close and open the switch, said assembly comprising a plate-like contact member disposed transversely of the switch blade in the closed position of the blade, said member having a free outer edge engageable with the blade, and an individual spring operatively engaging said member and biasing said member in the direction forcibly to engage said outer edge thereof with the blade.

2. A contact assembly for high capacity switches having a switch blade movable into and out of the contact to close and open the switch, said assembly comprising a plurality of spaced parallel plate-like contact members disposed transversely of the switch blade in the closed position of the blade, said members terminating at their outer ends substantially in a common plane parallel to the blade and each having a free outer edge engageable with the blade, and an individual spring for each of said members, said springs each operatively engaging the respective member and biasing the respective member in the direction forcibly to engage said outer edge thereof with the blade.

3. A high capacity contact assembly comprising a plurality of nested contact plates of angular shape and progressively increasing size, each of said plates including a base leg and a main leg, said main legs being superposed and secured together at the ends thereof opposite said base legs, said base legs extending parallel to one another and terminating at their free ends substantially in a common plane, the outer edges of said base legs at the free ends thereof comprising contact points, and a leaf spring operatively associated with the main leg of each of said contact plates to the side thereof opposite the side from which said base legs extend, said leaf springs being anchored at one end thereof and operatively engaging the respective main leg adjacent the free end of the main leg to bias said contact plates in the direction in which said base legs extend.

4. A contact assembly for high capacity switches having a blade movable into and out of the contact to open and close the switch, said assembly comprising a plurality of plate-like contact members each including a main leg and an angularly related base leg, said contact members being of progressively increasing size and being nested with said main legs superposed on one another and said base legs disposed in parallel relation to one another, said base legs extending at an angle to the switch blade in the closed position of the blade and terminating at their free outer ends substantially in a common plane parallel to the blade, an individual spring for each of said contact members, said springs comprising a stack of superposed leaf springs superposed on the main legs of said contact members to the side thereof opposite that to which said base legs extend, said springs and said main legs being anchored adjacent the ends thereof opposite said base legs, and an individual connector extending between the opposite ends of each main leg and a spring to establish operative connection between each spring and a contact member, said springs biasing said contact members in the direction in which said base legs extend forcibly to engage the outer edges of said base legs with the switch blade.

5. A high capacity contact assembly comprising a plurality of superposed contact plates, an equal number of superposed leaf springs superposed on said contact plates, said plates and springs being secured together adjacent one end thereof, said plates at their free outer ends being of progressively increasing length, said springs at their free outer ends being of progressively decreasing length, the longest of said plates and springs being disposed adjacent one another at the center of the resultant stack of plates and springs, said springs from the longest to the shortest thereof each being of a length substantially equal to the corresponding one of said plates, a pin between the adjacent surfaces of the longest spring and longest plate adjacent the outer ends thereof, each of the plates and springs between corresponding ones of said plates and springs being apertured along a line extending transversely of said plates and springs adjacent the outer ends of the corresponding plate and spring to define a passage therebetween, and a pin received within each of said passages and contacting at its opposite ends the corresponding plate and spring, each of said pins transmitting spring force to the plate it engages from the spring corresponding to the respective plate, each of said contact plates from the shortest to the longest thereof including a transverse leg extending from the outer end thereof in the direction opposite said springs, said legs being of progressively increasing length and terminating substantially in a common plane disposed in spaced substantially parallel relation to said plates and springs.

6. A contact assembly for high capacity switches having a blade movable into and out of the contact, said assembly comprising a generally U-shaped base, a contact subassembly mounted on each leg of said base, said contact subassemblies being juxtaposed and each comprising a plurality of superposed contact plates, an equal number of superposed leaf springs superposed on said contact plates, said plates and springs being secured together adjacent one end thereof, said plates at their free outer ends being of progressively increasing length, said springs at their free outer ends being of progressively decreasing length, the longest of said plates and springs

being disposed adjacent one another at the center of the resultant stack of plates and springs, said springs from the longest to the shortest thereof each being of a length substantially equal to the corresponding one of said plates, a pin between the adjacent surfaces of the longest spring and longest plate adjacent the outer ends thereof, each of the plates and springs between corresponding ones of said plates and springs being apertured along a line extending transversely of said plates and springs adjacent the outer ends of the corresponding plate and spring to define a passage therebetween, and a pin secured within each of said passages and contacting at its opposite ends the corresponding plate and spring, each of said pins transmitting spring force to the plate it engages from the spring corresponding to the respective plate, each of said contact plates from the shortest to the longest thereof including a transverse leg extending from the outer end thereof in the direction opposite said springs, said legs

being of progressively increasing length and terminating substantially in a common plane disposed in spaced substantially parallel relation to said plates and springs, said subassemblies being mounted on said base at the secured ends of the plates and springs thereof and being disposed in spaced relation with the free outer edges of said legs disposed in spaced opposed relation to receive the switch blade therebetween, said springs biasing the free outer edge of the leg of each contact plate into high pressure engagement with the switch blade, and a plurality of terminal leads interleaved with the contact plates of each subassembly at the secured ends thereof.

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