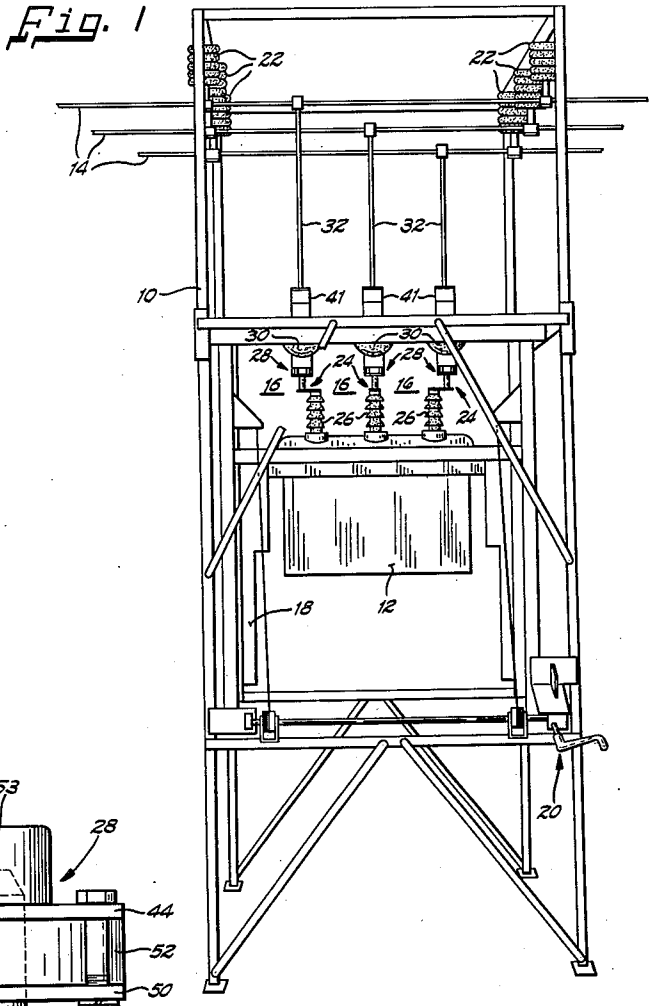
Dec. 25, 1962 C. E. MERCIER 3,070,770

ELECTRICAL CONTACTS

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Fig. 1



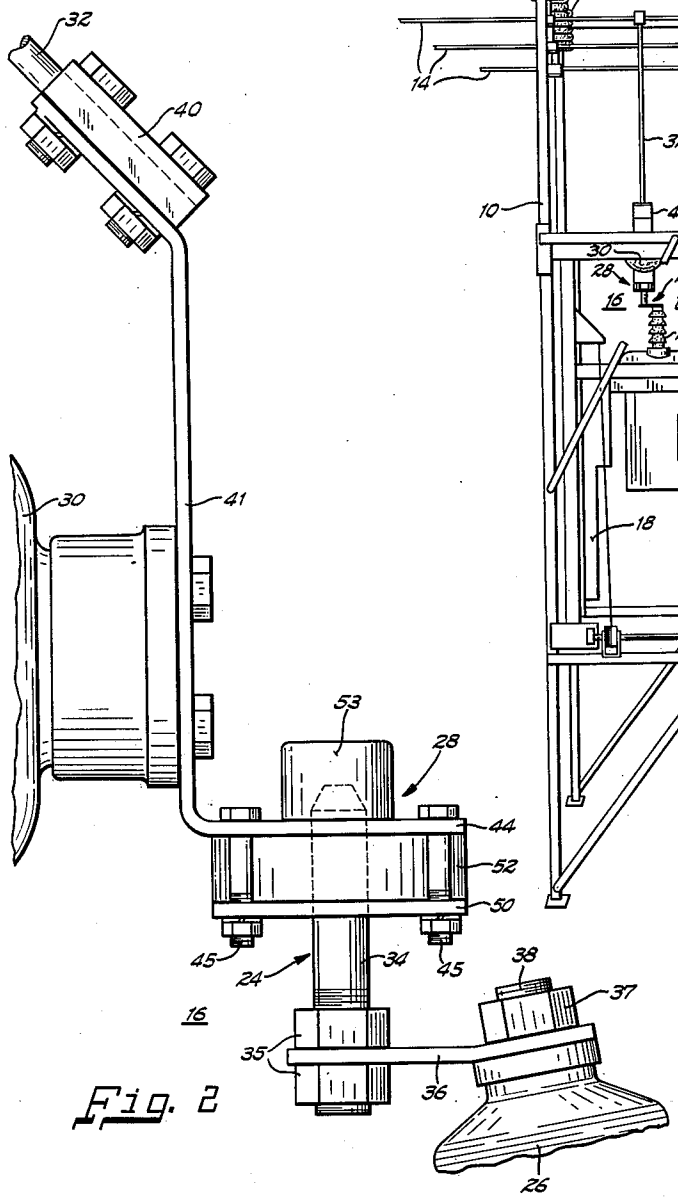


Fig. 2

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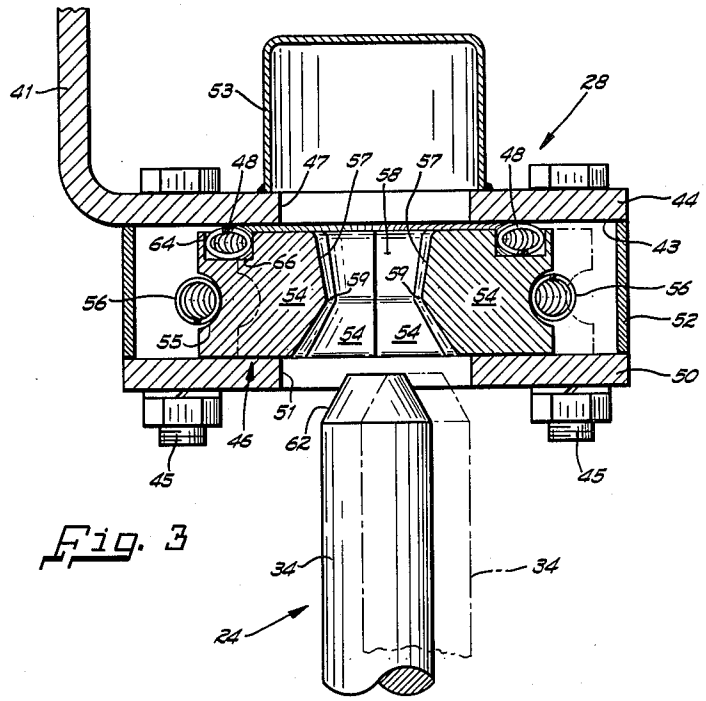


Fig. 3

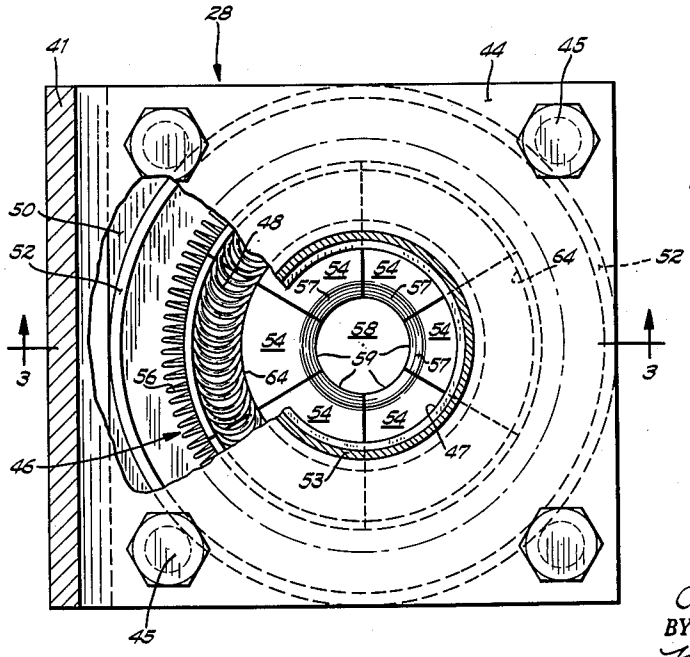


Fig. 4

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United States Patent Office 3,070,770 Patented Dec. 25, 1962

3,070,770
ELECTRICAL CONTACTS

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Filed Dec. 21, 1959, Ser. No. 860,821
9 Claims. (Cl. 339—64)

This invention relates to electrical contacts and more particularly to disconnect contacts for connecting electrical apparatus to a system.

In substation installations electrical apparatus such as circuit breakers are often adapted to be removed from the system upon vertical or horizontal movement out of engagement with bus bars carrying system power. For this purpose such apparatus are provided with disconnect contacts. The conventional arrangement includes a stationary metal frame upon which bus bars, load conductors and accessory apparatus are disposed, and a movable unit comprising a circuit breaker or other electrical apparatus which is connected by suitable disconnect contacts to the bus bars and the load conductors when in its operative position. The disconnect contacts generally include stationary contacts affixed to the frame and electrically connected to the buses and the load conductors and coacting movable contacts carried by the apparatus.

In vertically movable units the bus bars and cable leads are disposed in the upper part of the frame and their associated stationary contacts are automatically engaged by the movable contacts mounted on the upper ends of the circuit breaker terminals when said circuit breaker is raised to its operative position. When the circuit breaker is lowered, these contacts are disengaged and the circuit breaker is removed from the system. To facilitate the raising and lowering of the circuit breaker such units are generally provided with mechanical or hydraulic lift means.

In three phase systems such devices are provided with twelve contacts, a movable contact mounted on each of the three line and load terminals of the circuit breaker, and six coacting stationary contacts fixedly mounted on the frame. If there is misalignment between the circuit breaker and frame or between the different contacts, these contacts will not mate properly, which results in binding and incorrect seating of the contacts upon movement of the circuit breaker into its operative position. This results in non-uniform contact pressure, causing uneven current distribution which, in turn, may overheat the contacts causing them to become pitted and scarred. As a result, close tolerances were required in the assembly of the circuit breaker and its movable contacts and in the installation of the metallic frame and the fixed contacts, adding considerably to the cost of the device and requiring the use of costly aligning equipment. In addition, physical movement of the circuit breaker which often results from the energy released during the interruption of fault currents, may also cause misalignment of the contacts and place dangerous stresses on their mountings.

It is an object of the invention to provide new and improved self-aligning electrical contacts.

It is an object of the invention to provide disconnect contacts that are self-aligning in all direcions.

It is a further object of the invention to provide disconnect contacts having current transfer means between relatively slidable self-aligning portions.

It is another object of the invention to provide disconnect contacts for drawout type switchgear which allow a relatively large degree of misalignment between the circuit breaker and its mounting frame thereby eliminating the necessity for close tolerances and costly aligning devices.

These and other objects of the invention will become more apparent from the detailed description of the invention taken in view of the accompanying drawings in which:

FIG. 1 shows an electric substation assembly having disconnect contacts according to the invention;

FIG. 2 is an elevational view of the disconnect contacts according to the instant invention;

FIG. 3 is a sectional view of the disconnect contacts according to the instant invention; and

FIG. 4 is a top plan view of the invention with parts broken away.

According to one aspect of the invention self-aligning disconnect contacts are provided which include a pair of relatively movable contact means wherein one of said contact means is mounted for sliding movement in a direction generally perpendicular to the direction of said relative movement and wherein a guide surface is provided on one of said contact means for engagement by the other and which is inclined relative to said direction of relative movement. As a result, a component of force in said perpendicular direction is set up in the slidably mounted contact means whereby it is forced into alignment with the other.

According to another aspect of the invention self-aligning disconnect contacts comprising a pair of relatively movable members are provided wherein one of said members is mounted on a conductive base portion for movement generally perpendicular to the direction of relative movement and wherein resilient current transfer means is disposed therebetween. In a more specific form of the invention said current transfer means comprises a helically coiled conductor.

Referring now to the drawings in greater detail, FIG. 1 shows a metallic supporting frame 10 in which a three phase circuit breaker 12 is mounted for vertical movement relative to bus bars 14. When the circuit breaker is in its elevated position, shown in FIG. 1, it is connected to bus bars 14 and load conductors (not shown) by disconnect contacts 16.

More specifically, the circuit breaker 12 is secured on a rack 18 which is mounted in frame 10 for vertical movement by a lifting mechanism indicated generally by the reference numeral 20. Bus bars 14 are supported vertically above circuit breaker 12 in the upper portion of the frame 10 by suitable insulators 22. The disconnect contacts each include a movable contact 24 mounted on the upper end of each of the circuit breaker terminal bushings 26 and a cooperating fixed contact assembly 28 mounted on frame 10 by insulators 30. Each of the line stationary contacts 28 is electrically connected to bus bars 14 by conductors 32.

As shown in FIG. 2, the movable contact comprises a threaded rod like member 34 secured by nuts 35 to one end of a conductive bracket member 36 whose other end is affixed by means of a nut 37 to a threaded conductive stud 38 extending from the upper end of bushing 26. The fixed contact assembly 28 is mounted in the path of conductive rod 34 by a substantially L-shaped conductive

bracket 41, which is mounted on frame 10 by bushing 30 and which carries a terminal clamp 40 at its upper end for connection to conductor 32.

The stationary contact assembly 28 shown in greater detail in FIGS. 3 and 4 is secured to the under surface 43 of the lowermost portion 44 of bracket 41 by means of bolts 45 and generally includes a contact portion 46 disposed adjacent a movable contact receiving aperture 47 in portion 44 and current interchange means 48 for transferring current between said contact portion and surface 43. Contact portion 46 is supported by a base plate 50 which is secured to portion 44 by bolts 45 and which has a movable contact receiving aperture 51 formed therein and substantially coaxial with aperture 47 in portion 44. An annular shell 52 which surrounds contact portion 46 is suitably secured to the upper surface of base plate 50 to insure its proper spacing relative to surface 43 and to protect contact portion 46 from contamination. Aperture 47 is protected by an inverted cup shaped member 53 secured to the upper surface of portion 44.

Contact portion 46 comprises arcuate contact segments 54 each of which has groove 55 formed in its outer periphery to define a channel for containing a garter spring 56 which holds segments 54 in a compressive relation. The inner surface 57 of each of the segments 54 cooperate to form a circular contact receiving aperture 58 at the center of contact portion 46. The lower portion 60 of each of the surfaces 57 flares outwardly to define a frustro-conical surface for guiding the tapered upper end 62 of movable contact 34 into aperture 58.

An arcuate groove 64 is also provided in the upper surface of each of the segments 54 to define an annular current transfer spring receiving channel which opens toward surface 43. The depth of each of the grooves 64, i.e., the distance between their lower surfaces 66 and surface 43, is less than the outside untilted helical diameter of current transfer spring 48 so that its individual convolutions are forced to lay over at an angle with respect to its helical axis. The tendency of each of the convolutions of spring 48 to assume an uninclined position, provides contact pressure between surface 43 and each of the segments 54.

The upper portion of surfaces 57 may also be inclined away from the central axis to provide a central ridge 59 which is substantially coplanar with garter spring 56. This insures that regardless of the angular misalignment between conductor 34 and segments 54 their point of contact is always opposite the force of the garter spring 56.

By utilizing the current transfer spring 48 to interchange current between contact segments 54 and surface 43, a multiplicity of uniformly distributed current interchange points is achieved. This permits the use of a lower total contact force than was possible with prior art devices wherein only a relatively few points of contact existed. In addition, contact portion 46 is enabled to move with relative ease between members 44 and 50, thereby insuring that movable contact 34 can close easily without binding and with a minimum of wear between the conductive members. Also, the plurality of distributed contact points provide a plurality of parallel current interchange paths thereby reducing the contact resistance so that heating, inherent in some prior art devices, is substantially reduced.

When circuit breaker 12 is moved into its operative position the contact rod 34 on each of the movable contacts 26 moves through aperture 51 in base plate 50 until its frustro-conical surface 62 engages surfaces of contact segments 54. If conductive member 34 is out of alignment, as shown by the dashed lines in FIG. 3 it will engage the surfaces of contact segments 54 on one side of the contact portion 46. As contact member 34 moves further toward closed position the coaction between these surfaces generates a component of force on one of the segments 54 which is parallel to the surface 43. Because garter spring 56 initially holds all of the segments 54 in firm abutment, the entire contact portion 46 is thereby moved to the right as viewed in FIG. 3 due to the binding action of garter spring 56. This movement will continue until the assembly reaches the dashed position shown in FIG. 3 wherein opening 58 is coaxial with contact rod 34 at which time a portion of surface 62 will have penetrated opening 58.

Surfaces 57 are so proportioned that opening 58 is smaller than the cylindrical portion of contact rod 34 so that the entrance of contact rod 34 into opening 58 will spread the contact fingers 54 apart slightly whereby a firm contact pressure between the surface of contact rod 34 and surfaces 57 on contact segments 54 is provided by garter spring 56.

It will be seen that the contact pressure between current interchange spring 48 and the under surface of portion 44 of bracket 42 and surface 66 of each of the contact segments 54 will not be disturbed when contact portion 46 is moved during its alignment with contact rod 34. This results from the fact that a firm contact pressure is established by each individual spring convolution regardless of any irregularities in surface 43. In addition, because of the large plurality of individual current interchange points possible by the use of spring 48, the frictional drag between assembly 46 and support plate 50 can be limited to a very small value, so that there is little or no chance of the contacts to bind. This sliding movement between assembly 46 and plate 50 is further enhanced by a slight upward movement of assembly 46 which occurs upon its engagement by contact 34. Also, lubricant may be used to facilitate movement of the relatively movable portions of the fixed contact assembly 28.

Thus, by the use of the self-aligning contacts just described, a great deal of misalignment between the circuit breaker 12 and the frame 10 and between the individual disconnect contacts 16 is allowable without binding and without a sacrifice in current interchange between rod 34 and bracket 41.

I claim:

1. In self-aligning electrical contact structure the combination of, first and second relatively movable contact means engageable upon movement in a first direction and disengageable upon movement in an opposite direction, conductive base means having a surface substantially normal to the direction of relative movement, one of said contact means being mounted on said base member adjacent said surface for sliding movement in a direction parallel thereto, so that said one contact means may move into alignment with the other upon engagement thereof, and conductive means disposed between said contact means and said surface for transferring current therebetween and comprising a helical spring-like member having a multiplicity of turns, substantially all of said individual turns being in firm electrical engagement with said one contact means and said surface.

2. In self-aligning electrical contact structure the combination of, first and second relatively movable contact means engageable upon movement in a first direction and disengageable upon movement in an opposite direction, a conductive base member having a substantially planar surface normal to the direction of relative movement, one of said contact means being mounted on said base member adjacent said surface for sliding movement in a direction parallel thereto, and conductive means disposed between said contact means and said surface and comprising a helical spring-like member having a multiplicity of turns, substantially all of said individual turns being in firm electrical engagement with said one contact means and said surface, a surface formed on one of said contact means for engagement by the other and which is inclined with respect to the direction of relative movement between said contact means so that said slidably mounted contact means is forced to slide into align-

ment with the other upon movement in said first direction, and means independent of said conductive means for biasing said first and second contact means into high pressure engagement.

3. In self-aligning electrical contact structure the combination of, first and second relatively movable contact means engageable upon movement in a first direction and disengageable upon movement in an opposite direction, said first contact means including an elongate conductive member, the second of said contact means including a contact jaw, conductive base means having a substantially planar surface normal to the direction of relative movement, one of said contact means being mounted on said base member adjacent said surface for sliding movement in a direction parallel thereto, so that said one contact means may move into alignment with the other upon engagement thereof, conductive means disposed between said contact means and said surface and comprising a helical spring-like member having a multiplicity of turns, substantially all of said individual turns being in firm electrical engagement with said contact means and said surface.

4. In self-aligning electrical contact structure the combination of, first and second relatively movable contact means engageable upon movement in a first direction and disengageable upon movement in an opposite direction, said first contact means including an elongate conductive member, the second of said contact means including a contact jaw, a conductive base means having a surface normal to the direction of relative movement,, one of said contact means being mounted adjacent said surface for sliding movement in a direction parallel thereto, and having a channel formed therein which is presented toward said surface, current transfer means disposed in said channel and comprising a helical spring-like member having a multiplicity of turns, each of said individual turns being in firm frictional engagement with said contact jaw and said surface.

5. Electric contact means comprising a stationary portion and a relatively movable portion, one of said portions comprising an elongate conductive member, the other of said portions including a conductive base means having a surface normal to the direction of relative movement, contact jaw means mounted on said base means adjacent said surface for sliding movement in a direction parallel thereto and having a channel formed therein which is presented toward said surface, current transfer means disposed in said channel and comprising a helical spring-like member having a multiplicity of turns, each of said individual turns having their planes inclined at an angle with respect to the helical axis of said spring whereby the inherent resiliency of said turns maintains them in firm frictional relation between said contact jaw and said surface, at least one of said contact jaw and elongate conductive member having a diverging surface for engagement by the other so that it is forced to slide into alignment therewith upon the closing of said contact means, and means independent of said current transfer means for urging said contact jaw into high pressure engagement with said elongate conductive member.

6. In self-aligning electrical contact structure the combination of, first and second relatively movable contact means, said first contact means including an elongate conductive member, said second contact means, including a plurality of contact segments, arranged in abutting relation to define a segmented contact jaw engageable by said conductive member, conductive base means having a planar surface substantially normal to the direction of relative movement, said contact jaw being mounted on said base for sliding movement parallel to said planar surface, pressure spring means urging said segments together in a compressive relation, resilient conductive means disposed between said contact jaw and said surface for transferring current therebetween, and an inclined surface formed on at least one of said contact means for engagement by the other so that said contact jaw is forced to slide into alignment with said elongate conductive member upon the closing of said contact means.

7. Electric contact structure comprising relatively movable contact portions, one of said portions comprising an elongate conductive member, the other of said portions including a conductive base having a surface and a plurality of contact segments arranged in abutting relation to define a segmented contact jaw engageable by said conductive member, said segments being mounted on said base for movement relative to said surface, a groove formed in each of said segments to define a channel whose open side is presented toward said surface, current transfer means disposed in said channel and comprising a helical spring-like member having a multiplicity of turns, each of said individual turns being in firm frictional relation between said segments and said surface, said segments each having an inclined surface for engagement by said movable contact so that said segments are forced to slide into alignment with said movable contact upon the closing of said contact means.

8. Electric contact means comprising a stationary portion and a relatively movable portion, one of said portions comprising an elongate conductive member, the other of said portions including a conductive base having a substantially planar surface normal to the direction of relative movement, a plurality of arc shaped contact segments arranged in abutting relation to define a segmented substantially annular contact jaw having a central aperture, said contact jaw being slidably mounted on said base adjacent said planar surface for movement parallel thereto, pressure spring means surrounding said segments for urging them together in a compressive relation, a groove formed in each of said segments to define a continuous channel surrounding said central aperture and presented toward one of said members, current transfer means disposed in said channel and comprising a helical spring-like member having a multiplicity of turns, each of said individual turns having their planes inclined at an angle with respect to the helical axis of said spring whereby the inherent resiliency of said turns maintains them in firm frictional relation between said segments and said conductive member, one of said portions having a substantially conical surface presented toward said central aperture for engagement by the other of said portions so that said contact jaw may slide into alignment with said elongate conductive member upon the closing of said contact means.

9. Electric contact means comprising stationary and movable portions, said stationary portion including a surface and a plurality of arc shaped contact segments arranged in abutting relation to define a substantially annular segmented contact jaw having a central aperture, said segments being disposed adjacent said surface and movable relative thereto a groove formed in each of said segments to define a continuous channel surrounding said central aperture and presented toward said surface, current transfer means disposed in said channel and comprising a helical spring-like member having a multiplicity of turns, each of said individual turns having their planes inclined at an angle with respect to the helical axis of said spring whereby the inherent resiliency of said turns maintains them in firm frictional relation between said segments and said surface, said segments each having an inclined surface presented toward said central aperture to form a substantially conical surface for engagement by said movable contact so that said segments may slide into alignment with said movable contact upon the closing of said contact means.

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