July 16, 1963 C. J. YARRICK ETAL 3,097,904

TULIP CLIP PRIMARY CONTACTS WITH STAR SPACER

Filed July 25, 1960

FIG. 1.

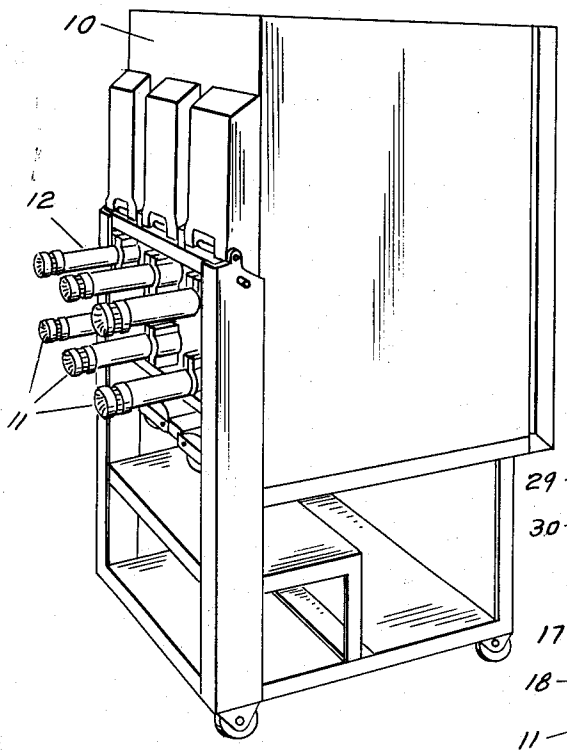


FIG. 3.

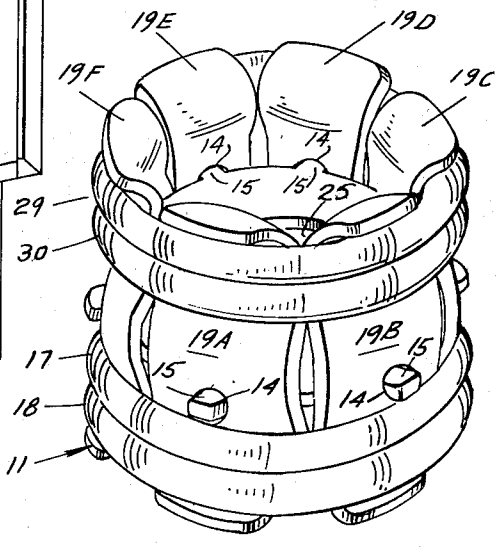


FIG. 2.

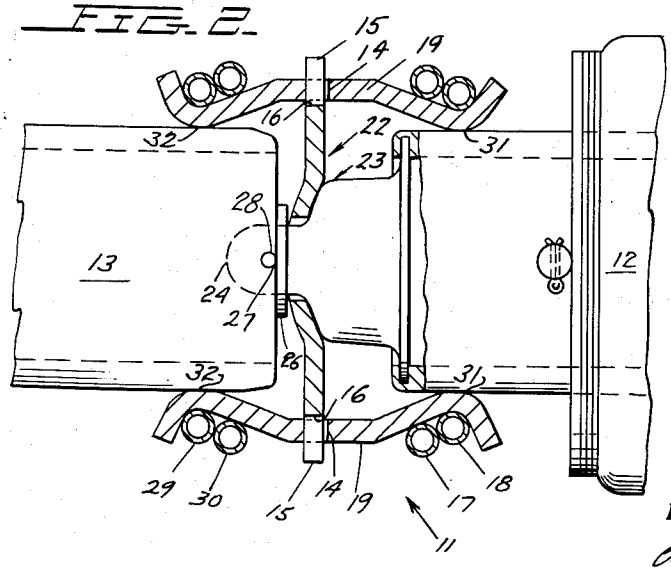
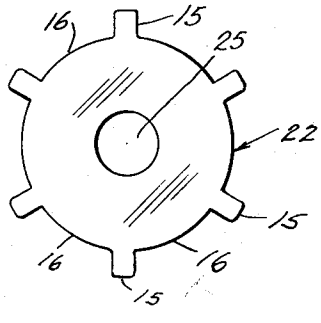


FIG. 4.



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TULIP CLIP PRIMARY CONTACTS WITH STAR SPACER

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3 Claims. (Cl. 339—64)

This invention relates to tulip clip disconnect contacts and, in particular, is directed to a novel arrangement wherein each of a plurality of elongated finger contacts is positioned by and pivotally mounted on a single spacing means and the unit may be loosely secured to a conductive element.

In electrical circuit interrupting apparatus such as high voltage circuit breakers, it is necessary to provide the equipment with disconnect contacts such as tulip clip contacts so that the circuit breaker can be selectively connected or disconnected with the system which it is to protect.

Prior types of tulip clip contacts have been primarily used for low current conditions and are typically shown in U. S. Patent No. 2,924,688 issued February 9, 1960, Serial No. 622,042, filed November 14, 1956, entitled "End Mounting of a Current Limiting Device Associated with a Circuit Breaker," in the name of William Harold Edmunds, and assigned to the assignee of the instant invention. In these devices, the finger type contacts are self supporting and traced toward one another by garter springs at each end of a cylinder formed by the finger contacts.

Where, however, high currents are involved and low contact pressure is needed, the spring force must be increased whereby the self supporting fingers of the prior devices would collapse.

We have provided a novel tulip clip contact assembly wherein a unitary spacing means is provided for all of the finger contacts, designed and constructed so that a single spacer serves to both space and position each finger in combination with two springs. Thus, collapse of the tulip clip is made impossible even though two very powerful ironing springs are provided.

A preferred embodiment of this invention is comprised of a tulip clip contact assembly wherein a star shaped spacer provides the function of being a positioning and spacing means for each of the finger contacts,

Furthermore, the star spacer may provide connecting means for securing the contact assembly to one stud in a mechanically loose, but high pressure electrical engagement. Therefore, when a cooperating stud is to engage the open end of the contact assembly, the engagement can take place even though the two studs are misaligned.

Accordingly, a primary object of this invention is to provide a novel tulip clip contact having a plurality of finger contacts wherein each contact is individually positioned by a common positioning means.

Another object of this invention is to provide a tulip clip contact for a circuit interrupter in which a common star spacer serves as a positioning, pivoting and spacing means for a plurality of finger contacts.

Still another object of this invention is to provide a tulip clip contact which is relatively simple in design and requires a minimum number of components.

Yet another object of this invention is to provide a contact which has free movement to within determined limits in a plane parallel with the star spacer.

An additional object of this invention is to provide a contact which could not be assembled on the circuit breaker incorrectly.

A further object of this invention is to provide a

star spacer for a plurality of finger contacts which will prevent the collapse of the finger contacts.

A further object of this invention is to provide a novel tulip clip type contact operable to give high contact pressure for use in high current circuits.

Yet another object of this invention is to provide a novel tulip clip type contact which is self aligning.

These and other objects of this invention will be apparent from the following description when taken in connection with the drawings in which:

FIGURE 1 is a perspective view of the rear of a typical circuit interrupter such as a high voltage circuit breaker having a relatively high current rating as adapted with tulip clip contacts of this invention.

FIGURE 2 is a side cross-sectional view of this novel invention where the tulip clip assembly is in contact engagement with the stationary contacts.

FIGURE 3 is a perspective view of the novel invention.

FIGURE 4 is a front view of the star-spacer of our invention.

FIGURE 1 illustrates a typical circuit breaker **10** to which the invention may be applied, and may be of any type of circuit breaker having a relatively high current rating well known in the art. By way of example, the device of FIGURE 1 is the device shown in Patent No. 2,646,481 issued July 21, 1953, to the assignee of the instant application and forms no part of our instant application. The circuit interrupter **10** must be provided with a pair of tulip clip disconnect contacts for each phase so it can be removably connected in an electrical system which it is designed to protect.

The purpose of the tulip clip contacts **11** is to provide a removable electrical connection between a first conductor **12** and a respective second conductor **13** as shown in FIGURES 1 and 2. The conductor **12** is associated with the circuit interrupter **10** and movable therewith, whereas the conductor **13** is usually stationarily positioned at the rear of a cubicle which receives interrupter **10** and is associated with the system which the circuit interrupter **10** is to protect.

Tulip clip contacts **11** are normally loosely carried from one of conductors **12** or **13**. Thus, as seen in FIGURE 2, conductor **12** has an elongated section **23** which has a narrow neck portion **24**. Neck portion **24** passes through an aperture **25** in star spacer **22** of the tulip clip assembly **11**, and has means for preventing its removal from aperture **25**. By way of example, a washer **26** which is larger than aperture **25** is maintained in place by cotter pin **27** which passes through aperture **28** in narrow neck portion **24**. Thus, the washer **25** serves as a retaining means to secure tulip clip contact assembly **11** to conductor **12**. A predetermined amount of play is permitted between washer **26** and spacer **25** whereby a loose mechanical connection is formed between spacer **25** and conductor **12**. However, as will be seen hereinafter, the assembly **11** is in high pressure electrical contact with conductor **12**. It will be noted that the washer and cotter pin configuration for loosely securing assembly **11** to conductor **12** is only one of many possible arrangements which could be used without departing from the scope of the invention.

The dimple in the star washer **22** is seen to have a mating curvature on the elongated section **23**, so as to provide a ball-in-socket arrangement for free movement. The dimple also prohibits reversing the tulip clip contacts **11** by preventing assembly of the cotter pin **27**.

The manner in which the assembly **11** is constructed is best seen in FIGURES 2 and 3. Thus, as seen in these figures, a plurality of elongated finger contacts **19**, identical in construction, are contained in the form of a cylinder. As illustrated in FIGURE 3, the finger contacts **19** each have an aperture **14** to receive radially spaced pro-

jections **15** of star spacer **22**. The radially spaced projections **15** serve as a positioning pivot and spacing means for each of the finger contacts **19** associated therewith and also serve as a peripheral positioning means for the fingers. The inner peripheral surface **16** of the star spacer serves as a pivot and stop point for the finger contacts **19**.

The coil springs **17—18**, **29—30** which may be formed by twisting one end into the other and deforming one of the engaged turns, bias the finger contacts **19** radially inward toward the center of the assembly. When the tulip clip contact assembly **11** is disengaged, the springs **17—18**, **29—30** bias the fingers against stop surface **16** which prevents the collapse of the fingers.

The coil springs **17—18** are relatively powerful springs and bias the associated finger contacts **19** into high pressure engagement with conductor **12**. That is, the conducting surfaces of the fingers such as surface **31** of the finger contact **19** are brought into high pressure electrical contact with conductor **12**. When the tulip clip assembly **11** is moved into engagement with conductor **13**, the coil springs **29—30** serve to bias the contact surface **32** of the contact fingers **19** into high pressure electrical engagement with the second conductor **13**. The contact surfaces **31—32** are made smooth to facilitate engagement with the conductors **12—13** respectively.

Thus, the tulip clip contact assembly **11** of the invention is comprised basically of a single star washer **22**, having a plurality of radially spaced projections **15** which serve as positioning and spacing means for a plurality of finger contacts **19**. Each of the elongated finger contacts **19** is then provided with an aperture **14** to receive the projections **15**. Furthermore, the finger contacts **19** are provided with a powerful biasing means such as coil springs **17—18** to bias them into high pressure electrical engagement with a first conductor to which the assembly is mechanically secured, and a second powerful coil spring means **29—30** to bias the same plurality of finger contacts **19** into high pressure electrical engagement with a second conductor **13**. Furthermore, surface **16** of star spacer **22** prevents movement of the finger contacts **19** toward the center of assembly **11**.

Thus, if the tulip clip contact assembly **11** is removed from engagement with the conductor **13**, the assembly will not collapse due to the heavy biasing springs. That is, the stop surface **16** of spacer **22** prevents movement of the finger contacts **19** past the outer diameter of the spacer. It is further noted that when conductor **13** is removed, finger contacts **19** pivot about projections **15** and thereby remain in high pressure electrical engagement with conductor **12** due to the bias exerted by coil springs **17—18**.

In addition to all the above noted advantages of the instant invention, it will be noted that the tulip clip contact assembly is simple to produce and the entire unit is compact and requires a minimum of operating parts.

Furthermore, in the event the tulip clip contact **11** with its associated conductor **12** is slightly misaligned from conductor **13**, there will, nevertheless, be automatic alignment due to the individual flexibility of the plurality of finger contacts **19**. As heretofore noted, the elongated element **23** and washer **26** provides this loose mechanical fit between the tulip clip contact assembly **11** and conductor **12**. Hence, the entire assembly **11** is free to move with respect to the conductors **12** and **13** to compensate for axial misalignment between conductors **12** and **13**.

In the foregoing we have described the invention only in connection with preferred embodiments thereof. Since many variations and modifications of the principles of the invention within the scope of the description herein are obvious, we prefer to be bound not by the specific disclosure herein but only by the appended claims.

We claim:

1. An electrical connecting means; said connecting means comprising a plurality of elongated contact fingers formed of a conducting material, and a spacing means; a first and a second conductor; said plurality of elongated fingers mounted to said spacing means and arranged in a parallel relationship to one another; said spacing means positioning said elongated finger contacts in a predetermined spatial shaping; said predetermined spatial shape being circular; first and second biasing means; one of said first and second biasing means located at the top of said plurality of contact fingers, and the other of said first and second biasing means located at the bottom of said plurality of contact fingers; said first and second biasing means biasing said electrical connecting means into high pressure electrical contact with said first and second conductors; said first conductor entered through the top of said electrical connecting means, and said second conductor entered through the bottom of said electrical connecting means; said spacing means being a rigid member having receiving means for mechanically receiving each of said plurality of elongated contact fingers; said spacing means being planar and having a thickness substantially limited to the longitudinal area of mechanical engagement with said contact fingers; said receiving means being a plurality of radially spaced projections of substantially the same thickness as said spacer means; each of said plurality of contact fingers having an aperture therein; each of said plurality of projections engaging with said apertures and extending completely through said apertures and beyond past the outer surface of said fingers to pivotally mount said plurality of finger contacts the engagement of said projections and apertures being limited to a small intermediate area of said contact fingers while providing substantial stability to collapse of said connecting means, preventing movement of said fingers from said predetermined spatial shape and movement of said fingers perpendicular to the plane of said spacing means.

2. An electrical connecting means; said connecting means comprising a plurality of elongated contact fingers formed of a conducting material, and a spacing means; a first and a second conductor; said plurality of elongated fingers mounted to said spacing means and arranged in a parallel relationship to one another; said spacing means positioning said elongated finger contacts in a predetermined spatial shaping; said predetermined spatial shape being circular; first and second biasing means; one of said first and second biasing means located at the top of said plurality of contact fingers, and the other of said first and second biasing means located at the bottom of said plurality of contact fingers; said first and second biasing means biasing said electrical connecting means into high pressure electrical contact with said first and second conductors; said first conductor entered through the top of said electrical connecting means, and said second conductor entered through the bottom of said electrical connecting means; said spacing means being a rigid member having receiving means for mechanically receiving each of said plurality of elongated contact fingers; said spacing means being planar and having a thickness substantially limited to the longitudinal area of mechanical engagement with said contact fingers; said receiving means being a plurality of radially spaced projections of substantially the same thickness as said spacer means; each of said plurality of contact fingers having an aperture therein; each of said plurality of projections engaging with said apertures and extending completely through said apertures and beyond past the outer surface of said fingers to pivotally mount said plurality of finger contacts the engagement of said projections and apertures being limited to a small intermediate area of said contact fingers while providing substantial stability to collapse of said connecting means, preventing movement of said fingers from said predetermined spatial shape and movement of said fingers perpendicular to the plane of said spacing means; a securing means; said securing means mechanically interlocking said connecting means with at least one of said conductors comprising a washer and a second aperture

in said spacing means; an elongation on one of said conductors; said elongation passing through said second aperture, said second aperture permitting a predetermined degree of movement between said elongation and said spacing means; said washer positioned a predetermined axial distance from said spacing means; said predetermined degree of movement and predetermined axial distance providing a loose mechanical fit between said connecting means and said conductor whereby said high pressure electrical contact is maintained during axial misalignment of said first and second conductors.

3. The electrical connecting means of claim 2 wherein said spacing means further includes a dimple surrounding said second aperture; said dimple being adapted to permit said loose mechanical fit of said connecting means

and said conductor in only one predetermined position; said elongation including a surface formation mating with said dimple to provide a ball in socket connection in cooperation with said loose mechanical fit to provide free movement of said connecting means.

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