Aug. 23, 1960 A. E. STRINGFELLOW 2,950,371

CERAMIC ARC PLATE CONSTRUCTION

Filed Oct. 9, 1957

FIG. 1.

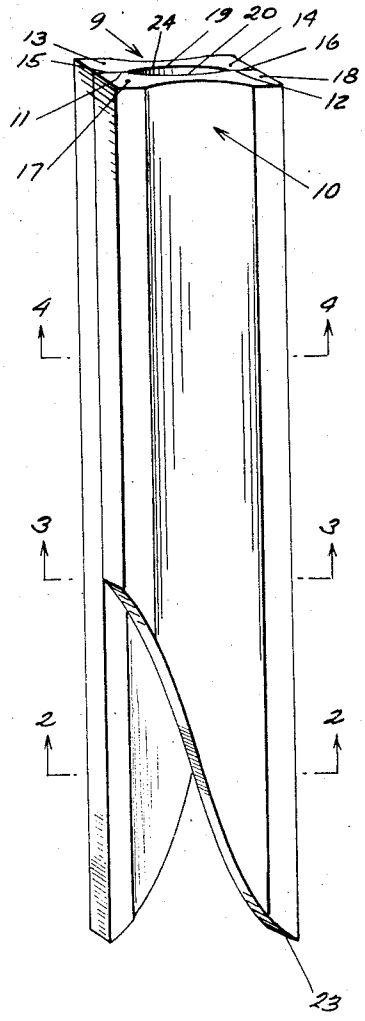


FIG. 4.

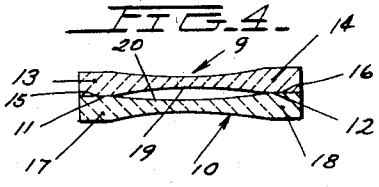


FIG. 3.

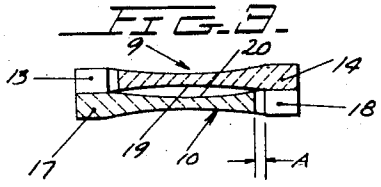


FIG. 2.

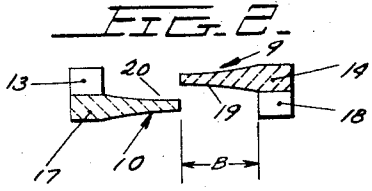


FIG. 5.

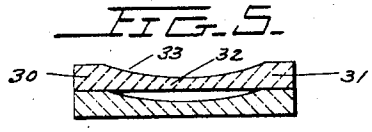


FIG. 8.

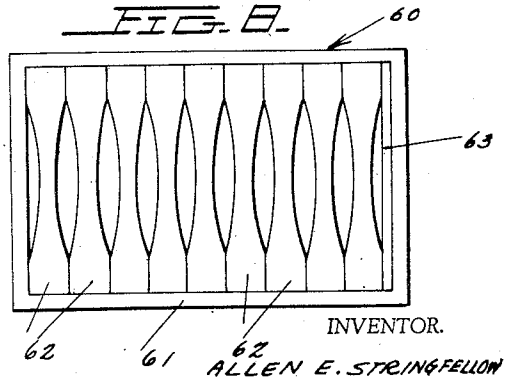
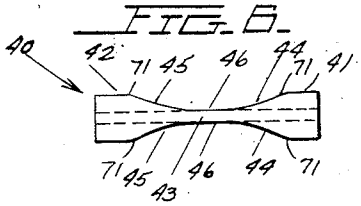


FIG. 6.



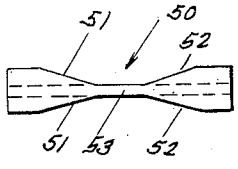


FIG. 7.

INVENTOR.
ALLEN E. STRINGFELLOW
BY Strauch, Faber, Hurt & Soffen
ATTORNEYS

United States Patent Office 2,950,371
Patented Aug. 23, 1960

2,950,371

CERAMIC ARC PLATE CONSTRUCTION

Allen E. Stringfellow, Haddonfield, N.J., assignor to I-T-E Circuit Breaker Company, Philadelphia, Pa., a corporation of Pennsylvania

Filed Oct. 9, 1957, Ser. No. 689,126

10 Claims. (Cl. 200—144)

This invention relates to arc plates and more particularly to a novel arc plate construction whereby an arc may be more rapidly extinguished. The construction also enables ceramic arc plates of the type having integrally formed flanges to be compression molded in steel dies while using mixtures having a water content of less than 5%.

As is well known in the art, circuit interrupting equipment must have arc extinguishing means in order to cool off and deionize the arc which is formed between the movable interrupting contacts. For relatively low voltage application, the arc extinguishing means comprises a plurality of metallic members which, through their high heat conductivity, are used to cool the arc and to prevent restriking thereof. However, for high voltage circuit interrupting equipment, it is necessary to use insulating plates which are spaced so as to provide a tortuous path for the arc and thereby more rapidly extinguish the same. These insulating plates are made of ceramics having a high dielectric strength and resistance to thermal shock such as zircon, the sillimanite refractories and glass-bonded mica.

It is highly desirable to construct an arc extinguishing means of members having integrally formed flanges extending from one or both surfaces to form U and I beams respectively as described in U.S. Patent No. 2,759,073 issued August 14, 1956 entitled, High Voltage Magnetic Arc Extinguishing Means, in the name of J. D. Wood and assigned to the assignee of the instant invention. The integrally formed flanges serve to space and support the arc plates when they are assembled in a shell to form an arc chute.

The instant invention provides novel arc plates having modified U and I beam shapes. That is, the flanges, or raised sections, and web, or depressed section, are joined by a gradually sloping surface.

An arc chute comprised of my novel arc plates will bring about more rapid arc extinction than heretofore possible in arc chutes of this type by simultaneously squeezing the arc in two directions, rather than one direction as heretofore done by prior art devices, as the arc is stretched under the influence of the blowout field and staggered slot arrangement. Heretofore the staggered slot arrangement was solely relied upon to squeeze the arc as it was driven into the chute. The squeezing of the arc caused by the narrowing dimension between plates in the flange region assists the blowout field in driving the arc toward the top of the chute thereby bringing about rapid extinction of the arc and also prevent the restriking thereof.

An early method of forming a ceramic product, such as a ceramic arcing plate, in which a depression is desired, was to press the ceramic ware flat and then carve out the desired depression with a sharp tool as is done with wet process porcelain. This has not proven to be a very economical production method, as it results in a relatively rough surface when used on dry pressed

ware which allows the entrapment of extraneous materials such as dust, thereby causing extra ionization in the arc chute.

Another early method, also producing a rather rough surface and resulting in the inclusion of impurities, was to plow a furrow in the ceramic mixture before pressing and then fill the furrow with sand. Upon the application of pressure the sand would tend to distribute the pressure throughout the arc plate. In addition to producing a rougher surface, this method also is uneconomical because it requires more pressing operations in order to obtain the desired product.

A third process would be to extrude the plate in channel form in a plastic condition and then cut the plate to the desired shape. This method, however, is uneconomical since it requires an extra set of operations to make the plate to the desired shape.

A more recent method, fully described in my copending application Serial No. 434,133, filed June 3, 1954, now abandoned, provides a piece of rubber or other suitable resilient material which is placed into a cavity formed in the ceramic mixture before die pressure is applied. This will not only give a smoother surface, but since the resilient material will transmit the pressure equally in all directions, the resulting product will be of constant density throughout, thereby making it less susceptible to cracking and stresses during the process of firing the arc plate to maturity and to stresses resulting from any subsequent temperature variations occurring when arcing takes place.

However, it has been found that the rubber or resilient material wears out rapidly and readily comes loose from the die.

The arc plate construction of the instant invention, wherein the flanges or raised portions of the plate are joined to the depressed portion by a gradually sloping surface, allows the material under compression to flow more freely and form the plates with a minimum of density variation and free of stresses or cracks. This shape permits the ceramic arc plates to be compression molded in all steel dies using a mixture having less than 5% water whereas prior art arc plate constructions were usually such that steel dies could not be used unless the mixture included a water binder combination in excess of 12%. The high moisture content creates many shrinkage problems.

Steel dies produce a much neater product than heretofore possible while the large radii fillets or gradually sloping flat surfaces joining the raised and depressed portions tend to strengthen the arc plates.

My novel arc plates, when assembled to form an arc chute, will act to squeeze the arc more as it rises to the top of the chute by forcing the arc into a narrowing dimension between arc plates. This will also result in greater elongation of the arc bringing about its rapid extinction and also prevent it from restriking.

Accordingly, it is a primary object of the instant invention to provide a novel arc chute construction whereby the arc is squeezed in two directions as it is driven higher in the chute.

Another object of the instant invention is to provide a construction for a ceramic arc plate whereby the plate may be compression molded in a steel die of a mixture having less than 5% water.

Still another object is to provide a ceramic arc plate that is of uniform density and free of stresses or cracks.

A further object is to provide a ceramic arc plate of the U or I-shaped type wherein the raised and depressed portions are joined by gradually sloping surfaces.

These as well as other objects of the instant invention

will become readily apparent after reading the following description of the accompanying drawings in which:

Figure 1 is a perspective view of two ceramic arc plates in mating relationship with each plate being constructed according to the instant invention.

Figures 2–4 are sections taken through lines 2—2, 3—3, and 4—4 respectively of Figure 1 looking in the direction of arrows 2—2, 3—3 and 4—4 respectively.

Figure 5 is a cross section similar to that of Figure 4 illustrating an embodiment of this invention wherein flanges extend from but a single surface of the arc plate.

Figures 6 and 7 are cross sections similar to that of Figure 4 with the arc plate construction of Figure 1 being slightly modified. In these figures the arc plates include depressed areas that are parallel to the raised flange surfaces.

Figure 8 is a plan view of an arc chute comprised of the arc plates of Figures 1–4.

In the embodiment of Figure 6 the raised and depressed areas are joined by concave surfaces, while in the embodiment of Figure 7 these areas are joined by flat surfaces.

Referring more particularly to Figures 1–4, two identical arc plates 9, 10 are shown in mating relationship with the support platforms or raised surfaces 11, 12 of flanges 13, 14 abutting raised surfaces 15, 16 respectively of flanges 17, 18 thereby maintaining the depressed surfaces 19, 20 of arc plates 9, 10 in operative spaced relationship.

Surfaces 19, 20 are continuously curved, of a constant large radius, between flange surfaces 11, 12 and 15, 16 respectively. While strictly speaking the depressed surfaces 19, 20 cannot be parallel to one another since they are curved in opposite directions throughout their lengths, since surfaces 19, 20 are of such a large radius the central portions thereof appear to be in spaced parallel relationship. In the embodiments of Figures 6 and 7, to be hereinafter described, the central portions of their depressed surfaces are truly flat and as such are disposed in spaced parallel relationship.

Surface 21 of arc plate 9 is of identical shape to that of the opposite depressed surface 19 so that the central section of arc plate 9 is reduced to the thickness of conventional type arc plates.

The arc is forced by the blowout field (not shown) and the triangular notches cut in each arc plate 9, 10 between points 22, 23 to follow the conventional serpentine path. However, the gradually sloping surfaces between the raised and depressed portions reduce the space between plates 9, 10 toward the long edges thereof. The reduced spacing will compress the arc and force it to extend toward the top of the arc chute thereby elongating the arc and bringing about its rapid extinction.

Figure 5 illustrates an embodiment of this invention in which the arc plates 9, 10 of Figures 1–4 are modified by having flanges 30, 31 which extend from but one surface of thin elongated section 32 which is indicated in phantom. Concave surface 33 extends downward from the top of flanges 30, 31 and is tangent to the top surface of section 32.

In the embodiment of Figure 6, ceramic arc plate 40 comprises flanges 41, 42 extending from both faces of thin section 43. The surfaces of flanges 41, 42 positioned parallel to thin section 43 are joined thereto by concave surfaces 44, 45 respectively. It is to be noted that surfaces 44, 45, while of large radius, do not meet at the midpoint between flanges 41, 42. Instead concave surfaces 44, 45 are joined by flat surfaces 46 so that when a plurality of arc plates 40 are stacked to form an arc chute flat surfaces 46 will be in spaced parallel relationship. It is also to be noted that concave surfaces 44, 45 are joined to the raised surfaces of flanges 41, 42 by means of surfaces 71 of large radii curved oppositely to curved surfaces 44, 45.

Arc plate 50, illustrated in Figure 7, is identical to arc plate 40 except that concave surfaces 44, 45 have been replaced by gradually sloping flat surfaces 51, 52.

While the ceramic arc plate illustrated in the figures include a notched corner section, it is to be understood that this invention is adaptable to other arc plate constructions such as the staggered center slot construction of copending application Serial No. 322,027, filed November 22, 1952. It is also to be understood that even though the arc plates have been described as being comprised of a number of sections, that is flanges, thin section etc., the sections are integrally formed in a single molding operation.

Thus, I have provided constructions for ceramic arc plates which enable the arc plates to be molded in all steel dies of a mixture having less than 5% moisture content to produce a product of uniform density.

Arc chute 60, illustrated in Figure 8, comprises a hollow rectangular shell 61 wherein a plurality of arc plates 62 are stacked. Shim means 63 is wedged between one end of the arc plate stack and the inside of shell 61 to maintain plates 62 therein and prevent relative motion between the plates. Arc plates 61 are identical to arc plates 9, 10 of Figures 1–4. However, it is to be understood that arc chute 60 may be comprised of a plurality of any of the arc plates illustrated in Figures 5–7.

As an arc enters chute 60 it is confronted by a wide mouth B (Figure 2) and as the arc is driven upward it is confronted by a narrowing dimension A (Figure 3) which is soon reduced to zero. Simultaneously the arc is squeezed by the narrowing dimension between plates. That is, the maximum distance between plates in region A is far less than the maximum distance between plates in region 8. This causes the arc to be squeezed in two directions simultaneously thereby causing it to rise rapidly in the chute and thereby be extinguished.

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

I claim:

1. An arc plate having a shape which permits it to be compression molded in all steel dies using a mixture of ceramic material having less than 5% water comprising a thin elongated section having integrally formed therewith a first and a second flange extending above a first surface of said section; and gradually sloping surfaces extending from each of said flanges to said first surface.

2. An arc plate having a shape which permits it to be compression molded in all steel dies using a mixture of ceramic material having less than 5% water comprising a thing elongated section having integrally formed therewith a first and a second flange extending above a first surface of said section; and gradually sloping surfaces extending from each of said flanges to said first surface; said first and second flanges being positioned flush with the long edges of said section for substantially the full lengths thereof.

3. An arc plate having a shape which permits it to be compression molded in all steel dies using a mixture of ceramic material having less than 5% water comprising a thin elongated section having integrally formed therewith a first and a second flange extending above a first surface of said section; and gradually sloping surfaces extending from each of said flanges to said first surface; said first and second flanges being positioned flush with the long edges of said section for substantially the full lengths thereof; a notch cut in said arc plate and extending from an intermediate point on one of the long edges of said section to one of the short edges of said section at a point substantially at the other of said long edges.

4. An arc plate having a shape which permits it to be compression molded in all steel dies using a mixture of ceramic material having less than 5% water comprising a thin elongated section having integrally formed therewith a first and a second flange extending above a first surface of said section; and gradually sloping surfaces extending from each of said flanges to said first surface; said sloping surfaces being concave.

5. An arc plate having a shape which permits it to be compression molded in all steel dies using a mixture of ceramic material having less than 5% water comprising a thin elongated section having integrally formed therewith a first and a second pair of flanges; said first pair of flanges extending from a first surface of said section and said second pair of flanges extending from a second surface of said section opposite to said first surface; gradually sloping surfaces extending from each of said flanges to the respective surfaces from which said flanges extend; one of said flanges of each of said pairs of flanges being positioned flush with a long edge of said section and the other of said flanges of each of said pairs of flanges being positioned flush with the other long edge of said section; a notch cut in said arc plate and extending from an intermediate point on one of the long edges of said section to one of the short edges of said section at a point substantially at the other of said long edges.

6. An arc plate having a shape which permits it to be compression molded in all steel dies using a mixture of ceramic material having less than 5% water comprising a thin elongated section having integrally formed therewith a first and a second pair of flanges; said first pair of flanges extending from a first surface of said section and said second pair of flanges extending from a second surface of said section opposite to said first surface; gradually sloping surfaces extending from each of said flanges to the respective surfaces from which said flanges extend; said sloping surfaces being flat.

7. An arc plate having a shape which permits it to be compression molded in all steel dies using a mixture of ceramic material having less than 5% water comprising two narrow elongated spaced parallel support platforms each having a first surface positioned in a common plane and a continuously curved concave surface extending between said first surfaces.

8. An arc chute comprising a hollow shell and a plurality of arc plates stacked therein; each of said plurality of arc plates having a shape which permits it to be compression molded in all steel dies using a mixture of ceramic material having less than 5% water and comprising a thin elongated member having a depressed portion extending longitudinally thereof, raised portions positioned along the long edges thereof and extending from at least one of the large surfaces thereof, and gradually sloping surfaces extending from said raised portions to said depressed portion; said gradually sloping surfaces combining to form a concave continuously curved surface.

9. An arc plate having a shape which permits it to be compression molded in all steel dies using a mixture of ceramic material having less than 5% water comprising a thin elongated section having integrally formed therewith a first and a second flange extending above a first surface of said section; and gradually sloping surfaces extending from each of said flanges to said first surface; said arc plate having a transverse cross-section wherein the combined lengths of said gradually sloping surfaces exceeds the length of said first surface.

10. An arc plate having a shape which permits it to be compression molded in all steel dies using a mixture of ceramic material having less than 5% water comprising a thin elongated section having integrally formed therewith a first and a second flange extending above a first surface of said section; and gradually sloping surfaces extending from each of said flanges to said first surface; said sloping surfaces being flat; said arc plate having a transverse cross-section wherein the combined lengths of said gradually sloping surfaces exceeds the length of said first surface.

References Cited in the file of this patent

UNITED STATES PATENTS

2,759,073	Wood	Aug. 14, 1956

FOREIGN PATENTS

1,128,986	France	Sept. 3, 1956
118,717	Sweden	Apr. 29, 1947