Oct. 21, 1952 J. A. FAVRE 2,615,109

ZIGZAG MAGNETIC LABYRINTH ARC MUFFLER

Filed Jan. 25, 1950

Fig. 1.

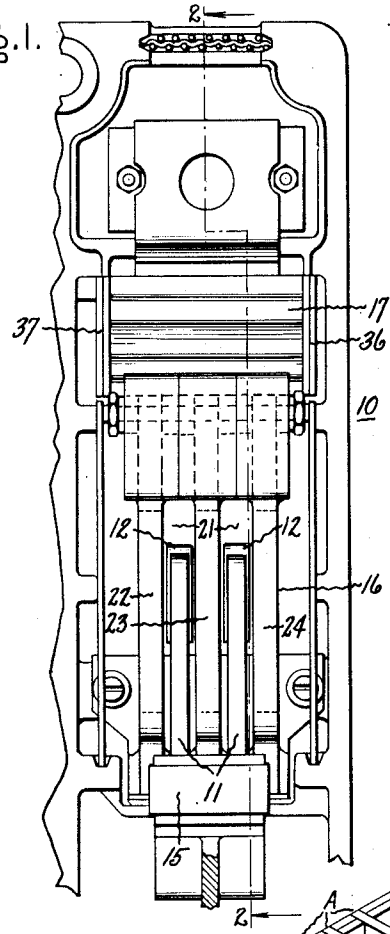


Fig. 2.

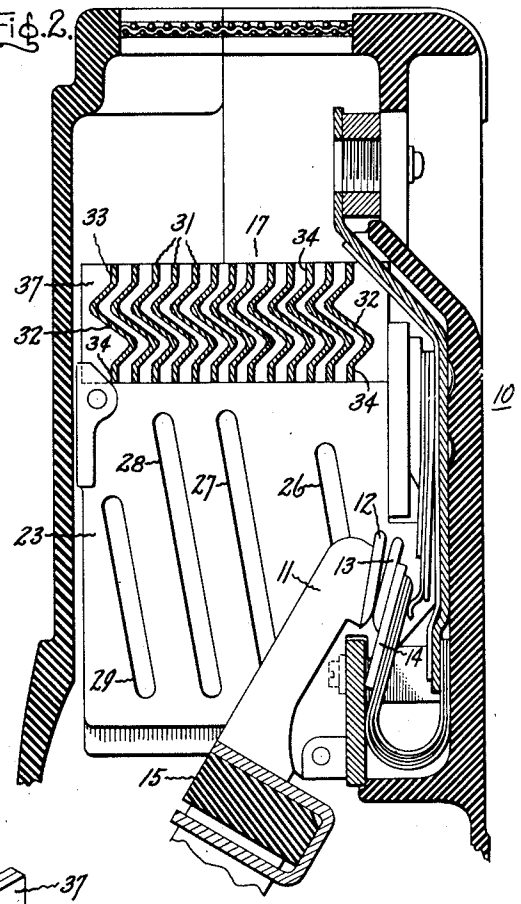
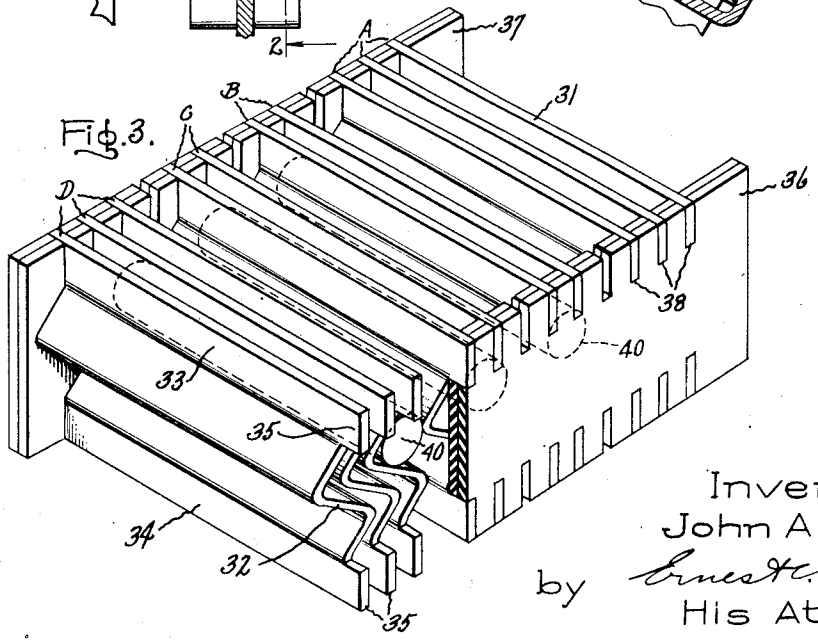


Fig. 3.



Inventor
John A. Favre
by Ernest C. Britton
His Attorney

Patented Oct. 21, 1952

2,615,109

UNITED STATES PATENT OFFICE

2,615,109

ZIGZAG MAGNETIC LABYRINTH ARC MUFFLER

John A. Favre, Drexel Hill, Pa., assignor to General Electric Company, a corporation of New York

Application January 25, 1950, Serial No. 140,414

5 Claims. (Cl. 200—147)

1

The invention relates to arc mufflers, particularly of a type suitable for suppressing the flash from the cooperating arc quenchers of enclosed or semi-enclosed circuit breakers or in other similar service where a severe arc flash resembling an explosion must be suppressed within a relatively small space.

The principal object is to provide an improved nesting type of double offset or zigzag corrugated magnetic labyrinth arc muffler capable of establishing magnetic attraction for drawing the arc into a loop inside a restricted arc-quenching space, providing abrupt changes in direction of the zig-zag passage formed between nesting zigzag magnetic members so that any incandescent particles projected with the gases are intercepted by the double offset corrugated members and deposited thereon, as well as providing a plurality of heat-absorbing zigzag passages spaced to secure good turbulence and scouring and hence rapid cooling or quenching of the hot arc gases, all without unduly drawing the arc into the muffler or unduly restricting the flow of the gases therethrough.

Another object is to provide an improved arc muffler unit assembly having a plurality of parallel tortuous paths formed by nesting double offset zigzag magnetic plates of sufficient mass and spacing adjacent the path of the arc to successfully withstand the maximum arcing action and insure efficient heat absorption of several arcing actions in close succession and with the nesting double offset zigzag corrugations of the plates serving to minimize buckling or warping thereof under maximum arcing conditions.

Other objects and advantages of the invention will appear in the following description of the accompanying drawing in which Fig. 1 is a partial front view of one pole of a semi-enclosed circuit breaker having an arc quencher provided with an arc muffler embodying the improvements of the present invention; Fig. 2 is a sectional view of the circuit breaker pole shown in Fig. 1 along the section line 2—2 and showing the spaced operating relation of the arc muffler with respect to the arc quencher wherein the arc is drawn between the stationary and movable circuit breaker contacts; and Fig. 3 is an enlarged perspective view showing the details of construction of a modification of the improved zigzag magnetic labyrinth type of arc quencher of the present invention suitable for heavy current service.

Referring to Figs. 1 and 2, the single pole of the semi-enclosed multi-slot circuit breaker indicated generally by the reference character 10 is

2

provided with a pair of shunt connected movable contact arms 11 having contact facings 12 operable into and out of abutting engagement with the contact facings 13 of the cooperating stationary contact members 14. The movable switch contacts 11 are carried by cross arm 15 that also carries the contacts of the other poles of the circuit breaker, not shown, and is operated by suitable operating mechanism, also not shown. The arc produced upon separation of contact facings 13 is quenched in an arc quencher 16 and the flash is suppressed by the improved magnetic labyrinth arc muffler 17 of the present invention.

As shown, the two movable switch members 11 operate in parallel slots 21 formed between arc-quenching barriers 22, 23 and 24 that are of the improved transverse slotted type more fully described and claimed in the patent application, Serial No. 132,258, filed December 10, 1949 by Charles H. Titus and assigned to the assignee of the present invention. Thus, the arc drawn between the contact faces 12 and 13 upon opening of the circuit breaker is immediately brought into intimate contact with the arc-quenching barriers 22, 23 and 24 and subjected to the arc-quenching action thereof which is materially improved by the provision of the series of parallel intercommunicating slots 26, 27, 28 and 29 in each of the barriers.

The improved zigzag magnetic labyrinth arc muffler 17 of the present invention serves to attract the arcs and to suppress the flash issuing from the slots 21 when parallel arcs are drawn therein to interrupt the circuit. As shown in Fig. 2, the arc muffler 17 is composed of a plurality of nested zigzag magnetic members 31 that are mounted in juxtaposition along the edge of the arc quencher plates 22, 23, and 24 to form a plural offset zigzag path magnetic labyrinth having each zigzag path traverse the path of the arc in each slot 21. Each of the magnetizable members 31 is provided with central double offset zigzag corrugations 32 projecting laterally on opposite sides thereof and with parallel poles 33 and 34 that project beyond the zigzag edges of the corrugations 32 to form mounting lugs 35 as more clearly shown in the perspective view of Fig. 3. A pair of side barriers 36 and 37 are formed of suitable insulating material for abutting the zigzag edges of members 31 and provided with a series of slots 38 in the opposite edges thereof for receiving the projecting lugs 35 therein so as to mount the magnetic members 31 with the oppositely projecting corrugations 32 of adjacent members in parallel nested spaced-apart relation on opposite

sides of the longitudinal axis of the zigzag passage formed therebetween and with each zigzag passage laterally closed by the insulating side barriers **36** and **37**. As shown, each of the side barriers **36** and **37** is formed of two duplicate pieces of insulating material in order to facilitate punching of the slots therein.

Upon the opening of the circuit breaker to establish parallel arcs in the slots **21**, magnetic members **31** are magnetizable by the current in the arcs and due to the concentration of the magnetic mass resulting from the nesting of the oppositely projecting zigzag corrugations **32** provide sufficient magnetic attraction for drawing the arcs into a loop inside the slots **21**, thereby elongating the arcs and facilitating the arc-quenching action of the transversely slotted insulating barriers **22, 23** and **24**. At the same time, the plurality of nested spaced-apart zigzag magnetic members **31** a provide a plurality of heat absorbing zigzag passages therebetween spaced to provide good turbulence and scouring, and hence rapid cooling or quenching of the hot arc gases that are recived from the slots **21**. Any incandescent particles carried in the gases are intercepted by the members **31** in their passage through the magnetic labyrinth and deposited thereon. The double offset zigzag corrugation of the members **31** also serves to minimize buckling or warping thereof under maximum arcing conditions. Hence, the improved nested zigzag magnetic labyrinth arc muffler **17** is able to successfully withstand several arcing actions in close succession.

The modified form of the invention shown in Fig. 3 is particularly adapted for heavy current service wherein somewhat less concentrated magnetic attraction and somewhat more restriction to gas flow is required of the magnetic labyrinth arc muffler **17** due to the increased loop self-expanding action of the arcs carrying the heavier currents. To reduce the magnetic attraction, a suitable number of the magnetic members **31** may be removed from the muffler **17** at spaced intervals, thus leaving the remaining members **31** in spaced-apart groups A, B, C, and D, as shown in Fig. 3. Then, in order to further restrict the passage of the arc gases through the enlarged passages in the muffler **17**, insulating pins **40** are interposed to substantially close the spaces between the aligned groups of magnetic members **31** forming the labyrinth. Thus, with the improved nested zigzag plural path magnetic labyrinth muffler modified as shown in Fig. 3, the overall restriction to gas flow through the zigzag members is somewhat increased but without correspondingly decreasing the insulation between the members. Furthermore, with the pins **40** located adjacent the top of the enlarged passage between the groups of magnetic members **31**, as shown, pockets for stagnant gas are provided by the enlarged closed space between the groups so as to act as insulators therebetween and also enable portions of the arc to be momentarily vented therein while the main flow of arc gases passes through the plural labyrinthine paths provided by the remaining spaced-apart groups of nested zigzag magnetic members **31**.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. An arc muffler having in combination a plurality of magnetic members, each provided with offset zigzag corrugations projecting laterally on opposite sides thereof, and insulating means for mounting the members in juxtaposition with the oppositely projecting corrugations of adjacent members in nested spaced-apart relation on opposite sides of the longitudinal axis of the zigzag passage formed therebetween to concentrate the magnetic mass of the members for attracting the arc and to intercept particles projected with the arc gases into the zigzag passage.

2. An arc muffler having in combination a plurality of magnetic members, each having parallel mounting lugs and offset zigzag corrugations projecting laterally on opposite sides thereof, and insulating side barriers abutting the zigzag edges of the corrugations and provided with slots for receiving the parallel lugs to mount the members in juxtaposition with the oppositely offset corrugations of adjacent members in nested spaced-apart relation on opposite sides of the longitudinal axis of the zigzag passage formed therebetween to concentrate the magnetic mass of the members for attracting the arc and to intercept particles projected with the arc gases into the zigzag passage.

3. An arc muffler having in combination a plurality of magnetizable plates, each having central double offset zigzag corrugations projecting laterally on opposite sides thereof and parallel poles projecting beyond the zigzag edges of the corrugations to form mounting lugs, and insulating side barriers abutting the zigzag edges of the corrugations and provided with slots for receiving the lugs to mount the members in juxtaposition with the oppositely projecting corrugations of adjacent members in parallel nested spaced-apart relation on opposite sides of the longitudinal axis of the zigzag passage formed therebetween to concentrate the magnetic mass of the members for attracting the arc and to intercept particles projected with the arc gases into the zigzag passage.

4. An arc muffler having in combination a plurality of magnetic plates, each having parallel poles at the ends thereof and central double offset zigzag corrugations projecting laterally on opposite sides of the poles, and insulating means for mounting the plates with the poles in juxtaposition and with the oppositely projecting corrugations of adjacent members in nested spaced-apart relation on opposite sides of the longitudinal axis of the zigzag passage formed therebetween to concentrate the magnetic mass of the plates for attracting the arc and to intercept particles projected with the arc gases into the zigzag passage.

5. An arc muffler having in combination a plurality of magnetizable members, each having double offset zigzag corrugations projecting laterally on opposite sides thereof and parallel poles extending beyond the zigzag edges of the corrugations to form mounting lugs, a pair of insulating side barriers in spaced apart parallel relation for abutting the zigzag edges of the corrugations and having slots for receiving the lugs to mount the members in juxtaposition in spaced-apart groups with the oppositely projecting corrugations of adjacent members of each group in nested spaced-apart relation on opposite sides of the longitudinal axis of the zigzag passage formed therebetween to concentrate the magnetic mass of the members for attracting the arc and to intercept particles projected with the arc gases into each passage, and insulating means closing the space between the groups to prevent

the passage of particles and arc gases therebetween.

JOHN A. FAVRE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,293,513	Linde	Aug. 18, 1942
2,337,949	Walle	Dec. 28, 1943
2,408,352	Titus	Sept. 24, 1946
2,442,199	Dickinson	May 25, 1948