IN THE CANADIAN PATENT OFFICE

DECISION OF THE COMMISSIONER OF PATENTS

Patent application 352,931 having been rejected under Rule 47(2) of the Patent Regulations, the Applicant asked that the Final Action of the Examiner be reviewed. The rejection has consequently been considered by the Patent Appeal Board and by the Commissioner of Patents. The findings of the Board and the ruling of the Commissioner are as follows:

Agent for Application

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Commissioner's Decision

Obviousness: Electric Fuse

Multiple helical cadmium fuse elements embedded in sand grains of specified purity now specified in the amended claims clear the cited art.

Final Action: Reversed

This decision deals with the applicant's request for review by the Commissioner of Patents of the Final Action on application 352,931 (class 306-157) filed on May 28, 1980. It is assigned to Kearney-National Inc. and is entitled Electric Fuse and Method of Interrupting an Electric Current. The inventor is Vojislav Narancic. The Examiner in charge issued a Final Action on August 6, 1982 refusing to allow the application. In view of information provided in supplemental letters subsequent to the response to the Final Action, the Patent Appeal Board believes a review of the evidence on file permits a sufficient assessment of the merits of the application without conducting a Hearing. The Board recognizes that Applicant's right to a Hearing has not been waived.

The subject matter of the application relates to electric fuses for interrupting all values of electric current in a high voltage circuit. Figures 2 and 3 are illustrated below.

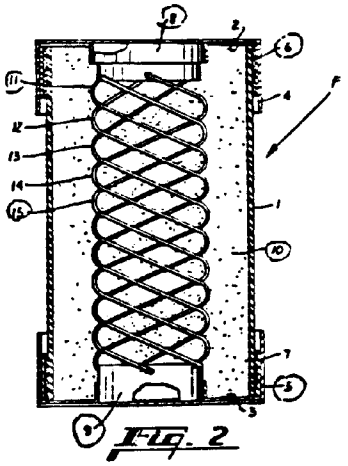

Fig. 2

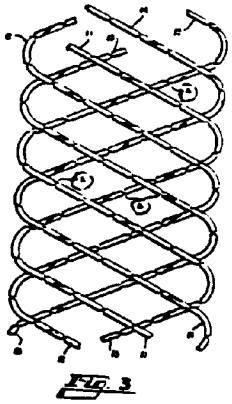

Fig. 3

Helical fusible ribbon elements 11-15 are embedded in silica sand 10 within tubular housing 1. These elements are attached to sleeves 8 and 9 contacting end caps 5 and 6. Each fusible element is provided with notches 16.

In the Final Action the Examiner refused the application in view of the following patents.

United States Patents

3,835,431	September 10, 1974	Rosen et al
1,208,448	December 12, 1916	Arthur
3,529,270	September 15, 1970	Kozacka

Rosen et al relates to a high voltage fuse designed for low overcurrent and short circuit duties. Figures 1 and 2 are shown here

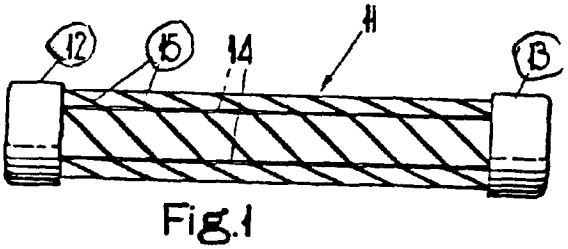

Fig.1

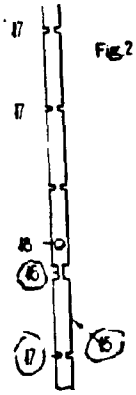

Fig.2

An electrically-insulating former 11 has spaced longitudinal ribs 14 and a plurality of silver strip fuse elements 15 that are wound in helical form between end caps 12 and 13. Element 15 is provided with "short circuit" necks 16 and 17 to ensure a rapid rate of arc extinction under short circuit conditions.

Arthur describes an electric fuse using a fusible member of metallic cadmium, as shown in Figure 1 below.

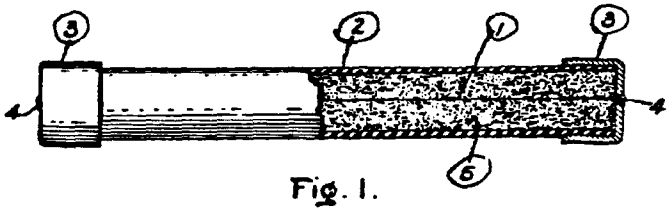

Fig. 1.

Insulating shell 2 has end caps 3 joined by a cadmium conductor 1. The interior of shell 2 is filled with a filler 5 of silicic acid particles.

Kozacka shows an electric fuse filled with quartz and surrounding a cadmium wire fusing element and having ends that are conductively connected by soft solder joints to the terminal caps.

In the Final Action the Examiner stated (in part):

> The applicant argues that, since neither Arthur nor Kozacka disclose a high voltage, general purpose, multi-element fuse, a person skilled in the art "would not be led to the structure as claimed by their disclosures". This argument is not persuasive. The object of the substitution of cadmium elements in a multi-element fuse, such as shown by Rosen et al, is to improve its reliability under sustained low intensity overloads and both Arthur and Kozacka clearly teach that cadmium is the most suitable material for this purpose. Furthermore, neither Arthur nor Kozacka state that their fuses are of special-purpose type, and Kozacka specifically states that his fuse is used in an electric system having a circuit voltage in excess of 600 volts.
>
> The applicant also argues that "the commutation action" is recited in the claims in considerable detail and the purity of cadmium is specified. The first of these two arguments is not valid. Since no "details" of the commutation action are defined in the claims apart from a mere functional statement that the arcs are "extinguished in random sequence in fusible elements via commutation action" (claim 1, last five lines and claim 7, lines 27-29). It is also pointed out that a sequential random melting and arcing "via commutation action" will occur in any fuse comprising a plurality of elements connected in parallel, as is clearly described in the Rosen et al disclosure (column 4, lines 59-68 and column 5, lines 1-18).
>
> Regarding the argument concerning the specification of purity of cadmium, it is obvious that the inherent properties of an element depend on the degree of its purity and, therefore, it is desirable to use material of the highest possible purity.
>
> In view of the foregoing, it is held that the application contains nothing of an inventive nature. Therefore this application is refused.

In response to the Final Action the Applicant deleted all but two claims. This was followed by two supplements to request for review. These supplemental requests submitted additional amendments to the remaining two claims as well as supplying affidavits from the inventor and the Director of Advance Product Planning for the Applicant. Those responses stated (in part):

> Arthur and Kozacka each disclose fuses having a single fusible element. Neither of these discloses a fuse having a plurality of helical fusible elements as required by applicant's proposed claims 1 and 2. This is a significant distinction. Reference is made to the enclosed Affidavit of the inventor Mr. Narancic. As noted in paragraph 2 of Mr. Narancic's Affidavit, multiple elements, as required by applicant's proposed claims 1 and 2, are used in high voltage, kilovoltage fuses, but are not used in low voltage fuses....
>
> ....As noted in paragraph 3 of Mr. Narancic's Affidavit, one reason why it would not have been obvious to employ cadmium in a high voltage fuse is that it could not have been predicted that the residue remaining after the cadmium element melts would be capable of holding up under the high voltages imposed across the fuse.
>
> Reference is also made to the enclosed Affidavit of Arthur C. Westrom. It will be noted from paragraph 2 of Mr. Westrom's Affidavit that the use of cadmium in the fuses produces distinct advantages, notably simplified construction and drastically reduced cost. As noted in paragraph 3 of Mr. Westrom's Affidavit, the fuses which are the subject of the invention have met with considerable commercial success.
>
> It is believed applicant has demonstrated that the prior art does not disclose or suggest applicant's fuse as claimed and that applicant has provided reasons why his structure as claimed would not have been obvious to one skilled in the art in view of the applied references. Applicant's evidence of commercial success supports the point. In view of the advantages and the commercial success, this can hardly have been an obvious development, since surely someone before the present applicant would then have made the development, in view of the advantages and the commercial possibilities....
>
> ....It may be noted, for example, that the prior publications of use of cadmium in the Arthur and Kozacka patents use cadmium in the context of a low voltage fuse. Arthur and Kozacka are not analogous art, as suggested, and neither of these has been reduced to commercial practice as far as applicant is aware. The present invention is, like the Rosen et al and the Kozacka Patent 3,743,994, concerned with a high voltage fuse. A high voltage fuse has requirements which distinguish it from low voltage fuses and has structural features which distinguish it from low voltage fuses. Thus, for example, because after the fuse has operated it must withstand a high voltage, high voltage fuses are considerably longer than low voltage fuses, so that the high voltage fuse has the ability to withstand a high voltage applied across it. In a high voltage fuse, one has to employ a fuse element of a certain length which will ultimately melt along its entire length and maximize the ability of the fuse to withstand the high recovery voltage. This is in contrast to low voltage fuses, where the simple opening of a gap is sufficient to sustain the recovery voltage. In a high voltage fuse, a plurality of individual fuse elements are used and the fuse elements are ordinarily coiled helically, so as to accommodate the relatively long fuse elements within compact length.

The issue before the Board is whether or not the application presents patentable subject matter in view of the cited references. Claim 1 as amended by applicant's letter received on July 15, 1987 reads:

> An electric general purpose current limiting fuse for use in circuits of at least 1000 volts, said fuse comprising a tubular housing of insulating material constructed to withstand the circuit recovery voltage following a circuit interruption by the fuse, a terminal cap mounted on each end of said tubular housing and constituting closure elements thereof, quartz sand of substantially spherical grains of which approximately 98% are retained on sieve mesh size 100, approximately 75% on mesh size 50, approximately 30% on mesh size 40, and approximately 2% on mesh size 30, said sand being formed in excess of 99% purity and disposed within and substantially filling said housing, a plurality of substantially homogeneous helical fusible elements formed of cadmium of 95% to 99.999% purity embedded in and supported on all sides by said quartz sand and having their ends connected with said terminal elements respectively to form a plurality of parallel conducting paths therebetween, said fusible elements melting and interrupting currents many times the rated current of the fuse with a high degree of current limitation and each of said fusible elements being heated throughout substantially the entire length thereof to a temperature approximating the melting temperature thereof and substantially below the boiling temperature thereof by currents of low magnitude and slightly in excess of normal rated current, whereby said fusible elements melt in random sequence and arcs thereafter being established and extinguished in random sequence in said fusible elements via commutation action for currents of low magnitude and slightly in excess of normal rated current.

It is the Examiner's position that substitution by cadmium elements to improve fuse reliability under sustained low intensity overloads is shown by Arthur and Kozacka. Further, he maintains that the applicant's use of notches in the fuse element is clearly shown in Rosen et al.

On the other hand, the Applicant argues that the Rosen et al fuse elements are supported on a former or core which reduces in insulating properties at the high temperatures produced during arcing. By supporting the fusible elements on all sides by quartz sand, the Applicant's arrangement provides numerous advantages such as relieving tension during heating and cooling cycles and absorption of arc energy. While acknowledging that Rosen et al indicates that silica sand may be used for arc quenching material, the Applicant emphasizes that his filler material of 99% purity enhances the efficiency of the fuse for he notes quartz sand can itself melt or fuse and this degree of purity is not suggested by the cited art.

Other disadvantages of Rosen et al pointed out by the Applicant are that cores or formers made of organic materials produce carbon on the surface during arcing conditions which can cause failure during the post-arc period and the former or core is more costly than quartz sand. In addition, Rosen et al uses a silver fuse element provided with an "M" spot to reduce the melting point which complicates fuse construction and increases the price of manufacturing that fuse.

Arthur discloses a single linear cadmium fuse element in fuses for circuits carrying 4 amperes having 500 volts or less. Use of silica containing substantial quantities of water is mentioned in Arthur. The application before us is for circuits of 1000 volts or more and the plurality of cadmium elements utilized therein have areas of reduced cross-section to provide uniform fusing characteristics in circuits carrying more than 30 amperes of current.

Kozacka shows a single wire element of cadmium in a cartridge fuse for electrical systems having a circuit voltage of 600 or more volts. It describes the methods of connecting the cadmium element to the end caps of the fuse. Quartz sand is used as a filling in the fuse but the degree of purity of the sand or the cadmium element is not specified.

We have carefully reviewed the IEEE TRANSACTIONS on POWER APPARATUS and SYSTEMS Vol. PAS-101, No. 7, July 1982, pages 1870 to 1877 submitted in response to the Final Action. As evidenced by the discussions at the end of this paper, it is clear that the use of cadmium in fuses carrying high current at 15 KV or more was not obvious to people skilled in the art of electrical power transmission.

Further we note that in a letter to the inventor dated July 6, 1982, the Industrial Research and Development Division of Dun & Bradstreet selected the applicant's invention as one of the hundred most significant technological advances of the year. Data showing sales figures indicates that the applicant's fuse enjoys considerable commercial success.

Amended claim 1 specifies a circuit of at least 1000 volts, quartz sand grains of at least 99% purity, of which 98% are retained on a sieve mesh size 100, 75% on mesh size 50, 30% on mesh size 40, 2% on mesh size 30, and helical fusible elements formed of cadmium of 95% to 99.999% purity. It may be argued that Rosen et al, Arthur and Kozacka to some extent show the components used in the applicant's invention. We note from the Narancic affidavit that prior to his invention multiple elements were not used in low voltage fuses. Further, he adds when the cadmium elements melt and the residue disperses onto the filler it is capable of withstanding high voltage subsequently imposed across the fuse, something not possible in the cited references. We believe that the Applicant's fuse containing multiple helical cadmium elements of specified purity embedded in sand grains of the specified purity represents a patentable advance in the art.

Consequently, we recommend withdrawal of the Final Action and acceptance of the claims submitted with the Applicant's letter of July 15, 1987.

M.G. Brown
Acting Chairman
Patent Appeal Board

S.D. Kot
Member

I concur with the findings and recommendations of the Patent Appeal Board. Accordingly, I remand the application for prosecution consistent with the recommendation.

J.H.A Gariépy
Commissioner of Patents

Dated this 16 day of November 1987
Hull, Québec.

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