

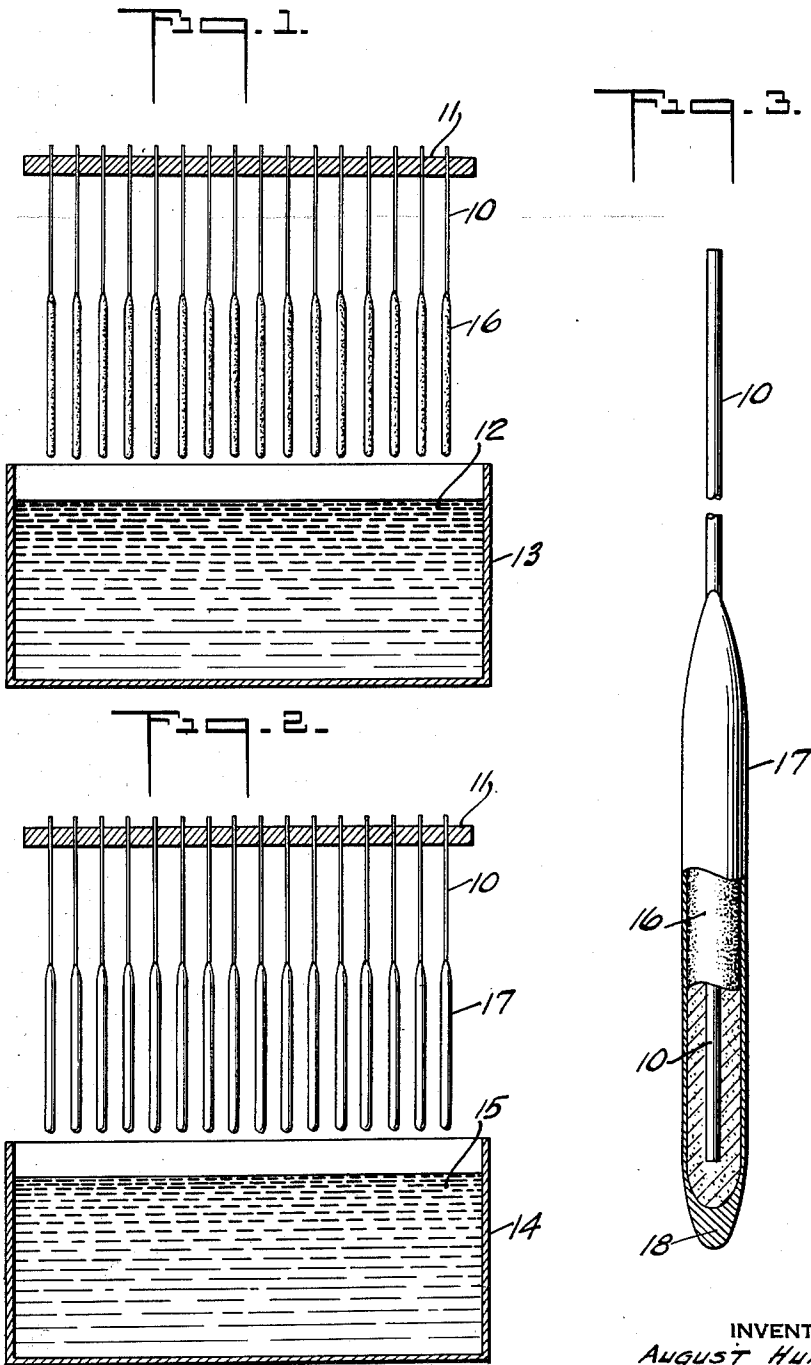
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SPARKLER

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## SPARKLER

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6 Claims. (Cl. 86—1)

My present invention in its most specific application is concerned with the pyro-technic devices commonly known as sparklers.

Among the objects of the invention are to provide a sparkler, which is not subject to the degeneration commonly incurred while the sparkler remains in stock, as by chemical deterioration due to the access of moisture thereto and the resultant flaking off of the composition.

Another object is to provide a sparkler of the above type, which has a surface finish rendering the composition substantially non-shatterable under mechanical impact and also materially enhancing its attractiveness and adding to its appeal, especially to children, to whom these articles are commonly sold.

Another object is to provide a sparkler of the above type which may be ignited with greater facility than conventional sparklers, which burns with enhanced brilliance without increasing in the least the hazard to the user, and the added utility of which is attained without the slightest danger of dripping, sputtering or evolution of noxious gases or fumes in use.

Another object is to provide a sparkler of the above type which can be produced without great increase in the cost of producing conventional sparklers.

The conventional sparkler composition comprises a slurry of barium nitrate and aluminum powder with iron filings, combined with an adhesive, usually dextrine, glue or gum arabic solution, with preferably a modicum of magnesium carbonate, into which slurry the wires are dipped, the body thus formed on the wire end by one or more dippings being allowed to dry. In drying, the aqueous content of the binder is evaporated but the conventional sparkler resulting will be satisfactory only so long as it is kept dry. Should moisture reach the sparkler, the barium nitrate will attack the metallic aluminum powder, with which it reacts to produce aluminum oxide and barium hydroxide with the evolution of ammonia gas. This renders the pyrotechnic body porous and mechanically weak, facilitating the entry of further moisture thereinto with marked deterioration of the burning quality as well as flaking off of the composition from the wire. This conventional sparkler must be carefully handled against impact, as the composition is readily shatterable or broken in rough handling.

In its broadest aspects, the invention comprises coating the elongated conventional pyro-technic composition body on the sparkler wire with an appropriate anhydrous waterproof coating, pre-

erably in the form of a dry, tenacious but flexible film, not subject to spontaneous combustion, non-odorous, which is, however, easily ignitable and vaporizes directly when ignited, and is, accordingly, not subject to melting or dripping, prior to or during combustion of the sparkler.

Another feature is the use in the waterproof protective composition of a combination of combustion promoting and combustion retarding ingredients so selected that in the use of the sparkler, the coating burns only slightly ahead of the advancing ember consuming the pyro-technic body.

In the combustion retarding ingredient of the coating, there is ordinarily included coloring matter, preferably a pigment such as a chromate, which imparts to the sparkler body a vivid highly polished colored finish of red, yellow, blue, green or any other selected color.

The preferred coating composition comprises low nitration organic bodies, such as collodion dissolved preferably with suitable coloring materials, such as pigments in a non-aqueous solvent. Preferably nitro-cellulose lacquer is employed, ordinarily mono-nitro-cellulose which with the pigment is dissolved in a solvent, preferably an ester such as butyl or amyl acetate, coal tar hydrocarbons, petroleum distillates or if desired, ethers and alcohols, such as ethyl or butyl alcohol.

The coloring matter used is preferably a pigment, ordinarily chromates, which by weight should not ordinarily exceed ten per cent of the weight of the entire lacquer. Instead of pigment, dyes may be used of the character soluble in the organic solvent of the lacquer, such, for instance, as sulphonated phenylated tri-phenyl methane.

The larger the proportion of nitro-cellulose used in the lacquer, the greater its rate of combustion. The more pigment, the slower its combustibility. By appropriate selection of proportions, the rate of combustion of the lacquer can be predetermined in accordance with the rate of combustion of the pyro-technic composition of the wire.

It is preferable to select the proportions so that the coating burns but a small fraction of an inch ahead of the burning ember. In practice a composition including 23.5 per cent by weight of mono-nitrocellulose and 4 per cent by weight of red or green pigment, or 9 per cent of yellow chrome, and the rest solvent, has been found especially suitable as a coating on the conventional sparkler above described.

The general type of lacquer coating is believed to be unique in its utility for present purposes.

Other coatings such as paraffin, silicate, paint, casein, gelatin, rubber cement and the like are each subject to one or more objections, some of fusibility and others of charring, rather than having the desired ignitability.

In the accompanying drawing, in which is illustratively shown equipment for producing the sparkler,

Fig. 1 is a diagrammatic view of the conventional mode of forming the pyro-technic composition upon the carrier wire,

Fig. 2 is a view similar to Fig. 1 showing the method of placing the protective coating on the conventional sparkler, and

Fig. 3 is a sectional view on a larger scale showing the completed sparkler.

Referring to the drawing, the conventional sparkler wires 10 usually are nine to ten inches long and of eighteen gauge wire, but may be longer, if desired, and are removably mounted to depend from a suitable rack 11 and are simply dipped ordinarily to the depth of about six inches into the slurry 12 of the conventional ignitable composition above described kept in a tank or tub 13. After each dipping in the slurry, the wires are hung up to dry and the dippings continued until the composition has been deposited to a thickness ordinarily of  $\frac{1}{8}$  to  $\frac{1}{4}$  inch.

After the composition has dried completely and while still depending from the rack 11, the protective coating is applied by dipping into a tub 14 with lacquer 15 therein of the composition above described. In this case also, the wires are preferably dipped to submerge the pyrotechnic composition therein, and such dipping may, if desired, be repeated should a thicker coating be wanted. Thereupon, the sparklers are hung up to dry and then removed from the carrying rack 11 and are ready to be packaged and marketed.

The cross-sectional view of Fig. 3 shows the construction of the finished sparkler, with its wire 10, its body 16 of pyro-technic composition, and its protective coating 17. The coating, it will be noted, has a thickened end 18 at the extremity of the wire due to the congealing of the final drop of lacquer from each dipping operation on the lower end of the drying sparkler.

While the lacquer coating is not subject to spontaneous combustion, this thickened end of lacquer facilitates ignition of the sparkler, which thereupon burns, as previously set forth, the burning lacquer contributing to the brilliance of the sparking without tending to quench the same and the lacquer burning a small fraction of an inch ahead of the advancing ember.

It will thus be seen that there is herein described an article and a method in which the several features of this invention are embodied, and which in operation attain the various objects of the invention and are well suited to meet the requirements of practical use.

As many changes could be made in the above article and method and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description shall be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A pyrotechnic sparkler comprising a wire having a slurry solidified thereon, consisting of aluminum powder, barium nitrate and iron filings, bonded by a binder and extending along part of the length of said wire, said slurry having a non-aqueous, non-hygroscopic substantially waterproof coating film thereon, said coating comprising mono-nitro-cellulose, a solvent carrier therefor and a pigment, said pigment comprising at least one of weight less than 10 per cent the total weight of the lacquer.

2. A pyrotechnic sparkler comprising a wire having a slurry solidified thereon, consisting of aluminum powder, barium nitrate and iron filings, bonded by a binder and extending along part of the length of said wire, said slurry having a non-aqueous, non-hygroscopic substantially waterproof coating film thereon, said coating including mono-nitro-cellulose, a pigment and a solvent carrier therefor, said carrier of at least one of the group including butyl alcohol, amyl acetate, ether and alcohol, the ingredients being in proportion to afford vaporization slightly in advance of the burning ember in the use of the sparkler.

3. The combination set forth in claim 2 in which the nitrocellulose is in the neighborhood of 25 per cent the weight of the lacquer and the pigment in the neighborhood of 4 to 10 per cent the weight of the lacquer.

4. A pyrotechnic sparkler comprising a carrying wire, a composition covering part of the length of said wire and including two elements performing a thermic reaction, a binder and metallic elements of low melting point brought to incandescence by the thermic reaction, said composition having a waterproof film coating thereon presenting a thickened end, said coating being readily ignitable for ready ignition of the sparkler from its said thickened end.

5. A pyrotechnic sparkler comprising a carrying wire, a composition covering part of the length of said wire and including two elements performing a thermic reaction, a binder and metallic elements of low melting point brought to incandescence by the thermic reaction, said composition having a waterproof film coating thereon presenting a thickened end at the extremity of the wire, said coating being readily ignitable for easy ignition of the sparkler from its end, said coating including nitro-cellulose, pigment and a solvent in proportion such as to afford a rate of combustion substantially that of the rate of advance of the burning ember in use of the sparkler.

6. The method of producing a pyrotechnic sparkler which consists in dipping part of the length of a wire into a slurry comprising aluminum powder, barium nitrate, iron filings and an adhesive binder, such as dextrin solution, hanging said product to dry and thereupon dipping said product into a waterproof lacquer coating, including a pigment therein, and of the type forming a tenacious flexible film and repeating the dipping operation a plurality of times after each previous coating has become sufficiently dry to cease dripping, and maintaining the sparklers suspended with the composition downward, thereby to form a thickened end of the lacquer film for facility in igniting the sparkler in use.