

[54] **SPARKLER COMPOSITION**
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 [22] Filed: **Nov. 29, 1972**
 [21] Appl. No.: **310,457**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 146,366, May 24, 1971, abandoned.
 [52] U.S. Cl. **149/19.91**, 102/31, 149/41, 149/44, 149/76, 149/20, 264/3 B
 [51] Int. Cl. **C06d 1/04**
 [58] Field of Search 149/19, 40, 41, 20, 44, 149/61, 76; 264/3 R, 3 C, 3 B; 102/31

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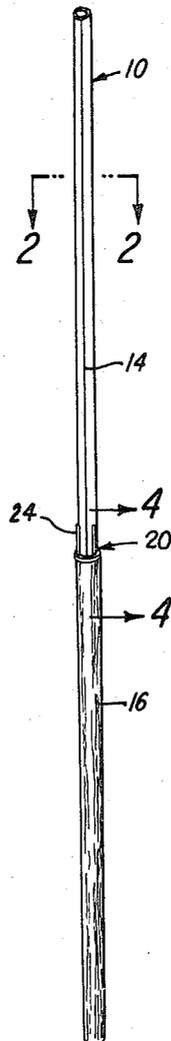
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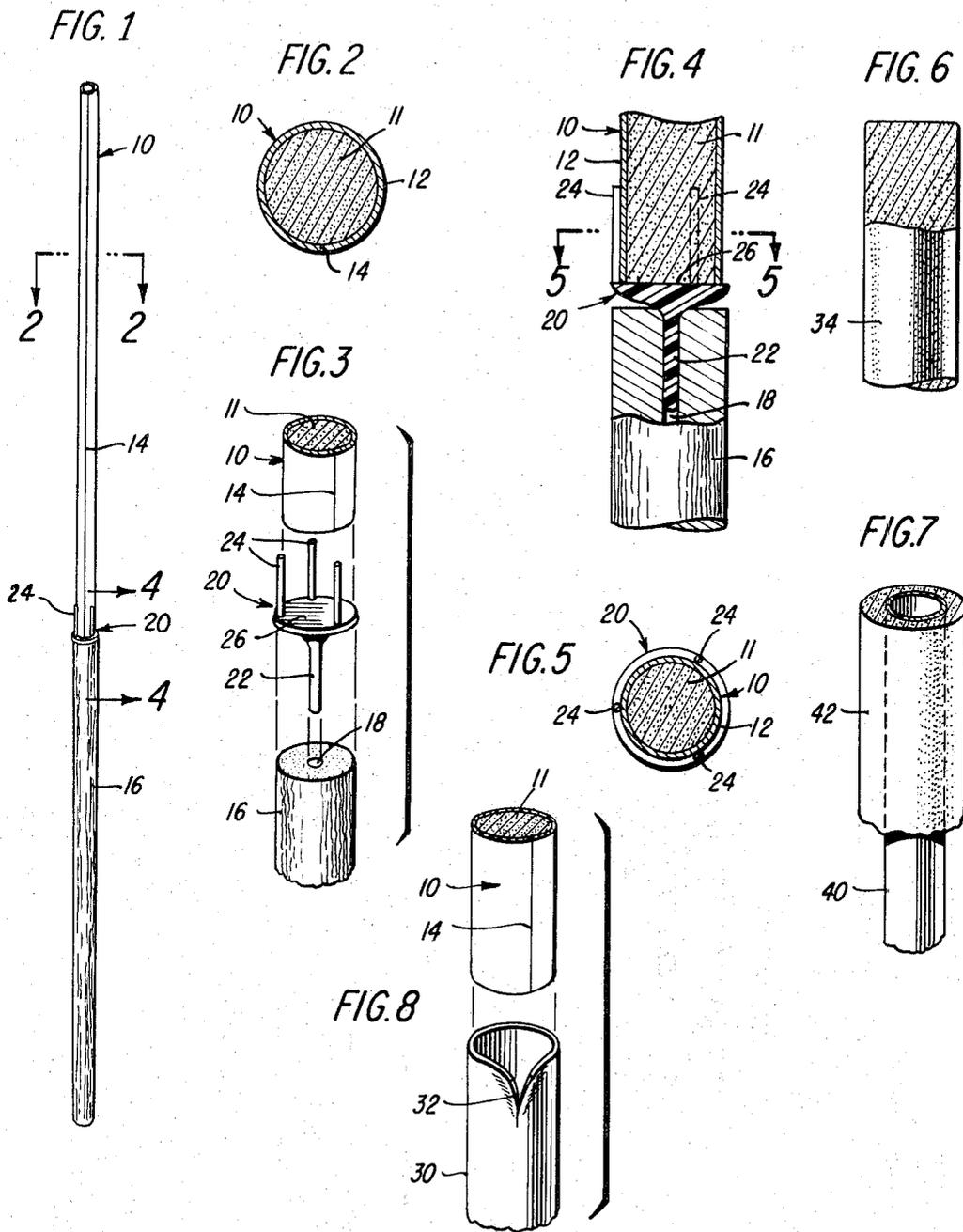
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[57] **ABSTRACT**

A sparkler capable of being molded into a self-supporting rigid stick capable of ignition at one end and of burning progressively to the other end with a suitable holder to support it while burning. The particulate pyrotechnic composition comprises an oxidizer, including ammonium perchlorate, a fuel preferably including a combustible binder, and a combination rate modifier and colorant may also be added. The pyrotechnic composition is preferable enwrapped in an outer paper or other combustible material covering.

13 Claims, 8 Drawing Figures





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SPARKLER COMPOSITION

This application is a continuation-in-part of application Ser. No. 146,366 filed May 24, 1971, now abandoned.

The present invention relates to a new type of sparkler and more particularly to a novel structure of sparkler and a novel composition for making it.

Heretofore, especially on the Fourth of July it has become a tradition for children to ignite pyrotechnical devices commonly known as sparklers which have a handle portion made of wire which is dipped into a pyrotechnic composition and the coating is dried thereon. During use, after igniting, the pyrotechnic composition burns with a bright light and produces a multiplicity of streamers of rays of light which project radially outwardly in all directions from the device giving a shower of beautiful sparks. The sparkler is lit at the far end and the flame progresses slowly towards the handle as the firework is consumed. The flame heats the wire and it becomes hot enough to glow requiring a period of time after the burning is completed to cool off to the point where it can be touched.

The metal wire core sparkler has been criticized due to the hot glowing wire reaching temperatures of 1,600°F. and upward while burning thereby causing more fires and injuries than any other kind of firework, except the firecracker. Various attempts have been made to correct this hazardous condition, such as by the use of wooden cores, however, such products have not proven successful.

Accordingly it is an object of the present invention to provide a new type of sparkler incorporating all of the beauty of the old sparklers but eliminating the hazards of the hot wire.

A further object of the present invention is to provide a novel composition which can be molded into a sparkler.

A still further object of the present invention is to provide a means for holding a molded sparkler during ignition.

Other objects, advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings, wherein:

FIG. 1 is a side view of the novel sparkler and its holder according to the invention;

FIG. 2 is a cross-sectional view along the line 2-2 of FIG. 1;

FIG. 3 is an exploded view showing the sparkling holder in more detail;

FIG. 4 is a cross sectional view along the line 4-4 of FIG. 1;

FIG. 5 is a cross sectional view along the line 5-5 of FIG. 4;

FIG. 6 is a partial view, partly in cross section of a modified form of the sparkler;

FIG. 7 is a partial view of a further modified form of the sparkler; and

FIG. 8 is an exploded view of a still further modified form of the sparkler.

Referring to the drawings, FIGS. 1-5 relate to one form of the structure of the sparkler and its holder according to the invention. The sparkler 10 itself is a solid stick of pyrotechnic material 11 bound together by a suitable binder and enwrapped in a paper or equivalent combustible material outer wrapper 12 extending about the sparkler and meeting at a seam 14. The spar-

kler 10 is generally about one-eighth inch in diameter, however, such dimension is not critical. It has been found that such a dimension results in an effective display for the desired length of time.

The sparkler 10 may be sold separately from any holder arrangement, and the same holder can possibly be used more than once. As shown in FIG. 1, the holder includes a handle 16 having an opening 18 at least in its upper end. The handle may be made of plastic, wood, paper, metal or any other suitable material. A common paper or plastic straw can be used as the handle 14. A small insert 20 can be utilized as an adapter between the sparkler and the handle. The insert 20 is provided with a downwardly extending projection 22 adapted to be received in the opening 18 of the handle and three upwardly extending projections 24 adapted to receive the sparkler tightly therebetween. The insert is also provided with a flat base 26 on which the bottom of the sparkler rests.

To assemble, the sparkler 10 is inserted between the projections 24 of the insert and the sparkler with the insert thereon is inserted into the handle to form an integral structure. During burning of the sparkler it is held by the handle 16. During the burning the sparkler composition is completely consumed and when the burning reaches the insert base 26 it extinguishes itself since the insert is made of a non-inflammable material. The handle can then be reused with a new insert and sparkler, or if the used insert is still integral it can be reused.

A simpler form is shown in FIG. 8 where a conventional paper or plastic straw or other tubular handle 30 is utilized having a hollow portion 32, a diameter suitable to receive the sparkler. For ease in insertion of the sparkler, the upper portion of the handle 30 is slit in one or more places 32.

As shown in FIG. 6, the sparkler 34 is a solid body of cast or extruded pyrotechnic composition and binder without the outer wrapper 12 as shown in FIGS. 1-5.

A still further form of the invention is shown in FIG. 7 wherein a hollow combustible tube 40 is coated with a pyrotechnic composition 42. After burning the sparkler composition 42, the tube 40 which is combustible will continue burning like a match and can be readily extinguished by blowing on it or crushing it. The hollow tube 40 may be a paper straw conventionally used for sipping drinks from a bottle.

The sparkler portion used in any of these embodiments is made up from a composition of the following ingredients:

1. Oxidizer	25-50	pts. by wt.
2. Iron or steel powder	3-14	do.
3. Fuel (including the binder)	3-27	do.
4. Flame Colorant if desired	0-5	do.
5. Combustion rate modifiers if desired	0-5	do.

The oxidizer which is the oxygen supplying ingredient includes ammonium perchlorate. A preferred form of oxidizer is a mixture of barium nitrate and ammonium perchlorate in a ratio of from 1:10 to 10:10 with a preferred ratio of 2:10. The barium nitrate acts to reduce the acrid odor given off by the burning sparkler and also acts to increase the sizzle which is a familiar and desired part of the burning sparkler. Strontium nitrate can be substituted for the barium nitrate. Other oxidizers which can also be included are ammonium

TABLE II

Ingredient	Parts By Weight													
	Ex. 13	Ex. 14	Ex. 15	Ex. 16	Ex. 17	Ex. 18	Ex. 19	Ex. 20	Ex. 21	Ex. 22	Ex. 23	Ex. 24	Ex. 25	
Ammonium perchlorate	25	25	25	25	25	25	25	25	25	25	25	25	25	
MnO ₂						1.0			1	1	1	2.5	1.5	
Iron Powder	6.3	6.3	10	10	10	10	10	12.5	10	10	10	12	10	
Aluminum powder	2.5	2.5	2.5	2.5	2.5	3		3	3	3	3	3	3	
Dextrin	6.3				2.5									
Methyl methacrylate powder		6.3	6.3	6.3	6.3									
MgCO ₃			1.3											
NaHCO ₃				0.5										
SrCO ₃						5								
Polyvinyl alcohol powder						6	6	6	6	6	6	6	6.5	
copper chromite							2.5	1.3						
barium chloride									5				5	
barium ferrite										5				
copper carbonate											5			
carbon												2.5		
dechlorane*													2	

* Dechlorane is a trade-mark of Hooker Chemical Co. for the dimer of hexachlorocyclopentadiene.

Example 26

parts by wt.

Ammonium perchlorate (100-200 mesh)	30. gms
Manganese dioxide (300 mesh)	1.5
Iron powder (60-200 mesh)	10.
Aluminum powder (325 mesh)	2.5
Charcoal Powder	0.5
Fine Polystyrene beads (5 micron avg. size)	5.0
Powdered stearic acid (100-200 mesh)	0.5

Example 27

parts by wt.

Ammonium perchlorate (100-200 mesh)	30
Manganese dioxide (300 mesh)	1.5
Iron powder (60-200 mesh)	10
Aluminum powder	2.5
Charcoal powder	0.5
Fine polystyrene beads (5 micron avg. size)	5.0

Example 28

parts by wt.

Ammonium perchlorate (100-200 mesh)	30
Manganese dioxide (300 mesh)	1.5
Iron powder (60-200 mesh)	10.
Aluminum powder (325 mesh)	2.5
Charcoal powder	0.5
Powdered stearic acid (100-200 mesh)	5.0

What is claimed is:

1. A particulate sparkler composition comprising 25 - 30 parts by weight of an oxidizer at least one half of which is ammonium perchlorate; 3-14 parts by weight of iron or steel powder; from about 8 to about 15.6 parts by weight of a fuel said fuel comprising a mixture of from about 20 to about 33 percent aluminum and/or magnesium powder and accelerators plus from about 67 percent to about 80 percent of a particulate combustible binder, said binder being capable of being activated by heat, solvent or a combination thereof to cause the bonding of the particles; 0 - 5 parts by weight of a combustion rate modifier and 0 - 5 parts by weight of a flame colorant said composition when bonded together into a relatively long thin rigid stick by heat, solvent or a combination thereof having a burning rate

30 suitable for use as a sparkler and being capable of being ignited at one end and of burning progressively to the other end giving off a shower of sparks.

2. A sparkler composition according to claim 1 wherein said oxidizer further includes barium nitrate or strontium nitrate in combination with said ammonium perchlorate.

35 3. A sparkler composition according to claim 2 wherein said oxidizer has a ratio of nitrate to perchlorate of 1:10 to 10:10.

40 4. A sparkler composition according to claim 2 wherein said oxidizer further includes MnO₂.

5. A sparkler composition according to claim 1 wherein said fuel includes approximately 3 parts by weight of aluminum powder.

45 6. A sparkler composition according to claim 2 wherein said fuel includes approximately 3 parts by weight of aluminum powder.

7. A sparkler composition according to claim 5 wherein said binder comprises polyvinyl alcohol powder.

50 8. A sparkler composition according to claim 5 wherein said fuel includes fine polystyrene beads as a binder.

9. A sparkler composition according to claim 8 wherein powdered stearic acid is also present as a part of said binder.

10. A sparkler composition according to claim 5 wherein said fuel includes powdered stearic acid as a binder.

60 11. A particulate sparkler composition in accordance with claim 1, comprising

ammonium perchlorate	30	parts/wt
manganese dioxide	1.5	parts/wt
iron powder	10	parts/wt

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-Continued

aluminum powder	2.5	parts/wt
charcoal powder	0.5	parts/wt
fine polystyrene beads	5.0	parts/wt
powdered stearic acid	0.5	parts/wt.

with claim 11, further comprising 2 - 5 parts by weight of said flame colorant.

13. a sparkler comprising the particulate pyrotechnic composition according to claim 1 bonded together into a rigid stick.

12. A particulate sparkler composition in accordance

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