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FLARE COMPOSITION

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1 Claim. (Cl. 52—23)

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This invention relates to pyrotechnic compositions, and more particularly to compositions for flares adapted to produce a bright illumination when burned.

One of the objects of this invention is to provide a composition for a smokeless flare producing a light of the order of 10,000 candle power, which burns safely and without danger of an explosive pressure building up therein, and which can be manufactured at a minimum cost.

Another object of the invention is to provide a composition for a smokeless flare so that the illumination produced can be projected in a direction tending not to blind an observer approaching from another direction.

It is an object to provide for a flare an illuminant composition which may be formed into a plurality of pellets, preferably in consolidated form, each pellet being separated by insulating material whereby the burning is controlled in a lateral direction and cannot spread longitudinally through the flare.

It is also an object to provide a composition for an illuminant candle which can be formed into one or more preformed pellets assembled together, and which contain pieces of ignitable material serving as a binding means holding the pellets together to prevent its cracking when being handled in assembly or in use. One of the features of the invention is to impregnate this binding material with a composition which when heated has incandescent properties. Another feature resides in forming a part of the pellet of a composition providing an oxidant and a fuel for heating the incandescent material.

It is one of the features of this composition that it may be formed into pellets either by compressing a plurality of increments of pellet composition, separated by thin perforated discs of ignitable material impregnated with compounds of rare earth elements that can be reduced to oxides of the same having incandescent properties when heated, and then covering each end of the pellet with non-ignitable material, or by mixing the loose pellet composition with pieces of similarly treated thread and compressing the mixture to form the pellets.

In the drawings:

The composition of the present invention is imbedded with carriers of impregnated material. Such carriers may be in the form of discs which are impregnated with a mixture of rare earth nitrates, etc. which when reduced form oxides and have incandescent properties upon heating. Nitrates of thorium and cerium are examples of

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this group found to be satisfactory. In the preferred form the carriers are saturated in a thorium solution and allowed to dry at room temperature. For example, one satisfactory formula for the impregnating solution is as follows:

	Per cent
Thorium nitrate mixture-----	99.22
Aluminum nitrate-----	.39
Barium nitrate-----	.39

In the above formula the thorium nitrate mixture comprises about 99% thorium nitrate and 1% cerium nitrate. The solution is then formed by dissolving about 34 parts of the chemicals in 66 parts of distilled water by weight.

It has been found desirable in connection with the thorium nitrate solution to use a very small percentage of aluminum nitrate and barium nitrate, as stated, or beryllium nitrate. Such nitrates tend to reduce the fusion point of the thorium oxide grains so that these refractory light producing oxides are sufficiently adhesive to remain in place and not be carried away too rapidly by the force of the burning. Thus the thorium oxide grains are retained a sufficient time to be heated to incandescence. The impregnated material is added to the discs in such quantities that they are efficiently brought to brilliant incandescence. This quantity can be varied to bring out the best illuminating properties of the rare earth oxides.

The oxidant and fuel contained in the present composition are preferably formed into pellets. Such pellets are consecutively assembled along an axis to form the flare body after each succeeding pellet, one of the carrier discs just described is inserted. Hence alternate layers of pellet composition and carrier material containing thorium nitrate are built up to form the flare body.

The pellet composition provides an oxidant that burns in connection with fuel to produce heat and a smokeless gaseous product. This heat brings the rare element oxides in the carrier discs to incandescence. It has been found that ammonium perchlorate, as an oxidant, and shellac, as a fuel, are satisfactory for this purpose. Other chemicals that could be used are those which break down upon reduction to give off gaseous, colorless products; for example, ammonium nitrate and ammonium oxalate. A solid hydrocarbon fuel can be used satisfactorily with either of these latter chemicals to produce a suitable pellet composition. Examples of suitable solid hydrocarbons burning with smokeless gaseous

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end products that can be used are shellacs, rosins, and gums if the proper oxygen balance is used.

In the preferred form the pellet composition is formed according to the following formula to obtain the most efficient burning rate and time:

	Per cent
Ammonium perchlorate	93.0
Shellac	7.0

This formula can be varied within the following limits where it is desired to change the burning time and rate:

	Per cent
Ammonium perchlorate	50 to 97.5
Shellac	50 to 2.5

In operation it will be apparent that the heat generated by the burning of the pellet composition converts the thorium and cerium nitrates in the impregnated carriers to their corresponding oxides which are refractory materials. These materials when heated to incandescence produce a visible light of the order of about 10,000 candle power.

A modified form of flare construction can also be employed utilizing a modification of the present composition. In this form the flare is ignited at one end only and burns inwardly from that end. The light is projected horizontally and thus directed in one direction only. With this construction, an observer approaching the flare, either walking or flying from a direction opposite to the burning end thereof is not blinded by the light produced.

The modification in the composition consists of using threads as carriers for the thorium nitrate, instead of the cloth disc carriers previously described.

In the modification, each of the pellets is individually formed from approximately 2500 grams of illuminant composition of the type previously described. To this composition is then added approximately 250 grams of treated No. 40 cotton thread. The loose composition and thread are mixed thoroughly and pressed at about 30 tons total pressure. The thread, before being mixed with the pellet composition, is treated by saturating it in a thorium nitrate solution and allowing it to dry at room temperature as described

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above. The treated thread also serves as a binding means preventing the pellet from cracking or breaking when being handled in assembly.

We claim:

A combustible flare composition consisting of a mixture of ammonium perchlorate and a shellac, the quantity of the perchlorate ranging from a maximum of 97.5% to a minimum of 50%, the shellac ranging from a minimum of 2.5% to a maximum of 50%, a textile carrier imbedded in said mixture so that particles of the mixture intimately surround the carrier, said carrier being impregnated with nitrates, predominately thorium nitrate.

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