

PATENT SPECIFICATION

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(54) PYROTECHNIC COMPOSITIONS

(71) We, WERKZEUGMASCHINEN
 FABRIK OERLIKON-BUHRLE AG,
 a company organised and existing under the
 laws of Switzerland of Birchstrasse 155, CH-
 8050 Zurich, Switzerland, do hereby
 declare the invention for which we pray
 that a patent may be granted to us and the
 method by which it is to be performed to be
 particularly described in and by the
 following statement:—

This invention relates to a process for the
 manufacture of a pyrotechnic composition.

According to a known process, a pyro-
 technic composition containing, by weight,
 30%—68% of magnesium powder,
 30%—60% of polytetrafluoroethylene
 powder and 2%—4% of a fluoroelastomer,
 is manufactured by suspending the
 magnesium powder and polytetrafluoro-
 ethylene powder in acetone and premixing
 them, homogenising the premix by
 circulating with acetone, filtering the
 homogenised premix and largely freeing it
 from the auxiliary medium acetone,
 granulating the filter cake and drying the
 granules.

A known pyrotechnic material of this
 type, disclosed in Swiss Patent
 Specification No. 512 406, contains, by
 weight, 51% of atomised magnesium having
 a particle size finer than 75 μ , 34% of poly-
 tetrafluoroethylene powder and 15% of a
 polytetrafluoroethylene telomer.

It has been found that difficulties arise in
 the manufacture and processing of a
 pyrotechnic material of this type. In
 particular, difficulties arise on granulation
 since granules of this type readily
 disintegrate after drying.

According to the present invention there
 is provided a process for the manufacture of
 a pyrotechnic composition containing, by
 weight, 30%—68% of magnesium powder,
 30%—60% of polytetrafluoroethylene
 powder and 2%—4% of a fluoroelastomer
 or a polytetrafluoroethylene telomer, which
 comprises:

a) suspending the magnesium powder and
 polytetrafluoroethylene powder in acetone
 and premixing them;

b) homogenising the premix by passage
 through a colloid mill which runs in
 circulation with acetone;

c) filtering the homogenised premix and
 largely freeing it from the auxiliary medium
 acetone;

d) mixing the filter cake with a
 granulating solution which contains the
 fluoroelastomer or polytetrafluoroethylene
 telomer;

e) adding a hydrocarbon as a granulating
 aid to the mixture after the acetone has
 evaporated; and

f) granulating the filter cake and drying
 the granules by intense mixing.

Referring is made to the accompanying
 drawing, the sole figure of which shows a
 schematic representation of the
 manufacturing process.

According to a preferable embodiment of
 the invention, the process comprises the
 following steps:

1) 568 g of magnesium powder (trade
 description Metallic Magnesium Atomized
 Powder—325 Mesh) and 392 g of polytetra-
 fluoroethylene (trade description Teflon TE
 801—N) are weighed into a plastic beaker
 10, for example a polypropylene beaker of
 about 5,000 cm³ capacity, about 1,000 cm³
 of acetone are added by pouring in and the
 mixture is gently stirred with a wooden
 spatula 11.

2) This premix is homogenised in a colloid
 mill 12. The colloid mill 12 runs with
 circulation. Initially, about 1,000 cm³ of
 acetone must be poured into the colloid mill
 12 and pumped around in the circulation 13.
 Subsequently, the premix can be filled into
 the colloid mill 12. A dispersion is thus
 formed.

3) The homogenised premix passes into a
 pressure filter 14 which is located
 underneath a drain cock 15 of the colloid
 mill 12. As soon as the premix is in the
 pressure filter 14, the drain cock 15 is closed
 and a pressure of about 0.5 atmospheres
 gauge is generated, whereby the premix is
 freed from acetone.

4) The filter cake passes into a planetary
 mixer unit 16. 400 g of a fluoroelastomer

(trade description Vitron B) are added as a granulating solution to the filter cake present in the mixing vat of the planetary mixer unit and the mixer unit is started up. At the same time, oil-free, water-free compressed air is blown as an evaporation aid into the mixing vat. As soon as the mixture has reached a sandy consistency, the first mixing step is ended.

5) With the mixer unit at a standstill, 150 cm³ of a hydrocarbon (heptane) are added as a granulating aid and the mixer unit is switched on again. The second mixing step is ended as soon as the mixture again has a sandy consistency.

6) Subsequently, the mixture passes into a granulating apparatus 17. For example, a sieving machine is used as the granulating apparatus 17.

7) The granules pass from the sieving machine into a vacuum drier 18 which is heated by hot water, and drying is carried out for about 4 hours at a temperature of 60°—70°C. Subsequently, air is admitted to the vacuum driver 18, the air being passed over an ioniser.

8) The dried, somewhat agglomerated granules are comminuted in a separating machine 19. This separating of the agglomerated cakes of granules takes about 10 minutes.

In order to obtain as homogenous a mixture as possible, the materials are used in pulverulent form, the particle size being smaller than 50 μ . The solvent in the granulating solution must not enter into a reaction with any of the other components used and must not have a dissolving effect on them. The granulating agent is a substance which actively participates in the combustion reaction and does not have any effect of reducing the light intensity or retarding the combustion reaction. In place of a fluoroelastomer, it is also possible to use a polytetrafluoroethylene telomer. The fluoroelastomer must first be dissolved, preferably in acetone. The granulating agent must be taken into account in the stoichiometry of the total mixture. The excess solvent (acetone) can be removed by blowing in compressed air or by means of a vacuum. Intense mixing is necessary during the drying step in order to achieve a homogeneous distributions of the granulating agent.

Since these operations can be carried out under remote control and since the polytetrafluoroethylene has good lubricating properties in the dry state, the mixtures can be dried down to eliminate the actone. The adhesive properties of a solution containing fluoroelastomer or polytetrafluoroethylene would make efficient mixing more difficult. To suppress the adhesive properties behaviour of the said agents, a readily

volatile hydrocarbon, for example heptane, is temporarily added, that is to say only for the granulating step. Moreover, lower hydrocarbons even enhance the sliding properties of polytetrafluoroethylene so that conventional sieve granulators and extrusion granulators can be used without difficulty. After the granules have been dried off, the adhesive behaviour of the granulating agent returns and ensures good mechanical properties of the granules. Residual solvents are removed in the vacuum oven. Depending on the proportion of granulating agent, the dried granules can be further processed immediately. Slightly caked granules must be separated using a mechanical separator.

The following are examples of compositions manufactured in this way:

- 1) 58% by weight of magnesium of a particle size smaller than 50 μ
40% by weight of polytetrafluoroethylene powder
2% by weight of a fluoroelastomer.
- 2) 58% by weight of magnesium of a particle size smaller than 28 μ
38% by weight of polytetrafluoroethylene powder
4% by weight of a fluoroelastomer.

WHAT WE CLAIM IS:—

1. A process for the manufacture of a pyrotechnic composition containing, by weight, 30%—68% of magnesium powder, 30%—60% of polytetrafluoroethylene powder and 2%—4% of a fluoroelastomer or a polytetrafluoroethylene telomer, which comprises:

- a) suspending the magnesium powder and polytetrafluoroethylene powder in acetone and premixing them;
- b) homogenising the premix by passage through a colloid mill which runs in circulation with acetone;
- c) filtering the homogenised premix and largely freeing it from the auxiliary medium acetone;
- d) mixing the filter cake with a granulating solution which contains the fluoroelastomer or polytetrafluoroethylene telomer;
- e) adding a hydrocarbon as a granulating aid to the mixture after the acetone has evaporated; and
- f) granulating the filter cake and drying the granules by intense mixing.

2. A process according to Claim 1, wherein the homogenising of the components is carried out in a dispersion using a homogenising and dispersing machine.

3. A process according to Claim 1 or 2, wherein the powders have a particle size less than 50 μ .

(trade description Vitron B) are added as a granulating solution to the filter cake present in the mixing vat of the planetary mixer unit and the mixer unit is started up. At the same time, oil-free, water-free compressed air is blown as an evaporation aid into the mixing vat. As soon as the mixture has reached a sandy consistency, the first mixing step is ended.

5) With the mixer unit at a standstill, 150 cm³ of a hydrocarbon (heptane) are added as a granulating aid and the mixer unit is switched on again. The second mixing step is ended as soon as the mixture again has a sandy consistency.

6) Subsequently, the mixture passes into a granulating apparatus 17. For example, a sieving machine is used as the granulating apparatus 17.

7) The granules pass from the sieving machine into a vacuum drier 18 which is heated by hot water, and drying is carried out for about 4 hours at a temperature of 60°—70°C. Subsequently, air is admitted to the vacuum driver 18, the air being passed over an ioniser.

8) The dried, somewhat agglomerated granules are comminuted in a separating machine 19. This separating of the agglomerated cakes of granules takes about 10 minutes.

In order to obtain as homogenous a mixture as possible, the materials are used in pulverulent form, the particle size being smaller than 50 μ . The solvent in the granulating solution must not enter into a reaction with any of the other components used and must not have a dissolving effect on them. The granulating agent is a substance which actively participates in the combustion reaction and does not have any effect of reducing the light intensity or retarding the combustion reaction. In place of a fluoroelastomer, it is also possible to use a polytetrafluoroethylene telomer. The fluoroelastomer must first be dissolved, preferably in acetone. The granulating agent must be taken into account in the stoichiometry of the total mixture. The excess solvent (acetone) can be removed by blowing in compressed air or by means of a vacuum. Intense mixing is necessary during the drying step in order to achieve a homogeneous distributions of the granulating agent.

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 - a) suspending the magnesium powder and polytetrafluoroethylene powder in acetone and premixing them;
 - b) homogenising the premix by passage through a colloid mill which runs in circulation with acetone;
 - c) filtering the homogenised premix and largely freeing it from the auxiliary medium acetone;
 - d) mixing the filter cake with a granulating solution which contains the fluoroelastomer or polytetrafluoroethylene telomer;
 - e) adding a hydrocarbon as a granulating aid to the mixture after the acetone has evaporated; and
 - f) granulating the filter cake and drying the granules by intense mixing.
2. A process according to Claim 1, wherein the homogenising of the components is carried out in a dispersion using a homogenising and dispersing machine.
3. A process according to Claim 1 or 2, wherein the powders have a particle size less than 50 μ .



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4. A process for the manufacture of a pyrotechnic composition, substantially as described herein and as described with reference to the accompanying drawing.
5. A pyrotechnic composition, when manufactured by a process according to any preceding claim.

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