Patented Aug. 2, 1927. 1,637,726

UNITED STATES PATENT OFFICE.

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PROCESS OF PRODUCING EXPLOSIVES.

No Drawing. Application filed June 18, 1926. Serial No. 116,975.

My invention relates particularly to a process for nitrating aliphatic oxides. It has relation, however, especially to the nitration of ethylene oxide.

The object of my invention is to provide a process by means of which aliphatic oxides may be nitrated in an advantageous manner so as to avoid the disadvantages hitherto inherent in connection therewith. Previously, ethylene oxide has been nitrated to form an explosive oil containing about 16% nitrogen, by nitration with nitric acid alone and subsequent precipitation with sulphuric acid (German Patent No. 376,000 of 1923). The product obtained in accordance with said patent is a mixture of glycol dinitrate and nitrated polymerization products of ethylene oxide. Furthermore, when ethylene oxide is nitrated with mixed sulphuric and nitric acids there is produced a mixture of solid and liquid products of low nitrogen content with little or no glycol dinitrate formed. These former processes are consequently disadvantageous. In the case of dissolving ethylene oxide in strong nitric acid there is considerable danger as the mixture of an organic body with nitric acid is potentially a high explosive. Also, the ethylene oxide reacts violently with the strong nitric acid, which evolves a large amount of heat.

I have found that the above disadvantages may be overcome by the use of a diluent, such, for example, as ethylene glycol or glycerol, and then nitrating the ethylene oxide with mixed nitric and sulphuric acids. The product thus obtained has a high nitrogen content and is free from the solid nitrobodies above referred to as being obtained from nitrating ethylene oxide alone with mixed acids.

While my invention is capable of being carried out in many different ways, by way of illustration I shall describe only certain ways of carrying out my invention hereinafter.

For example, I may use a mixture of from 2 to 50% of ethylene oxide and 98 to 50% ethylene glycol, depending upon how high a nitrogen content is desired in the product, inasmuch as the larger the percentage of glycol the larger the nitrogen content up to a point of 18.40% nitrogen. The two materials may be readily mixed in these proportions as ethylene oxide is miscible with ethylene glycol in all proportions. For instance, I may use a mixture of 70% ethylene glycol and 30% ethylene oxide, the same being added slowly to a mixed acid containing approximately 70 to 50%, but preferably 60% of sulphuric acid, and 30 to 50%, but preferably 40% of nitric acid, the mixture being either anhydrous or containing not more than 10% of water. The nitrated ethylene oxide appears as an oil on the surface of the acid and may be decanted therefrom and washed with a dilute alkaline solution comprising, for example, a 5% solution of soda in water, to produce a neutral stable oil capable of use as a powerful explosive. It is to be understood, also, that instead of the ethylene glycol and the ethylene oxide I may use similarly any other aliphatic oxide or oxides and any other glycol, as well as mixtures of the same, as, for instance, propylene oxide and a glycol. Also, instead of the glycol above referred to I may use other polyhydroxy alcohols such as propylene glycol, butylene glycol and glycerol, individually or in mixtures containing the same.

An explosive product obtained as above may be used alone as an explosive or may form one of the ingredients of any one of the dynamite compositions known. One example of such compositions would be the following:

	Per cent by weight.
Nitrated ethylene oxide-glycol mixture (as above)	20
Nitroglycerine	20
Sodium nitrate	47
Wood meal	12
Chalk	1

In the above composition it is to be understood that the nitrated ethylene oxide-glycol mixture may be used to replace the nitroglycerine as a whole or in part. Also, instead of the sodium nitrate other oxidizing agents, such as potassium nitrate, ammonium nitrate or potassium perchlorate, may be used. Furthermore, instead of the wood pulp other carbonaceous products may be used, such as starch. Also, it will be understood that the nitrated ethylene oxide glycol mixture may be used in any desired way for the making of the gelatin dynamites with

nitrocotton, one example of which would be the following composition:

	Per cent by weight.
Nitrated ethylene oxide-glycol mixture	10
Nitroglycerine	23
Nitrocellulose	.8
Sodium nitrate	52
Chalk	1
Wood meal	13.2

It is to be understood that in all the above compositions the proportions may vary widely as to each and all of the ingredients, according to the particular uses to which the explosive is to be applied.

While I have described my invention above in detail I wish it to be understood that many changes may be made therein without departing from the spirit of the same.

I claim:

1. The process which comprises forming a nitrated aliphatic hydrocarbon oxide by nitrating an aliphatic hydrocarbon oxide mixed with a polyhydroxy alcohol.

2. The process which comprises forming a nitrated aliphatic hydrocarbon oxide and a nitrated polyhydroxy alcohol by nitrating an aliphatic hydrocarbon oxide mixed with a polyhydroxy alcohol.

3. The process which comprises forming a nitrated alkylene oxide by nitrating an alkylene oxide mixed with a polyhydroxy alcohol.

4. The process which comprises forming a nitrated alkylene oxide and a nitrated polyhydroxy alcohol by nitrating an alkylene oxide mixed with a polyhydroxy alcohol.

5. The process which comprises forming a nitrated alkylene oxide by nitrating an alkylene oxide mixed with a glycol.

6. The process which comprises forming a nitrated alkylene oxide and a nitrated glycol by nitrating an alkylene oxide mixed with a glycol.

7. The process which comprises forming a nitrated alkylene oxide by nitrating an alkylene oxide mixed with ethylene glycol.

8. The process which comprises forming a nitrated alkylene oxide and a nitrated ethylene glycol by nitrating an alkylene oxide mixed with the ethylene glycol.

9. The process which comprises forming a nitrated aliphatic hydrocarbon oxide by nitrating an aliphatic hydrocarbon oxide mixed with a polyhydroxy alcohol, then decanting and washing the product with an alkaline solution.

10. The process which comprises forming a nitrated aliphatic hydrocarbon oxide and a nitrated polyhydroxy alcohol by nitrating an aliphatic hydrocarbon oxide mixed with the polyhydroxy alcohol, then decanting and washing the product with an alkaline solution.

11. The process which comprises forming a nitrated alkylene oxide by nitrating an alkylene oxide mixed with a polyhydroxy alcohol, then decanting and washing the product with an alkaline solution.

12. The process which comprises forming a nitrated alkylene oxide and a nitrated polyhydroxy alcohol by nitrating an alkylene oxide mixed with a polyhydroxy alcohol, then decanting and washing the product with an alkaline solution.

13. The process which comprises forming a nitrated alkylene oxide by nitrating an alkylene oxide mixed with a glycol, then decanting and washing the product with an alkaline solution.

14. The process which comprises forming a nitrated alkylene oxide and a nitrated polyhydroxy alcohol by nitrating an alkylene oxide mixed with a glycol, then decanting and washing the product with an alkaline solution.

15. The process which comprises forming a nitrated alkylene oxide by nitrating an alkylene oxide mixed with ethylene glycol, then decanting and washing the product with an alkaline solution.

16. The process which comprises forming a nitrated alkylene oxide and a nitrated ethylene glycol by nitrating an alkylene oxide mixed with ethylene glycol, then decanting and washing the product with an alkaline solution.

17. The process which comprises forming a nitrated alkylene oxide and a nitrated ethylene glycol by nitrating 2 to 50% of an alkylene oxide mixed with 98 to 50% of ethylene glycol, then decanting and washing the product with an alkaline solution.

In testimony that I claim the foregoing, I have hereunto set my hand this 11 day of June, 1926.

FRANK H. BERGEIM.