

UNITED STATES PATENT OFFICE.

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CONTINUOUS PROCESS FOR PRODUCING EXPLOSIVES.

1,056,367.

Specification of Letters Patent.

Patented Mar. 18, 1913.

No Drawing.

Application filed May 31, 1912. Serial No. 700,846.

To all whom it may concern:

Be it known that I, FRITZ RASCHIG, doctor of philosophy, chemist, a citizen of the German Empire, residing at Ludwigshafen-on-the-Rhine, Germany, have invented a new and useful Improvement in Continuous Processes for Producing Explosives, of which the following is a specification.

This invention relates to a novel and a continuous process for producing explosives of a substantially homogeneous nature from a mixture of water soluble ingredients such as those described in my prior applications, Serial Nos. 690,183 and 690,184 which is both rapid in operation and by means of which the dangers attending such production are minimized; and it comprises a process of evaporating a solution containing such a mixture of water soluble ingredients by running such solution in a stream on to a heated moving surface, such as a steam heated revolving cylinder, whereby almost instantaneous evaporation is effected, after which the evaporated mass is scraped from the heated surface, all as more fully hereinafter set forth and as claimed.

In the production of explosives from a mixture of ingredients it is necessary that an intermixture as nearly homogeneous as possible be obtained if the explosive is to be reliable, and complete combustion thereof is to be effected. With the old dry-mixture process it frequently happens that the intermixture is imperfect and that the explosive as a result incompletely combusts, giving off smoke and leaving unburned particles. Such explosives are unreliable and erratic in operation, and their production is attended with danger. Again when solutions are evaporated in order to remove the solvent, continual stirring is required to prevent fractional crystallization or separation of the dissolved ingredients. By the process of the present invention, however, the dangers and disadvantages of the old dry mixture process and the old methods of evaporation are minimized, and from a solution containing a plurality of ingredients an explosive is obtained in a substantially homogeneous condition.

The ingredients used in the novel process of the present invention may be the waste sulfite constituents (lignin sulfonic acids, etc.) and oxygen carriers described in my prior application, S. N. 690,183, or such aromatic sulfonic acids and oxygen carriers

as described in my prior application, S. N. 690,184. The sulfite waste liquors may be used in their diluted form, or may be concentrated or evaporated before intermixture or they may be otherwise treated as described in such prior application to give the solution to be evaporated and containing the sulfite waste constituents together with oxygen carriers. In these solutions homogeneous intermixture is possible and it is from these homogenous mixtures that the explosives according to the present invention are produced. Aromatic sulfonic acids such as those described in my aforementioned application can also be used according to the process of the present invention, or other aromatic sulfonic acids than those there mentioned. The solutions of the sulfonic acids and oxygen carriers can be produced as more fully described in said prior application to give a solution containing the ingredients from which the explosive is to be obtained by evaporation.

The evaporation of the solutions containing the water soluble ingredients according to the present invention is effected by running such solution in a thin regulated stream onto a heated moving surface. Such a surface may be a rotating disk or a rotating cylinder internally heated as by steam to a temperature above 100 C. Or such surface may be placed in a vacuum chamber and the evaporation carried out at a correspondingly lower temperature. The thin stream as it runs on to the moving surface is evaporated almost instantaneously and without danger, and the evaporated product is of a substantially homogeneous nature. From the heated surface the evaporated ribbon-like mass is scraped off the roller or disk or other heated surface by scrapers or other appliances. Where iron or steel surfaces are used the scrapers may advantageously be of bronze or of some other such softer metal.

The present invention which is of general application is further illustrated by the following specific embodiments of its application:

Example 1: 74 parts of sodium nitrate and 26 parts of benzol sulfonate of sodium are dissolved together in water and the resulting solution is run in a small stream on to a steam heated revolving cylinder heated to a few degrees above 100 C. Evaporation takes place almost instantane-

ously, and from the cylinder the evaporated ribbon like mass is removed by scrapers in a continuous manner, and is the desired explosive.

5 Example 2: 87 parts of ammonium nitrate and 14 parts of cresol sulfonate of sodium are dissolved and evaporated by running the solution in a thin stream onto a rotating hollow disk heated internally by
10 steam to a few degrees above 100 C. The evaporated mass is removed as already described and is the desired explosive.

Example 3: 69 parts of sodium nitrate and 31 parts of cresol sulfonate of sodium
15 are dissolved in water and evaporated as above described.

Example 4: 70 parts of sodium nitrate and 30 parts of xylenol sulfonate of sodium are treated as above described.

20 Other aromatic sulfonic acids than those mentioned can be used in a similar manner, *e. g.* the mono-sulfonic acids of phenol, toluol, cumol, cresol, etc., or the disulfonic acids of the above mentioned or other aromatic bodies; or mixtures of two or more
25 of the mono-, or di- or other sulfonic acids. It is usually more advantageous to use such acids in the form of their water soluble salts. Other oxygen carriers can be used
30 *e. g.*—sodium, potassium or ammonium nitrate, chlorates, perchlorates, etc.

Example 5: 85 parts of nitrate of ammonia are dissolved in waste sulfite liquors containing 15 parts of dry wood fiber constituents. The liquor is run onto steam heated
35 rollers as already described. The sulfite liquors can be partly evaporated before intermixture.

Example 6: 60 parts of nitrate of ammonia and 30 parts of sulfate of sodium are dissolved in waste sulfite liquors containing 10 parts of wood fiber constituents and evaporated as already described. The sodium sulfate acts as a diluent, but even as
45 so diluted reliable explosives are obtainable.

Instead of the ammonium nitrate of the foregoing examples, corresponding amounts of sodium or potassium nitrate, or of other oxygen carrier or carriers can be used. Sulfite waste made from other cellulosic material than wood can be similarly employed.

By the use of a vacuum chamber surrounding the heating surfaces on which evaporation takes place it is possible to
55 carry out the evaporation at correspondingly lower temperatures.

The explosives made by the novel evaporation process of the present invention contain the various ingredients in intimate intermixture and as a result their action is dependable, and substantially complete combustion, with a minimum or total absence of smoke, takes place. The process is moreover
65 minimized. one in which the danger to the operator is

Instead of dissolving both ingredients in water, one of the ingredients may be dissolved in a solution of the other; or a solution of one ingredient may be used to thoroughly moisten or partly dissolve the other, and the resulting solution or partial solution evaporated according to the novel process of the present invention. 70

The products resulting from the foregoing examples can be used as explosives alone, or can be compounded with other explosive ingredients or with modifying or water-proofing ingredients, and can be formed or molded into a desired form. 75

Variations and modifications can be made in the processes above described without departing from the spirit and scope of the invention, as set forth in the accompanying claims. 80

I claim:—

1. The process of producing explosives from a plurality of water soluble ingredients which comprises dissolving such ingredients in water and subjecting the resulting solution in the form of a regulated stream to a temperature sufficient to effect substantially instantaneous evaporation. 85 90

2. The process of producing explosives from a plurality of water soluble ingredients which comprises dissolving such ingredients in water and subjecting the resulting solution in the form of a thin stream to substantially instantaneous evaporation upon a heated surface. 95

3. The process of producing explosives from a plurality of water soluble ingredients which comprises dissolving such ingredients in water and subjecting the resulting solution in the form of a thin stream to a temperature above 100° C. to effect evaporation thereof. 100 105

4. The process of producing explosives from a plurality of water soluble ingredients which comprises dissolving such ingredients in water and allowing the resulting solution in the form of a regulated stream to flow on to a continuously moving heated surface. 110

5. The process of producing explosives from a plurality of water soluble ingredients which comprises dissolving such ingredients in water and allowing the resulting solution in the form of a regulated stream to flow on to a continuously moving heated surface heated by steam to above 100° C. 115

6. The process of producing explosives from organic sulfonic acids and oxygen carriers which comprises dissolving such ingredients in water and subjecting the resulting solution in the form of a regulated stream to a temperature sufficient to effect substantially instantaneous evaporation. 120 125

7. The process of producing explosives from organic sulfonic acids and oxygen carriers which comprises dissolving such ingredients in water and subjecting the resulting 130

solution in the form of a thin stream to substantially instantaneous evaporation upon a heated surface.

5 8. The process of producing explosives from organic sulfonic acids and oxygen carriers which comprises dissolving such ingredients in water and subjecting the resulting solution in the form of a thin stream to a temperature above 100° C.

10 9. The process of producing explosives from organic sulfonic acids and oxygen carriers which comprises dissolving such ingredients in water and allowing the resulting solution in the form of a regulated stream to flow on to a continuously moving heated surface.

15 10. The process of producing explosives from organic sulfonic acids and oxygen carriers which comprises dissolving such ingredients in water and allowing the resulting solution in the form of a regulated stream to flow on to a continuously moving heated surface heated by steam to above 100° C.

20 11. The process of producing explosives from aromatic sulfonic acids and oxygen carriers which comprises dissolving such ingredients in water and subjecting the resulting solution in the form of a regulated stream to a temperature sufficient to effect substantially instantaneous evaporation.

25 12. The process of producing explosives from aromatic sulfonic acids and oxygen carriers which comprises dissolving such ingredients in water and subjecting the resulting solution in the form of a thin stream to a temperature above 100° C.

35 13. The process of producing explosives from aromatic sulfonic acids and oxygen carriers which comprises dissolving such ingredients in water and subjecting the resulting solution in the form of a thin stream to a temperature above 100° C.

40 14. The process of producing explosives from aromatic sulfonic acids and oxygen carriers which comprises dissolving such ingredients in water and allowing the resulting solution in the form of a regulated stream to flow on to a continuously moving heated surface.

45 15. The process of producing explosives from aromatic sulfonic acids and oxygen carriers which comprises dissolving such ingredients in water and allowing the resulting solution in the form of a regulated stream to flow on to a continuously moving heated surface heated by steam to above 100° C.

50 16. The process of producing explosives from aromatic sulfonic acids and oxygen carriers which comprises dissolving such ingredients in water and allowing the resulting solution in the form of a regulated stream to flow on to a continuously moving heated surface heated by steam to above 100° C.

55 17. The process of producing explosives from aromatic sulfonic acids and oxygen carriers which comprises dissolving such ingredients in water and allowing the resulting solution in the form of a regulated stream to flow on to a continuously moving heated surface heated by steam to above 100° C.

60 18. The process of producing explosives from aromatic sulfonic acids and oxygen carriers which comprises dissolving such ingredients in water and allowing the resulting solution in the form of a regulated stream to flow on to a continuously moving heated surface heated by steam to above 100° C.

Witnesses:

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