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EXPLOSIVE

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This invention relates to an improvement in explosives and more particularly to explosives of the type known as dynamite. The invention has more specific adaptability to those explosives which include a carbonaceous material as an ingredient and lends itself to the production of explosives of low density and consequently of high cartridge count desirable for use, for example, in the mining of coal where the shattering effect of relatively dense explosives is undesirable in that it results in the production of an excessive proportion of fine coal as compared with the larger sizes.

In accordance with this invention an explosive is provided which contains as a carbonaceous ingredient an absorptive cellulosic material having a cellular structure produced by any suitable treatment of a cellulose material. The cellulosic material forming a carbonaceous ingredient of the explosives in accordance with this invention may comprise, for example, a regenerated cellulose formed with a minute cellular structure, or, in other words, a porous regenerated cellulose. Thus, for example, the cellulosic material may be cellulose foam, which is a mass of regenerated cellulose containing minute bubbles of entrapped gas, or it may be cellulose sponge which differs from foam in that it contains bubbles or pockets so connected as to form tortuous interconnecting channels. It will be understood that the use of cellulosic material treated to render it porous or of cellular structure by any means or form of treatment is contemplated as within the scope of this invention.

As illustrative of the production of a cellulose foam suitable for use as an ingredient of an explosive in accordance with this invention, for example, 1000 gm. alkali cellulose having about 14.4% alkali content, are allowed to ripen for 6–12 hours and are then treated with 100 cc. carbon disulphide at a temperature of about 20–23° C. for at least six hours, for the formation of a xanthate. The xanthate is then dissolved in water in the proportion of about three liters of water per kilo of xanthate for the formation of a viscose. The solution may be desirably effected by a Werner-Pfleiderer mixer.

The viscose formed as indicated is allowed to ripen at a temperature of about 14–16° C. until 20 cc. of the viscose diluted with 20 cc. of water are coagulated by the addition of about 1.5–1.2 cc. of a 10% ammonium chloride solution added slowly from a burette at 20° C. with constant stirring of the diluted viscose. The ripening will be complete when no drop falls from the stirrer with-

in thirty seconds after removal from the coagulate.

To 1000 gm. of the ripe viscose is added 10 cc. of oleic acid and 300–1000 gm. of water. The precise amount of water added will be dictated by the density desired for the foam, since the more water that is added the lighter in density is the foam produced. The solution formed is beaten into a foam by means of any suitable device and when tough enough is poured into warm molds and heated at about 100° C. to convert into cellulose. The masses thus formed are finally washed to free them from impurities. Where desirable, various ingredients as wood pulp, etc., may be included in the foam.

As illustrative of the formation of cellulose sponge, for example, 160 gm. of viscose solution having a cellulose concentration of up to 10% is mixed intimately with 16 gm. of any desired fibrous material, as cotton, hemp, flax, etc., and 1.2 kg. of sodium sulfate, or other low melting or water soluble substance. The mixture is then molded and heated with steam under a pressure up to 10 atmospheres for from a quarter of an hour to four hours, which treatment removes the water-soluble salt. The resultant product is thoroughly dried.

In the making up of explosives in accordance with this invention the usual procedure will be followed and likewise the usual ingredients will be used except for the use of the cellulose material described in place of the absorptive carbonaceous materials heretofore used.

As illustrative, satisfactory dynamites in accordance with this invention may be made up using the ingredients within the ranges as shown in the following table:

	Percent
Nitroglycerin, nitropolyglycerin, nitroglycerol, or mixtures thereof.....	9–13
Ammonium nitrate.....	60–75
Sodium nitrate.....	5–20
Cellulose material as sponge or foam (app. 1/8" pieces) etc.....	7–15

As more specifically illustrative, for example, a dynamite having a detonation rate of 1575 meters per second may be made up on the following formula:

	Percent
Nitroglycerin.....	9
Nitroglycol.....	3
Ammonium nitrate.....	65
Sodium nitrate.....	8
Cellulose foam (1/8" pieces).....	15

- Under any formulation explosives in accordance with this invention will have higher cartridge count than explosives produced as heretofore with low density carbonaceous materials.
- 5 Thus, for example, the dynamite of the above example will show a cartridge count of 574 standard $1\frac{1}{4}$ " x 8" cartridges per hundred pounds as compared with 478 for a similar dynamite containing, for example, balsa wood.
- 10 What we claim and desire to protect by Letters Patent is:
1. An explosive including as ingredients porous regenerated cellulose and a liquid sensitizer.
 2. An explosive including as ingredients a body
 - 15 of regenerated cellulose having a minute cellular structure and a liquid sensitizer.
 3. An explosive including as an ingredient cellulose foam.
 4. An explosive including as ingredients cellulose sponge and a liquid sensitizer.
 - 20 5. An explosive including as ingredients cellulose foam, an explosive salt and a sensitizer.

6. An explosive including as ingredients cellulose sponge, an explosive salt, an oxidizing salt and a liquid sensitizer.

7. An explosive including as ingredients porous regenerated cellulose, an explosive salt, an oxidizing salt and a liquid sensitizer. 5

8. An explosive including as ingredients a cellulose sponge, an explosive salt, an oxidizing salt and nitroglycerin.

9. An explosive including as ingredients a cellulose sponge and nitroglycerin. 10

10. An explosive including as ingredients a cellulose sponge, ammonium nitrate, sodium nitrate and a liquid sensitizer.

11. An explosive including as ingredients a cellulose sponge, an explosive salt, an oxidizing salt and a liquid sensitizer. 15

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