

# UNITED STATES PATENT OFFICE.

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## MANUFACTURE OF ENVELOPS FOR STORAGE BATTERIES.

SPECIFICATION forming part of Letters Patent No. 723,329, dated March 24, 1903.

Application filed August 12, 1901. Serial No. 71,712. (No model.)

*To all whom it may concern:*

Be it known that I, ELMER A. SPERRY, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in the Manufacture of Envelops for Storage Batteries, of which the following is a specification.

It is known that pyroxylin fibers may be used to good advantage in the formation of envelops for storage-battery elements to retain the active material of the elements, such fibers being themselves inert and capable of withstanding to a greater or less degree the action of the electrolyte. Difficulty has nevertheless been experienced in the use of such envelops by reason of the brittleness of the fibers and the fact that such envelops have not been capable, usually, of withstanding more than three or four discharges. In the present case it has been sought to produce a pyroxylin fabric for the purpose stated which shall have the necessary tenacity or toughness and shall have such molecular structure as will not be broken down by the nascent gases evolved during the action of the electrolyte upon the elements, becoming thereby practically indestructible under the ordinary conditions of use.

In the production of pyroxylin fabric having the desirable characteristics above mentioned the fabric employed preferably having or being only long fiber is first freed from all traces of soluble starchy matter and oleaginous matter in any usual manner, as by successive boilings in pure water, and is then thoroughly dried, as by the sulfuric-acid wash-bottle method, in which the air is deprived of all moisture and heated before reaching the fiber or cloth. Having been thus prepared the fiber or fabric is subjected to the nitrating mixture, which is of such a character (as to temperature and composition) as to nitrate those carbohydrates which are stable when nitrated, but not to nitrate the carbohydrates (including starch, dextrine, and others of this class) which are unstable when nitrated, the unsatisfactory nature of the pyroxylin fabric heretofore having been due, it

is now believed, to such instability. The nitrating mixture preferably consists of about one hundred and thirteen and one-half parts of nitric acid of 1.42° gravity, non-fuming, and about one hundred and fifty parts of chemically-pure sulfuric acid of 1.84° gravity. The proportions of nitric acid and sulfuric acid may be varied slightly; but certainly in attaining good results is better assured by adhering substantially to the proportions stated. It is highly important, also, that the nitrating should be carried on at a temperature not materially above 78° Fahrenheit, the best results being secured when the temperature is somewhat below 78° Fahrenheit. As soon as the fiber or fabric is removed from the nitrating bath it is thoroughly washed, and after several washings all traces of acid may be removed by passing the fabric through a weak soda solution. When dried out after this treatment, the fiber or fabric is highly combustible and explosive, and in order that it may not be dangerous to handle should be treated with some substance which will cause it to occlude moisture from the atmosphere. It has been found that about one-tenth of one per cent. of nitrobenzol added to the final washing will give the fiber or fabric this desired property and render it safe to handle. The nitrobenzol has no apparent effect upon the electrolytic action and seems to disappear altogether from the fabric during the action of the battery.

The pyroxylin fiber or fabric prepared in the manner described above is found to possess the necessary tenacity or toughness and to be practically indestructible by the action of the electrolyte in the battery.

I claim as my invention—

1. The process of preparing fiber or fabric for storage-battery envelops which consists in subjecting the fiber or fabric to a nitrating mixture composed of about one hundred and thirteen and one-half parts of nitric acid of 1.42° gravity and about one hundred and fifty parts of sulfuric acid of 1.84° gravity at a maximum temperature of about 78° Fahrenheit, whereby the carbohydrates other than the starchy carbohydrates are nitrated and the



starchy carbohydrates are not nitrated and subsequently washing out the fiber or fabric.

2. The process of preparing fiber or fabric for storage-battery envelops which consists  
5 in subjecting the fiber or fabric to a nitrating mixture composed of about one hundred and thirteen and one-half parts of nitric acid of 1.42° gravity and about one hundred and fifty parts of sulfuric acid of 1.84° gravity, washing  
10 out the fiber or fabric, and finally treating the fiber or fabric with nitrobenzol.

3. The process of preparing fiber or fabric for storage-battery envelops which consists in freeing the fiber or fabric from oleaginous  
15 matter and soluble starchy matter, drying the fiber or fabric and subjecting the fiber or fabric to a nitrating mixture composed of about one hundred and thirteen and one-half parts of nitric acid of 1.42° gravity and about one  
20 hundred and fifty parts of sulfuric acid of 1.84° gravity, washing out the fiber or fabric, and finally treating the fiber or fabric with nitrobenzol.

4. The process of preparing fiber or fabric  
25 for storage-battery envelops which consists in freeing the fiber or fabric from oleaginous matter and soluble starchy matter, drying the fiber or fabric, subjecting the fiber or fabric to a nitrating mixture composed of about one  
30 hundred and thirteen and one-half parts of nitric acid of 1.42° gravity, non-fuming, and about one hundred and fifty parts of chemically-pure sulfuric acid of 1.84° gravity at a maximum temperature of about 78° Fahrenheit,  
35 heit, whereby the carbohydrates other than

the starchy carbohydrates are nitrated and the starchy carbohydrates are not nitrated and washing the fiber or fabric.

5. The process of preparing fiber or fabric for storage-battery envelops which consists  
40 in subjecting the fiber or fabric to a nitrating mixture, washing out the fiber or fabric, and treating the fiber or fabric with a weak solution of nitrobenzol.

6. The process of preparing fiber or fabric  
45 for storage-battery envelops which consists in nitrating a portion of the carbohydrates without nitrating the starchy carbohydrates and subsequently washing out the fiber or fabric.  
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7. The process of preparing fiber or fabric for storage-battery envelops which consists in nitrating a portion of the carbohydrates without nitrating the starchy carbohydrates,  
55 washing out the fiber or fabric, and treating the fiber or fabric with a weak solution of nitrobenzol.

8. The process of preparing fiber or fabric for storage-battery envelops which consists in freeing the fiber or fabric from oleaginous  
60 matter and soluble starchy matter, drying the fiber or fabric, nitrating a portion of the carbohydrates without nitrating the starchy carbohydrates and washing the fiber or fabric.

This specification signed and witnessed this  
65 9th day of August, A. D. 1901.

ELMER A. SPERRY.

In presence of—

ROSWELL S. NICHOLS,  
LUCIUS E. VARNEY.