UNITED STATES PATENT OFFICE.

ISIDOR KITSEE, OF PHILADELPHIA, PENNSYLVANIA.

PYROXYLIN COMPOUND.

SPECIFICATION forming part of Letters Patent No. 701,357, dated June 3, 1902.

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To all whom it may concern:

Be it known that I, ISIDOR KITSEE, of the city and county of Philadelphia, State of Pennsylvania, have invented a certain new and useful Improvement in Pyroxylin Compounds, of which the following is a specification.

My invention relates to an improvement in pyroxylin or other cellulose compounds.

The compounds consisting primarily of dissolved cellulose are mostly known in commerce as "celluloid," "pyroxylin," &c. All these compounds are, electrically considered, of low resistance when compared to rubber or gutta-percha. The articles manufactured from same are to some extent brittle, and when subjected to the action of diluted acids the irresistance is usually greatly lessened, and these compounds are therefore not well adapted for electrical works.

It is the object of my invention to increase the resistance value of such compounds and to make such compounds of any degree of flexibility desired. To accomplish this object, I have carried out in the course of several years a series of experiments, and I have produced as the result of such experiments products in the shape of jars for battery-cells, insulating-plates, &c., which entirely justify me in saying that the production of articles from the dissolved cellulose of different degrees of flexibility and different degrees of resistance values is not only feasible, but if the process as laid down in this my specification is carried out entirely practical.

In the course of manufacturing articles out of soluble cellulose of my own make, as well as articles made of celluloid scrap redissolved, I found that it was necessary to make these articles, mostly when used as vessels to retain some liquid, of either too great a thickness or to line the same with a coating of rubber, shellac, or a like material. To obviate this, to make jars and other insulating articles from cellulose, and to be enabled to use the same for insulating-conductors in a manner so as to give it the required pliability, I intermixed the cellulose in its pliable state—that is, before the solvent was entirely dried out—with sulfur in various ratios, and I will give here the results of some of my experiments, taking such as refer to the production of jars as an example.

In the production of jars the soluble cellulose or in place of it scraps of celluloid were redissolved in amyl acetate and then with the aid of calenders were rolled into sheets of the required thickness. Before this latter process, I intermixed the mass with sulfur in the shape as is commercially known as "flowers of sulfur," using in various sheets different degrees of sulfur. The sheets were then with the aid of molds compressed into the shape of jars and subjected to a high degree of heat for the purpose of eliminating the moisture. The sulfur used, considering weight for weight, was in some instances as low as two per cent. and in some instances as high as ten per cent. The heat to which the articles were subjected varied from 150° to 250°. The result was as follows: With two per cent. of sulfur the jar itself became flexible to a great extent, and its resistance was found later on to be over one hundred per cent. greater than the resistance of jars made under the same process but without the addition of sulfur. The jars with the addition of ten per cent. sulfur were physically so weak that they could not stand at all without support; but they could be twisted, even after perfectly dry, into any desired shape without breaking or cracking.

After repeated trials it was found that for jars or similar articles an addition of three per cent. of sulfur was necessary to make perfect articles and that in the sheeting of the compound the sulfur should be thoroughly intermixed, as otherwise the jar will not be uniform throughout in strength or flexibility.

The addition of sulfur and the addition of heat to melt this sulfur, or better to cure the article, to "vulcanize" the same, so to speak, has the following advantages: First, it adds to the article a degree of flexibility it otherwise would not possess; second, this degree of flexibility can be regulated in accordance with the percentage of sulfur added; third, the process of curing or vulcanizing with an addition of sulfur gives the article a degree of resistance it did not formerly possess; fourth, it adds to the article the valuable

property of a greater degree of resistance to the action of aciduous or other moisture, which property is of greatest consequence when the compound should be used either as an insulator for electric conductors, jars for electric cells, or other component part of electric devices.

The resultant action of the sulfur on the pyroxylin compound is to make the same more pliable and soft. It is impossible to lay down a strict rule of the per cent. of sulfur to be added, as this per cent. has to vary according to requirements. It suffices here to say that the addition of two per cent. will add to the flexibility without impairing the supporting strength and that articles such as jars, &c., should be cured or vulcanized with two or three per cent. of sulfur. Every additional per cent. will make the article more flexible and softer, and if as high as ten per cent. is reached the article in the shape of a jar will not have the necessary supporting strength, but will collapse. From these results the necessary percentages for the various articles can easily be deducted. For insulating wires a four or five per cent. may not be too high. For mattings a ten per cent. may suit the purpose; but in all cases practical experience will soon teach the operator the required percentage needed for various articles.

It is best to allow the curing or vulcanizing to take place under pressure.

The sulfur instead of being in its elementary state can, where the higher price of the sulfur compound is not of material consequence, be used in its combined state, such as a chlorid. Whereas, therefore, whenever I use in this specification or claims following this specification the word "sulfur" I understand under it not only sulfur in its elementary state but also its salt—such, for instance, as chlorid, bromid, &c.

I have above specified that the degrees of heat to which the articles were subjected was from 150° to 250°. I have subjected articles to a far higher degree; but in such cases it very often happens that the too-high temperature carbonizes the article too much, and the degree of temperature will therefore have to vary according to requirements.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The process which consists in adding to an amorphous cellulose compound, sulfur, and curing or vulcanizing the same with the aid of heat.

2. The process of curing or vulcanizing an amorphous cellulose compound which consists in adding to said cellulose compound sulfur in its divided state, and subjecting the same to a high temperature.

3. The process of producing an article useful as an electric insulator which consists in adding to an amorphous cellulose treated with a solvent, sulfur in its divided state, and subjecting the same to the action of heat.

4. The process of curing or vulcanizing amorphous cellulose which consists in subjecting the cellulose to a solvent, adding sulfur to the compound, intermixing said sulfur with said cellulose, and subjecting the compound to the action of heat.

5. As an article of manufacture a compound consisting of amorphous cellulose and sulfur cured or vulcanized with the aid of heat.

In testimony whereof I hereby sign my name, in the presence of two subscribing witnesses, this 16th day of December, A. D. 1901.

ISIDOR KITSEE.

Witnesses:
EDITH R. STILLEY,
CHAS. KRESSENBUCH.