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METHOD OF COLORING FIBROUS MATERIAL.

1,332,982. Specification of Letters Patent. Patented Mar. 9, 1920.

No Drawing. Application filed August 10, 1916. Serial No. 114,200.

To all whom it may concern:

Be it known that I, WILLIS A. GIBBONS, a citizen of the United States, residing at Flushing, Long Island, county of Queens, State of New York, have invented certain new and useful Improvements in Methods of Coloring Fibrous Material, of which the following is a full, clear, and exact description.

My invention relates to improvements in coloring fibrous material, such as fabrics, particularly those in which it is desired to produce a yellow or orange color which is not only permanent and not liable to fade or be affected by moisture, but will also be practically impervious or opaque to ultra-violet rays of light. Such a fabric, when coated with rubber, is particularly adapted for use in balloons and airships which are sustained or partly sustained by gas that is lighter than air, such as hydrogen or illuminating gas. The rubber of the fabric is liable to deteriorate to a considerable degree if penetrated by actinic sun rays, or rays of light having ultra-violet components. The use of a metallic compound, hereinafter described, reduces the tendency of such rays to penetrate the fabric. A further object of my invention is to produce a coloring matter which is unaffected by heat and sulfur on fabric coated with rubber compounds.

Heretofore in the coloring or dyeing of fabrics, organic dyes have been used extensively, but these are not adapted for the uses above set forth, being imperfectly opaque to light and having a tendency to fade, as well as being expensive to manufacture. Lead chromate heretofore also used as a coloring matter for fabric is more opaque than organic dyes, but has the disadvantage when used with rubberized fabric, of darkening when exposed to vulcanizing heat because of the formation of lead sulfid.

Briefly, the invention comprises the formation of sulfids of antimony within or on the fibers of the fabric. These sulfids may be formed and deposited in any approved manner, either separately or mixed in different proportions. As an example, antimony chlorid may be subjected to the action of hydrogen sulfid, thereby forming antimony sulfid. As an example of the process by which this is produced, the following is given:

The fabric or yarn is first dipped in one of two solutions which interact with each other as follows:

$$2SbCl_3+3H_2S=Sb_2S_3+6HCl$$

In this case the fabric or yarn is first dipped in a solution of antimony chlorid and then in a solution of hydrogen sulfid. The dipping may be repeated as many times as necessary to produce the shade of color desired. The color may be varied by precipitating the antimony sulfid at the same time with some other material, as for example, cadmium sulfid.

Another example of compounds which may be used is a soluble thioantimonate with an acid such as hydrochloric acid which is represented by the following equation:

$$2Na_3SbS_4+6HCl=Sb_2S_5+3H_2S+6NaCl$$

Also the use of antimony penta-chlorid with a sulfid or polysulfid of calcium, gives a reaction similar to the following:

$$2SbCl_5+5CaS=Sb_2S_5+5CaCl_2$$

Another preferred treatment of the fabric is one involving the treatment of the fabric with solutions of both potassium antimonyl tartrate (tartar emetic) and a solution of a sulfid of ammonium, either ammonium sulfid $(NH_4)_2S$, ammonium hydrosulfid NH_4SH, or ammonium polysulfid $(NH_4)_2S_x$ at temperatures such that the antimony sulfid will not redissolve in an ammonium sulfid. This does not happen if temperatures below the boiling point of water are used.

The order of sequence in which the various compounds or solutions are applied to the fabric is not essential and it is practical to apply them simultaneously, such as by applying the ingredients to the same or opposite sides of the fabric respectively by brushing or spraying, the essential requirement being that the ingredients shall not become combined prior to their absorption by the fibers of the material.

Having thus described these examples of my invention, what I claim and desire to protect by Letters Patent is:

1. As a new article of manufacture, fibrous material rubberized and colored by a metal-compound-containing coloring matter resisting penetration by actinic rays and immune to discoloration by sulfur.

2. As a new article of manufacture, fibrous material treated with a vulcanizable plastic compound and having intimately deposited

in and about the fibers thereof sulfid or sulfids of antimony.

3. A fibrous material colored by a metal-compound-containing coloring-matter resisting penetration by actinic rays and immune to discoloration by sulfur, and combined with a vulcanizable plastic material.

4. A process of treating fibrous material which comprises applying to the material a metal-compound-containing coloring matter resisting penetration by actinic rays and immune to discoloration by sulfur, and treating the material with a vulcanizable plastic compound.

5. As a new article of manufacture, fibrous material having intimately deposited in or upon the fibers thereof a sulfid or sulfids of antimony, and impregnated or coated with a vulcanized plastic containing sulfur or sulfur compounds.

6. The process of coloring and rubberizing fibrous material which comprises dipping said material into a solution of potassium antimonyl tartrate and a solution of soluble sulfid adapted to precipitate antimony sulfid, whereby the latter is formed directly in or upon the fibers of said material, and treating the material with a vulcanizable plastic compound.

7. The process of coloring and rubberizing fibrous material which comprises dipping said material into a solution of potassium antimonyl tartrate and a solution of a sulfid of ammonium, whereby antimony sulfid is formed directly in or upon the fibers of said material, and coating the material with a vulcanizable plastic compound.

8. The process of treating fibrous material which comprises applying to the material an antimony-compound-containing coloring-matter resisting penetration by actinic rays and immune to discoloration by sulfur and treating the material with a vulcanizable plastic compound.

Signed at New York, N. Y., this 24 day of July, 1916.

WILLIS A. GIBBONS.