UNITED STATES PATENT OFFICE.

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WATERPROOF METHOD AND COMPOUND.

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To all whom it may concern:

Be it known that I, CHARLES S. FRIEDMAN, of Philadelphia, Pennsylvania, have invented certain new and useful Improvements in Waterproof Methods and Compounds, of which the following is hereby declared to be a full, clear, and exact description.

As is well known, ordinary chromic oxid (Cr_2O_3) will unite chemically with common glue or gelatin to form a hard non-putrescent compound, but owing to the insoluble character of the chromic oxid in water or customary reagents it is difficult to bring the oxid into the proper intimate contact desired. The same trouble is encountered, only in less degree, if chromium protosulfate $Cr_2(SO_4)_3$ or other chromium salt of marked stability be selected in lieu of the oxid. The reaction with the gelatin or glue is sluggish and incomplete.

To meet the objections noted, the present invention designs to employ a chromium salt of unstable sort, such as will break up on contact with the glue or gelatin and yield from solution enough of its chromium in the form of an oxid to quickly unite with and convert the glue or other equivalent medium into a hard tenacious substance highly suited for waterproofing. Thus, *e. g.*, if ordinary sodic hydrate (NaOH) be added to a solution of normal chromic chlorid (Cr_2Cl_6) up to the point where chromic oxid begins to precipitate it is seen that the resultant compound has been rendered basic in character and is capable of being expressed by the general formula xCr_2Cl_6,yCr_2O_3,zH_2O. In brief, the sodic hydrate has changed over the normal chromic chlorid into basic chlorid of chromium, which remains soluble, (together with a minor portion of sodic chlorid formed,) although the chromic oxid present is, after all, held in feeble bonds and reacts readily on contact with glue to produce the desired waterproof compound.

By selecting the unstable chromium salt proposed it is plain that the oxid thence derived reaches the glue in minutest subdivision as a part of the chemical solution and quickly responds in widespread fashion on reaction effected with the glue. The peculiar distribution of the chromic oxid as a constituent of the unstable basic salt renders the use of such salt most efficacious where the more stable chromic salts or the oxid itself would fail.

For the practice of the invention the compound distinctive thereof may consist of common glue dissolved in water and combined with basic chlorid of chromium, (xCr_2Cl_6,yCr_2O_3,zH_2O.) On contact with the glue the unstable chromium salt yields up more or less of its chromic sesquioxid, (Cr_2O_3,) which promptly unites throughout the mass, forming with the glue an insoluble compound that gradually dries out and in its set or hardened state becomes impervious to moisture. This distinctive property enables the compound to be used for waterproofing woods of various sort—such as railway-ties, piles, poles, structural lumber, barrels, veneers, &c.—and for the treatment of cotton or linen duck and other braided or woven fabrics, paper tissues, &c., if the object be to render them water-repellent.

Under ordinary conditions the finished compound cannot be melted and applied hot as an immersion-bath. When wood fibers or other cell-like interstices are to be impregnated, the selected material is saturated first with glue "soup" and second with basic chromo chlorid, or vice versa, the object being to effect the intimate combination of said ingredients within the minute recesses of the wood, &c., so that the waterproof compound resulting from the reaction may form and be deposited *in situ* throughout the cell structure. For illustration, suppose the purpose is to waterproof railway cross-ties. These are placed in a closed tank of the kind now frequently employed for "creosoting." The ties are first thoroughly desiccated by indirect steam heat with the aid of an air-pump to remove the evolved vapors. Then a charge of glue soup sufficient to submerge the ties is admitted. After soaking for twenty minutes the excess glue soup is drawn off and the basic-chlorid-of-chromium liquid admitted instead and applied under pressure—*e. g.*, seventy pounds—if desired. By such method the ultimate reaction occurs at minute points, leaving the resultant insoluble compound as a deposit ultimately distributed through and through

the cell tissues. After twenty minutes exposure the surplus liquor is tapped off and the treatment is at an end.

The glue soup may consist, by weight, *e. g.*, of thirty per cent. ordinary commercial glue dissolved in seventy per cent. of water. The soup can be thinner or thicker, as occasion demands. For every pound of glue can be taken, *e. g.*, one-half pound of basic chromium chlorid (xCr_2Cl_6,yCr_2O_3,zH_2O) of 8° Baumé. A more concentrated solution of the chlorid salt quickens the reaction and is indicated if the proportion of glue be increased.

Procedure similar to the foregoing is observed when materials other than cross-ties are to be dealt with. Fabrics, paper, paperboard, &c., ordinarily demand no drying, but can be at once soaked in the glue soup or basic chlorid according to the method. Isinglass or fish-glue serves as a substitue for animal glue, and doubtless some gums may be chosen to effect reduction of the basic chlorid as desired. Basic chromium sulfate, $xCr_2(SO_4)_3$, yCr_2O_3,zH_2O, is an unstable salt suited for use in lieu of the basic chlorid, the glue reacting therewith to change the chromium in part to the form of sesquioxid (Cr_2O_3) deposited as a solid in the hardened compound.

For some purposes it may be feasible to directly unite the glue and the unstable chromium salt, mixing them together and molding the resultant mass into balls or other forms by any of the usual appliances before the plastic compound dries out and becomes set and hard.

To effect more sluggish change of the unstable chromium salt to the condition of sesquioxid, as may be desirable at times, and to provide as well for a single instead of two separate immersions for waterproofing, a composite bath is prepared, *e. g.*, as follows:

Ingredients.	Chemical formula.	Weight.
		Per ct.
Potassium bichromate	$K_2Cr_2O_7$	4
Glue		33
Zinc chlorid (dry)	$ZnCl_2$	4
Glycerin		4
Water		56
		100

The water is used to dissolve the glue, the other ingredients being separately admixed and then stirred into the soup. In the presence of the glycerin the bichromate and chlorid salts gradually react, producing the unstable basic chlorid of chromium, which is changed in turn to insoluble sesquioxid by contact with the glue. A slow-action bath of such sort is useful in waterproofing paper or the lighter fabrics, since it remains limpid for a long period and avoids rehandling of the materials for double immersion. An equal quantity of zinc sulfate may be taken in lieu of zinc chlorid in preparation of the bath, and it is obvious that the given proportions are stated only in way of example and, together with other details, can be varied according to the knowledge of those skilled in the art. From what has preceded it also appears that "basic chromium chlorid" as employed in the claims is a term of definition rather than of limitation and includes any other unstable salt of chromium—*e. g.*, basic sulfate—which responds in like fashion to the reducing effect of glue.

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

1. A waterproof compound consisting of glue and water combined with an unstable basic salt of chromium, substantially as described.

2. A waterproof compound consisting of glue and water combined with basic chromium chlorid, substantially as described.

3. The method of waterproofing which consists in impregnating the material under treatment with basic chlorid or like unstable salt of chromium in the presence of glue "soup" whereby the chromium compound is changed to sesquioxid state and deposited *in situ* throughout the cellular spaces, substantially as described.

4. The method of waterproofing which consists in subjecting the material under treatment to separate baths of glue solution and basic chromium chlorid respectively whereby chromium sesquioxid is deposited in the cell-like interstices of the material, substantially as described.

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