

UNITED STATES PATENT OFFICE.

PHILIP A. SAWYER, OF HASBROUCK HEIGHTS, NEW JERSEY.

PROTECTED PAPER CURRENCY AND PROCESS OF MAKING SAME.

No Drawing.

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To all whom it may concern:

Be it known that I, PHILIP A. SAWYER, a citizen of the United States of America, residing at Hasbrouck Heights, in the county of Bergen and State of New Jersey, have invented certain new and useful improvements in Protected Paper Currency and Processes of Making Same, of which the following is a specification.

This invention relates especially to paper currency, bonds, or the like, which have been strengthened and more or less waterproofed and protected against wear and dirt by applying thereto by spraying or otherwise a suitable thin protective coating composition of a substantially transparent or somewhat tinted character which may comprise cellulose compounds of the nature of pyroxylin or dissolved cellulose ester incorporated with suitable softening or toughening material, so that especially in the extremely thin coatings applied cracking or brittleness is not present to an undesirable extent. The protecting coating which may advantageously be applied to both sides of the paper currency, etc. more or less penetrates the fibres of the paper so as to become strongly adherent thereto and by forming the engraved or other design on the paper of special ink which may comprise considerable proportions of pyroxylin or cellulose ester material particularly strong union may be effected between the ink and the protective coatings so that still longer wearing service is secured. Such protected currency may be formed by producing or applying the desired design by printing in various colors on the paper as by the use of such special cellulose body inks as above referred to or other suitable compositions which give ample adherence to the protective coatings employed. Then preferably after substantial drying of the ink the protective coating material in dissolved condition may be sprayed or otherwise thinly and substantially uniformly applied to one or both sides of the paper body and design so as to considerably add to the strength of the fabric as well as remarkably increase its waterproof and wearing properties, for which reason also accumulation of dirt is greatly minimized so that there is correspondingly less danger of spreading infectious diseases through paper

currency which necessarily passes through many hands. Such protective coating material may be applied in somewhat greater quantities where lower grades of paper are employed than are preferable for paper currency and in this way the strength and general properties of the paper can be greatly enhanced as well as giving the other desirable qualities referred to.

For best results the design on the paper currency is preferably printed or formed of such ink or material as is capable of strong adherent union with the protective coating material employed in connection therewith. For this purpose the engraving ink is preferably selected with this in mind and in some cases it is desirable to use engraving or other inks containing more or less incorporated dissolved cellulose compounds such as pyroxylin or cellulose ester material with which softening is of course incorporated to prevent undesirable brittleness and to give suitable working qualities when mixed with the color under printing or engraving conditions. In some cases the ink may comprise a large proportion of such dissolved cellulose ester material as a suitable acetate of cellulose, for instance, dissolved together with camphor or other incorporated oily softening material in a suitable solvent such as diacetone alcohol, acetylene tetrachloride, acetone or other suitable heavier solvents or mixtures thereof so as to secure the desired consistency and working properties of the finished ink with which suitable color is of course incorporated. An illustrative ink formula along this line and high in pyroxylin is twenty-four to thirty-six ounces of good high grade pyroxylin or soluble cotton with which may be used if desired two to six ounces of camphor and the whole dissolved in one gallon of heavy diacetone alcohol. For some purposes where slower drying or evaporation is desirable as where heated plates, etc., are used in the printing other heavier solvents such as benzyl acetate, refined heavy acetone oils, etc., may be substituted for twenty-five to fifty percent or so of the diacetone alcohol solvent in this composition with which suitable coloring matter of the ink is of course incorporated. Such ink when forced under high pressure into the fabric of the paper currency strong-

ly adheres thereto and even when a relatively small proportion of such cellulose ester material is used in the ink it considerably facilitates the strong adhesion thereto of the dissolved cellulose ester protective material which is preferably applied to the finished paper currency.

The protective material which may be applied to the printed and otherwise finished paper currency in the form of a thin uniformly sprayed coating is for this method of application preferably in a thinly fluid condition and may comprise or largely consist of a solution of suitable pyroxylin or cellulose ester such as acetyl cellulose material in a thinly fluent solvent therefor, such as acetone, methyl alcohol, acetylene tetrachloride or mixtures thereof with diacetone alcohol. Acetyl cellulose compositions which have the advantage of being less inflammable may be dissolved in thinly fluent condition in mixtures of acetone and diacetone alcohol, for instance, which may be used to the extent of five to fifteen percent more or less of the composite solvent and of course for most purposes it is desirable to incorporate a suitable softening agent such as waxy or oily material of the general character of camphor, castor oil, etc. to give the protective coating a greater degree of toughness and pliability for which purpose five to twenty percent more or less of such softening material may be used as compared to the nitrate or acetate of cellulose employed. For many purposes the soluble grades of gun cotton or pyroxylin may be used in this connection, and an illustrative composition for spraying purposes may be made by dissolving twelve to sixteen ounces of soluble gun cotton together with five to twenty percent of camphor or castor oil or mixtures thereof in five gallons of a suitable solvent solution, such as acetone or wood alcohol mixtures with which diacetone alcohol or amyl alcohol or amyl acetate may, if desired, be incorporated to the extent of ten to twenty percent or so. When these components are thoroughly incorporated by stirring and suitable moderate heating if desired, a thinly fluent composition is formed which may be efficiently applied to the face of the paper currency by air pressure spraying apparatus or the like, so that a thin and substantially uniform protective coating is applied to the design and the paper body of the currency and which when dried strongly adheres thereto and may form when in sufficient quantity a slightly glossy protective and fairly waterproof coating of sufficient flexibility to allow the paper currency to be used in the ordinary way, while at the same time considerably increasing its strength so that twenty to forty percent or more increased strength may be secured as compared with untreated United States currency, for

example. This spraying may of course be conveniently performed while the currency is on an endless carrier travelling through a substantially closed spraying chamber where the protective material is applied and then travelling through a drying chamber where air currents which may in some cases be somewhat heated facilitate the drying of the extremely thin protective coating under uniform conditions so that rapid and satisfactory drying is effected. Both sides of the paper currency may of course have such protective coatings applied thereto so that aside from the increased strength above referred to which minimizes the tearing of the paper currency its comparatively smooth more or less waterproof character greatly minimizes the accumulation of dirt thereon so that the currency has a much longer period of service before it is necessary to withdraw it from circulation for cleansing or replacement. While the spraying application of the protective coatings has the decided advantage that undesirable smearing of the design can be obviated in this way yet for some purposes other modes of application may sometimes be used where, for instance, the application of the protective coating material is quickly or instantly effected by passing the currency through rolls moving at the same surface speed as the paper currency, bonds or the like.

It is sometimes desirable to use suitable tinting material in the sprayed or otherwise applied protective coating compositions so as to give a slight general tint to the entire currency which sometimes adds to the artistic effect and furnishes a further safeguard against counterfeiting. Furthermore, it is sometimes desirable to have such tinting material of a more or less fugitive character so that it is destroyed or radically changed in case any attempt is made to bleach or chemically obliterate any of the writing or design on the currency, bonds, etc. Suitable sensitizing of safety tinting materials for this purpose are alcohol yellow, or auramine, naphthol yellow, aurine, saffranine, Biebrich scarlet, malachite green, opal blue or methylene blue for example, which may be incorporated in the protecting composition to such extent as to produce the desired light tint on the protected article, a few tenths of a percent or thereabouts of the aniline colors above referred to being ample for this purpose in most cases. By spraying both sides of paper currency with any suitable protecting composition of this general character in which any desirable sensitizing or safety tinting material has been incorporated the currency may not only be given a thin uniform and largely waterproof impervious coating, but the yellow, green, or other body tint which may penetrate the paper itself to a considerable extent is de-

sirable from the artistic standpoint and gives additional protection against fraudulent alteration.

This application is a substitute for application Serial No. 317,213.

This invention has been described in connection with a number of illustrative embodiments, forms, materials, proportions, formulas, methods of preparation and use, to the details of which disclosure the invention is not of course to be limited, since what is claimed as new and what is desired to be secured by Letters Patent is set forth in the appended claims:

1. The paper currency, bond or other instrument of value comprising a relatively open textured paper body to which the design has been applied in ink comprising dissolved cellulose ester material and incorporated oily softening material and a thin substantially transparent and uniform sprayed protective coating applied to both sides of the paper currency and permanently united to the design and to the exposed portions of the paper body.

2. The paper currency comprising a paper body to which the design has been applied in ink comprising cellulose ester material and incorporated softening material and a thin substantially transparent uniform protective coating applied to both sides of the paper currency and permanently united to the design and to the exposed portions of the paper body.

3. The paper currency comprising a paper body upon which the design has been printed and a thin coating containing sensitizing coloring material applied to both sides of the paper currency, the design material and coating material both containing a substantial portion of a common binding ingredient, thereby uniting the coating to the design and to the exposed portions of the paper body to promote the strength and waterproof properties thereof.

4. The paper currency, bond or other instrument of value comprising a relatively open textured paper body on which the design has been printed, and after which a thin sprayed protective coating has been applied to both sides of the paper currency, the design and the coating material containing substantial proportions of cellulose ester material whereby the coating is united to the design and to the exposed portions of the paper body.

5. The process of making paper currency, bonds or other instruments of value which

comprises printing the desired design on the relatively open textured paper body with ink comprising sufficient dissolved cellulose ester material to give strong adherence with the protective coating employed, substantially drying the design and successively spraying on both sides of the paper currency a thin solution of cellulose ester, sensitizing tinting material and incorporated softening material dissolved in volatile solvent and drying the same to secure permanent union of the thin colloidal coating with the design and with the exposed fibres of the paper body to promote the strength and impermeable character thereof.

6. The process of making paper currency which comprises printing the desired design on the paper body with ink comprising sufficient dissolved-cellulose ester material to give strong adherence with the protective coating employed, substantially drying the design and successively spraying on both sides of the paper currency a thin solution of cellulose ester, and incorporated softening material dissolved in volatile solvent and drying the same to secure permanent union of the thin colloidal coating with the design and with the exposed fibres of the paper body to promote the strength and impermeable character thereof.

7. The process of making paper currency, bonds or other instruments of value which comprises printing the desired design on the paper body with ink adapted to give strong adherence with the protective coating employed, substantially drying the design and successively spraying on both sides of the paper currency a thin solution of cellulose ester dissolved in volatile solvent and drying the same to secure permanent union of the thin substantially transparent colloidal coating with the design and with the exposed paper body to promote the strength and impermeable character thereof.

8. The process of making paper currency which comprises printing the desired design on the paper body with ink adapted to give strong adherence with the protective coating employed, and spraying on both sides of the paper currency a thin solution of cellulose ester dissolved in volatile solvent and drying the same to secure a permanent union of the thin substantially transparent coating with the design and with the exposed paper body to promote the strength and impermeable character thereof.

PHILIP A. SAWYER,