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SAFETY PAPER

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Fig. 1.



Fig. 2.



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SAFETY-PAPER

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This invention relates to safety papers to be used for the manufacture of cheques, mortgage deeds, draft forms, bank notes and similar papers and documents.

According to this invention there is provided a compound safety paper adapted to indicate whether markings thereon have been defaced or tampered with, said compound paper including two or more chemicals or chemical compounds adapted to react with one another and to leave visible evidence of such reaction, said chemicals or chemical compounds being normally separated from one another by a protective layer, and such protective layer being adapted to be destroyed or lose its protective effect if the paper is tampered with and thus permit said chemicals or chemical compounds to react with one another.

The chemical components which are provided in or on the safety paper according to this invention enter into a visible reaction with one another, if in contact, and these interacting chemical components may be for example

(1) Silver salts or lead salts on the one hand and sulphur, or sulphides or chromates on the other hand, or (2) copper salts on the one hand and benzidine or diphenylcarbonacide on the other hand, or (3) iron salts on the one hand and tannin or tannic or gallotannic acid or the like on the other hand.

These interacting chemical components are separated by an intermediate layer, composed for example of casein, starch, dextrine, animal size, or mixtures thereof, and this layer swells or absorbs readily or is readily permeable to liquids or can be easily damaged mechanically.

In practice the paper according to the invention may be manufactured by adding one of the two components which enter into a coloured reaction with one another or form coloured chemical compounds, to the pulp in the hollander or grinding machine, or by spreading it over the length of the paper or over the finished sheet, while the other component is brought upon the paper after the first component has been protected by a protective layer, which is capable of absorbing or soaking or is permeable to liquids or which can be readily damaged mechanically. Alternatively the paper could be composed of several layers, the first component being incorporated in or applied upon one layer, and this layer being then stuck to or couched by couching rollers to another layer containing or carrying the second chemical component by means of an adhesive layer of, for example, casein, starch, dextrine, animal size or mixtures thereof, which

readily swells or absorbs liquids or is permeable to liquids or which can be easily damaged mechanically.

It will be understood that in any case, the second of the two chemical components of the safety paper according to the invention must be applied to the compound paper already containing the first component in the absence of considerable moisture or liquid, so that no premature reaction will take place. For instance, two sheets of paper each containing one of the chemical components may, if necessary, be submitted to a special partial drying operation before they are united together to form a safety paper according to this invention. In any event the chemical components of the layers and the adhesive chosen will generally be such that the reaction between the chemicals does not take place immediately the layers of paper are united together by the adhesive. Even if particularly sensitive chemical components are used however, it will be possible to prevent any premature reaction when the paper is being produced, by passing the safety papers immediately after the components thereof have been united together by the adhesive over a drying device, for example heated drying cylinders.

For producing the safety paper according to the present invention a raw paper which is weakly sized or is unsized, and thus consists of an absorbent material, may be used. The first chemical component may be incorporated into the material itself or may be brought upon the paper during or after its production.

Reactive papers have already been proposed which are treated or prepared with iron salts and which have another component, such as tannic acid, gallic acid and so on, in powder form, spread on the prepared side. When such papers are, for instance, stored for a long time, slight causes, such as the influence of light or atmospheric humidity, may bring about an undesirable reaction between said chemical components, which in the known papers are in direct contact with each other.

Safety papers have also been previously proposed, which are provided with designs or marks printed in colour on one side of the paper. To make these designs show through the entire thickness of the paper layer, the other side of the paper was treated with a size solution. Thus in this case one side of the paper is prepared with a colouring matter, whilst the other side is prepared with a size, which serves as a penetrating agent for the paper and as a solvent for the colour

agglutinants, drawing the colour through and fixing it in the paper.

Also a safety paper has previously been known, which consists of a basic layer made of a weakly sized or unsized absorbent material, and an opaque covering layer which is so thin as to be damaged or broken through when written or printed upon.

This safety paper thus only enables mechanical damage or tampering to be recognized to a certain extent and within certain limits, but it only permits attempts at falsification by means of chemical agents to be recognized with difficulty.

On the contrary this invention provides a safety paper which makes it very easy to recognize any kind of attempts at falsification, such as those carried out by washing in water or alcohol or treating with ink-decolourizing or removing agents or any kind of mechanical damage such as erasure.

The safety papers according to the present invention thus have the following important advantages against the known processes:

The paper has an unlimited durability without there being any possibility of the components reacting prematurely in an undesirable way. When stored no precautionary measures are necessary. For instance even under the influence of light or excessive moisture and/or warmth of air the components cannot enter into reaction with one another. Therefore the papers according to the invention also have the advantage that chemical components which react very sensitively with one another can be used without impairing the durability of the papers. Also the protective layer permits the paper to be written upon in the ordinary way, even when the paper is made of weakly sized or even entirely unsized materials; for the protective layer prevents the ink penetrating into the paper and thus running out or spreading. Any treatment with water or other liquids leads to an immediate reaction between the chemical components because of the ability of the protective layer to absorb or swell, and because of its permeability to liquids. Also any mechanical action or attack upon the paper, such as erasing is rendered evident by the paper being coloured at the damaged spot, the component on one side of the protective layer coming into contact, through the damaged part of the protective layer, with the component on the other side thereof.

In order that the invention may be clearly understood and readily carried into practice, I have appended hereto one sheet of drawings, in which two forms of paper made according to the present invention are illustrated diagrammatically and by way of example.

In Figure 1, *a* indicates a sheet of paper which consists of unsized or weakly sized absorbent material, in which one of the chemical components has been incorporated. *b* indicates a protective layer, which can be easily damaged mechanically, this layer being provided over one or both sides of the sheet or layer of paper. (In the example illustrated the protective layer is provided on both sides of the paper.) *c* indicates a second paper layer containing another component, this layer being in the example shown provided on the protective layer on both sides, to form the outer surfaces of the compound sheet.

In Figure 2 a safety paper containing several layers according to the invention is represented. Here the first chemical component is incorpo-

rated in a paper layer *e*, the second component being incorporated in a paper layer *f*.

Both paper layers are united together by a size or adhesive layer *g*, which serves as a protective layer.

On safety papers which are produced in this way, even the most careful treatment with water or alcohol causes a visible unfading and irremovable reaction. This safety paper also offers a complete protection against any mechanical treatment, such as erasure or the like.

What I claim is:—

1. A safety paper including a layer of paper having incorporated therein metal salts, and a second layer of material containing a chemical substance capable of reacting with said metal salts to form a visible product coloured differently from said layer of paper and said layer of material, said paper layer being attached to said layer of material by an intermediate layer of an adhesive substance, which swells readily upon the action of liquids, said intermediate layer being adapted normally to separate said metal salts and said chemical substance from contact with one another but adapted, when the safety paper is treated with liquids, to permit said metal salt and said chemical substance to come into contact and react with one another to form said visible coloured product.

2. A safety paper including a layer of paper having incorporated therein a chemical substance comprising a copper salt, and a second layer of paper including a chemical substance comprising a compound containing two phenyl-groups which is adapted upon contact with copper salts to react with the latter to give a coloured product, said layers of paper being attached together by an intermediate layer of size which is adapted to swell readily under the action of liquids, said intermediate layer normally separating said chemical substances from one another but being adapted, when treated with liquids, to permit said chemical substances to come into contact and react with one another to form a visible product coloured differently from said layers of paper.

3. A compound safety paper including a layer of paper having incorporated therein an iron salt, and a second layer of paper including a tannin containing substance, said layers of paper being attached together by an intermediate layer of an adhesive which is readily permeable to liquids, said intermediate layer being adapted normally to separate said iron salt and tannin containing substance from contact with one another but, when treated with liquid, to permit said iron salt and tannin containing substance to come into contact and react with one another to form a visible product coloured differently from said layers of paper.

4. A safety paper comprising a layer of material having incorporated therein one or more inorganic salts, and a second layer of material including a chemical substance capable of reacting with said inorganic salt or salts, said layers of material being attached together by an intermediate layer of an adhesive substance adapted to swell under the action of liquids and to be permeable by the latter and being adapted normally to separate said inorganic salt or salts and said chemical substance from contact with one another, but being susceptible, when the safety paper is treated with liquid, to allow said inorganic salt or salts and said chemical substance to come into contact and react with one another

to form a visible product coloured differently from said layers of paper.

5 5. A safety paper including a layer of paper having incorporated therein an inorganic salt, a
10 second layer of paper carrying a chemical substance which reacts when in contact with said
15 inorganic salt to leave visible evidence of such reaction, and a layer of protective material arranged between the first and second layers of
20 paper and normally separating said inorganic salt and said chemical substance from contact with one another, but adapted when pierced to allow
25 contact and consequent reaction between said inorganic salt and said chemical substance to form a visible product coloured differently from said
30 layers of paper.

6. A safety paper including a layer of paper having incorporated therein an iron salt, a second layer of paper carrying a tannin containing
20 substance and a layer of protective material arranged between the first and second layers of paper and normally separating said iron salt and
25 tannin containing substance from contact with one another but adapted when damaged to allow contact and consequent reaction between said
30 iron salt and said tannin containing substance to form a visible product coloured differently from said layers of paper.

7. A compound safety paper including a layer
30 of paper having associated therewith a chemical substance, a second layer of material having associated therewith a further chemical substance which is capable of reacting with said first
35 named chemical substance to form a visible coloured product, and a third and protective layer of material adapted normally to separate said
40 first and second-named chemical substances from contact with one another, but adapted under the action of liquids to be deformed and thereby to permit contact and consequent reaction between
45 said first and second-named chemical substances to form said visible coloured product.

8. A compound safety paper including a layer
45 of paper carrying an inorganic salt, and a second layer of paper having incorporated therein an organic compound capable of reacting when in contact with said inorganic salt to form a
50 visible product coloured differently from said layers of paper, said layers of paper being attached together by means of a layer of adhesive material which is adapted normally to separate

said inorganic salt and said organic compound, but which is susceptible to expansion under the action of liquids to allow said inorganic salt and organic compound to come into contact and react with one another to produce said visible coloured
5 product.

9. A compound safety paper comprising a layer of paper and a plurality of layers each composed entirely of a chemical substance, said chemical
10 substances being so selected that adjacent layers are adapted upon contact with one another to react to form a visible coloured compound, and being normally separated from contact with one
15 another by a protective layer of material which is capable of allowing contact between said adjacent layers of chemical substances when submitted to the action of a liquid.

10. A compound safety paper comprising a layer of paper having incorporated therein an
20 inorganic salt, two outer layers of material disposed one on each side of said layer of paper and each including a chemical substance adapted upon contact with said inorganic salt to react therewith to form a visible product coloured differently from said layers of material and said
25 layer of paper, and two intermediate layers of adhesive material disposed one on each side of said layer of paper and each normally separating said inorganic salt from the chemical substance included in the adjacent outer layer of
30 material, but being adapted upon treatment with liquids to allow contact and consequent reaction between the inorganic salt and the chemical substance included in the adjacent outer layer of
35 material whereby said visible coloured product is formed.

11. A safety paper comprising a layer of weakly
40 sized paper having incorporated therein an inorganic salt, a layer of paper carrying an organic compound capable upon contact with said inorganic salt of entering into reaction therewith to form a visible product coloured differently from
45 said paper layers, and a layer of adhesive material binding said layers of paper together and normally interposed between said inorganic salt and organic compound, but being adapted under
50 the action of liquids to permit contact and consequent reaction between said inorganic salt and organic compound to form said visible coloured product.

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