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LUMINESCENT TRANSFER PAPER

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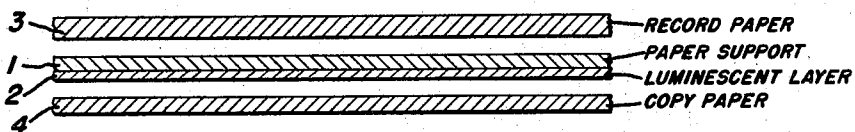


FIG. 1.

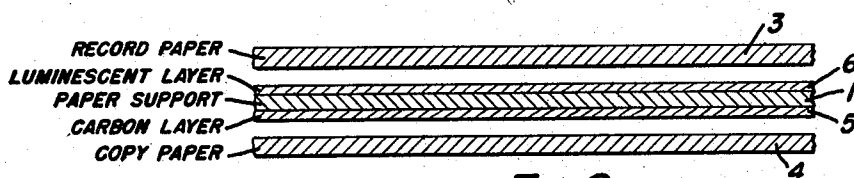


FIG. 2.

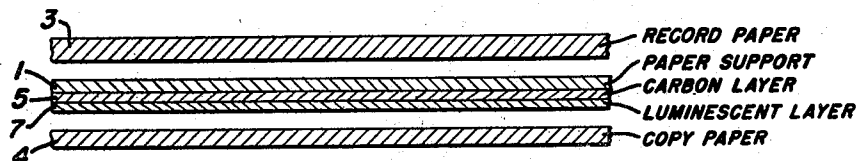


FIG. 3.

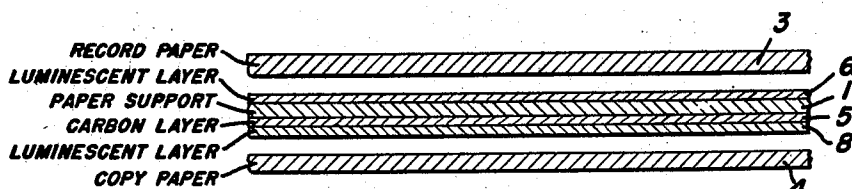


FIG. 4.

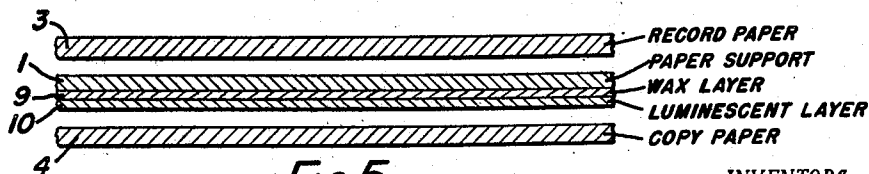


FIG. 5.

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LUMINESCENT TRANSFER PAPER

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6 Claims. (Cl. 117—33.5)

This invention relates to a carbon paper, carbon ribbon, fabric ribbon, or other copying or marking element such as crayon or chalk, or the like, and has for its object to afford a copying or marking structure that is capable of producing a secret mark or record which is invisible or partially visible normally or in ordinary light, and which fluoresces and becomes visible or more visible when exposed to ultraviolet light or to some form of radiating energy.

A more particular purpose is to provide a carbon paper with a copying surface or coating which when exposed to ultraviolet light or other radiation fluoresces and re-emits a different color or light wave length from that to which it is exposed, thus enabling a mark or record that is invisible in ordinary or normal light to become visible when exposed to ultraviolet light or to other selected wave lengths of electro-magnetic radiation, or when subjected to such energy stimulations as those produced by magnetic fields, sonic and ultrasonic agitations and the like.

A further objective is to provide a paper with a copying layer including an organic or inorganic luminescent substance or material for making normally invisible or secret records, such for instance as orders, directions, or communications to air pilots which can be read in the cockpit of a plane when exposed to ultraviolet light.

An additional purpose is to produce a carbon or copying paper having on its under surface a carbon coating that is transferred to the top surface of an underlying copy sheet, and on its top surface a copying coating including a luminescent substance or material that produces on the under surface of an overlying record sheet a negative or reverse copy which is invisible in ordinary light and which becomes visible when exposed to ultraviolet light or other selected methods of activation, or energy. This enables producing a conventional carbon copy of typewritten matter on an underlying copy sheet, and a reverse or negative normally invisible copy on the under surface of an overlying record sheet on which the matter is typewritten, thus retaining an invisible or secret copy of the matter in question which can be referred to in case the carbon copy is erased or obliterated.

A further object is to provide a carbon paper such that when a series of such carbon sheets are interleaved between a series of sheets of copy paper, and matter is typewritten on the top or record sheet of paper, a carbon copy of the typewritten matter is transferred to the top surface of each underlying sheet of copy paper, and a substantially invisible negative or reverse copy of the typewritten matter is transferred to the under surface of the top sheet of record paper, and of each sheet of copy paper, except the lowermost sheet, such reverse copies being invisible in ordinary light and visible when exposed to ultraviolet light or to other radiating energy having a wave length different from the wave length that is re-emitted from the copy, so that as erasures are made on a carbon copy, the normally invisible negative or

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reverse copy remains on the under surface of the record and copy sheets and can be read under ultraviolet light.

An additional purpose is to provide a carbon paper or other marking element that will produce on a paper sheet an invisible record which fluoresces and can be read when subjected to the proper selective light or energy wave length, and contains a luminescent substance that can be applied to or embodied in carbon paper, carbon ribbons, fabric ribbons, crayons, chalk, and other applications where normal invisibility and secrecy is important.

Another object is to provide on a paper support a carbon coating layer containing therewithin or coated thereover a luminescent substance which protects the carbon layer and results in a more or less permanent and determinable record when subjected to ultraviolet light or other radiation of energy, in the event that the carbon record is partially obliterated.

A further purpose is to afford a paper support coated with a layer of wax and oil containing or having applied to its surface a luminescent material which enables making a record that is normally invisible and which fluoresces and becomes visible when exposed to energy or radiation of a selected wave length.

Another purpose is to produce a carbon paper having a carbon coating containing a luminescent substance which gives a more legible and clearer copy, and which is less subject to erasure than a conventional carbon coating layer, and it is also within the province of the invention to afford a carbon paper support with various selected coatings capable of being rendered fluorescent by magnetic fields alone, or in conjunction with activation by electromagnetic radiations.

To these and other ends, the invention consists in the construction that will appear clearly from the following description when read in conjunction with the accompanying drawings, the novel features being pointed out in the claims following the specification.

In the drawings:

Fig. 1 is a diagrammatic sectional view illustrating one embodiment of the invention comprising a paper support coated with a luminescent copying layer, and illustrating sheets of record and copy paper above and below the carbon paper;

Fig. 2 is a similar view illustrating the invention as applied to a carbon paper in which one surface is coated with a luminescent copying layer and the reverse surface is coated with a conventional carbon copying layer;

Fig. 3 is a similar view illustrative of the invention as applied to a carbon paper in which one surface of the paper support is coated with a conventional carbon copying layer and the carbon copying layer is coated with a luminescent layer;

Fig. 4 is a similar view in which a paper support is provided on one surface with a luminescent copying layer and on its reverse surface with a conventional carbon copying layer which in turn is coated with a luminescent copying layer, and

Fig. 5 is a similar view in which a paper support is coated on one surface with a wax layer and the wax layer in turn coated with a luminescent layer.

Referring more particularly to the drawings in which like reference numerals refer to the same parts throughout the several views, and to Fig. 1, 1 designates a tissue paper or other support which is coated with a luminescent copying layer 2, while 3 designates a sheet of record paper which is positioned against the top surface of the support 1 to receive typewriting, and 4 designates a sheet of copy paper that is positioned against the bottom surface of the luminescent copying layer 2 and receives therefrom a copy of the matter that is typewritten upon the top surface of the record layer 3. The luminescent layer may be

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visible or substantially white or invisible and formed from organic or inorganic materials or combinations thereof, as will be described hereinafter.

The matter transferred to or recorded on the surface of the copy paper 4 may be partially visible or invisible in normal or ordinary light and fluoresces to become visible when exposed to ultraviolet light or other energy having a different wave length from that which is re-emitted from the luminescent copy on the copy paper 4, so that the matter recorded thereon is of a secret or invisible nature, and readable only when exposed to the proper selected activation.

In Fig. 2, the paper support 1 has a conventional carbon copying layer 5 applied to its under surface and a luminescent copying layer 6 coated upon its upper surface, and in the use of such a copying element, when the record and copy sheets are in contact with the copying element and typewritten matter is applied to the top surface of the record sheet 3, a conventional carbon copy is produced on the top surface of the copy paper 4, and a normally visible reverse or negative copy is produced on the under surface of the record sheet 3, thus affording a permanent secret record on the under surface of the record sheet 3 of the matter that is typewritten on the top surface of the record sheet and transferred by the carbon layer 4 to the top surface of the copy sheet 4.

With this arrangement, by interleaving a series of the copy elements between a multiplicity of sheets of copy paper, the top or record sheet and all the copy sheets will have an invisible copy on their under surfaces in negative or reverse, capable of being read under ultraviolet light or other selected activation different in type or wave length from that of the energy re-emitted from the luminescent record, and each sheet of copy will have on its upper surface the usual carbon copy. If a carbon copy is erased or obliterated, recourse can always be had to the permanent invisible records on the reverse surfaces of the record or copy sheets.

The term luminescent where used throughout this application is intended to include and denote both fluorescent materials, which are activated by energy of shorter wave length and re-emit energy of longer wave length, and phosphorescent materials which continue to re-emit light or energy after excitation is discontinued, and the invention includes any luminescent, fluorescent, or phosphorescent materials, either organic or inorganic, or any materials which are partially visible or substantially invisible, in normal or ordinary light, and which become visible or re-emit energy when exposed to light or energy differing in kind or wave length from that remitted by the luminescent substance.

In the use of such materials for carbon paper, a suitable mix consists of carnauba wax and pharmaceutical grade mineral oil, with which is mixed zinc sulfide phosphor or other substances treated to produce luminescence. The complete mix consists of approximately 32% carnauba wax, 21% mineral oil, and approximately 47% of pigment or zinc sulfide component.

Where zinc sulfide is employed, a pure zinc sulfide is ground in a porcelain ball mill with an anionic or cationic impurity, or activator, such as gold which produces a slightly yellow color, in the concentration of one part of gold in ten thousand parts of zinc sulfide, and heated to approximately 1050° C., to form a crystal structure. A greater or less proportion of gold may be used and in place of gold for combining with zinc sulfide, other suitable activators may be employed, such in general as copper, silver, bismuth, or manganese in the same concentration as gold, depending upon the particular color that is to be imparted to the luminescent substance.

The luminescent substance may be incorporated in a conventional carbon coating layer or it may be applied as a coating 7 over the conventional carbon copying layers as illustrated in Fig. 3, in which instance the luminescent

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record is imposed on the copy sheet 4, and the carbon record overlies the luminescent record so that if the carbon record is erased, the luminescent substance adheres to the copy paper 4, and serves as a secret record of the typewritten matter which is visible only when exposed to ultraviolet light or other source of activation or energy.

Where the luminescent layer is applied to a paper support, the luminescent activator may be incorporated in the wax mixture and applied to the paper support as in Fig. 1, or a wax coating consisting for instance of carnauba wax and mineral oil may be applied to the paper support and the luminescent substance dusted over or otherwise applied to the surface of the wax layer, and where an element such as disclosed in Fig. 1 is used, it may be employed to produce an invisible copy or record on the underlying copy sheet, or it may be reversed and employed with the luminescent layer against the under surface of the record sheet, thus operating to produce an invisible reverse or negative record on the under surface of the record sheet 3.

Fig. 4 shows a luminescent layer 6 coated on the upper surface of a paper support 1, with a carbon layer 5 coated on the under surface of the support 1, and a luminescent layer 8 over the carbon layer, resulting in a luminescent carbon record on the upper surface of the copy sheet and an invisible reverse copy on the under surface of the record sheet, and Fig. 5 shows a paper support 1 having a wax layer 9 applied to its under surface, and a luminescent coating 10 covering the outer surface of the wax layer 9, the luminescent substance being dusted or otherwise affixed on the wax layer.

Instead of zinc sulfide phosphor for the luminescent substance, any suitable dyes or other substances, organic or inorganic, may be employed that have the characteristic of fluorescing when exposed to energy, such as sound or light waves, or electromagnetic rays of different wave length from that which the luminescent material re-emits.

The luminescent coating layer may be no either or both surfaces of a paper support and may be either visible in ordinary light or substantially invisible or white in ordinary light, and when the coating is more or less visible, it is sharper, becomes more legible when subjected to certain energy wave lengths, and affords additional protection to a carbon impression and a permanent record if the carbon is erased.

While the invention has been described with reference to certain embodiments, it is not restricted to the particular details herein set forth, and this application is intended to cover such changes or modifications as may come within the intent of the improvements and the scope of the following claims.

We claim:

1. As an article of manufacture, a paper support having coated directly thereon a readily transferrable mixture containing wax and a luminescent substance, which luminescent substance is substantially invisible in ordinary light and fluoresces when exposed to energy having a wave length different from that re-emitted by the luminescent substance.

2. As an article of manufacture, a paper support having directly thereon a readily transferrable coating of wax carrying on its surface a luminescent substance which is substantially invisible in ordinary light and fluoresces when exposed to energy having a wave length different from that re-emitted by the luminescent substance.

3. A transfer element comprising a paper support coated directly with a readily transferrable copying layer containing wax and a luminescent substance which is substantially invisible in ordinary light and fluoresces when exposed to energy having a wave length different from that re-emitted by the luminescent substance.

4. A transfer element comprising a paper support coated directly on one surface with a carbon copying layer and directly on its reverse surface with a readily transferrable copying layer containing wax and a lumi-

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nescent substance which is substantially invisible in ordinary light and which fluoresces when exposed to energy having a wave length different from that re-emitted by the fluorescent substance.

5. A transfer element comprising a paper support coated directly with a readily transferrable copying layer containing wax and oil and having an exposed surface of luminescent substance which is substantially invisible in ordinary light and which fluoresces when exposed to energy having a wave length different from that re-emitted by the luminescent substance.

6. A transfer element comprising a paper support coated directly on one surface with a readily transferra-

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ble copying layer containing wax, oil, and a pigment, and coated directly on its reverse surface with a copying layer containing wax, oil, and a luminescent substance which is substantially invisible in ordinary light and which fluoresces when exposed to energy having a wave length different from that re-emitted by the luminescent substance.

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