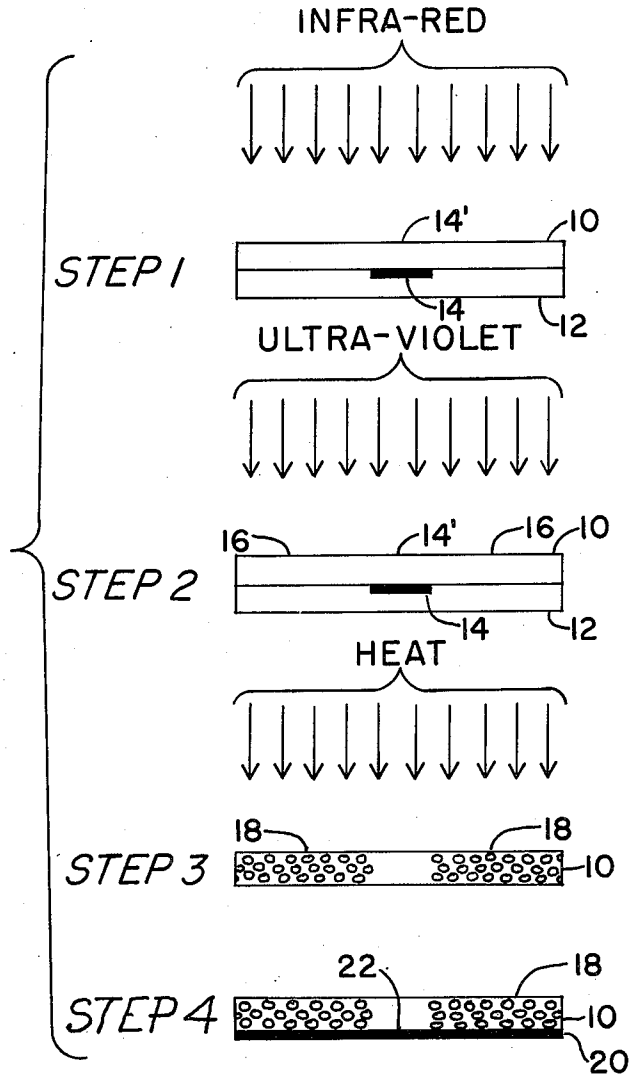
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REFLEX COPYING METHOD

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REFLEX COPYING METHOD

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This invention pertains to the making of copies by use of heat developable, light scattering type materials. More particularly, the invention relates to the preparation of right reading copies of original opaque documents using the light scattering materials as referred to above.

Materials as aforesaid and the making and use thereof and components therefor are described for example in U.S. Patent 2,911,299 and pending applications of James et al., Serial No. 623,050, filed November 19, 1956, now U.S. Patent 3,032,414, and Baril et al., Serial No. 767,094, filed October 14, 1958, now U.S. Patent 3,149,971. These materials comprise a supported or unsupported emulsion including a vehicle, e.g. polyvinylidene chloride, having dispersed therein a compound which is sensitive to certain radiations. For example, by use of certain sensitizer materials, the vehicle may be sensitive to radiations at and around the blue end of the visible spectrum, usually the ultraviolets, and when exposed thereto in given areas, this compound acts to establish scatter centers when heated. Thus, in photographic terminology, "exposure" to form a latent image is to such blue end radiation, and development to form the latent image, is by application of heat. No "wet" or chemical treatment is necessary for development, same being accomplished quite simply by means of dry heat. The record is a permanent one, in the truest sense of the word as known in conventional photography.

Heat development as aforesaid may be accomplished by contact with a heated surface, a hot roller or ordinary flat iron being good examples. However, since the aforesaid radiation sensitive compound is sensitive only to the blue-end radiations, and not to the red-end ones, infrareds may be used in the heating for development step.

Using the scatter center, heat developable materials or emulsions as aforesaid, it is known that a copy of a document may be made by first exposing a film of such material over all of its area to blue end radiations, then plying it to the document, and irradiating the document with infrared radiations. The areas of the document which are of colors which absorb the infrared radiation then undergo an increase in temperature. The best case is a white document with black print upon it. In this case, the black areas increase greatly in temperature compared to white areas. Where colors are present other than black, for example, reds, yellows or blues, these do not undergo as much differential temperature increase, but the effect is present to some extent, depending upon the colors involved. In the past, it has been known that black characters on a white background could, by said infrared radiation, create enough heat in the black areas to heat develop the already exposed scatter center material in areas corresponding to the blacks of the document. However, it has not been possible to obtain development of colors other than blacks (and perhaps deep reds) without also developing the other areas.

It has also been known, of course, that copying in scatter center as well as other materials can be accomplished by the "optical reflex" method. This involves placing the copying material upon the document and irradiating this plied pair through the copying material with radiations, e.g. ultraviolets, which "expose" it. A latent image in the copy occurs because the ultraviolets which pass through it but meet a character on the document are absorbed, and this one pass does not sufficiently expose these areas. However, where the ultraviolets are reflected by the document (the white areas), some make a second pass through the copy material. This second pass is sufficient to "expose" the copy. Thereafter, heat development may be effected to bring out the desired image.

Obviously, the optical reflex operation demands close control of the intensity of the exposing radiation, lest other developable exposure occurs on one pass of the radiation, or no developable exposure occurs even for two passes.

In a copending application filed on March 6, 1961, by René Baus, Jr., and myself, there is described an improved method of making copies in scatter center, heat developable materials using the optical reflex technique. The method according to said application comprises plying the copy material, still unexposed, to the document, and first irradiating the document (through the copy material or otherwise) with red end radiations (normally infrareds) which have the differential heating effect mentioned above. In this way, the areas of the copy corresponding to the characters of the document are heated. Following this heating step, the optical reflex exposure step (irradiating with blue end radiations, e.g. ultraviolets, through the copy material) is carried out. It has been discovered that a greatly improved reflex copy is thusly obtained. It appears that the improved result is based upon the fact that heating of the scatter center material in certain areas decreases the sensitivity thereof to the exposing radiations. Therefore, by the time the exposure is made, the copy material is in a preferential condition such that in the regions where only one pass of the exposing radiation occurs, the sensitivity has been lowered, and developable exposure will not occur, or is less likely to occur to any appreciable extent. However, the sensitivity in the other areas has not been diminished, and developable exposure is obtainable upon two passes of the exposing irradiations.

As will be appreciated, the method described in the abovementioned application of Baus and myself provides an opposite or negative copy of the original and requires for exposure purposes the use of unsupported copying material, i.e. the emulsion in film form without a backing member therefor or copy material which includes a backing member or support having special light transmission characteristics.

The principal object of the present invention is to provide a unique modification of the invention described in said copending application of Baus and myself whereby right reading copies or positives of original opaque documents can be obtained. A more specific object of the invention is to provide a method of making such right reading copies without the use of backing members which have specific radiation transmission characteristics.

The above and other objects of the present invention are realized by first exposing the copy material in the manner described in said copending application, without the use of any backing or supporting member for the copy material and, thereafter, either during heat development or subsequent thereto, bonding the exposed material to an opaque backing, preferably black (e.g. black paper) in such a way as to give a right reading copy of black or opaque letters on a white background.

According to one embodiment of the invention, an unsupported emulsion according to Example 1 of Serial No. 623,050 is placed directly on the document to be copied. The copy material is then exposed by the reflex copying method described in the copending application of Baus et al. Thereafter, the exposed emulsion may be placed upon an opaque backing member, preferably black

paper, with the side of the emulsion which was on the document being placed on the backing member. The resulting product is then subjected to dry heat sufficient to heat develop and, if desired, to simultaneously heat seal the emulsion to the backing. Normally, temperatures in the neighborhood of 180–250° F. for from 2–10 seconds using heated plates or the like, as described in Serial No. 623,050, are sufficient to effect both development and the heat sealing. However, it will be appreciated that the temperature and time for development and bonding will vary depending upon the emulsion material utilized. In the case where the emulsion comprises Saran F–120 (vinylidene chloride homopolymer or copolymer) or the like, the emulsion may be effectively heat sealed to the paper without any other bonding means, and the temperature and time selected should, of course, be sufficient to effect development and fuse the surface of the emulsion adjacent the backing member. However, if desired, an appropriate bonding medium, e.g. a thermoplastic resin, having a fusing temperature at or below the developing temperature, may be used to improve the heat seal between the emulsion and the backing member. In such event, a desirable bonding medium may comprise a coating or film of polyethylene, polyvinyl chloride, or like material which fuses on being heated to the developing temperature and, upon cooling, seals together the emulsion and backing. Preferably, the bonding medium, if used, is transparent to permit the black color of the backing member to show through.

The invention is diagrammatically shown in the accompanying drawing wherein the scatter center emulsion is indicated as **10** and the document as **12**. Excellent results have been obtained with material **10** made in accordance with Example 1 of each of the aforesaid copending applications. Reference character **14** indicates a colored area on the document. Optimum results are obtained when **14** is black. In step 1, the plied sheets are irradiated with infrareds, causing the area **14'** of the material **10** adjacent area **14** to increase in temperature and reduce the sensitivity thereof as aforesaid. In step 2, the plied sheets are irradiated with ultraviolets, causing the areas **16** of material **10** adjacent the white area of **12** to become exposed due to double pass of the ultraviolets therethrough. Area **14'** will not be exposed, because (a) the ultraviolets pass only down therethrough, and are absorbed and not reflected, and, (b) the area **14'** has been desensitized as aforesaid. Step 3 is the heat developing step which, according to the invention, also includes the heat bonding of the backing layer of black paper or the like. Reference character **18** designates the regions of developed scatter centers which are formed during heat development. There is no need for the presence of the document **12** in step 3, although it could be present. The numeral **20** designates the black backing layer which is bonded to the material **10** during the heat development. If desired, the backing layer may be bonded to the material **10** by means of a separate further step subsequent to development, designated step 4 on the drawing. In either case, a positive or right reading copy is obtained since the black portion **22** shows through according to the black reference character **14** on the original and the scatter center areas **18** are white as in the case of the original.

All scatter center materials known to date exhibit a desensitized effect when subjected to dry heat, and thus are operable in the method described above and claimed hereinbelow. Any given emulsion or scatter center material containing vehicle and radiation sensitive compound may be tested to determine its suitability for use herein by heating a part of it, exposing and heat developing. Less image in the initially heated part establishes that it is material suitable for use herein as described in the following claims.

The foregoing description of exemplary embodiments is intended only for purposes of illustration, and the scope of the invention is to be determined from the appended claims.

What is claimed is:

1. A method of copying a document having areas of differing light absorption qualities onto a material of the light scattering, heat developable type comprising a vehicle which is optically substantially homogeneous and in the form of a dry film having dispersed therein a light decomposable solid agent which is sensitive only to radiations in the region of the blue end of the visible spectrum, substantially uniformly dispersed in said vehicle as the sole essential image producing agent, said decomposable agent itself being substantially non-reactive to said vehicle and upon exposure to light decomposing into products which are also chemically substantially non-reactive to said vehicle and which products upon warming are volatile to form radiation scattering discontinuities only in the light struck area in said film to thereby furnish an image,

said method comprising plying the document and said material together, irradiating the document with radiations in the regions of the red end of the spectrum to which said material is substantially not sensitive, and then irradiating the plied document and material with said radiations in the region of the blue end of the visible spectrum, whereby said radiation of the red end of the spectrum is absorbed selectively by said document to raise the temperature of the area thereof by which it is absorbed preferentially, thereby also selectively heating the areas of the said material adjacent thereto, to reduce the sensitivity of said material selectively, and the blue end irradiation produces a latent reflex copy of said document in said material of improved contrast, and thereafter heat developing said material to form a reflex copy and bonding an opaque backing thereto.

2. The method of claim **1** wherein the steps of heat development and bonding are carried out together.

3. The method of claim **1** wherein the bonding step follows heat development.

References Cited by the Examiner

UNITED STATES PATENTS

1,997,507	4/35	Akintievsky	96—49
2,684,341	7/54	Anspon et al.	96—754 X
2,703,756	3/55	Herrick et al.	96—49
2,740,895	4/56	Miller	250—65.1
2,908,572	10/59	Schoen	96—75 X
2,916,622	12/59	Nieset	117—36.8
2,950,194	8/60	Glavin	96—49 X
2,995,466	8/61	Sorensen	117—36.8
2,995,805	8/61	Kpy	96—49 X
3,032,414	5/62	James et al.	96—49 X
3,042,517	7/62	Wainer	96—90

FOREIGN PATENTS

573,975	12/45	Great Britain.
645,825	11/50	Great Britain.
815,005	6/59	Great Britain.

OTHER REFERENCES

IBM Technical Disclosure Bulletin, vol. 3, No. 9, February 1961, p. 1.

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