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Brewitz

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[54] DEVELOPER

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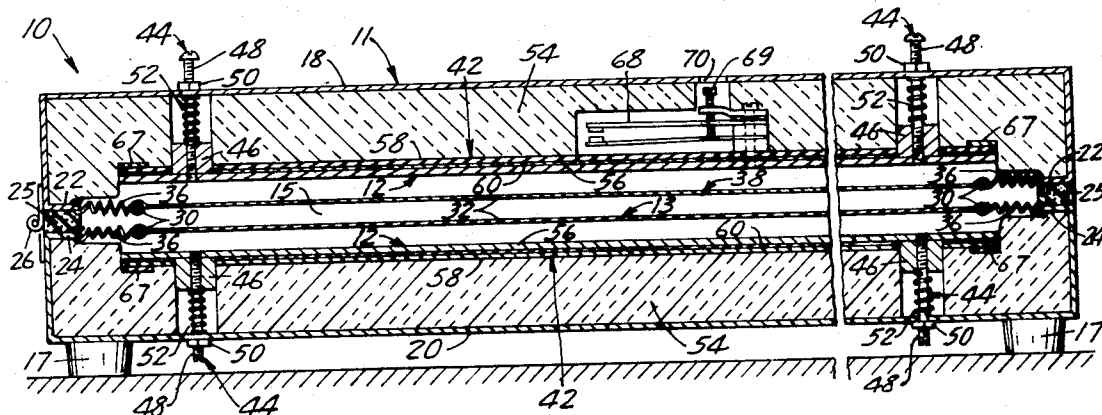
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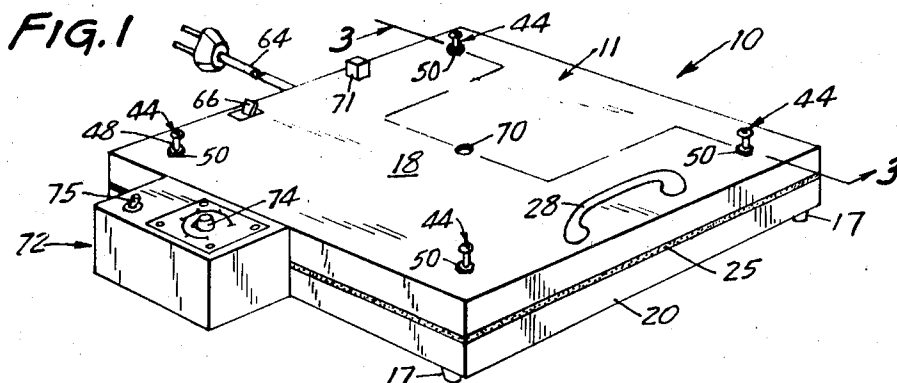
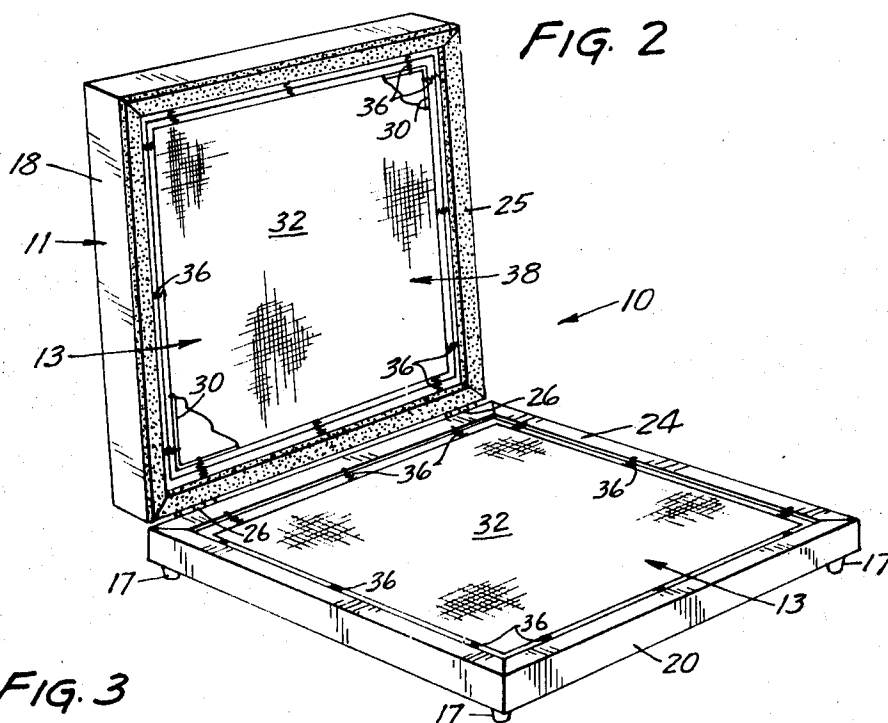
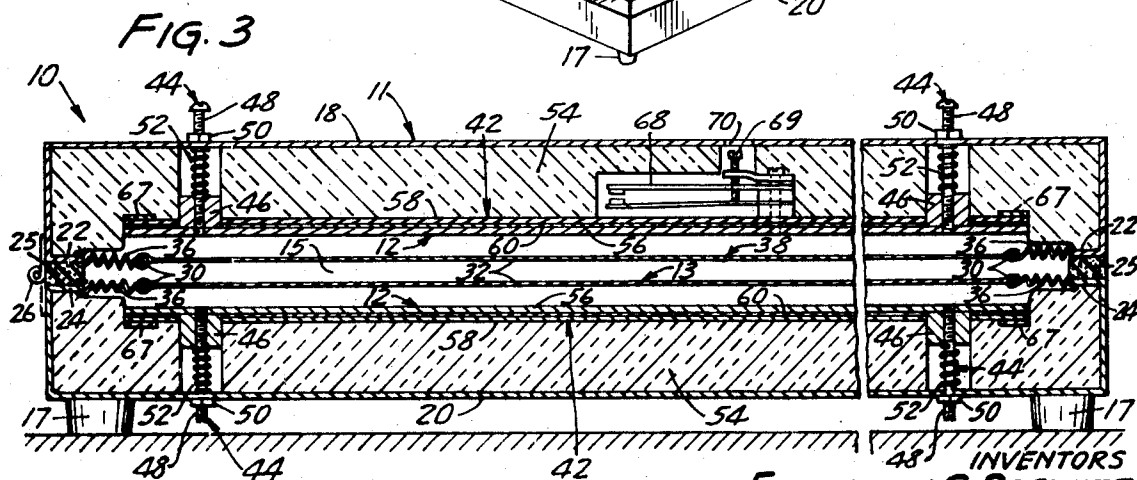
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ABSTRACT

A simple and portable developer for a sheet of heat developable paper or film. The developer includes a pair of heaters mounted in parallel opposed relationship to define a heated zone and to provide a generally uniform temperature gradient within the heated zone. A support member is mounted for supporting a sheet at an essentially constant temperature level within the heated zone to develop the sheet in a predetermined time. Two halves of the developer are separable to afford insertion and removal of the sheet.

6 Claims, 3 Drawing Figures





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BACKGROUND OF THE INVENTION

The development of heat developable photographic coatings for films and paper of a type sensitive enough to be used for copying photographic films (such as are disclosed in the Morgan and Shely U.S. Pat. No. 3,457,075) has produced a need for a simple, portable, inexpensive and reliable device for heat developing the film after exposure which complements the simplicity of the heat development. Heretofore the advantage of simplicity of development which sensitive heat developable photographic films or paper have had over solution developable photographic films or paper was somewhat offset by the fact that the equipment available for heat developing these films was complex, not easily portable, and/or produced uneven development.

Heretofore the approach for developing exposed heat developable film or paper has been to bring the backing into direct contact with the heated surface of a roller or platen for a predetermined time to conduct sufficient heat through the backing to the coating thereon to affect development. This form of development relies on conduction between the platen and the backing, and is therefore sensitive to variances in the intimacy of contact between the backing and the platen. Also, the heat developable coating (which generally becomes softened or tacky at the development temperature) cannot undergo pressures which might cause distortion or receive direct contact without danger of transfer. Therefore, the contact developers which have produced acceptable results generally have required precise and complex mechanisms, have not been readily portable, and have been too expensive for the occasional user, while simple and inexpensive conductive development equipment has generally produced uneven development.

Additionally, the method of development in some prior art devices includes grasping and manipulating the sensitized sheet material to expose it to a source of heat. This method affords the possibility that the sensitized coating may be marred or distorted. Also, grasping of the film or paper, while perhaps more suitable for roll material, is undesirable for individual sheets because of potential marking or heat sink effects that may occur at the points of contact.

SUMMARY OF THE INVENTION

The present invention provides a simple, inexpensive and portable developer for sheets of heat developable film or paper which does not rely primarily on direct conduction of heat between a heated platen and a film to develop the coating, but rather provides a constant temperature development zone within the developer in which the film to be developed may be placed without contact with a highly thermally conductive surface so that the film or paper may be developed by convection or radiation of heat within a predictable predetermined time. The present invention is capable of developing the film or paper uniformly from edge to edge, and does not make contact with the film or paper in such a way that the soft sensitized coating may be marked during development.

According to the present invention there is provided a developer for a sheet of heat developable film or paper which comprises a housing and at least a pair of heaters mounted in the housing in spaced opposed, generally parallel relationship to define a heated zone therebetween. The heaters are of special design and are carefully thermostatically regulated to produce essentially a uniform temperature gradient between the heaters within the heated zone. A locating means having a low thermal mass is mounted within the heated zone for defining an essentially constant temperature position within the heated zone for locating a sheet of heat developable material to be developed. The developer also affords access to the locating means for insertion and removal of a sheet of heat developable material so that a sheet to be developed may be positioned within the heated zone for a predetermined time to affect development thereof.

BRIEF DESCRIPTION OF THE DRAWING

The invention will be more fully understood after reading the following description which refers to the accompanying drawing wherein:

FIG. 1 is a perspective view of a developer constructed in accordance with the present invention which is shown in the closed position;

FIG. 2 is a perspective view of the developer of FIG. 1 shown in the open position; and

FIG. 3 is a fragmentary vertical sectional view taken approximately along lines 3—3 of FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing, there is illustrated a developer 10 for a sheet of material having a heat developable coating thereon, which material will be referred to hereinafter as a film. The developer 10 includes a housing 11 and a pair of heaters 12 mounted in the housing 11 in spaced opposed relationship to define a heated zone 15. A generally nonconductive locating means or screen assembly 13 is mounted within the heated zone 15 for defining a position within the heated zone 15 at which a sheet of film inserted into the developer 10 may be supported during development thereof.

The developer 10 also affords access to the screen assembly 13 and heated zone 15 for insertion and removal of the film. The housing 11 is a boxlike member formed of sheet metal and supported by four supporting feet 17. The housing 11 comprises a shallow upper boxlike member 18 and a similar lower boxlike member 20, each of which members 18 and 20 has an open side surrounded by an inwardly extending flange, 22 and 24 respectively, from its edge walls. A gasket or strip of insulating material 25 is attached as by adhesive to the exterior surface of the flange 22. The members 18 and 20 are joined by a hinge 26 so that the flange 24 of the member 20 will mate with the exposed surface of the insulating material 25, and so that the upper member 18 may be moved with respect to the lower member 20 from a closed position as shown in FIG. 1 to an open position as shown in FIG. 2 by manual manipulation of a handle 28. Thus, the openable housing 11 affords insertion of a sheet of film to a position on the screen assembly 13 within the developer 10 to affect development thereof.

The nonconductive locating means or screen assembly 13 is mounted within the housing 11 to support thereon within the heated zone 15 the noncoated side of a sheet of film. The screen assembly 13 comprises a wire frame 30 and a section 32 of an open-mesh material which has a low thermal mass and is able to withstand the development temperature (i.e. typically between 240° to 290° F.). Examples of suitable material include nylon, silk, or rayon cloth which is stretched and fastened as by sewing to the frame 30. To insure the retention of a desired planar condition in the cloth section 32 the frame 30 is mounted by a plurality of springs 36 to the flange 24. A second screen assembly 38 identical to the screen assembly 13 and having similar parts similarly numbered, may be mounted to the flange 22 of the member 18 to afford protection against accidental contact between the coated surface of the film and the surface of the heater 12 located in the upper member 18 which may be caused by air currents as the developer 10 is closed or opened during insertion or removal of the film. The screen assembly 38 is sufficiently spaced from the screen assembly 13 by the thickness of the insulating strip 25 so that the coated surface of a sheet of film positioned on the screen assembly 13 will not normally contact the screen assembly 38.

The heater means or the pair of heaters 12 are mounted within the housing 11 in generally parallel spaced relationship to define the heated zone 15, and to produce essentially a uniform temperature adjacent the screen assembly 13. The heaters 12 comprise platelike heating elements 42 each mounted within the housing 11 at their respective corners by four mounting post assemblies 44 which, as illustrated, are adjustable. Each mounting post assembly 44 comprises a nonconductive and heat resistant block 46 attached at one end to

the heating element 42 and adapted at its other end for receiving an adjusting screw 48. The adjusting screw 48 extends through a clearance hole in the respective upper or lower wall of the housing 11. A desired position of the portion of the heater element 42 attached to each block 46 with respect to the screen assembly 13 is maintained by a nut 50 mounted on the screw 48 to limit movement of one corner of the heating element 42 toward the screen assembly 13, and a spring 52 positioned between the inner surface of the adjacent wall and the insulating block 46 bias the corner of the heating element 42 toward the screen assembly 13. By adjustment of the appropriate positioning nuts 50, the spacing between each heating element 42 and the screen assembly 13 may be precisely adjusted to insure that a uniform temperature gradient is maintained in the heated zone to uniformly heat all areas of the surface of a sheet of film located on the screen assembly 13.

A layer of insulating material 54 is provided between each of the heating elements 42 and the walls of the housing 11 to reduce heat losses from the developer 10 and to help produce an even temperature within the heated zone 15.

The heating elements 42 coextend to at least cover the surface of the cloth 32 on the screen assembly 30 and preferably extend beyond the boundaries of the cloth 32 to prevent the effects of thermal fall-off from the edge of the heating elements 42. The heating elements 42 are designed to produce even heat output over their surfaces positioned adjacent the screen assembly 13. Each heating element 42 comprises a heat distributing plate 56, such as a conductive aluminum plate positioned adjacent the screen assembly 13 to aid in assuring even output of heat over the surface of the heating element 42, and a heat generating member 58 secured by suitable electrically insulating attaching means to the side of the distributing plate 56 opposite the screen assembly 13. The electrically insulating attaching means is illustrated as a double-coated pressure sensitive adhesive tape 60. The heat generating member 58 may be any heating element capable of producing a generally even output of heat into all portions of the heat distributing plate 56; however, as illustrated, the heat generating member 58 is an inexpensive and effective construction comprising a sheet of semiconductive material made from a non-conductive binder which may be asbestos filled with randomly distributed conductive fiber material having the commercial designation of "Pluton" fibers. "Pluton" fibers are produced by a process of thermochemically converting regenerated-cellulose fiber starting material to corresponding black insulative organic fiber material and then carbonizing the latter to provide corresponding conductive fiber material as disclosed in U.S. Pat. No. 3,235,323 and 3,484,183, incorporated herein by reference.

Electrical potential to cause heating in the member 58 is connected across the member 58 through a pair of conductive or copper strips 67 attached across opposite ends of the heat generating member 58 by a conductive adhesive. Close regulation of the temperature in the heated zone 15 is provided by connecting an electrical potential (which may be supplied from a 110 volt source through a cord 64 and off-on switch 66) to both of the heating elements 42 through a thermostat 68 mounted centrally of the heating element 42 in the member 18. The thermostat 68 is selected and adjusted for cycling within a close temperature differential to affect essentially a constant temperature within the heated zone 15, and may be adjusted for temperature setting via a screw 69 through an orifice 70 in the member 18. A neon light 71 may be connected in the circuit on the controlled side of the thermostat 68 to give a visual indication of proper cycling of the thermostat 68.

An electrically operated timing unit 72 (shown only in FIG. 1) with an audible or visible indicator or signal may be provided to indicate that a film has been positioned within the developer 10 for a time sufficient for development. The timing unit 72 is activated by contact between a switch (not shown) on the side of the timing unit 72 adjacent the housing 12 which is operated by contact with the upper housing member 18

upon opening and closing thereof. The timing unit 72 includes a timing clock which may be set for a predetermined period of time by a manual adjustment of a knob 74, and which is activated upon closing of the member 18 to measure the predetermined time period after which the unit 72 produces a signal. Upon opening of the developer 10, the switch is operated to reset the timer for another operation upon insertion of the subsequent film. The timing unit 72 is also provided with an off-on switch 75 to disable the timer.

The following is an example of preferred design and operational parameters which have produced excellent results for heat sensitive coatings on papers or film. With a housing 11 having overall dimensions of 16 by 16 by 2 1/4 inches fitted with two 350-watt heating elements 42 each 14 by 14 inches square and having an 0.080-inch thick aluminum distributing plate 56 located with the adjacent surface of the heating element 42 in the upper member 18 spaced approximately 5/16 inch from the screen 13, and the adjacent surface of the heating element in the lower member 20 spaced 3/16 inch from a centered 12 by 12 inch nylon cloth 32 in the screen assembly 13, and with the thermostat 68 set to maintain 250° F. ± 2° F. at the surface of the screen assembly 13, a consistent development time of 1 to 2 minutes is required, depending upon the type of film developed. The preceding example represents a design which affords good development characteristics and compactness for developing common commercial films generally having a 10 by 10 inch surface area.

It has been found that to vary the physical characteristics of the developer 10, the following parameters should be observed for satisfactory results:

The heated surface of the heating elements 42 should extend beyond the peripheral edges of the film to be developed by a distance at least one-half the distance between the adjacent surfaces of the heating elements 42, and it is preferable to have an extension equal to or greater than four times the spacing between the planar heating elements 42. The heating elements should not be spaced greater than 4 inches apart to avoid an air volume within said heated zone 15 which causes air currents, which are considered the cause for nonuniform development and increased development time. The film should also be located within the central one-fourth of the heated zone 15 between the heaters to avoid underdevelopment of the edges of the film.

What is claimed is:

1. A developer for developing a sheet of heat developable material comprising:

a housing having wall portions;

a pair of planar heaters mounted in said housing in opposed generally parallel relationship for defining a shallow heated zone within said housing for producing essentially a uniform temperature gradient in said heated zone between said heaters;

insulating material disposed between said heaters and the adjacent wall portions;

planar locating means mounted generally centrally within said heated zone for positioning a said sheet of heat developable material generally parallel to said heaters within said heated zone, said locating means being constructed of a woven material having low thermal mass to limit conductive heat transfer between said locating means and a said sheet of heat developable material; and means for affording access to said locating means in said housing to allow insertion and removal of a sheet of heat developable material.

2. A developer according to claim 1 wherein said heaters have length and width dimensions which are greater than the corresponding dimensions of a said sheet to extend beyond the edges of a said sheet on the locating means by an amount at least one-half the distance between said planar heaters.

3. A developer according to claim 2 wherein said spacing between said heaters is not greater than 4 inches.

4. A developer according to claim 1 wherein said housing comprises two similar rectangular shallow boxlike members

hinged along one mating edge, one of said heaters being positioned in each said boxlike member and spaced from the open side of said boxlike member, said planar locating means being positioned at the open side of one of said boxlike members.

5. A developer according to claim 1 wherein said supporting means locates a said sheet of heat developable material within the central one-fourth of said heated zone between said

heaters.

6. A developer according to claim 4 comprising a timer adapted to be energized upon closure of said boxlike members to mating position and a thermostat connected to one of said heaters for regulating current flow from a source to said heaters.

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