Dec. 29, 1959 R. G. VYVERBERG ET AL 2,919,119

XEROGRAPHIC PLATE CONDITIONING APPARATUS

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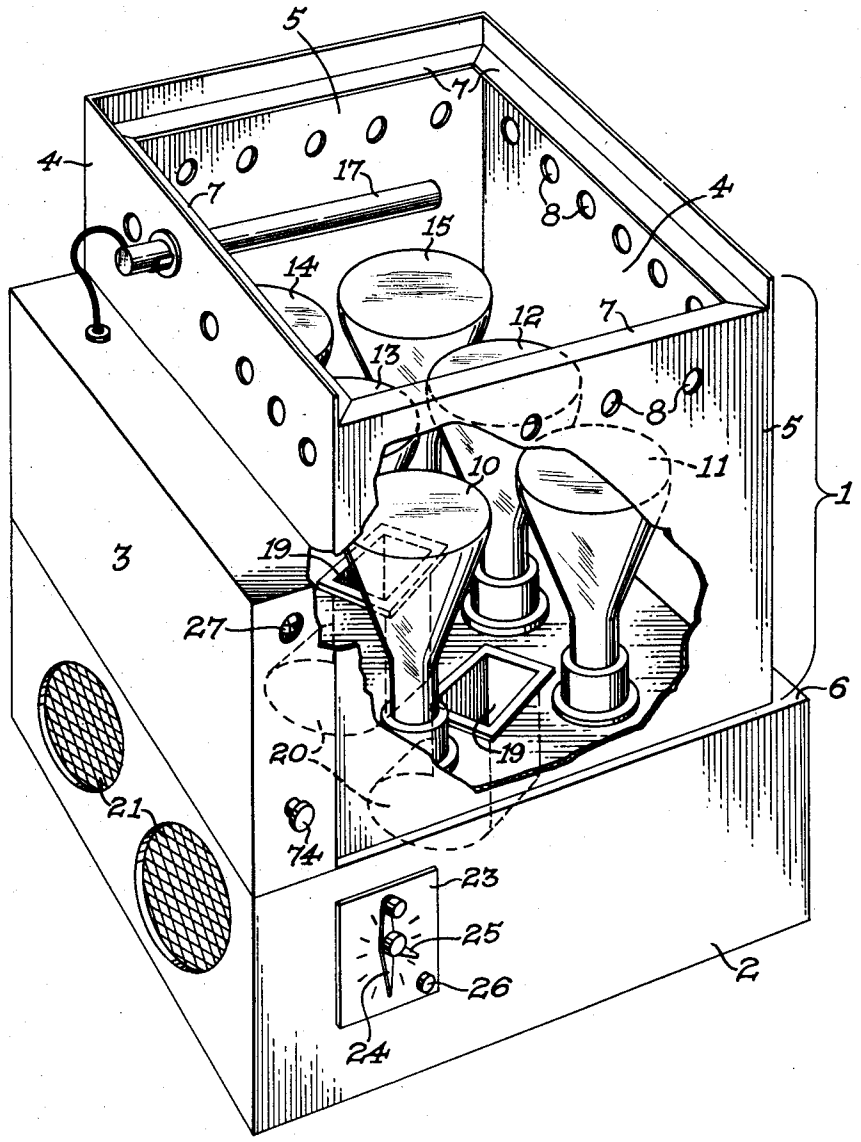


Fig. 1

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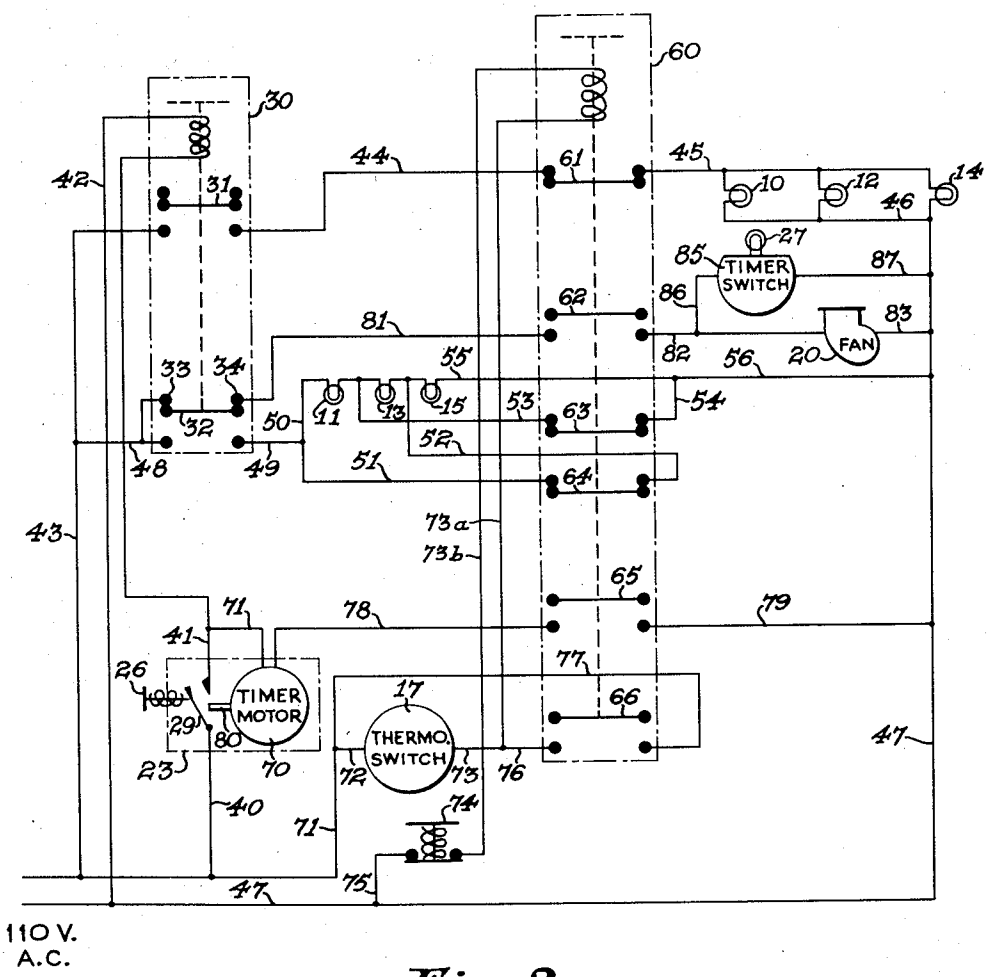


Fig. 2

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XEROGRAPHIC PLATE CONDITIONING APPARATUS

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Application May 23, 1956, Serial No. 586,854

3 Claims. (Cl. 257—274)

This invention relates to the field of xerography and, particularly, to improvements in apparatus for conditioning xerographic plates for reuse after exposure.

In co-pending application S. N. 482,384, filed in the names of Robert G. Vyverberg and James H. Neyhart on January 17, 1955, now Patent No. 2,863,767 dated Dec. 9, 1958, the phenomenon of fatigue caused by radiation exposure of xerographic plates, in which selenium is employed as a photoconductive agent, is described in detail. The phenomenon of xerographic plate fatigue is evidenced as high dark decay rates and/or differential dark decay rates that result in lowered contrast sensitivity, ghost images, or both. This phenomenon usually does not occur in xerographic applications for the reproduction of line, half-tone or continuous tone copy, in which light radiation and short exposure times are involved. However, as applied in the field of xeroradiography, in which long exposure periods of high energy penetrating radiation are employed, such as from an X-ray machine or radioactive sources, fatigue constitutes a substantial problem.

In such cases, unless other means are employed, a plate that has been exposed may be required to be rested or "relaxed," i.e., stored in a dark place, for twelve or more hours before its electrical characteristics are returned to their normal condition of utility. Obviously, such a slow recovery or relaxation rate is not conveniently suited to commercial applications in which frequent reuse of plates is desirable in order to minimize supply and storage problems. As a solution to this problem, the cited application also describes a relaxation method whereby xerographic plates can be caused to recover from this type of fatigue at an accelerated rate by raising the photoconductive selenium to an elevated temperature in a relatively short time period, maintaining the selenium at such elevated temperature for a predetermined time period, and then rapidly cooling the selenium substantially to ambient temperature.

Although the nature of the phenomena involved in connection with fatigue is not definitely known, there is evidence indicating that it is caused by a number of carriers becoming trapped in vitreous portions of the selenium layer during the conventional xerographic operations of charging the plate and exposing it to activating radiation. When the selenium layer is subjected to the fatigue recovery technique outlined in the cited application, it is believed that trapped conductors are dissipated and perhaps are rendered free to combine with untrapped holes, whereby the adverse fatigue effects are wholly or largely eliminated. It is also believed that the fatigue recovery phenomena are induced and accelerated by the heating step, while, at the same time, avoiding the conditions that are known to convert vitreous selenium to the more conductive types that are inoperative for use in xerography.

The principal object of the present invention is to provide automatic apparatus, operating in accordance with the method of the invention disclosed in the cited application, for causing exposed xerographic plates rapidly to recover from fatigue caused by exposure. A further object is to provide an automatic fatigue recovery or relaxation device whereby xerographic plates may be reconditioned for use quickly and economically, and without damaging the photoconductive layer thereof. A further object is to provide such a relaxation unit that is fully automatic throughout the entire relaxation cycle of preliminary heating, sustained heating, and rapid cooling.

These and other objects of the invention are attained by means of a xerographic plate relaxation apparatus that includes a box-like structure having means to support a xerographic plate, an array of heating elements contained in the box-like structure and arranged to direct radiant energy against a plate supported therein, a blower element arranged to project an air stream against a plate supported by said structure, and a control circuit to effect a programmed cycle of operation of said heating and blower elements, said control circuit comprising a first switching means operable to connect all of the heating elements to a source of power, a second switching means operable to disconnect certain of said heating elements from said source of power, thermostatic means actuated by said heating elements to operate the second switching means, a timing mechanism actuated by the second switching means to disconnect the remainder of the heating elements from the power source and concomitantly to initiate operation of the blower, a time delay device in the blower circuit, and a signal lamp operable by the time delay device.

A preferred form of the invention is disclosed in the appended drawings, in which:

Fig. 1 is a schematic perspective view, partly broken away, of the xerographic plate relaxation apparatus of the invention, and

Fig. 2 is a wiring diagram of the control circuit of the invention.

Before considering the specific apparatus of the invention, it is preferred briefly to discuss the phenomenon known as fatigue in xerographic plates. In Carlson Patent No. 2,297,691, issued October 6, 1942, in which basic xerographic techniques and apparatus are described, several photoconductive insulating materials are proposed for use, such as sulfur, antracene, anthraquinone, mixtures of sulfur and selenium, and other sulfur-containing compositions. Subsequently it was found that vitreous selenium is more responsive photoelectrically than the substances described by Carlson, with the result that a high proportion of xerographic plates currently being manufactured are formed primarily of this substance. When selenium is deposited on the conductive backing member of a xerographic plate under a high vacuum at a moderate temperature, the resulting layer is deposited in a vitreous condition that is amorphous or very slightly crystalline, wherein it has a sufficiently high insulating value in the absence of activating radiation to permit of its use in a xerographic plate, while at the same time providing a high degree of response to activating radiation. Selenium, when occurring in this form or condition, is referred to herein as vitreous selenium.

In commercial utilization of xerographic reproduction processes, the activating radiation which is utilized in producing the latent electrostatic image on the xerographic plate commonly is daylight or artificial light such as that produced by an ordinary incandescent lamp, or a lamp of the type commonly used in photography. However, other sources of activating radiation may be employed and among them are sources of X-ray radiation. Thus, X-rays that have been brought in to form an image or outline of an exposed subject, as in conventional X-ray radiography, likewise produce an electrostatic latent image on a xerographic plate.

While a xerographic plate comprising a layer of photoconductive vitreous selenium has very great utility in effecting high quality and rapid xerographic reproduc-

tion, it has been a serious source of inconvenience and practical disadvantage that such xerographic plates suffer from fatigue, i.e., show impaired performance for an objectionably long period of time after having passed through an operational cycle comprising the charging of the plate and its exposure to activating radiation. Moreover, if any such xerographic plate is subjected to successive operational cycles the fatigue tends to continue to increase. The occurrence of fatigue is evidenced by substantial diminution of the capacity of the xerographic plate to accept an electrostatic charge and diminution of the capacity of the plate to retain an electrostatic charge when in the absence of activating radiation. Lack of capacity to retain an electrostatic charge in the absence of activating illumination is commonly referred to and is referred to herein as dark decay. Even in the case of a freshly prepared xerographic plate there is substantial dark decay such as 5% to 10% of the original charge over a period of about one minute. However, after a xerographic plate has become fatigued, the fatigue is evidenced by an increase in the dark decay rate and the extent of the fatigue may be measured by comparing the dark decay over a stated period, such as three or five minutes, after one or more operational cycles, with the dark decay in the case of a freshly prepared or fully recovered xerographic plate.

For obtaining preferred results the rate of dark decay should be about 5% or less for one minute. When the dark decay rate is not greater than about 10% for one minute the results obtainable are reasonably satisfactory. However, when the fatigue that has resulted from one or more operational cycles is such that the dark decay rate is 20% or more, the resulting impairment in effectiveness is a matter of serious concern.

Fatigue that has resulted from one or more operational cycles of a xerographic plate normally decreases upon passage of time and usually may be eliminated by permitting the plate to stand idle for a substantial period of time, such as overnight. However, in commercial applications of xerographic reproduction it is not convenient to store plates for so long a time, and it is highly desirable to be able to keep using a plate again and again without anything more than a very short waiting period between operational cycles. While the recovery of a xerographic plate is most rapid immediately after the conclusion of a cycle, the rate of recovery decreases with the result that even after thirty minutes or so a substantial amount of fatigue persists. Such plate characteristics are a serious defect, especially when high contrasts are desired.

The fatigue problem that results from exposure to visible light differs in certain respects from that which results from X-ray exposure, the fatigue problem being especially troublesome in connection with xeroradiography. When the vitreous selenium layer of a xerographic plate is exposed to visible light a very substantial amount of fatigue results even from a single operational cycle, but upon successive cycles the total fatigue tends to level off. In the case of X-ray radiation, on the other hand, the fatigue from a single operational cycle may not be as great as that resulting from exposure to visible light, but there is a greater tendency for the fatigue to continue to accumulate when the operational cycles are repeated until the total fatigue becomes excessive. Moreover, there is a greater tendency to fatigue upon increase in the thickness of the selenium layer. Fatigue is especially troublesome when the thickness of the selenium layer exceeds 75 microns, and for X-ray work the selenium layer generally runs over 75 microns and may even be as much as 300 microns. When a xerographic plate is activated by visible light the layer of photoconductive vitreous selenium usually ranges from about 10 to about 75 microns in thickness.

Another difference in the phenomena that occur as between light exposure and X-ray exposure is that in the

case of light exposure fatigue produced thereby tends to be relatively uniform over the entire plate, with the result that poor acceptance and retention of an electrostatic charge is troublesome primarily because of the poorer contrasts that are obtainable. In the case of X-ray exposure the fatigue may be non-uniform in the pattern of the radiographed image and in such case one is troubled by residual image difficulties. X-ray fatigue is most noticeable when adjoining areas are exposed to X-ray radiation of much different intensity.

In the particular embodiment of the invention disclosed in the drawings, the xerographic plate relaxation apparatus comprises a relaxation chamber **1** (see Fig. 1) mounted on a base housing **2**, and is provided with a housing **3** enclosing the control circuitry, whereby the several steps of the relaxation technique are carried out. Relaxation chamber **1** comprises side walls **4** and end walls **5** that are integrally connected to form an open box-like structure that is supported on the upper surface member **6** of housing **2**. Side and end walls **4** and **5** are preferably formed of a highly reflective aluminum or other metallic surface, e.g., 2S No. 1 reflector sheet aluminum in order to reflect scattered radiation upwardly and to minimize the heat retained by the chamber walls. Mounted on the interior faces of side and end walls **4** and **5** are a plurality of horizontally arranged rails **7** that serve to support a xerographic plate assembly at the top of the relaxation chamber. A plurality of holes **8** are formed in the side and end walls, immediately below rails **7**, in order to permit circulation of air through the chamber when a plate assembly is positioned thereon. If desired, suitable clamping means may be provided to secure a plate assembly to the chamber.

Within the chamber is an array of six commercial type 250-watt infrared heat lamps **10–15** inclusive, each mounted on a suitable insulating base on member **6**, and arranged to direct radiant energy of substantially uniform intensity against the entire surface of a plate assembly supported by rails **7**. Obviously, any of the variety of types of heating elements may be employed to effect the required temperature rise in the relaxation chamber. However, heat lamps of the type indicated are preferred because of their relatively quick temperature rise and convenient directional control.

In order properly to actuate the control circuit when a predetermined temperature is attained, as described below, a variably settable thermostatic switch **17**, having normally open contacts, is mounted on side wall **4**, immediately below the supporting surfaces of rails **7**, and extends inwardly preferably at least halfway across the chamber, and is preferably painted black to enable it more accurately to serve as a measure of the radiant heat level. By this arrangement, switch **17** is exposed to the same radiation as the xerographic plate surface and, for most applications, is set to close its contacts and function as an element in the control circuit when the temperature of the selenium surface of the xerographic plate is elevated to approximately 130° F. Although a variety of thermostatic devices may be used for this purpose, that disclosed in the drawings and preferred for use in this invention is of the type manufactured by the Fenwall Corporation of Ashland, Massachusetts, catalog No. 17301.

At the bottom of relaxation chamber **1** are provided two openings **19** that serve as outlets for a pair of blowers or cooling fans **20** that are housed in base member **2**, and are electrically connected in parallel to function simultaneously to blow air against the surface of a plate assembly supported on rails **7**. Suitable air inlet openings **21** are provided in the walls of base member **2** to provide an adequate flow of ambient air to the inputs of the fans. It may be noted that one or more fans could be used to serve the purpose of the two fans disclosed, namely, to attain rapid cooling of the xerograhic plate. However, from the geometry of the relaxation chamber,

two fans are preferred in order to provide more uniform distribution of the cooling air blast. When employed to relax conventional xerographic plates having a surface area of approximately 10" x 15", an arrangement of cooling fans with an output of at least 200 c.f.m. is preferred.

Also mounted on base member 2 is the control panel of a variably settable timing device 23 that forms an element of the control circuit, as described below. It includes a manually settable indicator 24 that may be pre-set for any desired period from one second to three minutes to regulate the length of the constant temperature heating portion of the relaxation cycle, and an indicator 25, operable by a clockwork mechanism, to indicate elapsed time. Timer 23 also includes a push-button 26 to actuate a toggle switch 29, described below, to initiate the operation of a relaxation cycle. A signal lamp 27 is mounted on the forward face of control housing 3 to provide a visible signal for the operator when the relaxation cycle is completed. A disconnect switch button 74 is also mounted on housing 3 to permit the operator to recondition the appaartus for a subsequent cycle of operation.

The several elements of the control circuit can best be understood by reference to a typical cycle of operation of the relaxation apparatus. For example, when a xerographic plate assembly is to be conditioned for reuse, it is placed with its selenium side facing upwardly on supporting rails 7 of relaxation chamber 1, thereby enclosing the upper portion of the chamber. Preferably, the selenium surface of the plate is covered with a dark slide in order to shield the plate from ambient radiation. However, if the operation is carried on in subdued light, shielding is not necessary. Push-button 26 (see also Fig. 2) of timer mechanism 23 is then depressed to initiate the relaxation cycle. Button 26 is effective to close a toggle switch 29 to energize a control relay 30 via lead 40, switch 29, lead 41, the winding of the relay, and lead 42, and serves to shift contact arms 31 and 32 of the relay to their actuated positions, i.e., downwardly in Fig. 2. In this position, contact arm 31 is effective via lead 43, lead 44, contact arm 61 of a second control relay 60, and leads 45, 46 and 47, to energize heat lamps 10, 12 and 14, in parallel. At the same time, contact arm 32 is effective to energize heat lamps 11, 13 and 15, in parallel, via leads 43, 48, 49 and 50, connected to one side of lamp 11; and lead 51, contact arm 64 on second control relay 60, and lead 52, connected between lamps 13 and 15; and lead 53, connected between lamps 11 and 13, contact arm 63 of second control relay 60, and leads 54 and 55, connected to one side of lamp 15; and lead 56 that connects leads 54 and 55 to return lead 47. In this manner, all of the heat lamps 10 to 15, inclusive, are energized and serve immediately to direct radiant energy against the surface of the zerographic plate, as well as against thermostatic switch 17.

It may be noted that the closure of toggle switch 29 also serves to connect one side of the clock motor 70 of timer 23 to the power source, via lead 71, lead 41, switch 29, and lead 40. However, since the other lag of the clock circuit is open at contact arm 65 of control relay 60, the timer mechanism is not operated at this point in the relaxation cycle.

As soon as the xerographic plate assembly reaches the desired temperature, i.e., 130° F. in the present illustration, the contacts of thermostatic switch 17 close to supply power to second control relay 60 via lead 71, lead 72, lead 73, lead 73*a*, the relay winding, lead 73*b*, a normally closed disconnect switch 74, lead 75, and lead 47. This usually occurs within 5 to 20 seconds after the actuation of starting button 26, depending upon ambient temperature conditions. Energization of control relay 60 serves to shift its contact arms 61 to 66, inclusive, to their actuated positions, i.e., downwardly in Fig. 2. In this position, contact arm 61 is disconnected from its contacts to open the circuit to heat lamps 10, 12 and 14. Also, contact arms 63 and 64 are disconnected from their contacts to open the parallel circuit connections to heat lamps 11, 13 and 15. However, since first control relay 30 remains energized at this time, it is effective by means of its contact arm 32 to supply current to heat lamps 11, 13 and 15, in series, via leads 43, 48, 49, 50, 55, 56 and 47. By this arrangement the high radiant energy output of the heat lamps is substantially decreased to a level such that it maintains the surface of the zerograhic plate substantially at the temperature it had attained at the time thermostatic switch 17 was operated, namely, 130° F.

In addition to the heat lamp controls exercised by relay 60, its contact arm 66 is effective to close a holding shunt circuit around thermostatic switch 17 via leads 76, 77 and 71, whereby relay 60 remains energized independently of switch 17. Also, contact arm 62 is effective to complete a portion of the circuit for blowers 20. However, since first control switch 30 remains energized at this point in the cycle, its contact arm 32 is disengaged from its back contacts 33 and 34 so that the blower circuit remains open.

The last remaining contact arm 65 of control relay 60 is effective, via lead 78, lead 79 and lead 47, to complete the circuit to energize and initiate the operation of clock motor 70 of timer mechanism 23. Timer 23 is preferably of the type manufactured by Industrial Timer Corporation of Newark, New Jersey, catalog No. J480, which includes an electrical clockwork mechanism and a variably settable control therefor, described above. It also includes a mechanical connection, schematically indicated at 80, that is actuated under the control of the clock mechanism, at the termination of the pre-set time, to open toggle switch 29.

Thus, heat lamps 11, 13 and 15 remain energized, in series, to maintain the elevated temperature of the plate assembly for the complete period pre-set on timer 70. At the end of this period, mechanical connection 80 is actuated to open switch 29 which opens the circuit to first control relay 30, thereby de-energizing the relay and permitting its contact arms 31 and 32 to be returned to their starting positions, as shown in Fig. 2. This occurs in accordance with the setting made on timer 23 which, for most applications, is preferably on the order of 45 seconds. The de-energization of relay 30 causes its contact arm 32 to be moved from engagement with its front contacts and into engagement with its back contacts 33 and 34, whereby the circuit to heat lamps 11, 13 and 15 is opened and the circuit to blower fans 20 is closed, via lead 43, lead 48, contact arm 32, and lead 81, contact arm 62 of second control relay 60, and leads 82, 83 and 47. In this manner all of the heat lamps are turned off at the end of the predetermined time period, and blowers 20 are energized immediately to direct a blast of ambient air on the surface of the xerographic plate.

Concomitantly with the energization of fans 20, a shunt circuit including a time delay switch 85 is also energized, via leads 86 and 87. Switch 85 is preferably of the type manufactured by the R. W. Cramer Company, catalog No. TC–2M, which is of the timing motor type that is effective after a time period of approximately two minutes to close a circuit to signal lamp 27. When signal lamp 27 lights, it indicates to the operator that the air blast has been directed at the plate for a sufficient time to cool it substantially to ambient temperature.

At this point in the cycle, the desired relaxation of the plate is complete. Thus, if desired, the apparatus could be restored to its starting condition under control of time delay switch 85. However, since the operator may not always be available to remove the plate, it is preferred that fans 20 continue to operate to direct a stream of ambient air on the xerographic plate assembly so that its temperature cannot be again elevated by residual heat

that may remain in the relaxation chamber. Therefore, the circuit is arranged so that relay **60** remains energized through its holding contact arm **66**, whereby the fan circuit is maintained energized, via contact arm **62**. When the operator removes the plate assembly from the chamber, he presses disconnect switch **74**, whereby control relay **60** is de-energized to permit the contact arms thereof to be restored to their starting position, as shown in the drawing. This action opens the circuits to blowers **20**, timer **23** and signal lamp **27**, and opens the holding circuit of relay **60**. Since switch **17** was sufficiently cooled by the action of the fans to open its contacts during the cooling portion of the cycle, relay **60** remains de-energized when the operator releases the actuating button of switch **74** and permits it to be restored to its normally closed condition. Thus, the entire apparatus is restored to its original condition, in readiness for a subsequent cycle of operation.

Thus, there is disclosed a xerographic plate relaxation apparatus wherein an exposed and/or fatigued xerographic plate may be conditioned for immediate re-use in a period of several minutes by subjecting the plate to a programmed processing cycle, wherein the plate is raised from ambient temperature to a predetermined elevated temperature in a relatively short time period, is maintained at such elevated temperature for a predetermined time period, and is restored to ambient temperature conditions immediately thereafter.

In the preceding description of operation, it is suggested that the xerographic plate assembly be raised to a temperature of 130° F. during a short, high intensity heating period, then be maintained at that temperature for a time period of forty-five seconds, and then be cooled for a period of approximately two minutes by an air blast of ambient air. It should be noted that the suggested time periods and temperatures are recommended as optimum conditions that are suitable to effect substantially complete relaxation of the xerographic plate, in most applications. However, it should also be noted that such temperature and times are not to be regarded as limitations in connection with the present invention.

From the nature of the problem, it is apparent that higher or lower temperatures and longer or shorter time periods may be used under certain conditions, if desired. For example, temperatures in the range from 120° F. to 135° F. may be employed with or without corresponding variations in the holding time period allotted to maintain the plate assembly at constant temperature. In the latter respect, a time period from several seconds to two or three minutes may be found preferable. Certain of such variations in time and temperature may be required by variations in quality and type of the xerographic plates being used. For example, variations in the thickness of the selenium coating, the nature and amount of other ingredients or impurities used with or contained in the selenium coating, the age of the plate, the amount of radiation to which the plate has been exposed, and ambient conditions may, individually or in combination, require variations in the several parameters involved. For situations departing from the general case, described above, temperature and time variations are readily determined empirically for any given application.

Since many changes may be made in the above construction and many apparently widely different applications of the present invention may be made without departing from the present scope thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A relaxation unit for xerographic plates including a box-like structure having means to support a xerographic plate, an array of a plurality of heating elements contained in said box-like structure and arranged to direct radiant energy against a plate supported in said structure, an air inlet connected to the box-like structure to conduct ambient air to the interior thereof, a blower element arranged adjacent the air inlet to project an ambient air stream against a plate supported by said structure, and a control circuit to effect a programmed cycle of operation of said heating and blower elements, said control circuit including a first switching means operable to connect said heating elements to a source of power, means to operate said first switching means, a second switching means operable to disconnect certain of said heating elements from said source of power, thermostatic means actuated by said heating elements to operate the second switching means, a timing mechanism actuated by the second switching means to disconnect the remainder of the heating elements from the power source after a predetermined time period and concomitantly to initiate operation of the blower, and means to limit the duration of operation of the blower.

2. In a relaxation apparatus for xerographic plates wherein a xerographic plate is to be heated to a predetermined temperature, maintained at such predetermined temperature for a predetermined time period, and cooled to ambient temperature, the combination of a box-like structure mounted on a base, means for supporting a xerographic plate in said box-like structure, a plurality of heater elements mounted on said base to direct thermal radiation against a plate held on said supporting means, an air inlet in said base to conduct ambient air to the interior thereof, a blower element mounted on said base adjacent said air inlet to direct an ambient air stream against a plate held on said supporting means, switching means for energizing the heater elements, thermostatic control means supported in the box-like structure adjacent the plate supporting means, a timing device, means controlled by the thermostatic control means for reducing the thermal output of the heater elements and for initiating operation of the timing device when a predetermined temperature is reached, and means controlled by the timing device for de-energizing the heater elements and for initiating operation of the blower element.

3. In a relaxation apparatus for xerographic plates wherein a xerographic plate is to be heated to a predetermined temperature, maintained at such predetermined temperature for a predetermined time period, and cooled to ambient temperature, the combination of a box-like structure mounted on a base, said box-like structure having heat reflective interior walls, means for supporting a xerographic plate in said box-like structure, a plurality of heater elements mounted on said base to direct thermal radiation against a plate held on said supporting means, an air inlet in said base to conduct ambient air to the interior thereof, a blower element mounted on said base adjacent said air inlet to direct an ambient air stream against a plate held on said supporting means, switching means for energizing the heater elements, thermostatic control means supported in the box-like structure adjacent the plate supporting means, a first timing device, means controlled by the thermostatic control means for reducing the thermal output of the heater elements and for initiating operation of the first timing device when a predetermined temperature is reached, a second timing device, a signal device, means controlled by the first timing device for de-energizing the heater elements and for initiating operation of the blower element and the second timing device after a predetermined time period, and means controlled by the second timing device for operating the signal device.

References Cited in the file of this patent

UNITED STATES PATENTS

2,464,213	Cataldo	Mar. 15, 1949
2,767,118	Gaymont	Oct. 16, 1956