Sept. 2, 1969 S. KOLLESS 3,465,122

CONTROL ARRANGEMENT FOR COPYING DEVICES

Filed Sept. 9, 1966 2 Sheets-Sheet 1

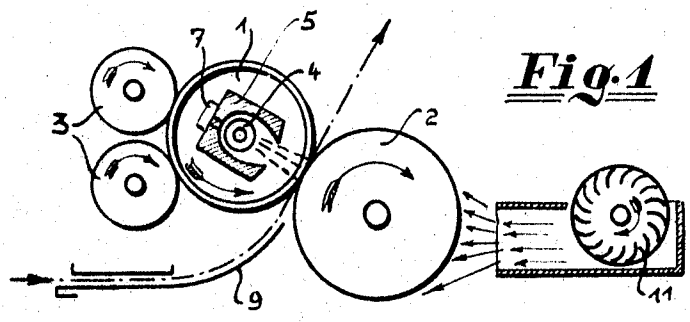


Fig.1

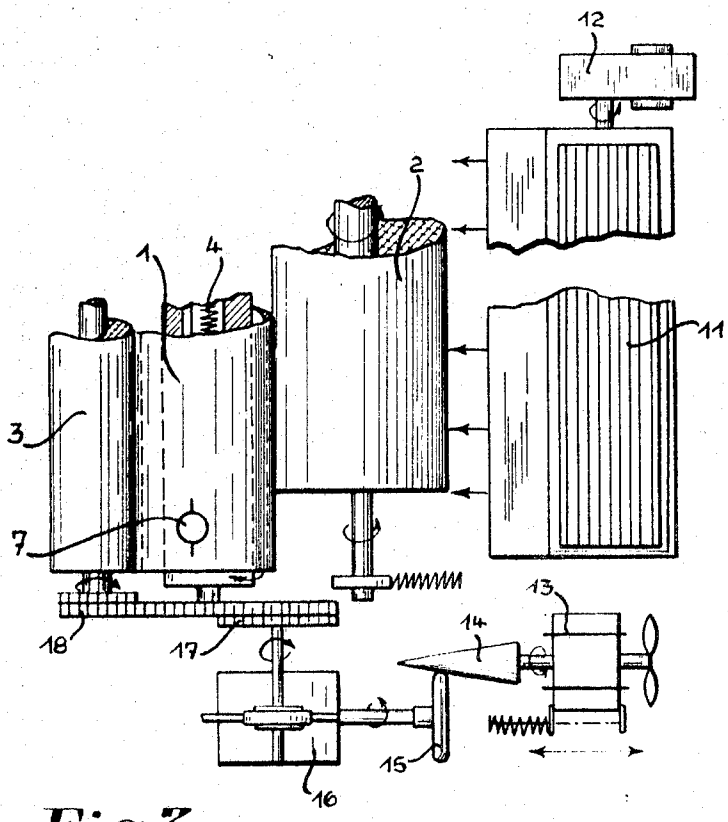


Fig.3

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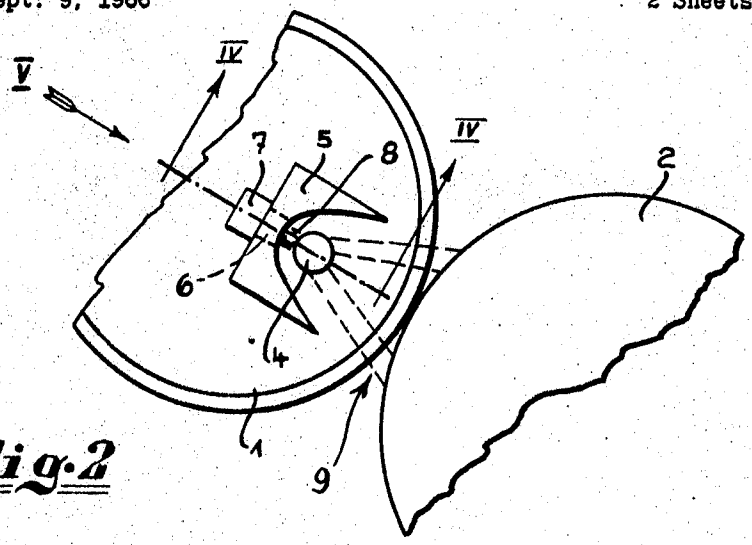


Fig.2

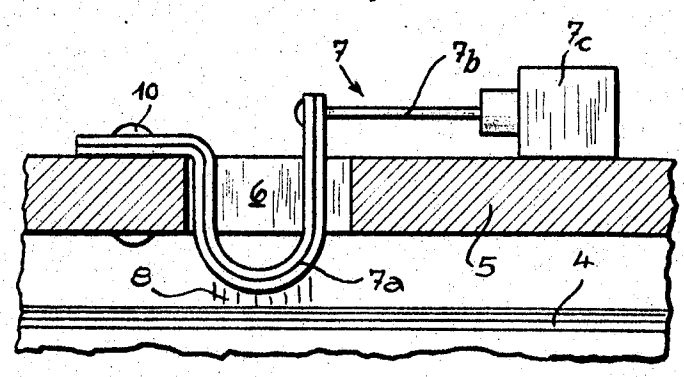


Fig.4

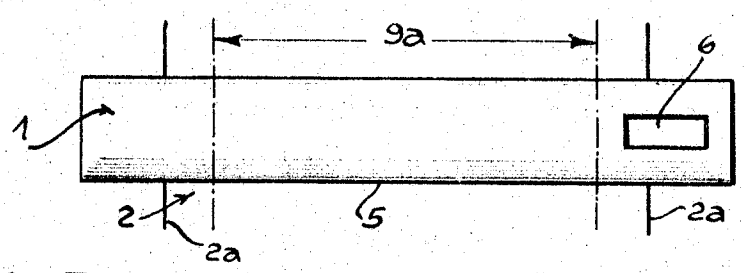


Fig.5

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CONTROL ARRANGEMENT FOR COPYING DEVICES

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Int. Cl. H05b 1/02
U.S. Cl. 219—216 18 Claims

ABSTRACT OF THE DISCLOSURE

A control arrangement for copying devices of the type utilizing heat and light for their copying function protects sensitive components of the apparatus against damage resulting from overheating. Cooling means actuated by a heat-responsive detector keep the temperature to which the components are exposed within a predetermined range.

The present invention relates to a control arrangement. More specifically, the invention relates to a control arrangement for copying devices. Still more specifically, the invention relates to a control arrangement for copying devices of the type utilizing heat and light for their copying function.

In copying devices which require the application of heat to material to be copied, such material and also the material onto which the copy is to be made are passed through a zone of radiated heat. Since it is essential that the material to be copied and the material on which the reproduction is to be made be in intimate contact when the actual image transfer takes place, the two materials are passed between two or more co-operating rollers which press the materials together in face-to-face contact. It is necessary for the materials to be heated precisely at this time when they are pressed together by the rollers, and the heating zone is therefore so arranged that the heating action coincides with the passage of the materials between the rollers. In other words, the heating means provided for this purpose is intended to heat the papers during the time of their passage between the rollers and it necessarily therefore also heats the rollers at the same time.

The heat required for the process is such that, were the materials to remain stationary, they would be damaged by the heat. Since, however, the materials are in continuous movement between the rollers and therebeyond such damage does not occur. The same considerations are true for the rollers themselves which, if stationary, would also be damaged by the heat. Of course, while the materials are transported between the rollers, the latter are in rotation so that no portion of their circumference is subjected to prolonged influence of the heat. To mitigate still further the influence of the heat on the rollers, which consist at least in part of rubber and/or similarly heat-susceptible materials, it is known to provide suitable cooling means for directing a flow of coolant, such as air, against the rollers.

Upon completion of the copying process, that is when the materials have passed between the rollers and therebeyond, the source which radiates the heat is switched off, usually automatically. The rollers, which have also completed their assigned function, can now be stopped. However, the intensity of heat radiated from the source does not immediately and drastically decline but decreases only gradually. One is therefore faced with the problem of protecting the rollers against localized overheating while the heat intensity from the now non-operative source of heat is still above a predetermined permissible level. In other words, if the rollers were to be stopped as soon as the source of heat is switched off, those portions of the

rollers exposed to the heat and located directly in its path would very likely suffer highly undesirable damage.

It should be reiterated here that the rollers consist partly or completely of material which is susceptible to such damage, for instance rubber, plastic, glass or similar materials, either individually or in combination. In particular it is very customary to dispose the source of radiant heat, usually an elongated element, within a glass cylinder in axial parallelism therewith. Obviously, such a cylinder cannot be stopped from rotating until its associated source of radiant heat has cooled off to the required degree.

Various efforts have been made to overcome this problem and an arrangement is known in which the source of heat energy is moved when it has been switched off, so that the rollers are no longer directly exposed to the emanating heat. Of course, such movement necessitates the provision of additional relatively complicated features, such as a means for carrying out the movement, a timing arrangement for coordinating such movement with the stopping of the rollers, and the like. Another arrangement proposes to connect the heat-sensitive detector in heat-conducting relationship with a portion of the device which becomes heated during operation of the source, but is not directly disposed in the path of the radiated heat. For instance, the suggestion has been made to connect such a heat-sensitive detector with a portion of the reflector which is generally used to focus the heat of the source, and to establish the connection with a portion of the reflector which is not directly located within the range of the impinging heat radiation. The disadavantage of this arrangement is that the detector will not operate if only a single copying "episode" or run is undertaken, that is if only a single copy is to be made. The reason for this is that the reflector will not become heated uniformly and that the part located outside the direct path of the radiant heat will during a single run not be heated to a temperature which could cause the detector to operate. Conversely, after several copies have been made the reflector will become heated throughout and the heat-sensitive detector will then become constantly actuated, which obviously is not desirable either.

It is therefore a general object of the present invention to provide a control arrangement which overcomes the above-mentioned disadvantages of the prior art.

A more specific object of the invention is to provide such a control arrangement which will protect heat-sensitive components of a copying device reliably and accurately.

A further object of the invention is to provide such a control arrangement which is simple to construct and therefore inexpensive.

A concomitant object of the invention is to provide such a control arrangement which can be added, if desired, to existing copying devices.

Yet a further object of the invention is to provide such a control arrangement which will maintain operation of a cooling means operative for cooling heat sensitive components of a copying device, until the intensity of heat radiated by a source of heat has fallen below a predetermined level.

One important feature of my invention resides in the provision of a control arrangement which comprises a source of radiant heat, and heat-absorbing means positioned to receive heat from the source. Such heat-absorbing means, it will be understood, incorporates the rollers between which the material to be copied and the material on which the copy is to be made must pass. My novel control arrangement further includes cooling means which is arranged for cooling the heat-absorbing means so as to preclude heating of the same beyond a predetermined temperature, and heat-responsive detector means which

is positioned so as to be directly heated by heat radiated from the source. This heat-responsive detector means is operative for terminating the operation of the cooling means upon a predetermined drop in the temperature in the heat radiated by the source.

To assure accurate response by the detector means I prefer to provide the same adjacent a side of the source of radiant heat which is located remote from the material passing between the rollers. In other words, the paper will pass by the source to one side thereof and will thereby be heated, and the detector will be located at the opposite side. In a further embodiment I contemplate positioning the detector completely or inpart either in an aperture provided in a reflector surrounding the source of heat energy, or slightly spaced from the reflector but in line with the aperture. Additionally, and to reduce the loss of radiated heat through this aperture, I contemplate providing the aperture as well as the detector associated therewith at a location which is outside the path of the material to be copied and the material on which the copy is to be produced. In other words, the source of heat energy will be made longer than the axial extension of at least one of the rollers, and this latter is a well-known expedient employed in the art in any case. Since the width of copying material and material to be copied is determined by the smallest axial length of the cooperating rollers it will be obvious that, if the aperture is provided in a portion of the reflector which projects axially beyond the shorter roller, no heat energy which would otherwise be directed onto the copying material can be thereby lost. Nevertheless, the detector will be exposed to the direct heating action of the source of heat, but only to the action of that part of the source which extends axially beyond the shorter of the rollers. As a heat-detector I prefer to use a bimetallic element whose response is so selected that its operating temperature at which it actuates the switch for shutting off the cooling means will be reached on exposure to the direct radiation of heat upon passage of only a single copy through the copying device.

Various modifications of this basic arrangement are of course possible, for instance, and just to mention one such possibility, I contemplate an arrangement wherein the insertion of the material to be copied and of the material on which the copy is to be made will automatically start all functions, with the source of heat energy being switched off as soon as the copying process is completed, and with the detector means subsequently shutting off all other functions of the machine when the temperature of the source of heat energy has dropped to the desired level.

In fact, the arrangement can be still further modified so that the detector actuates the switch which automatically starts the drive means and the cooling means when the materials are introduced into the copying device.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a very schematic end view of an arrangement in accordance with the present invention;

FIG. 2 is a fragmentary enlargement of the arrangement shown in FIG. 1;

FIG. 3 is a top plan view of an arrangement such as that shown in FIG. 1;

FIG. 4 is a partially sectional view on an enlarged scale, showing the detector means; and

FIG. 5 is a schematic view by way of illustrating the relative positions of the rollers and the detector means.

Discussing now the drawing in detail, and firstly FIG. 1 thereof, it will be seen that reference numeral **1** indicates a rotatable hollow cylinder of glass or another transparent material. FIG. 2 indicates a pressure roller consisting wholly or partly of rubber. Reference numeral **3** indicates two additional rollers which extend in axial parallelism with the cylinder **1** and abut against the peripheral surface thereof. It should be understood that roller **2** is journalled for rotation as are both of the rollers **3**, whereas the cylinder **1** is loosely held by the rollers **2** and **3** in a "floating" relationship. In other words, cylinder **1** is not journalled. Only one of the rollers **3** need actually be driven and the rollers **2** and **3** rotate in the direction of the respective arrows associated with them.

As is more clearly evident from FIG. 2 the cylinder **1** have disposed therein in axial parallelism therewith a source **4** of radiant heat energy. This source **4** is, as will be best seen from FIG. 3, of a length corresponding or at least substantially corresponding to that of the cylinder **1**. A reflector **5** surrounds the source **4** on one side thereof, so that heat energy radiated by the source **4** is concentrated onto the point at which cylinder **1** and roller **2** peripherally engage one another. It is between the cylinder **1** and the roller **2** that the material to be copied and the material onto which the copy is to be made, both of which will for the sake of simplicity hereafter be referred to as "paper," must pass. The path of the paper is indicated with the arrow **9**.

Reflector **5** is provided in the embodiment illustrated with a cutout or aperture **6** in which there is located a detector means **7** which, as is clearly evident from FIG. 4, comprises a substantially U-shaped bimetallic portion **7***a* which is secured to the reflector **5** by a screw or rivet **10**, and one arm of which is secured to a rod portion **7***b* which in turn is connected to the switch **7***c*. The lines indicated with reference numeral **8** in FIGS. 2 and 4, show clearly that the detector means or at least the temperature-sensitive portion **7***a* thereof is located directly in the path of heat radiated by the source **4** towards the reflector **5**, a portion of this heat passing through the opening **6** and impinging on the temperature-sensitive portion **7***a* of the detector means **7**.

FIG. 5 indicates how in the preferred embodiment of the invention the opening **6**, through which direct radiated heat impinges on the detector means **7**, is located outside the range in which the paper is to be heated. In other words, the opening **6** is located to one side of the path **9**. The width of this path **9** is indicated in FIG. 5 with reference numeral **9***a*, and it will be obvious that the opening **6** is located to one side of the path **9**. The width of this path **9** is indicated in FIG. 5 with reference numeral **9***a*, and it will be obvious that the opening **6** is located to one side of the area **9***a*, that is to one side as seen in axial direction of the roller **2** and of the cylinder **1**, which latter will be seen to be longer than the roller **2**. This arrangement assures that the loss of heat energy which is useable for heating the area of the path **9** is negligible inasmuch as the heat energy which is lost through the opening **6** with this arrangement would not ordinarily contribute to such heating in any case.

FIG. 3, finally, is a top plan view of the entire apparatus utilizing the arrangement in accordance with my present invention. Those elements which are identical with elements described heretofore are indicated with like reference numerals. It will additionally be seen that there is provided a blower **11**, which may be of the radial-flow type, for directing a stream of coolant onto the roller **2**. The blower **11** is driven by a separate drive **12** of any desired well-known type. The main drive motor for the arrangement is indicated with reference numeral **13** and again any well known motor will be suitable for this purpose. Carried by the shaft of motor **13** is a cone structure **14** which engages a friction wheel **15** and thus rotates the same. The friction wheel **15** in turn cooperates with a gear-transmission **16** which drives a first pulley **17** from whence a transmission belt **18** leads to a second pulley **19** rigidly associated with the driven roller **3**, so that the latter is thereby rotated. The switch **7***c*, it will be under-

stood, is actuated by the movement of portion 7*a*, transmitted to it by the rod 7*b*, and it in turn switches off the drive **12** for the blower **11** and the drive **13** for the roller **3** which actuates the roller **2** and the cylinder **1**. Since the switch 7*c* is actuated only when the temperature of the heat emitted by the source **7** has fallen below a predetermined level it will be clear that the drives **12** and **13** continue to operate until this temperature drop has taken place, so that danger of localized or total over-heating of the cylinder **1** and the roller **2** is thereby prevented.

The possibility of modifications has been pointed out earlier and several such modifications have been mentioned by way of example. It might be reiterated here that one such modification could be the use of the switch 7*c* for turning on the drives **12** and **13** upon insertion of paper into a copying device utilizing the novel control arrangement.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of control arrangements, differing from the types described above.

While the invention has been illustrated and described as embodied in a control arrangement, it is not intended to be limited to the details shown since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge readily adapt it for various applications without omitting features that from the standpoint of prior art fairly constitute essential characteristics of the generic or specific aspects of this invention.

What is claimed as new and desired to be secured by Letters Patent is:

1. A control arrangement comprising, in combination, a source of radiant heat; heat-absorbing means positioned to receive heat from said source and comprising a rotary element having a peripheral surface at least partly consisting of material subject to damage on heating beyond a predetermined temperature; cooling means arranged for cooling said heat-absorbing means so as to preclude heating of the same beyond said predetermined temperature; and heat-responsive detector means positioned so as to be directly heated by heat radiated from said source and operative for terminating operation of said cooling means in response to a predetermined drop in the temperature of the heat radiated by said source.

2. A control arrangement as defined in claim **1**, wherein said cooling means includes drive means for rotating said rotary element whereby to effect cooling of said rotary element through movement of the same relative to the ambient atmosphere, and through preventing continuous exposure of any portion of said peripheral surface to the heat radiated by said source.

3. A control arrangement as defined in claim **2**, said cooling means further including blower means arranged to direct a flow of gaseous cooling medium against said rotary element.

4. A control arrangement as defined in claim **1**, wherein said cooling means includes blower means arranged to direct a flow of gaseous cooling medium against said rotary element.

5. A control arrangement as defined in claim **1**, wherein said heat-responsive detector means comprises a bimetallic element.

6. A control arrangement as defined in claim **1**, wherein said heat-absorbing means comprises a pair of axially parallel rotary elements at least one of which has a peripheral surface at least partly consisting of material subject to damage on heating beyond said predetermined temperature.

7. A control arrangement as defined in claim **6**, wherein one of said rotary elements is a hollow cylinder, said source being at least substantially arranged within said hollow cylinder.

8. A control arrangement as defined in claim **7**, wherein said material of said hollow cylinder is transparent.

9. A control arrangement as defined in claim **7**, wherein said source is an elongated heat radiating device extending axially parallel with said hollow cylinder.

10. A control arrangement as defined in claim **9**, wherein said heat-radiating device comprises a heat-radiating member and a reflector element partly surrounding said member and directing heat radiated thereby in direction toward the other of said rotary elements.

11. A control arrangement as defined in claim **10**, wherein said reflector element is provided with a cut-out, said detector means being at least partly located in alignment with said cut-out so as to be directly heated by heat radiating from said heat-radiating member.

12. A control arrangement as defined in claim **11**, wherein the peripheral surfaces of said rotary members together define a path of a given width, as seen in axial direction of said rotary members, for passage of sheet material between said members, said cut-out and said detector means aligned therewith being located to one side of said path with reference to the axial extension of said rotary members.

13. A control arrangement as defined in claim **11**, wherein said detector means comprises a bimetallic element located in alignment with said cut-out.

14. A control arrangement as defined in claim **13**, wherein said detector means further comprises double-acting switch means operatively connected with said bimetallic element, said switch means being operative for actuating said cooling means and for terminating operation of said cooling means upon said drop in the temperature of the heat radiated by said source.

15. A control arrangement as defined in claim **11**, wherein said cooling means comprises drive means operatively connected with at least one of said rotary elements for driving the same.

16. A control arrangement as defined in claim **11**, wherein said peripheral surfaces of said rotary elements are in frictional engagement with one another; said cooling means comprising drive means operatively connected with at least one of said rotary elements for driving the same and thereby rotate both of said rotary elements.

17. A control arrangement as defined in claim **15**, said cooling means further comprising blower means arranged to direct a flow of gaseous cooling medium against the peripheral surface of at least one of said rotary elements.

18. A control arrangement as defined in claim **17**, said drive means and said blower means being operatively connected for simultaneous operation.

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