June 10, 1969 R. C. GOODMAN ETAL 3,449,547

THERMOGRAPHIC DEVELOPING APPARATUS

Filed Dec. 27, 1966

Fig. 3.

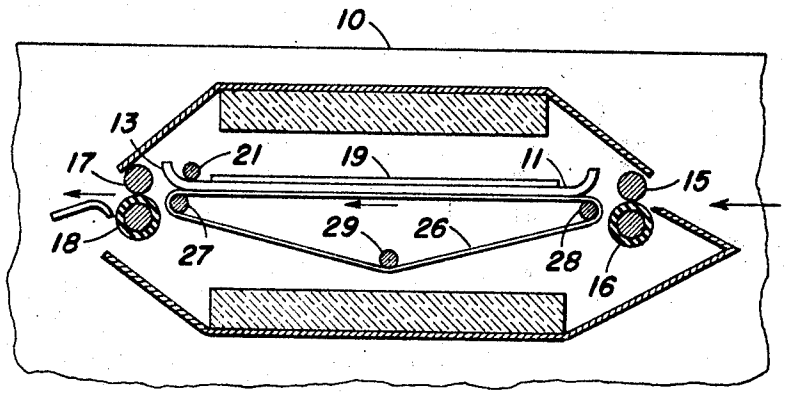


Fig. 2.

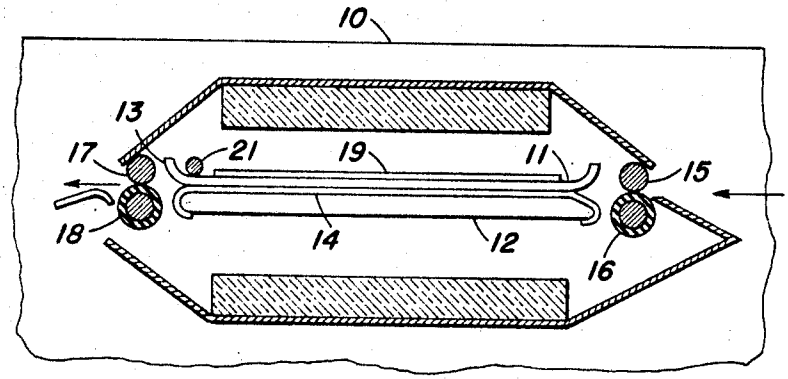
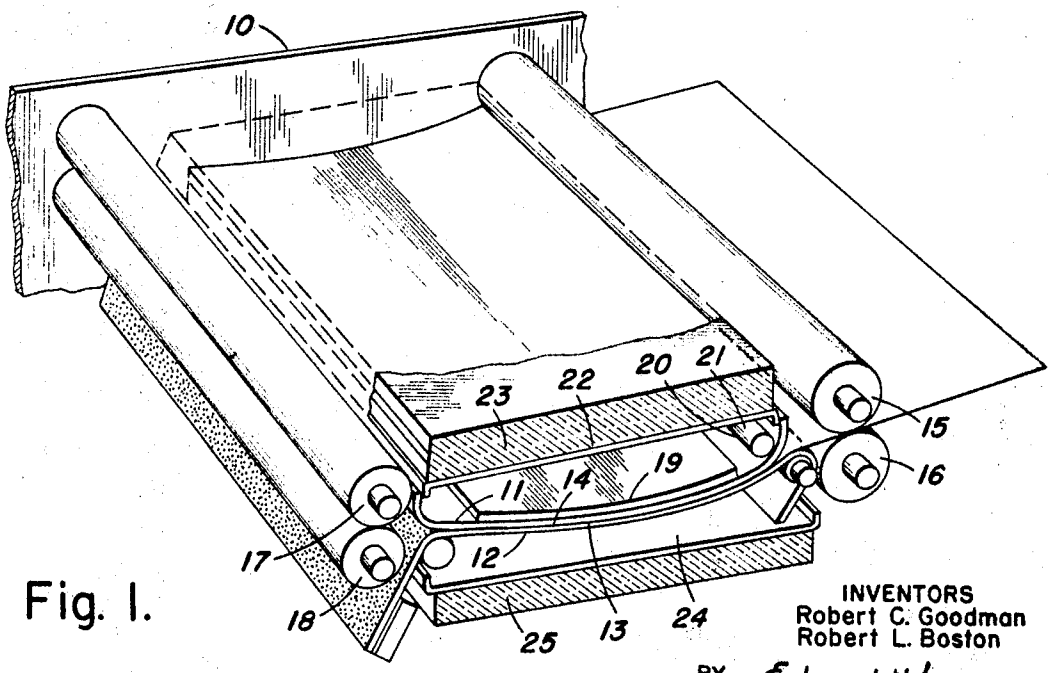


Fig. 1.



INVENTORS
Robert C. Goodman
Robert L. Boston

BY Edward H. Foreman

ATTORNEY

United States Patent Office 3,449,547
Patented June 10, 1969

3,449,547

THERMOGRAPHIC DEVELOPING APPARATUS

Robert C. Goodman, Binghamton, and Robert L. Boston, Vestal, N.Y., assignors to GAF Corporation, New York, N.Y., a corporation of Delaware

Filed Dec. 27, 1966, Ser. No. 604,722
Int. Cl. H05b 1/02
U.S. Cl. 219—216
1 Claim

ABSTRACT OF THE DISCLOSURE

An apparatus for developing thermodiazo materials which utilizes a heated stationary platen and a resilient support guide member placed in contact therewith. Thermodiazo material is passed in sliding contact between the platen and guide member under the influence of infeed roller means. The effect of the heated platen on the material for a predetermined time will affect the chemicals in the material and cause the developing process to be completed.

This invention relates to photocopying apparatus and, more particularly, to improvements in the developing segment of the device for processing and developing diazo-type copying materials.

Apparatus for processing diazo-type materials are widely known and used in industry. Generally, an apparatus of this type utilizes three basic processing segments or assemblies combined into a single complete operating unit. The first segment pertains to the printer segment of the apparatus wherein sensitized material, in contact with an original to be copied, is exposed to high intensity light. Subsequently, in the second segment or assembly of the apparatus, commonly designated as the separator-conveyor unit, the exposed sensitized material is separated from the original. The original may be delivered at a predetermined location into a suitable receiving tray, whereas the exposed sensitized material is conveyed to the third segment of the apparatus, generally designated as the developer. In the developer the exposed sensitized material is subjected to the vapors of a volatile developing agent, as for example, heated aqueous ammonia, and thereafter delivered into a print delivery receiving tray.

Recently, the developing processes have been improved with regard to specific types of idazo materials which no longer require the application of either fluid or vaporized developing agents. These materials, frequently designated as "thermodiazo materials" include chemical substances which, upon application of heat, liberate either ammonia or other alkaline agents which will effect the development of the previously exposed original copy sheet.

The developing portions of the photocopying device heretofore utilized in the developing of the so-called "thermodiazo materials" have employed rotating heated cylinders generally constituted of a heat-resistant vitreous, glass or metallic material over the surface which the exposed sensitized material is moved by means of moving conveyor belts. Although these developers have proven satisfactory during commercial operation, the need for numerous rotating and moving parts has rendered the complex construction thereof expensive and difficult to maintain.

The present invention overcomes the foregoing and other disadvantages by providing an improved developing apparatus for developing diazo-type materials with heat utilizing an advantageous construction having a minimum of moving components. One of the major features of this invention lies in the use of a stationary heated low-friction platen in lieu of the rotating cylinder, along or past which the exposed sensitized material moves over a guiding

member spaced in proximity to the platen. Simple and inexpensive rollers are employed in feeding the materials to the developer and removing it therefrom.

It is accordingly a primary object of this invention to provide an improved heating apparatus of simple and inexpensive construction for the development of thermodiazo materials.

A further object of this invention is to provide a simplified apparatus for moving exposed sensitized thermodiazo materials through the developing section of a photocopying device.

A more particular object of this invention is to provide a stationary platen member heated to an optimum temperature range and contacted by thermodiazo materials moving at a predetermined rate of speed along the surface of the platen.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

FIG. 1 is a perspective view, partially in schematic section, of one embodiment of the apparatus for developing diazo-type materials according to this invention;

FIG. 2 is an elevational sectional view, partially in schematic, of a second embodiment of the developing apparatus according to this invention; and

FIG. 3 is an elevational sectional view, partially in schematic, of a third embodiment of the developing apparatus according to this invention.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts throughout the several views, there is shown in FIG. 1 a pair of end frames **10**, only one of which is illustrated, the other having been deleted to permit viewing of the internal mechanism.

A platen **11** of somewhat dish-shape cross-section is positioned between and fastened to end frames **10** through suitable fastening means, not shown. The platen consists essentially of a low-friction material, such as aluminum or of a heat-resistant vitreous material. For this specific purpose a borosilicate glass, as for example, the commercially available trademarked "Pyrex" would be satisfactory, although understandably other types of material having high resistance to heat and low coefficients of friction, would quite readily lend themselves to this application.

A resilient plate or guide member **12** is positioned to contact the surface **13** of platen **11** and serve as a supporting surface for the diazo-type material when said materials are transported between guide member **12** and surface **13**. Guide member **12** may be formed of fiberglass coated with a surface layer **14** of low-friction polytetrafluoroethylene, known commercially by the trade name "Teflon." Although not all surfaces of the guide member **12** need be coated with the Teflon, at least that portion of member **12** contacting surface **13** of platen **11** should be so coated, to thereby provide a relatively frictionless passage for diazo-type materials passing along platen **11** between surfaces **13** and **14**.

Preferably, resilient guide member **12** should be positioned with respect to platen **11** so that the Teflon surface **14** exerts a degree of uniform pressure against contacting surface **13** of platen **11**. The uniform pressure between surfaces **13** and **14** will assure a constant contact between the diazo-type materials passing through the developer and surface **13** of platen **11**.

It also becomes readily apparent that the resilient construction of guide member **12** permits lateral movement of Teflon surface **14** toward and away from surface **13**, thereby facilitating the processing of diazo-type materials having different thicknesses and also maintaining the

desired compressive force on the materials against platen **11**.

Although the guide member **12** has been described as being constituted of an essentially resilient material, such as, for example, fiberglass, it will be obvious to one skilled in the art that a relatively rigid guide member may be utilized, which may be suitably spring-mounted so as to present a resilient surface relative to the surface of platen **11**.

Resilient member **12** may be fastened to end frames **10** in a manner quite similar to that employed in attaching platen **11**. In planar physical dimensions platen **11** and guide member **12** may be substantially identical for reasons to be more fully explained further below.

A materials infeed roller assembly comprising a drive roller **15** and an idler roller **16** is positioned adjacent to and substantially parallel with one edge of platen **11** and guide member **12**. The rollers **15** and **16** may be suitably journaled in end frames **10**, and rotative motion imparted to drive roller **15** through a prime mover (not shown). Parallel with the infeed roller assembly and adjacent to the opposite edge of the platen **11** and guide member **12** is a materials egress roller assembly constituted of a drive roller **17** and an idler roller **18**.

The construction of the egress roller assembly **17, 18** is quite similar to that of infeed roller assembly **15, 16**. Thus, idler rollers **16** and **18** may be of resilient construction and positioned in compressive or spring-loaded relationship with their respective drive rollers **15** and **17**. This, in effect, will assure that the diazo-type materials fed into the bite between the driver rollers and the idler rollers will be firmly and positively gripped for movement therethrough.

Egress roller assembly **17, 18** is journaled in the end frames **10** in a manner substantially analogous to that of infeed roller assembly **15, 16**. Similarly, driver roller **17** may be driven in synchronous rotation with driver roller **15** by the identical prime mover rotating the latter or by other means (not shown).

The platen **11** is heated to within a predetermined temperature range through a heater **19** fastened or bonded to the surface of the platen. The optimum operating temperature of the platen **11** has been found to be in the range of 148 to 160° C. The heater **19** may be essentially of the flexible silicone-molded type covering a substantial portion of the platen surface **11** in order to impart uniform heat thereto. A satisfactory heater may be formed of #32 wire, 180 alloy-resistance wire which has been covered with a silicone rubber-coated glass blanket and subsequently vulcanized by heat and pressure. A feature of this construction is that the heater **19** will rapidly raise the platen **11** temperature to the required operating temperature while using only a relatively small amount of electrical energy input.

In order to maintain the temperature of the platen **11** within the desired operating range, a temperature control **21** or thermostat for the heater **19** is positioned on or near the surface of the platen **11**. The thermostat is preferably of the differentially expansible type, basically consisting of a closed end copper tube **20** containing a metal rod of a dissimilar material. Operation of the thermostat unit **21** is a function of the difference in expansion rates of the two dissimilar metals. A thermostat of this type will provide close control over the temperature and energy output of the heater **19**. Differentially expansible thermostats are widely and commercially available and no further detailed description is required in this regard.

To facilitate retention of the desired heat and temperature range in the platen **11** and developing apparatus a suitable thermal deflector **22**, formed of sheet metal, and an insulating material **23** may be placed above the platen **11** and heater **19**. A similar thermal deflector **24** and insulating material **25** may be positioned below guide member **12**, thereby providing a generally well insulated developer assembly.

In operation, exposed sensitized material is fed into the bight of infeed rollers **15, 16**. The material is gripped between the rollers and conveyed between heated platen surface **13** and Teflon coated surface **14** of guide member **12**. The edge of platen **11** is bent upwardly while the edge of the guide member **12** slopes downwardly to thereby form a substantially V-shaped groove facilitating the conveyance of the material therebetween.

As the exposed sensitized material passes in sliding contact with the practically frictionless surfaces **13, 14** of platen **11** and guide member **12**, the heat of the platen will effect the desired developing process in the material.

When the leading edge of the developed material emerges between surfaces **13** and **14**, it will be introduced into the bite of egress rollers **17, 18**; gripped therebetween and conveyed out of the developing apparatus into a suitable receptacle or tray.

Preferably, the infeed roller assembly **15, 16** and the egress roller assembly **17, 18** should be driven at synchronous speeds in order to maintain a uniform tension on the diazo-type material as it is conveyed through the developing apparatus. Satisfactory roller and material speeds of up to 10 linear feet per minute may be attained with this developing apparatus.

Referring now to FIG. 2, the embodiment of the apparatus shown therein is basically the same as that in FIG. 1, and accordingly, like components have been given identical reference numerals. Here, however, the platen surface **13** and guide member cover surface **14** are straight, whereas in the embodiment of FIG. 1, they are, respectively, convex and concave. The present embodiment thus eliminates the possible need for straightening the material after it emerges from the space between surfaces **13** and **14**.

A further feature of this embodiment is that the heat reflectors and insulating materials have been re-arranged to some extent. This in essence, however, has no material effect on the operation of the developing apparatus.

Referring now to FIG. 3, this embodiment of the apparatus is quite similar to that of FIG. 2, however, the guide member **12** has been replaced by a moving endless conveyor belt **26** moving around rollers **27, 28** and **29** in synchronous motion with rollers **15** and **17**. The belt **26** will assist in sliding the material past surface **13** of stationary platen **11**. The belt **26** may be constituted of low coefficient of friction, high temperature-resistant material. It may be of two-ply construction, consisting of fiberglass cloth coated with a silicon rubber compound, the laminations being appropriately wound and vulcanized.

Although the apparatus of each of the embodiments herein described has been shown with a single platen only, it will be readily apparent that by utilizing a plurality of platens and infeed rollers in series, or by increasing the width of the platen, the contact time between the material and platen will increase and thus will provide higher processing speeds.

While particular embodiments of this invention are shown above, it will be understood that the invention is obviously subject to variations and modifications without departing from its broader aspects.

What is claimed is:

1. An improved thermographic developing apparatus including in combination a flat, stationary platen; a resilient support guide member; a roller assembly for conveying thermographically responsive material between said platen and said guide member and heating means adjacent one surface of said platen for heating said platen, the improvement including a resiliently supported guide member positioned to contact a surface of said platen when said thermographically responsive material is not being processed; said roller assembly including infed roller means adapted to convey materials between said platen and said guide member at feed rates up to 10 linear feet per minute; and an egress roller assembly for conveying said thermographic material from the area be-

tween said platen and said guide member to the exterior of said apparatus, having a drive roller and an idler roller in contact therewith to maintain a uniform force on said infed roller assembly permitting uniform tension on the material conveyed between said platen and said guide member.

References Cited

UNITED STATES PATENTS

2,941,573	6/1960	Cassady	34—41 X
3,114,254	12/1963	Rose	34—41 X
3,115,731	12/1963	Blythe et al.	156—583 X
3,163,104	12/1964	Lapham	100—93 X
3,236,174	2/1966	Hutchinson et al.	156—583 X
3,291,466	12/1966	Aser et al.	219—216 X
3,313,913	4/1967	Limberger	219—216
3,331,592	7/1967	Cassano et al.	95—1.7 X
3,359,404	12/1967	Limberger	219—216
3,363,530	1/1968	Rice	95—89
3,378,430	4/1968	Aizqwa	100—93 X

RICHARD M. WOOD, *Primary Examiner.*

C. L. ALBRITTON, *Assistant Examiner.*

U.S. Cl. X.R.

100—93; 219—388