

12

EUROPEAN PATENT APPLICATION

21 Application number: **84300420.1**

51 Int. Cl.³: **G 03 D 13/00**

22 Date of filing: **24.01.84**

30 Priority: **31.01.83 US 462648**

71 Applicant: **TEKTRONIX, INC., D/S Y3-121 4900 S.W. Griffith Drive P.O. Box 500, Beaverton Oregon 97077 (US)**

43 Date of publication of application: **05.09.84**
Bulletin 84/36

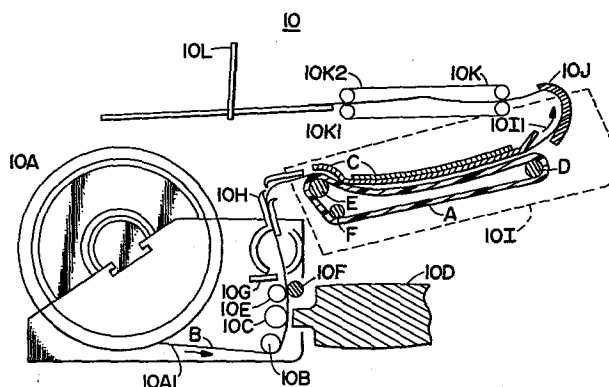
72 Inventor: **Loofbourow, Donald I., 8430 S.W. Mohawk, Tualatin Oregon 97062 (US)**

84 Designated Contracting States: **DE FR GB NL**

74 Representative: **Wright, Peter David John et al, R.G.C. Jenkins & Co. 12-15, Fetter Lane, London EC4A 1PL (GB)**

54 **Improved thermal development apparatus for thermal development of a photographic medium.**

57 A thermal development apparatus is disclosed for thermal development of a photographic medium disposed therein. A non-elastic drive belt is utilized by said apparatus for driving said photographic medium therethrough. As a result of the use of a non-elastic drive belt, the thermal development apparatus is modified to accommodate the non-elastic drive belt. A heater platen of said apparatus is spring loaded for urging said platen toward one surface of the drive belt when the photographic medium is not disposed within the apparatus and toward the photographic medium when said medium is disposed within the apparatus. In addition, a drive roller forcedly drives the non-elastic drive belt through the thermal development apparatus. An outer circumferential surface of the drive roller is knurled in order to provide an increased frictional contact between the drive roller and one surface of the non-elastic drive belt.



IMPROVED THERMAL DEVELOPMENT APPARATUS FOR
THERMAL DEVELOPMENT OF A PHOTOGRAPHIC MEDIUM

5

The subject matter of the present invention pertains to an improved thermal development apparatus for thermal development of a photographic medium passing
10 therethrough.

Various apparatus is used for producing a hard copy reproduction of an image displayed on a cathode-ray-tube (CRT). One such apparatus utilizes a fiber-optic CRT and a thermal development apparatus to produce said hard copy reproduction through thermal development of a special photographic medium. The thermal development apparatus includes a processor assembly
15 for driving said photographic medium in a direction transverse to the longitudinal axis of the fiber-optic CRT. As the photographic medium moves in said direction across an outer faceplate of the fiber-optic CRT, a line of image information on said fiber-optic CRT
20 is transferred to the photographic medium disposed adjacent thereto. Eventually, as the processor assembly drives the photographic medium in the above-mentioned direction, each line of image information displayed on the fiber-optic CRT is transferred to the
25 photographic medium.
30

The processor assembly includes a drive belt stretched to extend between two drive rollers and one or more idler rollers. One surface of the drive belt
35 faces one surface of a heater platen. Disposed between

the drive belt and the heater platen is the photographic medium, the drive belt moving the photographic medium in the direction transverse to the longitudinal axis of the fiber-optic CRT. The heater platen heats the photographic
5 medium thereby producing the hard copy reproduction of the image.

A problem associated with the processor assembly has been encountered. The processor assembly has been experiencing a very short operating life, due to elon-
10 gation of the drive belt. In addition, the photographic medium exudes a chemical exudate, the exudate being absorbed into the drive belt causing the drive belt to swell, to soften and to stick to portions of the heater platen.

15 Application Serial No. 403,970, filed August 2, 1982, assigned to the same assignee as the present application, discloses a new silicone rubber drive belt. The stiffness qualities associated with the drive belt of the prior art were disclosed, due to certain new
20 characteristics thereof described in application serial No. 403,970. This resulted in the new silicone rubber belt. Use of the new silicone rubber drive belt in the processor assembly improved significantly the operating life thereof, but the problems associated with the
25 processor assembly of the prior art still to some extent remained.

We have found that a further improvement is achieved by using a non-elastic drive belt in the processor assembly. Furthermore, use of a non-elastic
30 drive belt in the processor assembly renders desirable a further modification to the processor assembly in order to accommodate a new non-elastic drive belt. If

the processor assembly is further modified to accomodate the new non-elastic drive belt, a further improvement in the operating life and in the operating efficiency thereof is evidenced.

5

It is therefore a primary object of the present invention to further improve the operating life and the operating efficiency of the processor assembly
10 associated with the thermal development apparatus of the prior art by utilizing a non-elastic drive belt and by modifying the processor assembly to accomodate the non-elastic drive belt used thereby.

15 This and other objects of the present invention are accomplished by utilizing a non-elastic drive belt and by modifying the processor assembly to accomodate the non-elastic drive belt. The processor assembly is modified by spring loading a platen of the processor
20 assembly against the photographic medium disposed therein or against the non-elastic drive belt of said processor assembly if no photographic medium is disposed therein. The spring loaded platen forcedly urges the photographic medium to contact the non-elastic
25 drive belt. In addition, a first drive roller is knurled at an outer circumferential surface thereof, the knurled outer circumferential surface being adapted to contact an inner surface of said non-elastic drive belt. The knurled outer surface of said
30 first drive roller grips the non-elastic drive belt and drives the non-elastic drive belt in a desired direction. A second drive roller is not knurled at an outer surface thereof, since this drive roller is disposed at a receiving end of said processor assembly
35 for receiving the drive belt and the photographic medium passing therethrough.

Further scope of applicability of the present invention will become apparent from the description given hereinafter. However, it should be understood that the details of the description and the specific
5 examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from the detailed descrip-
10 tion.

Brief Description of the Drawings

A full understanding of the present invention will be obtained from the detailed description given
15 hereinbelow and the accompanying drawings, which are given by way of illustration only, and thus are not limitative of the present invention, and wherein:

FIG. 1 illustrates an apparatus for producing a
20 hard copy reproduction of an image displayed on a fiberoptic CRT, the apparatus including a processor assembly having a drive belt disposed therein.

FIG. 2 illustrates a processor assembly according
25 to the present invention for producing a hard-copy reproduction of an image displayed on a fiberoptic CRT, the processor assembly utilizing a non-elastic drive belt and being modified to accomodate the non-elastic drive belt.

30

Description of the Preferred Embodiment

FIG. 1 illustrates one apparatus for producing a hard copy reproduction of an image displayed on a fiberoptic CRT. In FIG. 1, the apparatus 10 includes a
35 storage canister 10A for storing the photographic medium therein, such as photographic paper 10A1. When the photographic paper is removed from the canister

10A, it is disposed in contact with and adjacent to a first idler roller 10B. The photographic paper 10A1 contacts the first idler roller 10B and moves circumferentially therewith. The photographic paper 10A1 is then disposed between and in contact with a foam pressure roller 10C and an outer faceplate of a fiber-optic CRT 10D. As the photographic paper 10A1 moves across the outer faceplate of the fiber-optic CRT, the image displayed on the CRT is transferred to the photographic paper 10A1. The paper 10A1 is then disposed between a pinch roller 10E and a first drive roller 10F. The driver roller 10F aids in driving the belt in a direction transverse to the longitudinal axis of the fiber-optic CRT 10D. The paper 10A1 then moves in said direction beyond a paper cutter stationary blade 10G and a paper cutter rotary blade 10H. The photographic paper then moves into the processor assembly 10I. The processor assembly 10I includes a heater platen C, two drive rollers D and E, a second idler roller F, and the drive belt A (processor belt) extending between the second idler roller F, the drive roller E, on one end, and the drive roller D on the other end. The photographic paper 10A1 is disposed between the drive belt A and the heater platen C, the drive belt A driving the photographic paper in said direction indicated by arrow 10I1 transverse to the longitudinal axis of the fiber-optic CRT 10D. The photographic paper 10A1 then contacts a processor rear paper guide 10J which guides the photographic paper 10A1 into a position intermediate two belts 10K1 and 10K2 of conveyor 10K. The drive rollers D and E, in addition to the drive roller 10F, drive the photographic paper 10A1 from its storage canister 10A, past the fiber-optic CRT 10D, through the processor 10I, and to the conveyor 10K, which moves the paper 10A1 to the front panel 10L, where it exits from the apparatus.

However, the operating life and the reliability of the apparatus shown in FIG. 1 has been severely reduced due to certain undesirable characteristics associated with the drive belt A. The belt A would stretch and elongate, thereby reducing the tension of the belt between the drive rollers D and E. In addition, the belt would soften, swell, and become very sticky. The belt A stretches due to an inherent lack of stiffness qualities associated therewith. The belt becomes soft, swells, and becomes sticky as a result of a chemical exudate exuded from the photographic paper 10A1 when the paper contacts the drive belt A. For example, the photographic paper 10A exudes stearic acid and water, major constituents of the chemical exudate referred to hereinabove. The stearic acid and water exudate is responsible for the softness qualities and the stickiness qualities associated with a surface of the belt which contacts the photographic paper and the heater platen. These disadvantages associated with the drive belt A of the prior art have been eliminated by using a new non-elastic drive belt. Use of the non-elastic drive belt in the processor assembly of the apparatus of figure 1 renders necessary a modification to said processor assembly.

25

The new, non-elastic drive belt, utilized as the drive belt in the processor assembly of the apparatus of figure 1, comprises a woven, endless, Nomex fiber within a non-marking silicone rubber saturant stock. The inside of said non-elastic belt comprises a fine-fabric impression on a silicone rubber saturant. The outside of said non-elastic belt, the side which faces the heater platen C, is ground thereby exposing the fabric. As a result, a reduced frictional contact between the side of said non-elastic belt, which faces the heater platen C, and the heater platen C per se, will result. The preferred dimensions of the non-elas-

30
35

tic drive belt are: length - 26" $\pm$.125 " @ 10 lbs
tension with maximum variation of $\pm$.032" edge to edge
within any one belt; width - 8.875" $\pm$.032"; thickness
- .021" $\pm$.004" with maximum variation of .004" within
5 any one belt.

A non-elastic drive belt, sufficient to perform
the function of the non-elastic drive belt referred to
hereinabove, may be purchased from ALBANY Interna-
10 tional, Precision Components Division, 150 Industrial
Park Rd., Middletown Connecticut. The non-elastic
drive belt may be identified by part number 214-3455-
00, or, alternatively, by ALBANY part number E-1505-HG.

15 Referring to FIG. 2, an apparatus 20 for produc-
ing a hard-copy reproduction of an image, according to
the present invention, is illustrated, the apparatus
utilizing the non-elastic drive belt described herein-
above. In FIG. 2, the apparatus 20 includes a first
20 drive roller 20A, a second drive roller 20B and two
idler rollers 20C and 20D. A non-elastic drive belt
20E, of the type described hereinabove, is disposed
tightly around the drive rollers 20A and 20B and the
idler rollers 20C and 20D.

25 A heater platen 20F is disposed in contact with
the non-elastic drive belt 20E. A spring 20G urges the
platen 20F into tight contact with the non-elastic
drive belt 20E.

30 An outer circumferential surface of the first
drive roller 20A is disposed in contact with the non-
elastic drive belt 20E. The outer circumferential sur-
face of drive roller 20A is knurled in order to pro-
35 vide an increased frictional contact between drive
roller 20A and the non-elastic drive belt 20E.

An outer circumferential surface of the second drive roller 20B is smooth. When belt 20E contacts the outer surface of the second drive roller 20B, the belt 20E, of the type described hereinabove, is allowed to slip on the smooth outer surface thereof.

In operation, since a non-elastic drive belt 20E is being utilized in the processor assembly 20 of FIG. 2, it is necessary to provide an alternative method of placing drive belt 20E, adjacent the heater platen 20F, under tension. In addition, it is necessary to provide an alternative method of driving the drive belt 20E.

In the prior art, when an elastic drive belt was utilized, the stretched belt was tightly wrapped around the drive rollers and in contact with one surface of the heater platen. The tight contact between the belt and the drive roller permitted the drive roller to rotatably drive the drive belt through the processor assembly. Due to the tension of the belt, the stretched belt also contacted substantially the entire surface of the heater platen. However, excessive stretching and elongation of the belt resulted in performance problems associated with the processor assembly and resulted in a shorter operating life as a result thereof.

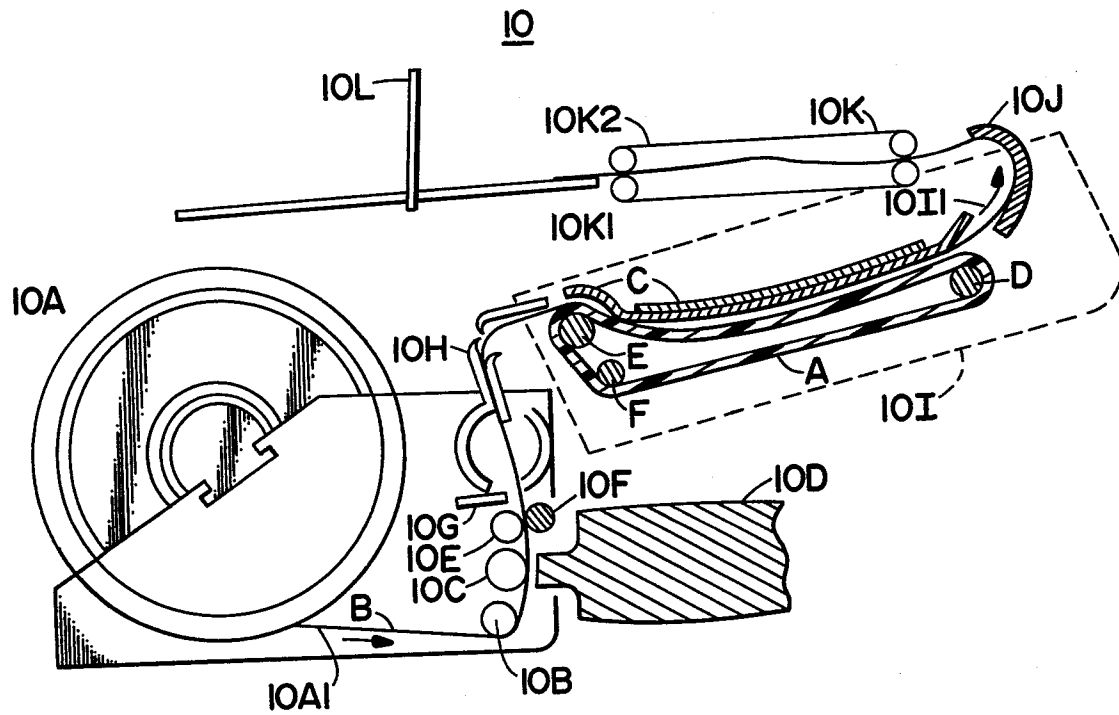
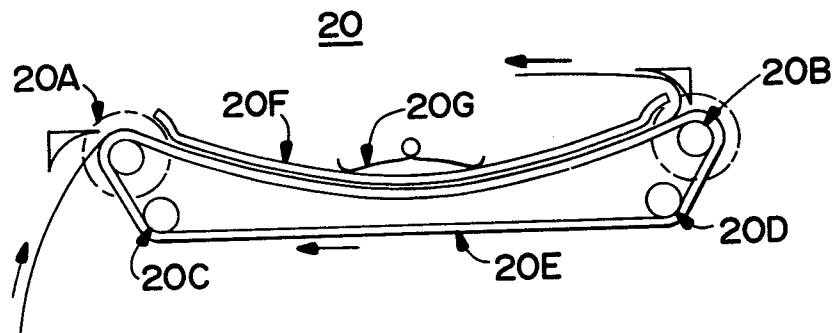
If the elastic belt disposed within the processor assembly is replaced by a non-elastic belt, the problem involving excessive stretching of the drive belt, referred to hereinabove, is solved. However, the processor assembly itself should be modified to accommodate the non-elastic belt. The modification of the processor assembly should inherently involve the two alternatives indicated hereinabove, that is, the alternative method of placing drive belt 20E under tension, and the alternative method of driving the drive belt 20E.

Accordingly, the spring 20G urges the heater platen 20F into tight contact with the drive belt 20E. As a result, the drive belt 20E is placed under tension. However, since the belt 20E is non-elastic, it is necessary to provide the alternative method of driving the drive belt 20E. Consequently, the first drive roller 20A is knurled at the outer circumferential surface thereof. The knurled outer surface causes an increased frictional contact to exist between drive roller 20A and drive belt 20E. Furthermore, the surface of belt 20E, contacting the heater platen 20F, is ground, thereby exposing the internal fabric. Therefore, a reduced frictional contact exists between the side of the non-elastic belt which contacts the heater platen, and said heater platen. As a result of the combined effect of (1) the increased frictional contact between drive roller 20A and non-elastic drive belt 20E, and (2) the reduced frictional contact between the surface of said belt 20E in contact with the heater platen and said heater platen, the drive roller 20A more easily drives said belt 20E through the processor assembly and, in particular, past the heater platen 20F.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the invention and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

CLAIMS:

1. A drive apparatus for use in a hard copy reproduction apparatus for driving an image receiving
5 medium therethrough, comprising:
 drive means for providing driving energy;
 a non-elastic drive belt means rotatably driven
by said drive means for forcedly driving said image
receiving medium through said drive apparatus;
10 heater means in contact with one surface of said
drive belt means when said image receiving medium is
not disposed within said drive apparatus and in contact
with said image receiving medium when said medium
is disposed within said drive apparatus; and
15 means for forcedly urging said heater means toward
said one surface of said non-elastic drive belt
means and in tight contact therewith when said image
receiving medium is not disposed within said drive
apparatus and toward said image receiving medium when
20 said medium is disposed within said drive apparatus.
2. A drive apparatus in accordance with claim 1
wherein said drive means comprises drive roller means,
the outer circumferential surface of said drive roller
25 means being knurled for increasing the frictional contact
between said drive roller means and said non-elastic
drive belt means.

FIG. 1.FIG. 2.



European Patent
Office

EUROPEAN SEARCH REPORT

0117620

Application number

EP 84 30 0420

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
A	ELECTRO-OPTICAL SYSTEMS DESIGN, vol. 12, no. 7, July 1980, pages 37-44, Milton S. Kivez Publications, Chicago, US J. ERIKSEN: "Making a hard copy from a raster scan monitor" * Page 41, paragraph 2; figure 2 *	1	G 03 D 13/00
A	FR-A-2 291 865 (MANNINO UGO) * Page 4, lines 14-22; figure 2 *	1	
A	FR-A- 976 363 (B.F. GOODRICH CY.) * Page 1, column 1, lines 20-26 *	1	
A	US-A-3 749 491 (MAXFIELD et al.) * Column 4, lines 19-23 *	1	
A	GB-A- 919 125 (OZALID CY.) * Page 3, lines 23-29; figure 2 *	2	
A	US-A-3 294 003 (BELL & HOWELL CY.) * Column 3, lines 3-9 *	2	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11-05-1984	Examiner CIGOJ P.M.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			