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(54) **Improved silicone rubber drive belt and an apparatus for thermal development of a photographic medium using said drive belt.**

(57) A drive belt for use in a processor assembly for a hard copy reproduction apparatus is disclosed. The first section is a layer of cured silicone rubber impregnated with 26 parts by weight or greater of a filler element, such as carbon black for providing said belt with a stiffness characteristic thereby reducing its propensity to stretch and reducing its capacity to absorb a chemical exudate exuded from a photographic paper medium disposed adjacent a heater platen within said hardcopy reproduction apparatus. The drive belt also includes a second section, the second section, the second section being a hard coating, such as a silicone coating disposed over the first section for lowering the friction between the drive belt and said photographic paper medium, or between the drive belt and said heater platen. In an alternative embodiment, to further improve the performance of the drive belt, a third section is disposed over the second section, the third section being a lubricating film disposed over the hard coating for further reducing the friction developed between the drive belt and the photographic medium or between the drive belt and the heater platen.

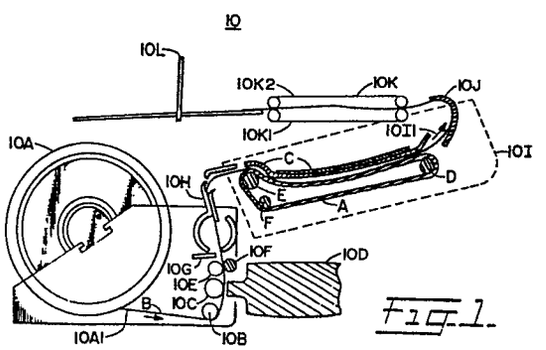

Fig. 1.

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IMPROVED SILICONE RUBBER DRIVE BELT AND AN APPARATUS FOR THERMAL DEVELOPMENT OF A PHOTOGRAPHIC MEDIUM USING SAID DRIVE BELT

Background of the Invention

Field of the Invention

The subject matter of the present invention pertains to an improved silicone rubber drive belt for use in an apparatus for thermal development of a photographic medium using said drive belt.

Description of the Prior Art

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 to produce said hard copy reproduction through thermal development of a special photographic medium. A processor assembly drives 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 the outer faceplate of the fiber-optic CRT, the line of image information on said fiber-optic CRT is transferred to the photographic medium adjacent thereto. Eventually, as said processor assembly drives said photographic medium in the direction transverse to the longitudinal axis of the fiber-optic CRT, each line of image information displayed on the fiber-optic CRT is transferred to the photographic medium.

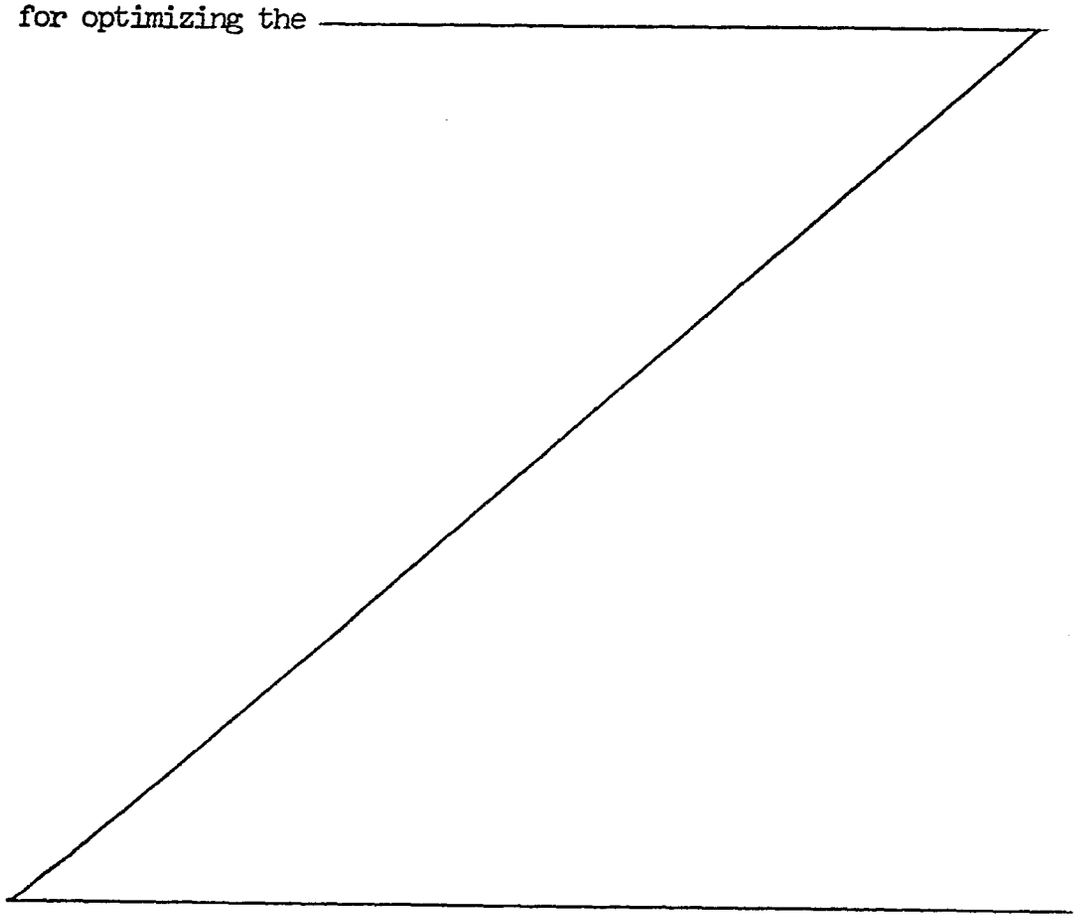
The processor assembly includes a drive belt stretched to extend between two drive rollers and an idler roller. One surface of the drive belt faces one surface of a heater platen. Disposed between the drive belt and the heater platen is the photographic medium, the drive belt moving the photographic medium in the direction transverse to the longitudinal axis of the fiber-optic CRT.

The known processor assembly experiences a very short operating life, due to elongation 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.

Summary of the Invention

It is a primary object of the present invention to eliminate the deficiencies associated with the drive belt of the prior art contained within the processor assembly thereby improving the reliability and the performance of the drive belt and therefore the processor assembly.

The object of the present invention is accomplished by impregnating the drive belt with a filler element, such as carbon black for optimizing the



belt's resistance to stretching, swelling, and softening without producing undesirable side effects, and by disposing on one side of said drive belt, adjacent to the heater platen, a hard coating, or a lubricating film, or both for reducing the friction between the drive belt and the heater platen or between the drive belt and the photographic medium.

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 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 description.

Brief Description of the Drawings

A full understanding of the present invention will be obtained from the detailed description given 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 hard copy reproduction of an image displayed on a fiber-optic CRT, the apparatus including the processor assembly having the drive belt disposed therein.

FIG. 2 illustrates in cross section the drive belt according to the present invention, as illustrated in FIG. 1.

FIG. 3 illustrates in cross section another embodiment of the drive belt according to the present invention, as illustrated in FIG. 1.

Description of the Preferred Embodiment

FIG. 1 illustrates one apparatus for producing a hard copy reproduction of an image displayed on a fiber-optic CRT. In FIG. 1, the apparatus 10 includes a 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 moves in contact the first idler roller 10B. Following the first idler roller, the photographic paper 10A1 is disposed between and in contact with a foam pressure roller 10C and the outer faceplate of the 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 the 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) stretched to extend 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 comes into contact with a processor rear paper guide 10J which guides the photographic paper 10A1 into a position disposed between the 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, to the conveyor 10K which moves it 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 processor 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 is sticky as a result of a chemical exudate exuded from the photographic paper 10A1 when the paper comes into contact with 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 produces the softness qualities of the belt and also produces the stickiness qualities associated with the 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 virtue of a new drive belt, the qualities and characteristics of the new drive belt being described in the paragraphs hereinbelow.

Referring to FIG. 2, the new drive belt A according to the present invention is illustrated. In FIG. 2, the drive belt A comprises a first section A1, the first section being a cured silicone rubber layer impregnated with 26-32 parts by weight of a filler element, such as carbon black. The filler element must be resistant to the chemical exudate (stearic acid and water) exuded from the photographic paper 10A1 and it must produce a stiffness or hardness quality in the cured silicone rub-

ber layer. In addition, the filler element must be electrically conductive. As a result of the impregnation of the first section A1 (the cured silicone rubber) by the filler element, the new drive belt A exhibits a stiffness characteristic. The hardness of the cured silicone rubber layer constituting section A1 is increased (relative to the prior art drive belt) to 60 points shore A or greater as a result of said impregnation. This reduces the propensity of the drive belt A to stretch. As a result of said impregnation, the capacity of the belt to absorb the chemical exudate exuded from the photographic paper 10A1 is reduced. This reduces the propensity of the belt to soften and swell. The new drive belt A further comprises a second section A2, the second section being a hard coating disposed in contact with the first section A1. The hard coating must have a characteristic whereby the friction between the new belt A and the heater platen C or between the new belt A and the photographic paper 10A1 is reduced. This reduction in friction reduces the probability that the drive belt A will stick to the heater platen C and reduces the power required to drive the drive belt A via the drive rollers D and E. As a result, the image quality of the image transferred to the photographic paper 10A1, by the fiber-optic CRT 10D, is improved. One example of a hard coating which may be used for section A2 shown in FIG. 2 is Dow Corning 1-2577 conformal silicone coating. The hard coating comprising the second section A2 of the new belt A should be approximately 1/2 to 1 mil in thickness.

Referring to FIG. 3, an alternative embodiment of the new drive belt A according to the present invention is illustrated. In FIG. 3, the new drive belt A comprises the first section A1, the second section A2 disposed over said first section, the first and second sections A1 and A2 of the new drive belt A being described in the paragraphs hereinabove with reference to FIG. 2 of the drawings. However, in addition to the first and

second sections A1 and A2, a third section A3 is disposed over and is in contact with said second section A2, the third section A3 being a lubricating film for still further lowering the friction between the drive belt A and the heater platen C or between the drive belt A and the photographic paper medium 10A1. Molybdenum disulphide powder is one example of the lubricating film which may be used as the third section A3.

If desired, either the hard coating characterized by the second section A2 or the lubricating film characterized by the third section A3 may be disposed over the first section A1. Alternatively, the second and third sections A2 and A3 may be used together as two separate layers, or mixed together as one layer, and disposed over and in contact with the first section A1. The choice of the use of either section A2, or section A3, or both sections A2 and A3 to be disposed over the first section A1 depends upon the frictional characteristics of the drive belt path.

It should be emphasized that the new drive belt A of the present invention may comprise the first section A1 in combination with the second section A2 or the combination of the first and second sections A1 and A2, further in combination with the third section A3. In the former combination (the first and second sections A1 and A2), the operating life of the processor assembly 10I associated with the apparatus shown in FIG. 1 is greatly increased. However, in order to further increase the operating life of the processor assembly 10I, relative to the former combination, the latter combination (the combined sections A1, A2, and A3) must be utilized. Consistent test results are achieved in demonstrating this greater operating life when the latter combination comprises the new drive belt A.

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 ———————— 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 belt having a stiffness characteristic and a stickiness chracteristic associated therewith, comprising:

a rubber layer (A1), said rubber layer including a filler element means impregnated therein for increasing the stiffness characteristic associated with said rubber layer; and

a coating means (A2) disposed over said rubber layer for reducing the stickiness characteristics associated with one surface of said rubber layer.

2. The belt of claim 1 further comprising a lubricating film means (A3) disposed over said coating means (A2) for further reducing the stickiness characteristic associated with said one surface of said rubber layer.

3. The belt of claim 1 or 2 wherein said filler element impregnated in said rubber layer comprises twenty-six parts by weight or greater of carbon black.

4. The belt of any preceding claim wherein said coating means comprises a silicone coating, said silicone coating being approximately 1/2 to 1-mil in thickness.

5. The belt of claim 2 or claims 3 or 4 when appended to claim 2 wherein said lubricating film means comprises a molybdenum disulphide powder.

6. A drive apparatus for use in a hardcopy reproduction apparatus for driving an image receiving medium (10A1) therethrough, comprising:

drive means (10F) for providing driving energy;

a drive belt (A) rotatably driven by said drive means (10F) for forcibly driving said image receiving medium (10A1) through said drive apparatus, characterized in that said drive belt (A) has a stiffness characteristic and a stickiness characteristic associated therewith, said drive belt further including,

a rubber layer (A1), said rubber layer including a filler element means impregnated therein for increasing the stiffness characteristic associated with said drive belt, and

coating means (A2) disposed over at least one surface of said rubber layer for reducing the stickiness characteristic associated with said drive belt.

7. The drive apparatus of claim 6 further comprising a lubricating film means (A3) disposed over said coating means (A2) for further reducing the stickiness characteristic associated with said

drive belt.

8. The drive apparatus of claim 6 or 7 wherein said filler element impregnated in said rubber layer comprises 26 parts by weight or greater of carbon black.

9. The drive apparatus of claim 6, 7 or 8 wherein said coating means (A2) comprises a silicone coating, said silicone coating being approximately 1/2 to 1-mil in thickness.

10. The drive apparatus of claim 7 or claims 8 or 9 when appended to claim 7 wherein said lubricating film means comprises a molybdenum disulphide powder.

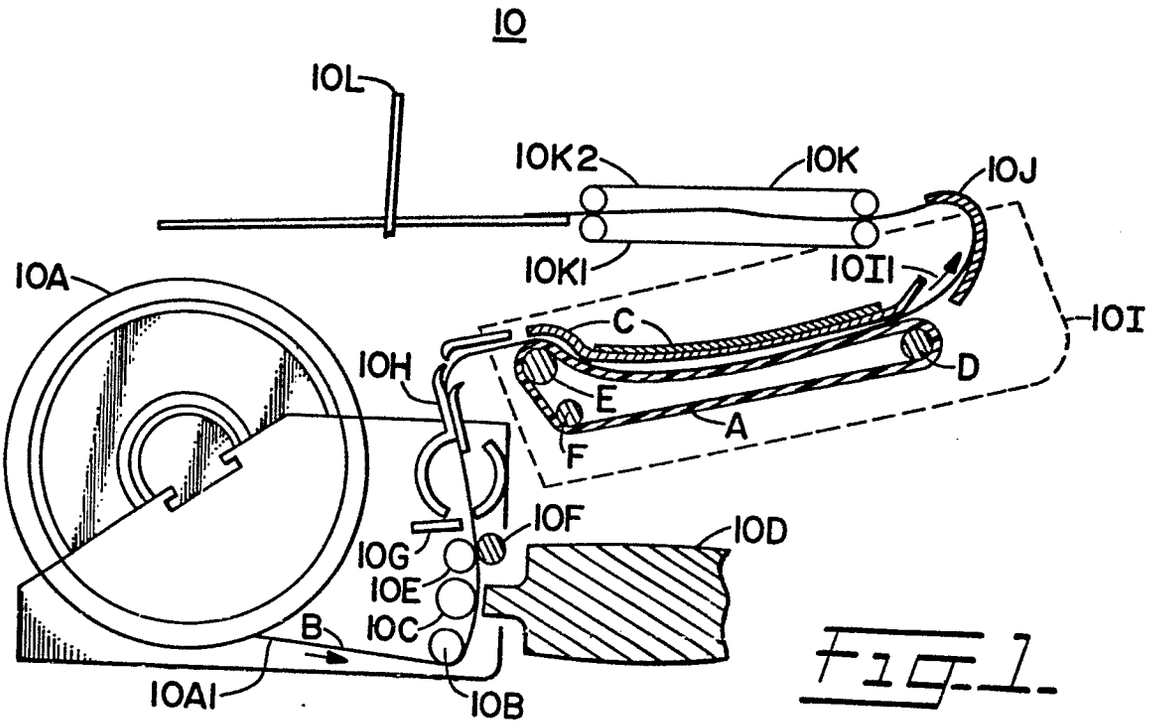


Fig 1

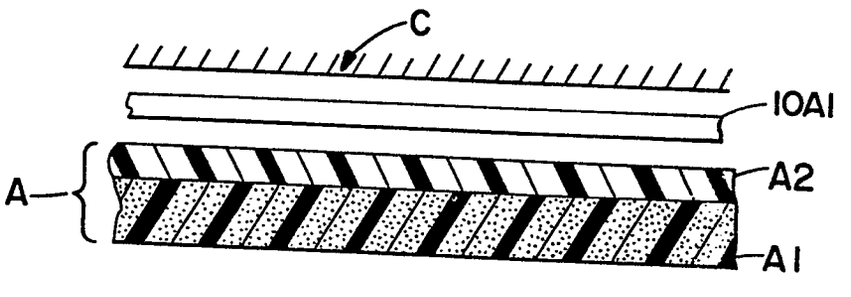


Fig 2

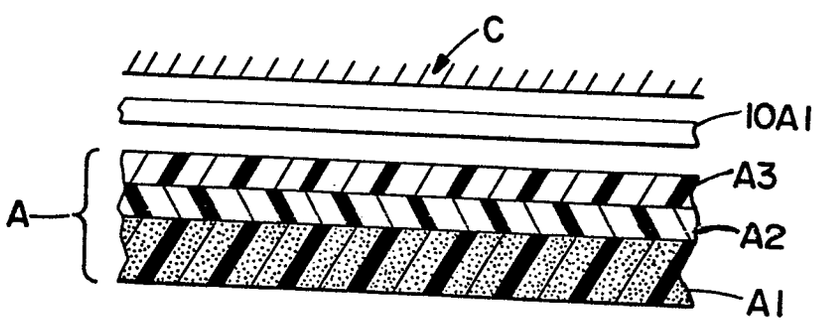


Fig 3