July 21, 1959 E. D. GERN 2,895,395

CONVEYOR DEVICE FOR PHOTO-PRINTING MATERIAL IN PHOTO-PRINTING MACHINES

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Fig. 1.

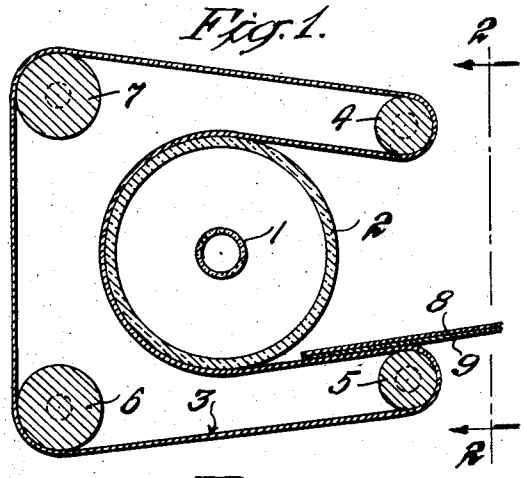


Fig. 2.

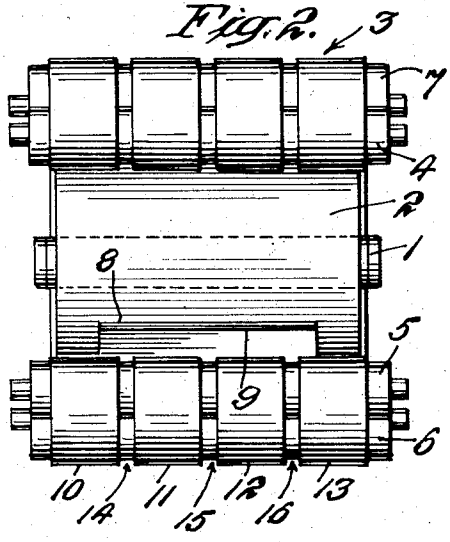


Fig. 3.

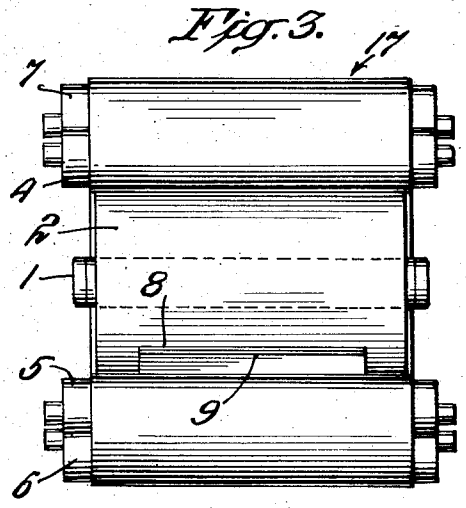


Fig. 4.

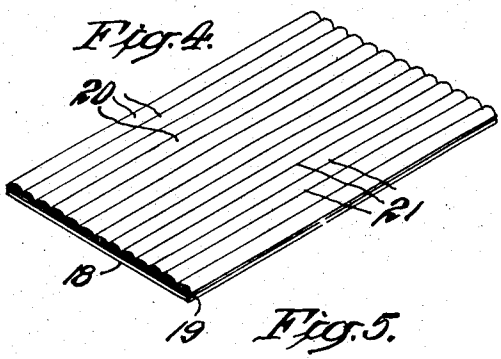


Fig. 5.

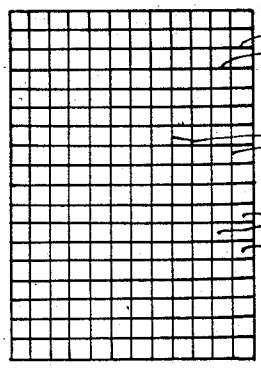
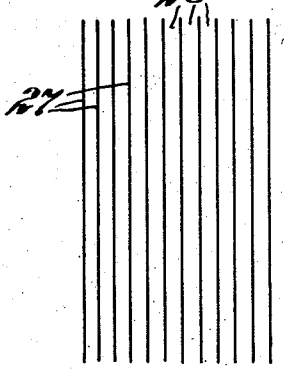


Fig. 6.



Fig. 7.



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CONVEYOR DEVICE FOR PHOTO-PRINTING MATERIAL IN PHOTO-PRINTING MACHINES

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3 Claims. (Cl. 95—77.5)

The present invention deals with a conveyor contact belt and, more particularly, with an endless conveyor belt for photo-printing machines.

In photo-printing machines designed for the exposure of engineering reproduction materials, such as positive working diazo type papers, both dry and moist developing, the material to be exposed is positioned, together with the drawing to be copied, on a moving endless belt or a plurality of belts and fed over a rotatable or rotating glass cylinder or a convex cylindrical surface of a transparent glass sheet or semi-tubular member, or the like. Exposure is effected by means of a light source positioned therein. The endless belt or belts move over a series of rollers and convey the tracing and light-sensitive material over the cylindrical surface. During exposure, the belt or belts hold the printing material in contact with the cylindrical transparent surface while passing thereover.

Usually, in connection with the above mentioned rotating cylinder, a plurality of narrow individual conveyor belts are arranged in parallel relation to assure uniformity in pressing the printing material against the cylindrical surface. However, the use of such parallel individual belts leaves an unavoidable spacing therebetween, e.g. a minimum spacing of about 1 mm. whereby the light-sensitive printing material is rendered unprotected along such spacing. It has been observed that such spacing is reflected in the finished photo-prints and results in a noticeable pattern, such as if exposed to more intense light than the rest of the photo-sensitive material. In combustion printing and developing machines where the developer is synchronized to operate at the speed of the printing section, which operates at variable speed, frequently automatic separation of the tracing and the light-sensitive material following the exposure phase is provided for. This is accomplished by vacuum requiring that the belts be perforated. These perforations also appear in the belt pattern. Hitherto, the above phenomenon has been ascribed to difference in the reflection of light caused by said spacing, and/or perforations. However, it has been now determined that the said belt marks result from the difference in the temperatures of the light-sensitive paper at the location of the belt spacing, and/or perforations, and the areas of paper covering the belts, said differences in temperature being occasioned by the better heat conductivity of belts than that of the spacing between the belts and/or the perforations. As a result, the light-sensitive paper at the location of the spacing or holes reaches a higher temperature than the belt-backed areas of the paper. The photo-chemical reaction effected by a light source is accelerated by the increase in temperature, whereby the areas of higher temperature result in belt marks on the finished photo-print. More particularly, the "belt pattern" phenomenon is due to temperature differences between areas of the contact glass covered by the belt surface and areas not covered, i.e. interstices and perforations. As the diazo type material sensitivity to light varies substantially with the temperature during exposure, "cooled" areas, i.e. areas covered by the belt surface, bleach out more slowly than "hot" areas, i.e. interstices and perforations. This undesirable condition is encountered periodically and depends on several variable conditions, including humidity of the sensitized paper, speed of operation (depending upon transparency of the original, opacity of design and sensitivity of the paper), ambient temperature of the room and surface temperature of the contact glass surface.

It is an object of this invention to provide an endless conveyor belt for photo-printing machines which eliminates the belt marks heretofore visible from time to time on finished photo-prints. It is another object of this invention to provide an endless conveyor belt which is adapted to provide a substantially uniform temperature condition along the entire width of the conveyor belt in photo-printing machines. Other objects and advantages will be apparent from the following description and drawings forming a part hereof, in which:

Figure 1 is a cross-sectional and schematic view of a conventional photo-printing conveyor belt and associated members,

Fig. 2 is a front view of Figure 1 along the lines 2—2,

Figure 3 is a view similar to Figure 2, but incorporating a wide conveyor belt,

Figure 4 is a perspective view of a portion of a conveyor belt according to this invention,

Figure 5 is a top plan view of a modification of the conveyor belt,

Figure 6 is a cross-sectional view of another modification of the invention, and

Figure 7 is a plan view of still another modification of this invention.

According to the invention, the conveyor belt employed in photo-printing machines is structurally adapted to eliminate the occurrence of belt marks in finished photo-prints by providing a substantially uniform temperature condition along the entire width of the conveyor belt.

Figures 1 and 2 illustrate a conventional photo printing conveyor system and associated members, including a source of light **1** within a transparent cylinder **2**. An endless belt system **3** is moved over rollers **4**, **5**, **6**, and **7**, at least one of which may be driven by a driving means. The rollers are arranged to permit the belt system **3** to engage the convex surface of the cylinder **2**, which, for example, is mounted for rotation about the light source **1**. A master sheet **8**, such as a drawing, printed sheet, and so forth, is superposed on a photo-sensitized sheet **9**, and both are fed partly around the convex cylindrical surface of cylinder **2** for exposure to the said light source, said belt system pressing the sheets **8** and **9** against the convex surface during passage thereover.

The belt system is composed of a plurality of parallel belts **10**, **11**, **12**, and **13**, with spacings **14**, **15**, and **16** therebetween.

While a conventional conveyor system is capable of adequately moving the photo-printing material, the said spacings **14**, **15**, and **16** are deleterious in that they result in the occurrence of belt marks on the finished photo-prints as aforesaid.

Figure 3 shows a modified form of the conveyor system in that the conveyor system comprises a single wide belt **17** with the cooperating members of the conveyor system being substantially similar to those illustrated by common numerical designation in Figures 1 and 2. In such modification, the wide belt, while tending to stabilize the temperature along the width of the conveyor system, whereby the pattern problem is not encountered except when the wide belts are perforated as described above, the belt conducts heat from the printing material whereby the wide belt runs warmer than the narrow belts and the

paper between the glass and the belt runs at a decreased temperature effecting decreased photo-chemical printing reaction. This condition, of course, depends entirely on the design of the machine.

In operation, and according to the invention, the unsensitized side of the printing paper is positioned on an endless belt structurally adapted to provide a minimum contact surface against said paper by means of spaced ridges or raised members on the contact surface of the belts, said ridges and the like offering reduced contact area whereby the paper is virtually insulated by air over its entire contact surface. In this manner, the heat conductivity of the belts is practically no greater than the spacing between the individual belts hereinbefore described. Therefore, a single wide conveyor belt may be employed or a plurality of spaced parallel individual belts may be employed since the heat conductivity is substantially uniform over the width of the conveyor system.

The conveyor belt as one form of the invention consists of pile fabric, such as corduroy, which is illustrated by Figure 4, and which may comprise, for example, a base 18, a pile fabric layer, and a cement layer 19 therebetween, said pile fabric being cut to provide a surface of longitudinal parallel-spaced ribs or ridges 20 separated by longitudinal grooves 21. Alternatively, the belt may consist of ungrooved pile fabric 22, such as velveteen, as illustrated by Figure 6, showing the erect threads 23.

Operatively, the belts are mounted on the above described rollers, with the pile side of the belts facing the light source 1. The unsensitized surface of the paper 9 is positioned on the ribs or ridges 20 or threads 23, whereby the paper surface contacting the upper surface of the belt is effectively insulated against heat conduction by means of the air gaps or spaces afforded by the grooves 21 or equivalent spaces between the erect threads 23. The ribs 20 and threads 23 are present in sufficient number to support the printing material and exert sufficient pressure to press the paper 9 against the master 8 and the master against the cylindrical surface of cylinder 2. The air spaces of the pile fabric described insulates against transfer of heat from the printing material to the belt per se, and prevents undesirable heating of the belt. Due to said insulation, the rediated heat from the light source raises the temperature of the printing material uniformly across the entire width of the conveyor system which contacts the cylindrical surface of cylinder 2. The effected increase in temperature of the printing material contacting the belts of this invention is equal to the temperature of the printing material overlying the spaces between adjacent belts due to the above-described insulation. The uniform temperature increase across the printing material accelerates the photo-chemical reaction of the light-sensitive material, whereby photo-printing can be run at increased speed in comparison with the permissible printing speed with conventional belt materials on the same machine.

While Figure 6 shows a smooth pile fabric material, e.g. velveteen, and Figure 4 shows a ribbed pile fabric, e.g. corduroy, it is herein intended that pile fabrics of waffle pattern and other design are also contemplated.

Instead of using pile fabrics, wire mesh or net fabric, as illustrated by Figure 5, may be employed as a belt or belts, such as illustrated by Figure 2 or 3. The wire mesh or net fabric comprises warp strands 24 and weft strands 25, with spacings 26 therebetween. In the case of the wire mesh, the belt contacts the unsensitized side of the sensitized printing material and affords limited contact

with the printing material in comparison with the overall belt surface area. In spite of the conductivity of the wire mesh, heat conduction from the printing material is not disadvantageous, due to the poor heat conduction of the paper printing material and the very small heat conductivity by the wire is not limited to the points of contact with the paper, because the heat is conducted from the paper uniformly and precludes the occurrence of the aforementioned belt marks. The photo-printing material is effectively insulated by air in the spaces 26.

Another modification of the conveyor belt is shown by Figure 7, which illustrates a plurality of parallel fibrous strands 27 laterally spaced from each other as at 28 and which are arranged on the above-described rollers in endless lengths and spaced from each other by means of laterally spaced grooves or radial rings on the said rollers. The strands afford the printing material only narrow support surfaces and are relatively poor heat conductors. As a result, the photo-printing material is uniformly air-insulated against heat conductivity over the entire surface of the belt system.

While several modifications of this invention have been illustrated, it is intended that equivalent belt structure not illustrated is also contemplated within the scope of the appended claims.

What I claim is:

1. Photo-printing apparatus comprising a light source, a conveyor means, a transparent member having a cylindrical surface, the transparent member being positioned between the light source and the conveyor means, the conveyor means being an endless belt, a plurality of spaced contact surfaces on one side of the belt and distributed across the entire width thereof, heat insulation means between said contact surfaces, said heat insulation means being longitudinal grooves and said contact surfaces being longitudinal ribs, said grooves and ribs being the surface of a pile fabric, said contact surfaces contacting said cylindrical surface whereby the heat transfer from said light source to said belt is uniformly distributed across the width of said belt.

2. Photo-printing apparatus comprising a light source, a conveyor means, a transparent member having a cylindrical surface, the transparent member being positioned between the light source and the conveyor means, the conveyor means being a system of endless parallel belts laterally spaced from each other, a plurality of spaced contact surfaces on one side of each of said belts and distributed across the width thereof, heat insulation means between said contact surfaces, said heat insulation means being longitudinal grooves and said contact surfaces being longitudinal ribs, said grooves and ribs being the surface of a pile fabric, said contact surfaces of each of said belts contacting said cylindrical surface, whereby the heat transfer from said light source to said belt system is uniformly distributed across the width of the belt system.

3. Photo-printing apparatus according to claim 2, wherein said pile fabric comprises a corduroy surface.

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