Dec. 22, 1964 J. P. KNIGHT 3,162,290

INK TRANSFER

Filed June 29, 1961 2 Sheets-Sheet 1

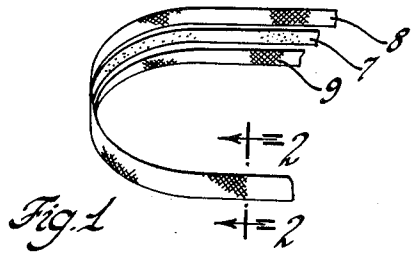

Fig. 1



Fig. 2

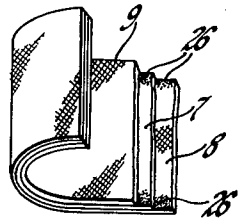

Fig. 3

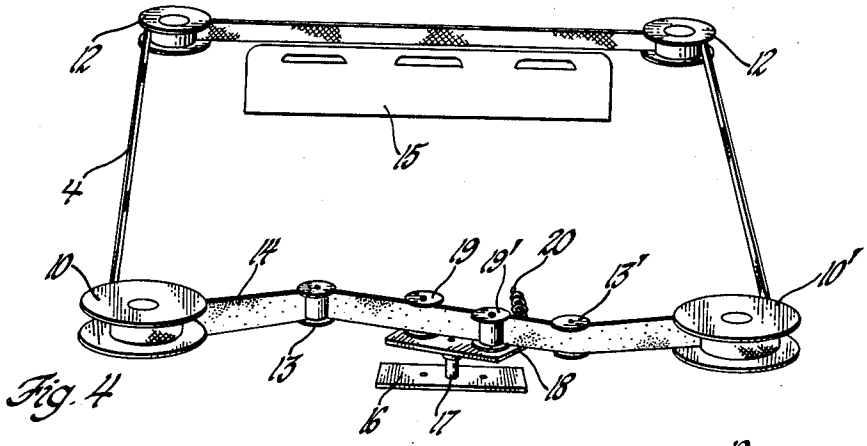

Fig. 4

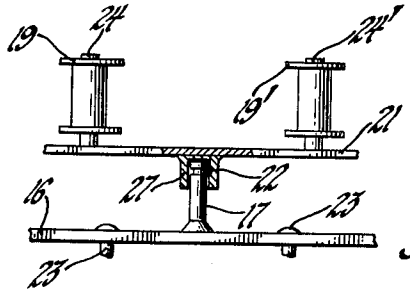

Fig. 5

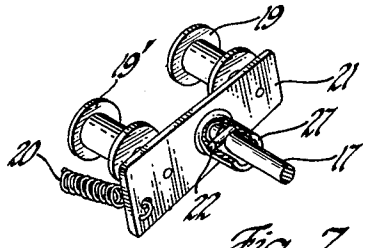

Fig. 7

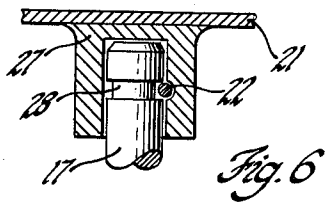

Fig. 6

INVENTOR.
John P. Knight
BY Shanley & O'Neil
ATTORNEY

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INK TRANSFER

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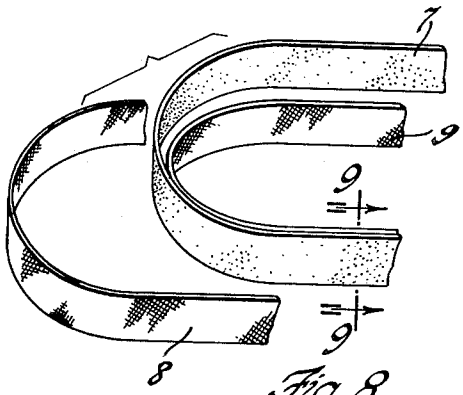

Fig. 8

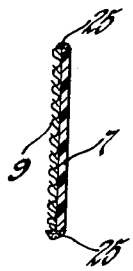

Fig. 9

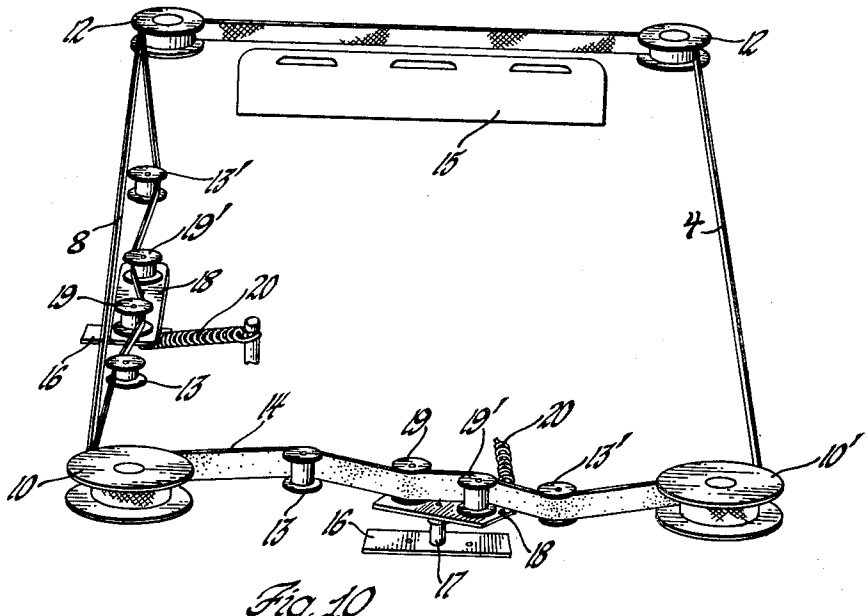

Fig. 10

INVENTOR.
John P. Knight
BY Shanley & O'Neil
ATTORNEY

United States Patent Office

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INK TRANSFER

John P. Knight, P.O. Box 364, Detroit, Mich.

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9 Claims. (Cl. 197—151)

The present invention relates to ink transfer, more particularly by ink-permeable transfer members in the environment of printing machines such as typewriters and tabulators and the like, in which at least one type element exerts pressure on an ink-permeable transfer member such as a ribbon to transfer the impression of the type element from the ribbon to a surface that receives the printing.

The mechanism of the transfer of the ink from the ribbon to the surface to be printed, such as a paper surface, is that the ink is squeezed out of the ribbon by the raised contour of the type element such as a type pallet or type bar or embossed plate. Some of the ink is deposited on the paper, while some is reabsorbed by the ribbon after the impact pressure is released. In addition, some is deposited on the type element, which in time tends to become filled or clogged with this superfluous ink.

Clogging of the type element with ink is undesirable, not only for the obvious reason that the type impression is worsened, but also because in various machines delicate mechanism are operated in conjunction with the type bars or in sufficiently close proximity to the impact area that the superfluous ink tends to deposit in this delicate mechanism. The ink has a relatively high viscosity and clogs the mechanism.

A number of solutions of this problem of accumulated superfluous ink have been proposed. For example, it has been proposed to provide protector ribbons in the form of uninked ribbons passing between the ink-impregnated ribbon and the type, as in U.S. Patents Nos. 2,699,244, January 11, 1955, and 2,849,096, August 26, 1958. However these second ribbons merely delay and do not prevent the fouling of the mechanism, for the inks soak through them from the impregnated ribbon. It remains necessary to halt the operation of the machine at frequent intervals in order to clean the deposits of ink from the mechanism; and these frequent interruptions and the expense of the labor they entail are serious disadvantages of operation according to the prior art.

Another attempted solution has been to provide a film of ink-impervious material on the same side of the impregnated ribbon as the type. This film could be secured to the impregnated ribbon, as in U.S. Patent No. 1,953,316, April 3, 1934, or could be separate from the impregnated ribbon, as in U.S. Patent No. 514,517, February 13, 1894. These latter devices, however, have failed, either because the added film has become distorted under the action of the type elements, or because the ink-impervious films have broken down under the chemical action of components of the ink, or both. The mechanical breakdown of these films under the impact of the type elements need not go so far as to break the film, in order to render the ribbon unsuitable. Instead, the film becomes a hazard to proper operation if it is merely stretched beyond its elastic limit by the type elements, for thus to stress the film beyond its capacity to recover causes distortion and buckling of the ink-impermeable film, and this in turn tends to cause the film to fold upon itself and leads to improper guiding and winding of the film in strip form.

Although these and many other efforts have been made to overcome the deficiencies of the prior art in this field, none, as far as is known, has been entirely successful when practiced commercially on an industrial scale.

Accordingly, it is an object of the present invention to

provide ink-transfer devices that will not deposit ink on the type or on other portions of the printing mechanism.

Another object of the present invention is the provision of ink-transfer devices adapted to withstand the deleterious effects of the components of printing inks.

A further object of the present invention is the provision of ink-transfer devices including ink-impermeable barriers that are not stretched beyond their elastic limit during the course of a printing operation.

It is also an object of the present invention to provide ink-transfer devices that give a clear visual indication of the condition of the device and that give unmistakable warning when the device has become damaged and needs replacement.

A still further object of the present invention is the provision of ink-transfer devices specially oriented and arranged relative to the printing station of a printing machine.

Very broadly stated, the invention comprises the discovery that the spread of extraneous ink can be stopped and at the same time the stresses in an ink-impermeable film for this purpose can be more widely distributed and greatly relieved by providing a fabric member on the type side of an ink-impermeable member, that is, on the side of the ink-impermeable member opposite the ink-saturated member. Such a third or fabric layer receives the impact of the type and distributes it over a wider area of the ink-impermeable member. The ink-impermeable member, in turn, keeps the ink from seeping through and impregnating the third or fabric member. However, should the ink-impermeable member become damaged, then ink will leak through the break and will show up unmistakably on the third or uninked member, thereby giving a visual indication of damage to the ink-impermeable film. A second ink-impermeable member is also wound on the spool with the three-member transfer ribbon, in order to keep the inked member from contacting and directly inking the uninked member in the roll on the spool. Means are also provided, however, for causing this second ink-impermeable member to bypass the printing station.

It has also been found that if the ink-impermeable film is made of silicone rubber, then it can withstand not only the deleterious action of the ink components but also the impact of the type elements, regardless of whether a fabric member is interposed between the type and the ink-impermeable member.

Other objects, features and advantages of the present invention will become apparent from a consideration of the following description, taken in connection with the accompanying drawings, in which:

FIGURE 1 is a fragmentary perspective view of one embodiment of ink-transfer device according to the present invention;

FIGURE 2 is an enlarged cross-sectional view taken on the line 2—2 of FIGURE 1;

FIGURE 3 is an enlarged fragmentary perspective view showing one of the many possible ways of securing together the members that make up the ink-transfer device of the present invention;

FIGURE 4 is a somewhat diagrammatic perspective view of a printing assembly according to one embodiment of the present invention;

FIGURE 5 is an enlarged fragmentary elevation, with parts broken away, showing a tensioning device according to the present invention;

FIGURE 6 is an enlarged fragment of a portion of FIGURE 5;

FIGURE 7 is a fragmentary perspective view, with parts broken away, of a tensioning device according to the present invention;

FIGURE 8 is a view similar to FIGURE 1, but showing another embodiment of the present invention;

FIGURE 9 is an enlarged cross-sectional view on the line 9—9 of FIGURE 8; and

FIGURE 10 is a view similar to FIGURE 4, but showing still another embodiment of the present invention.

Referring now to the drawings in greater detail, there is shown an ink-transfer member **4** comprised of a plurality of overlying thin elongated films which may be separate from each other or joined together. The assembly of these films in overlying relationship, whether they are joined together or are merely in area contact with each other without also being joined together, will hereinafter be called a "ribbon," it being understood that the component parts of the ribbon may be separate from each other and in certain positions of the ribbon may even be spaced substantial distances apart.

One such component of the ribbon is an ink-impermeable thin elongated film **7** and another such component is the ink-transfer member proper, indicated at **8**. The purpose of member **7** is to prevent the flow of ink in one direction from member **8**; and accordingly, member **7** is of an ink-impermeable material such as silicone rubber, nylon film, or the like, and may have, for example, a film thickness of as low as 0.00025 inch. When nylon film is used, it is important from a standpoint of durability of the film that the nylon be less than about 0.0015 inch in thickness, more preferably less than about 0.001 inch and most preferably less than about 0.0005 inch, e.g., 0.00025 inch. The thinner nylon yields more readily under the blows of the type without passing its elastic limit and hence is neither permanently deformed nor broken in use. By contrast, the prior art had not used nylon films in printing operations of a thickness less than 0.002 inch, and as a consequence had achieved only poor results. Particularly preferred, however, is silicone rubber. This material has been found not only to possess the necessary resistance to fatty acids and other components in ink that are ordinarily destructive to natural rubber films, but also possesses desirable characteristics of resiliency, elastic memory and durability in extremely thin sections under the blows of type, which properties are unique to silicone rubber and not possessed by other natural or synthetic rubbers. A suitable such film of silicone rubber may be made by spreading in a solid substrate a suitably thin film of a dispersion of commercially available material such as "Silastic 140 Adhesive" of the Dow Corning Corporation in a volatile carrier such as ethylene dichloride.

Member **8** is inked and is ink-permeable and ink-saturable and is of a fabric which may be any of the usual ribbon materials such as cotton or nylon or other synthetic or cellulosic or animal fibers. Woven nylon is preferred. The term "fabric" as used herein, however, is not restricted to woven fabrics but includes nonwoven fabrics such as thin felted materials and the like.

An extremely important feature of the invention is the provision of a backup member **9** of uninked fabric (the word "fabric" being used in the broad sense defined above) on the side of film **7** opposite inked member **8**. Member **9** is uninked and is preferably of woven nylon, although, like inked member **8**, it can be of woven or felted or other nonwoven construction and can be of synthetic or woolen or cotton or other cellulosic fiber or other synthetic substance of an over-all density much less than the density of film **7**. Member **9** is a cushioner or shield for film **7**. It is disposed on the type side of film **7** and receives the blows of the movable type elements that would otherwise be delivered direct to film **7**. It provides locally a pad that slightly distributes the impact of these blows so that there are no sharply defined regions of stress in film **7**, without, however, blurring the type image as printed. In this way, it is assured either that no portion of film **7** is stretched beyond its elastic limit, or that any such stretching is greatly reduced.

Apart from being uninked, member **9** can be identical to member **8**, and a number of ribbons already developed commercially as single ribbons are quite suitable for the purpose, although it is within the invention that members **8** and **9** be either the same or different from each other.

Member **9** also performs another unique function. Bearing in mind that member **9** is clean and uninked relative to member **8**, thanks to the presence of film **7** which serves as a barrier between inked and uninked members **8** and **9**, it will now be realized that should film **7** be damaged or broken despite the presence of member **9**, ink from member **8** will leak through film **7** at the point of damage and will enter into and spread through member **9** to the exposed surface of member **9**, where it will show up as a visible area of color sharply contrasting with the color of the rest of member **9**. There is thus provided a visual indication of the condition of film **7**; for although film **7** may be hidden between members **8** and **9**, nevertheless, any ink that becomes visible at any point along member **9** will indicate a break in an adjacent portion of hidden film **7**.

Therefore, like member **8**, member **9** is preferably ink-permeable; but unlike member **8**, it need not necessarily have the ability to hold substantial quantities of ink nor need it have ink-transfer properties. It should have good wearing properties, however, for it takes most of the punishment from the type elements; although because it is not the printing ribbon, member **9** can be subjected to considerably more damage than can member **8** before replacement is necessary. Indeed, the sacrificial nature of member **9** makes it possible to reduce the wear resistance of member **8** without shortening the life of the ribbon, should this be desirable for economy of manufacture or for rendering the ribbon thinner or more flexible over-all.

A typical assembly in which ink-transfer device **4** may be used is shown in diagrammatic fragmentary perspective in FIGURE 4. As is there indicated, the multicomponent ribbon is wound on a spool **10** and unwinds therefrom and passes about and between a pair of guide rollers **12** on opposite sides of the printing station **15**, at which are disposed movable type elements or the like (not shown). The type elements in the printing station strike the ribbon in the usual way to leave the imprint of the type on paper or the like disposed on the opposite side of the ribbon, in the usual manner, with the difference that the type strikes uninked member **9** instead of an inked member such as **8**, as in the prior art. Of course, the printing station can be of the sort in which the type element is stationary and a movable platen on the opposite side of the paper strikes the blow. From the second guide **12**, the ribbon is rewound on a spool **10'**.

When wound on spools, such as spools **10** and **10'**, the inner and outer surfaces of a ribbon are ordinarily in area contact with each other. This means that the exposed surfaces of members **8** and **9** would be in area contact with each other if the ribbon were wound in the usual way on spools **10** and **10'**. As a result of this, ink would pass directly from member **8** to member **9**, thereby bypassing film **7**.

Accordingly, another feature of the present invention is the provision of an ink-impermeable separating film **14**, which is wound up with the ribbon on the spool. Flm **14** may, for example, be of "Mylar," which is a polyester of ethylene glycol and terephthalic acid. When thus wound, separating film **14** is spaced from the first impermeable film **7** by member **8** on one side and by member **9** on the other side. Members **8** and **9**, however, are spaced apart from each other by member **7** on one side and by member **14** on the other side of each other. The order of the layers in the roll, in part, from the inside out, is therefore **14–9–7–8–14–9–7–8–14–9–7** and so on.

Use of a second impermeable film **14**, on the type side of member **9**, however, is disadvantageous in that the type elements **10** could chew up film **14** and member **9** cannot

protect it, for member 9 is on the opposite side of film 14 from the type.

Therefore, the protection that member 9 affords to film 7 is not available to film 14. Accordingly, another important feature of the invention resides in the special handling of film 14 to protect it from the type elements. To this end, film 14 is made to bypass the printing station and be handled separately from ribbon 4 downstream of the spool 10 from which it unrolls. Specifically, when the sandwich of ribbon 4 and film 14 is unrolled from spool 10, film 14 is separated from ribbon 4, the ribbon passing on through the printing station, and the film bypassing the printing station and proceeding to wind on spool 10'. In this connection, it is important to note that film 14 is coiled with but not assembled to ribbon 4 on spools 10 and 10'.

Between spools 10 and 10', film 14 passes over guide rollers 13 and 13' and is trained about tensioning rollers 19 and 19' mounted for rotation on spindles 24 and 24' parallel to the axes of spools 10 and 10' on a mounting 18 comprising a plate 21 journalled at 27 on a spindle 17 having at its upper end an annular groove 28 in which is disposed a set pin 22 to maintain the parts in axial assembly with each other but to permit rotation of mounting 18 about the axis of spindle 17. Spindle 17 is carried on a plate 16 mounted by bolts 23 or the like on the printing machine frame. A coil tension spring 20 continuously urges plate 21 to rotate counterclockwise as seen in FIGURE 4, that is, so that roller 19 moves downward and outward of that figure and roller 19' moves inward and upward of that figure. Spring 20 is secured at one end to the printing machine and at its other end to plate 21 a substantial distance from the axis of spindle 17.

As indicated above, the components of the composite ribbon may be secured together or may be separate from each other. For convenience and simplicity of the structure of the ribbon-handling mechanism, it is preferred that they be all secured together, at least along their adjacent edges. This may be done by thermally welding the components together along their edges as shown in FIGURE 2 at 25, or by cementing or glueing them together adjacent their edges as shown in FIGURE 3 at 26. Alternatively, they may be adhesively secured together over their entire interfaces.

If desired, however, the components may all be separate from each other, or only two may be secured together. One such arrangement is shown in perspective in FIGURE 8, in which the uninked member 9 and the ink-impervious film 7 are secured together along their edges by thermal welding, as is also shown in section in FIGURE 9, while inked member 8 is separate from the other two components of the ribbon.

The ribbon-feeding mechanism for the ribbon of FIGURE 8 is shown in FIGURE 10 in the same manner as the preceding embodiment was shown in FIGURE 4, it being understood that all portions of the devices shown in FIGURES 4 and 10 are mounted on and supported by the printing machine. As the ribbon has two separate portions and the back torque on spool 10 is adequate to tension only one of these portions, a separate tensioner identical to the tensioner just described is provided for the composite of film 7 and member 9, as shown at the left of FIGURE 10. Of course, it remains necessary to provide a separate tensioner for film 14 as also in the preceding embodiment. And needless to say, if all three of components 7, 8 and 9 were separate from each other, still another tensioning means would be needed. It is preferred, however, to secure film 7 to one of members 8 and 9, because film 7 is so thin and flexible, and preferably to uninked member 9 if not also to inked member 8.

From the foregoing disclosure, it will be obvious that all of the initially recited objects of the present invention have been achieved.

Although the present invention has been described and illustrated in connection with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit of the invention, as those skilled in this art will readily understand. Such modifications and variations are considered to be within the purview and scope of the present invention as defined by the appended claims.

What is claimed is:

1. An ink-transfer device comprising an ink-permeable member which is inked, a thin ink-impermeable member disposed in area contact with the first member, and a fabric member which is free from liquid ink disposed in area contact with the second member on the side of the second member opposite the first member.

2. A device as claimed in claim 1, said ink-impermeable member having a thickness not more than about 0.0015 inch.

3. A device as claimed in claim 1, said second member and said fabric member being secured to each other.

4. A device as claimed in claim 1, all three said members being secured to each other.

5. A device as claimed in claim 1, a spool on which the ink-transfer device is wound, and a second ink-impermeable member wound on the spool and in area contact with the first member and the fabric member and on the side of the first and fabric members opposite the first ink-impermeable member.

6. A device as claimed in claim 5, and means for removing the second ink-impermeable member from proximity to the ink-transfer device subsequent to unrolling the ink-transfer device from the spool.

7. In a printing machine using an ink-permeable transfer member part of which is rolled on a spool and having a printing station in which another part of the transfer member is disposed and at which is located at least one type element, the improvement comprising a first thin ink-impermeable member disposed in area contact with the ink-transfer member on the same side of the ink-transfer member as the printing element in the printing station, a fabric member disposed in area contact with the second member on the side of the second member opposite the first member, a second ink-impermeable member wound on the spool and in area contact with the first member and the fabric member and on the side of the first and fabric members opposite the first ink-impermeable member, and means spacing the second ink-impermeable member from the other said members at the printing station so that the second ink-impermeable member bypasses the printing station.

8. A device as claimed in claim 7, and resilient means continuously yieldably tensioning the portion of the second ink-impermeable member that bypasses the printing station.

9. A device as claimed in claim 7, and a second spool on which the ink-permeable transfer member and the second ink-impermeable member are rewound in area contact with each other after the ink-permeable transfer member has passed through the printing station.

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