FIG. 1

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CONTINUOUS TYPE BELT

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Filed Jan. 11, 1960, Ser. No. 1,761
4 Claims. (Cl. 101—111)

This invention relates to a printing mechanism and more particularly to an improved type belt suitable for use in high speed printing apparatus.

While not limited thereto, the type belt of the present invention has particular utility in on-the-fly print apparatus of the type sometimes referred to as a chain printer, embodiments of which are shown and described in the copending U.S. application of F. M. Demer et al., filed December 24, 1957, Serial No. 704,938, now U.S. Patent No. 2,996,896, and U.S. Patent No. 2,918,865 issued to E. R. Wooding on December 29, 1959.

In printing apparatus of the type disclosed in the above-mentioned references, the printing mechanism comprises a "chain" of type-uniformly spaced, means for moving the type chain in a continuous path at a constant speed, and a plurality of hammer located on a print line portion of said path, said hammer being selectively operable to strike a print medium against the type as they align with the various hammers.

Previously known type belts have had short operating life under the rigors of multiple hammer on-the-fly printing. Rupture, stretching, frequently followed by rupture, loosening of type, or a combination of all, have been consistent failings of previously known type belts. Under such conditions, therefore, a serious limitation on the commercial utilization of the so-called chain printer existed. With frequent ruptures of the type belt, interrupting of printer operation was frequently to be expected. In addition, consistently high print quality was virtually impossible to attain, and maintenance costs could be expected to be high.

It is therefore the principal object of the present invention to provide a new and improved type belt capable of overcoming the aforesaid defects and to provide more reliability in printing.

It is more specifically an object of the present invention to provide an improved type belt capable of withstanding the rigors of on-the-fly multiple hammer printing without rupture and undue stretching or loosening of type for extensive periods of operation.

It is also an object of the present invention to provide an improved type belt capable of attaining the above objects while being relatively simple in construction.

The above and other objects are attained in accordance with the practice of the present invention by providing a type belt which comprises a composite type member to which type members are clamped. The belt member comprises an inner thin band of flexible sheet steel coated with a uniform layer of plastic material bonded to the surface of the steel band. The steel band has the ends thereof connected to form a continuous loop. Type members, preferably made of engraved or rolled metal type integral with a metal base, are clamped to the belt member so as to place the belt in compression. The bonded coat is preferably a polyester film or a synthetic linear polyamide of low molecular weight. Thus there has been provided an improved type belt capable of vigorous use in multiple hammer on-the-fly printer operation. The composite belt member is capable of withstanding stretching and yet is flexible for bending around short radii. In addition, the plastic coating serves as a compression distributor to reduce stress concentrations which tend to fatigue the inner steel band, as an impact energy absorber and damper of high frequency shock waves due to hammer strokes, and as an insulator of the steel band from metal contacts which waste the metal band through fretting corrosion.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments of the invention, as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is an isometric view of a schematic version of a chain printer in which the present invention is particularly suitable.

FIG. 2 is a fragment of the drive sprocket and type belt showing the relations existing therebetween whereby motion of the type in a continuous path is produced.

FIG. 3 is an exploded isometric view of an engraved metal type member suitable to be removably attached to the belt member of FIG. 3.

FIG. 4 is a cross section of the composite belt member of the type belt of the present invention.

FIG. 5 is a horizontal cross section of a type member and the belt member taken along line 5—5 in FIG. 2.

FIG. 6 is a vertical cross section of the same member and belt member taken along line 6—6 in FIG. 5.

FIG. 7 is a cross section of the ends of the belt member showing their manner of connection to form a continuous belt with a type member shown in relief.

FIG. 8 is an enlargement of a fragmentary portion of FIG. 5 showing physical conditions of the belt member under compressive forces applied by the type member clamped thereto.

Referring to the drawings, a preferred form of a printer is shown in FIG. 1 comprising an endless type "chain" or type belt 10 supported on spaced apart sprocket wheel 11 and an idler pulley 12 carrying a plurality of equally spaced type members 13 clamped to a continuous belt member 14. The type members 13 may be any number of a set of a predetermined number of type characters arranged in a predetermined sequence and uniformly spaced along the type belt to completely fill the same. The sprocket wheel 11 is adapted to be driven by motor means, not shown, through the shaft 15 or the like to move the belt transversely across a record strip 16.

The record strip is adapted to pass over the under guide members 17 and 18, respectively, and to be advanced step by step by conventional means including lower and upper sprocket wheels 19 and 20, respectively. The wheels 19 and 20 may be mechanically coupled through pulleys 21 by suitable means, such as a drive belt not shown adapted to drive them in synchronized manner.

Printing of the characters represented by the type members 13 on record strip 16 is accomplished by a plurality of type hammers 22 horizontally mounted on vertical leaf springs 23 anchored in a base member 24. The hammers 22 are normally biased by the springs 23 out of engagement with the record strip 16 and are adapted to be actuated by individual electromagnets 25 having armatures 26 pivotally mounted on shaft 27. Upon the actuation of any hammer 22, it strikes a type member 13 of the type belt 10 so that the corresponding character is printed on the record strip through an ink ribbon 28 supported by supply and take-up spools 29 and 30, respectively. A guide member 31 is provided to guide the type members 13 and to provide impact resistance therefor. The guide member itself may have shock absorbing properties to further enhance the life expectancy of the type belt and associated components.

The type carried by the type members may be desirably spaced apart further than the hammers, the ratio...
of the type spacing to hammer spacing being sufficient to insure that type members are in alignment with spaced apart hammers at any one instance. A further illustration of this principle of spacing may be understood by reference to co-pending application of F. M. Demer et al. filed October 5, 1959, Serial No. 844,511.

In accordance with the practice of this invention, the resistance to rupture of the type belt 10 is obtained by providing a composite belt member 14. A composite belt member 14, shown in FIG. 4, comprises an inner tension member 32, and an outer plastic coating 33 bonded to the surface thereof. The tension member 32 is a flexible strip of high tensile strength, high modulus of elasticity steel. A particular example of a suitable steel is the chrome nickel alloy steel commonly referred to as stainless steel. Also suitable are cobalt, nickel base alloys of the type marketable under the trade names Dynavar and Eligloy.

In the preferred embodiment, the plastic coating is either a polyester film or nylon. An example of a suitable polyester film was found to be polyethylene terephthalate, types of which are marketable under the trade names of Mylar and Videne. Examples of nylon found suitable as a plastic coat for the purpose of the present invention were the linear polyamides of low molecular weight, marketable under the trade names of Zytel 61 and Zytel 63.

A composite belt member 14 was made by sandwiching a thin (.005 inch) strip of preclamped stainless steel between layers of Mylar polyester film (.001 inch) with the steel tape under slight tension to keep it flat. The sandwich was heated to a temperature of approximately 250° F. while being subjected to a mechanical pressure of approximately 2,000 lbs. Upon removal of the pressure and heating, the composite sandwich is permitted to cool, thereafter it is trimmed to suitable width leaving a plastic covering over the edge of the steel band 32. The bond between the layers of polyester film and the steel band is enhanced if, prior to the forming of the sandwich, steel band is surface roughened. Various suitable methods for accomplishing this result may be used, e.g., vapor blasting or etching. In the event the roughening process leaves sediments or bond inhibiting agents on the surface of the steel band, a separate cleaning process is recommended prior to the forming of the sandwich. For example, in the case of vapor blasting with mixed particles of water and sand in small quantity, the surface of the steel tape is thoroughly washed in alcohol.

A second suitable composite belt member is also formed by spraying a Zytel 61 coating (.001 inch thick) over a stainless steel band (.003 inch thick). Steel band surfaces were vapor blasted and cleaned with alcohol prior to being sprayed. It was not necessary to completely dry the steel band after washing with alcohol, since the alcohol may, if present, act as a desirable softening agent to further enhance the bonding of the Zytel coating to the steel band.

The type members 13 are individually removable from band member 14. The type members are shown in detail in FIGS. 3, 5, and 6, each having a type block member 34 and a clamping member 35. The type block member 34 has a face on which type characters 36 are formed in any suitable manner, such as by the well-known engraving techniques. Two extensions 37 and 38 projecting from the back side thereof, are spaced apart to form a band receiving groove 39. Grooves 40 and 41 in the upper and lower extensions, respectively, provide recesses for the clamp member 35. Clamp member 35 is attached to the type block member 34 by screws 42 which are receivable in openings 43 and 44 provided for that purpose, the latter being threaded. While not necessarily limited thereto, the type block member 34 will comprise more than one spaced engraved type 36 which may be given a spacing characteristic relative to the hammer spacing in accordance with the principle previously discussed.

The attachment of the type members 13 to band 14 then is effected by lacing band 14 within central groove 39 placing the clamp member 35 in grooves 40 and 41 and then securing the same with screws 42 threaded into the openings 43 and 44.

Referring to FIGS. 5 and 6 in particular, it will be seen that the compression surface 45 of clamp member 35 is rounded to prevent damage, such as aching, to the plastic coating 33. In addition, the slight rounding enables the clamp member 35 to indent the plastic coating 33 (see FIG. 8) without concentrating pressures in the band to thereby effect a more firm attachment of type members 13 to the belt member 14. In effect, serving to coat with type block 34 to attach the type members 13 to belt 14, the clamp member 35 serves also as the driving connection between sprocket 11 and the type belt 14. The manner in which the type belt 10 is driven by the sprocket wheel 11 may best be seen by reference to FIG. 2. For purposes of clarity, only a few of the type members 13 are shown attached to belt 14. Thus it will be seen that the clamp member 35 is received between teeth 46 of sprocket wheel 11 as that element turns clockwise. To provide the necessary clearance for entry between teeth 46 of the sprocket wheel 11, the side surfaces 47 of the clamp members 35 are beveled.

The manner of forming belt member 14 into a continuous type belt is shown in FIG. 7. The ends of a length of belt member 14 are prepared by removing portions of the plastic coating from upper and lower surfaces of the steel band. A suitable method for accomplishing this might be to use a finely abrasive rubbing tool which is applied to an end portion of one side of the belt member until the steel band surface is exposed. Other methods will readily occur to persons skilled in this phase of the art. When the steel band has been thus prepared, an adhesive 48 is applied and the ends overlapped, and pressure is brought to bear to effect a secure binding. The bond thus made may be fortified by clamping a type member 13 over the overlapping portion of the ends of the tape.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:
1. A type belt comprising in combination a plurality of type members formed of metal or the like material and a thin flat composite belt member for carrying said type members, said type members being removable and attachable at spaced points along said belt member, said attachment being such as to subject said belt member to concentrated spaced exterior compressive pressures tending to induce wear and rupture of said belt member, said belt member having a single thin flexible substantially inextensible flat uniform tension member of metal or the like, said tension member being susceptible to corrosive wearing upon contact with said type members, and said uniform thin energy absorbing pressure distributing coating of plastic material adhering to and isolating the outer surfaces of said tension member from corrosive contacts with said type members.

2. A type belt in accordance with claim 1 in which said steel band is stainless steel and said coating is a polyester film.

3. A type belt in accordance with claim 1 in which said steel band is stainless steel and said coating is a synthetic linear polyamide of low molecular weight.

4. In a printer apparatus having a print mechanism comprising a plurality of type members, a plurality of
hammers selectively operable for striking said type members along a print line, means for moving said plurality of type members in a uniformly spaced manner along said print line and in a continuous path including a thin composite belt member adapted to carry said plurality of type members, said type members being removably attached to said belt member by compressive clamping action of metallic members engageable with opposite surfaces of said belt member, said composite belt member comprising a single thin flat sheet steel core tension member having ends joined to form a continuous type carrying loop, and a uniform thin impact energy absorbing plastic coating bonded to the outer surface of said steel core, whereby said coating isolates said core from corrosion causing metal contacts.

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