Sept. 20, 1971 S. M. DE PUY ET AL 3,605,613

REINFORCED TYPE CARRIER BELT FOR IMPACT PRINTING APPARATUS

Filed June 4, 1968

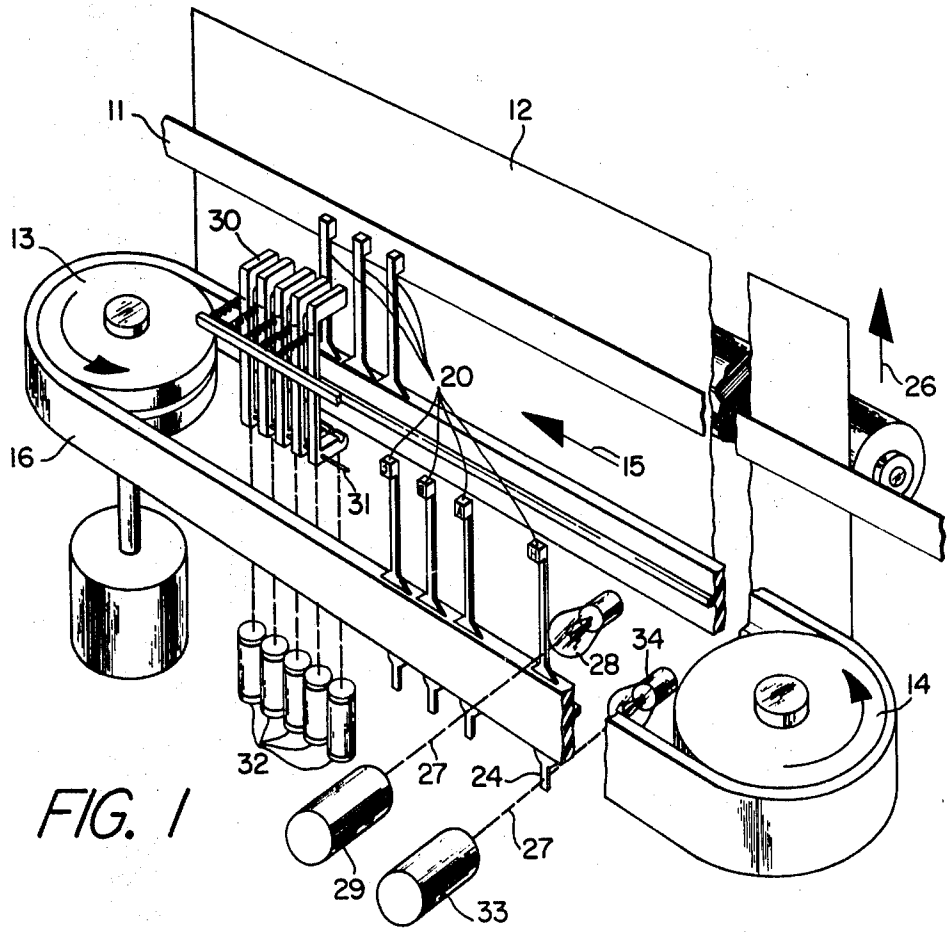

FIG. 1

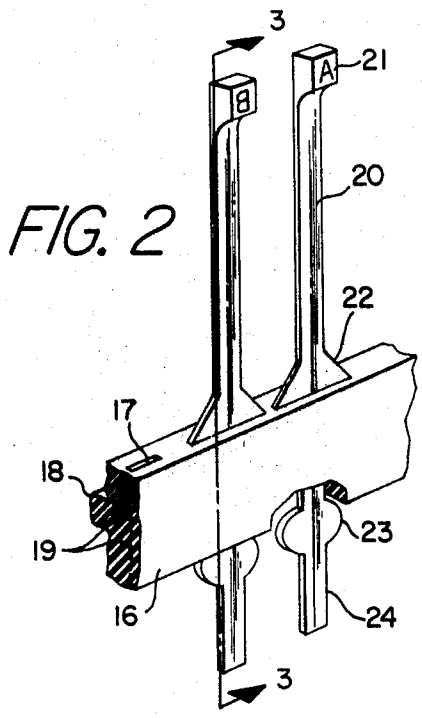

FIG. 2

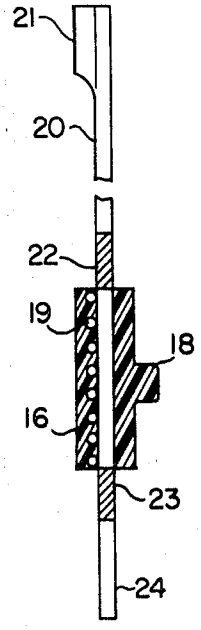

FIG. 3

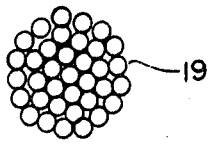

FIG. 4

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REINFORCED TYPE CARRIER BELT FOR IMPACT PRINTING APPARATUS

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Int. Cl. B41j 1/20
U.S. Cl. 101—111 28 Claims

ABSTRACT OF THE DISCLOSURE

A belt of elastic material that is reinforced to provide a critical peripheral dimension. Precisely positioned, yet removable, type carrying members project from transverse slots in the belt.

BACKGROUND OF THE INVENTION

The present invention relates to a unique character carrying device for use in conjunction with impact printers more particularly, it relates to a character carrying device of the belt type.

It has been discovered that in order to effect the extremely high speed printing that is required for compatibility with the automatic data transmission systems now coming into being, it is essential to have printing apparatus that can respond wth a minimum delay to the input data available. Standard typewriters print information sequentially at approximately the same speed at which it is received. The maximum speed of such apparatus is limited by mechanical inertia and motion of the print head during printing. Greater printing speed is attained with systems which provide a buffer storage between the incoming data and the printing mechanism. In some forms of electrostatic printing, for example, clouds of charged particles are directed toward an electrostatic recording medium in response to signals that have been stored. Still another type of printing apparatus is commonly known as a line printer. With this apparatus, continuously moving type elements periodically pass adjacent each print position of a recording medium and they are activated under control of an electronic storage means that stores all of the characters required to print a full line. The latter apparatus has been developed with rotating drums and also with a chain or belt which carries the type elements and moves across the recording medium at a continuous speed.

United States patent application Ser. No. 734,501 filed June 4, 1968, by Earl B. McDowell and Clifford M. Jones, discloses an improvement over conventional line printers wherein a storage unit is employed which does not store all data for an entire line; but, rather stores only a sufficient number of characters for the required speed of operation. The apparatus of the cited copending patent application utilizes a type carrying belt that carries a number of flexible arms, each of which hase the type for a particular character on one end thereof. The number of arms carried on the belt depends upon the number of characters or symbols the apparatus is to print. The type carrying belt is mounted upon drive devices which rotate about parallel axes in order to effect passage of the belt between the recording medium and a plurality of hammers across the entire face of the recording medium. There is no positive drive connection between the drive devices and the belt and therefore it is essential that frictional contact be appropriate to prevent slippage. The position of each character relative to a fixed point on the printer, is determined by detecting the passage of a particular character past that point and thereafter triggering a

counting mechanism at a rate proportional to the rate of character movement. As the characters on the belt move past each possible column position in the recording medium, circuitry compares the column position with the stored input data to determine whether or not a character is to be presented at that column position and whether or not that character is presently in position. When this comparison indicates coincidence between the character on the belt and the character desired to be printed at that column, the hammer at that column position is actuated and urges the character bearing arm to impact the type face on the recording medium and impress a replica of the character thereon.

If the format of a page provides for a line length of eighty characters, this means that the printer must be capable of printing any desired character in any one of eighty columnar positions. Assume that it is desired to print an entire line of the character E. The control circuitry will indicate the presence of the character E at, for example, column **80** and actuate the hammer in that position. This impresses E on the recording medium in column **80**. As the character belt moves the character to column **79**, the hammer at that position is actuated impressing E in column **79** on the recording medium. Subsequently, as the belt moves at a continuous speed across the surface of the recording medium, successive hammers are actuated at the appropriate time to repetitively strike the character carrying element and impress the character E.

In order to present a line of type with appropriate spacing between each character, it is of the utmost importance that the belt initially have each type carrying element precisely positioned relative to all other type carrying elements. Furthermore, in printers of the type described herein, the positioning of each type carrying element is made even more critical because the control circuitry detects only one character position on the belt and uses this position to determine the location of all other characters. Thus, a slight variation in the spacing between each type carrying element could cause a cumulative error that would make it impossible to reliably print characters that are located on the belt at some distance from the detected character position.

Other important characteristics of the character carrying unit concern the dynamic reaction of the character carrying members in a direction transverse to the movement of the belt, i.e., in the direction the member must move to impact on the recording medium. The possibility of repetitive operation (such as that described above) makes it essential that the type carrying element has sufficiently low inertia to respond to the hammer operation and return for subsequent impacting within the period of time required for the belt to pass from a first to a second column position.

It is also important that each character carrying member have sufficient resilience to permit it to rebound from impact with the recording medium and at the same time be appropriately damped so that it can be reapplied for impact in the next column.

The flexibility of the character carrying member along the longitudinal axis of the belt is also of concern. When the hammer strikes a member, it drives it into the recording medium and then retractts. Since the printed character should not be blurred, and because the character belt moves at a constant rate, the character carrying member must flex in order to permit the type-face to rest for a short time on the surface of the recording medium. This flexure is in the direction opposed to the direction of belt movement. Once again, it will be noted that rebound to the original position on the belt is important to permit hammer impacting at subsequent column positions.

The rather stringent requirements placed on character belts for use with the described printing apparatus, lead to the aspect of manufacture. In general, the high dimensional stability and accuracy needed in this type of article results in high manufacturing costs for material and labor. Prior art impact printers have used belts and chain arrangements. However, these have possessed undesirable qualities affecting their usefulness and performance. For example, such prior arrangements were noisy, made operation difficult, required extensive maintenance, lubrication and adjustment and were costly or unreliable.

SUMMARY OF THE INVENTION

As explained above, a belt of the type required in impact printers must possess characteristics of dimensional stability as a prime requirement. Furthermore, the specific type carrying means must exhibit flexibility or resilience transverse to the longitudinal axis of the belt while at the same time exhibiting sufficient dampening to prevent undue oscillation subsequent to each impacting stroke. Still further, there must be sufficient flexibility in the longitudinal direction to permit the type-face to rest momentarily upon the recording medium following each impact.

Accordingly, it an object of the present invention to provide a type carrying belt wherein the position of each type carrying member is rigidly determined and which exhibits a minimum of dimensional variation as a result of operating conditions involving temperature, belt tensioning, aging, etc.

Another object of the invention is to provide an improved type carrying belt wherein each type-face is individually mounted upon a member that is resilient and wherein the movement of the member is damped in order to prevent undue oscillation following impact upon the recording medium.

In any printing system, it is a valuable feature to be able to modify the type-face conveniently. It will be appreciated that belts of the type described herein, because of their precision requirements, tend to be relatively expensive items and the ability to change the type-face without purchasing an entirely new belt is an important economical consideration.

It is another object of the present invention to provide a type carrying belt wherein members carrying individual typefaces may be replaced without special tools and without requiring any particular skill.

Another object of the invention is to provide a type carrying belt wherein the replacement of the individual members carrying each type-face does not affect the dimensions of the belt.

Another object of the invention is to provide improved location of the instantaneous position of print characters carried by a moving belt.

Another object of the invention is to provide a type carrying belt which permits the attainment of the required precision dimensioning without excessive cost.

A further object is to provide an improved means for carrying printing type.

In accordance with one aspect of the invention, a type carrying belt is provided which comprises a body of elastic material having a plurality of transverse openings or slots therethrough, a plurality of type bearing elements secured within said openings and held against vertical displacement, and dimensionally stable or reinforcement means maintaining the peripheral dimensional stability of said belt.

In accordance with another object of the invention, there is provided a belt for carrying type members, wherein the belt is formed of elastomer material having cores for receiving type fingers and which is stabilized by reinforcing filaments precisely positioned in the belt.

The matters discussed above, as well as further objects and features of the present invention, will be more clearly

understood and appreciated following a consideration of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an illustrative sketch showing the environment within which the character belt of the present invention is used;

FIG. 2 is a perspective view of a portion of the character belt of the present invention illustrating the positioning of several character carrying members; and

FIG. 3 is a sectional view taken along line 3—3 in FIG. 2.

FIG. 4 illustrates a cross section of one embodiment of a filamentary cable used in a character belt.

DETAILED DESCRIPTION OF THE INVENTION

The perspective sketch of FIG. 1 illustrates the principal components of an impact printing apparatus of the type shown in the aforecited U. S. patent application, Ser. No. 734,501. This sketch shows a type carrier **10** adapted to be driven at a constant speed around pulleys or reels **13, 14** in a counterclockwise direction as viewed from above. The direction of movement of type carrier **10** relative to a recording medium **12** is such that it traverses a line or proposed line of print on the recording medium. Interposed between type carrier **10** and the recording medium **12**, is an inking ribbon **11**. It will be understood that any suitable materials may be used for recording medium **12** and inking ribbon **11**.

Type carrier **10** carries a plurality of flexible finger members **20** which are attached to the belt **16** and extend through it at precisely located positions. At the upper external end of the flexible fingers, a type-face **21** is provided for cooperation with the ribbon **11** in order to impress particular characters on the recording medium. Fingers **20** are preferably equally spaced along the length of the belt; the specific spacing between centers being equivalent to an integral multiple of the distance between the characters to be printed. The number of flexible fingers and the particular characters represented thereon, are not germane to the invention. Only a few typical fingers are shown in the sketch. One or more complete fonts of type formed characters may be provided, and as explained hereinafter, the particular characters may be changed by changing the fingers **20**. They may take the form of numerals, letters, marks, or other symbols in accordance with the desire of particular users.

A row of hammers **30** is disposed across the entire usable width of the recording medium **12**, a separate hammer being provided for each position at which a character may be printed on the recording medium. The hammers are located behind type carrier **10** and are controlled by circuitry to move forward when a character is to be impressed on the recording medium. The hammer is designed to strike a finger **20** and drive it into ribbon **11** and the surface of recording medium **12**. The fingers are formed of material highly resistant to taking a set. A plurality of electromagnets **32** is illustrated to show the general method of actuating hammers **30**. It will be understood that the hammers pivot about an axis **31** and spring means (not shown) are provided for returning them to the position shown.

As previously noted, as the type carrier **10** moves at a continuous velocity across the face of the recording medium, hammers **30** are selectively actuated to impress the various characters at desired locations on the recording medium. As a result of each hammer impact, the flexible fingers are urged in a direction transverse the moment of the belt and into the ribbon and recording medium and they must return in time to permit the possible subsequent impacting of a succeeding hammer. The dynamic characteristics required to satisfactorily permit this functioning are what place the stringent requirements upon the design of the type carrier belt.

Another aspect of the apparatus shown in FIG. 1 should be noted before proceeding to a description of the novel type carrier of the present invention. In order to sense the instantaneous position of the type during belt rotation around the pulleys, means are provided for utilizing the ends of the fingers protruding outside the belt as markers. A light source **28** in the lower right foreground of FIG. 1, projects a beam **27** toward a photoelectric pickup device **29**. This light beam is interrupted as each flexible finger **20** interposes itself between the light source and pickup device. The interruption of the light beam is utilized by control circuitry to provide discrete indications of where each character appears relatve to the recording medium. As a result of these indications, and information determining which characters are to be printed in respective locations on the recording medium, the appropriate hammers are actuated at appropriate times. Another sensor **33** in like manner senses the elongated bottom finger **24** to indicate the start of a font. The sensors **29** and **33** are thus used to define the location of the desired character print on the recording medium.

A more complete understanding of the specific features of the invention will be available upon consideration of FIGS. 2 and 3. FIG. 2 illustrates a short segment of belt in an enlarged and somewhat exaggerated form. This segment illustrates two flexible finger members **20** properly mounted in the belt **16**. It also shows a slot **17** as it appears prior to insertion of a flexible finger. Fingers **20** are preferably made of metallic material and are provided with upper and lower shoulder portions **22** and **23** respectively. The belt itself is made of an elastic material such as urethane, or the like. In order to insert a type finger **20** into the belt **16**, the lower portion **24** is simply forced through a preformed slot **17** and the lower shoulder **23** acts to expand the slot as the finger traverses it. When the finger member is in the correct position, upper shoulder **22** and lower shoulder **23** reside on the upper and lower surfaces of the belt, respectively. The shoulders maintain the alignment of the type along a desired line by assuring the rigid vertical positioning of the fingers and restraining the fingers within their respective slots until sufficient pressure is applied to purposely remove the fingers from their position.

The upper portion of each finger **20** carries a type-face **21**. These type-faces may be fastened or form an integral part of the upper portion of the fingers.

The cross-sectional view in FIG. 3 clearly illustrates the presence of reinforcing cable or thread **19** formed preferably of filaments embedded within elastic belt **16**. These filaments are useful to maintain the required dimensional integrity of the belt. They also serve an important function relative to the dynamic characteristics of the fingers **20**. As shown in FIGS. 2 and 3, the cable **19** extends in a single level layer within the carrier belt and at a position exterior to and in contact with the slots containing each finger **20**. The cable **19** may be a single continuous wire or fiber strand. In particular satisfactory embodiments of the invention, continuous filaments of steel or plastic having a high modulus of elasticity to substantially limit stretching of the belt in the direction of rotation and in a particular embodiment were wound with a density of 40 to 100 strands per inch of belt width. The filaments are made fine enough to permit flexing of the cable in going around the pulleys. The continuous winding is preferably on the neutral axis of the belt section to minimize stresses in the slot walls due to flexure of the belt in going around the pulleys and the successive turns may, or may not, be separated by the basic belt material. As the belt is flexed in passing around the pulley as shown in FIG. 1, one part of the belt abutting the pulley is in compression whereas the other part of the belt facing away from the pulley is in tension. The axis which defines where the forces change from compression to tension, that is, the axis of zero tensile or compressive stress, is commonly referred to as the neutral axis.

The structure of the present belt is also an important aspect of the invention. By using polyurethane as the elastic material for the body **16** of the carrier belt, it is possible to manufacture the belt by casting techniques. Thus, the belt is cast having the desired peripheral dimensions and including an inner projecing portion **18** for engagement with the pulley means **13** and **14** that will subsequently be used to drive the belt as it functions on an impact recording printer.

This structure leaves the strands **19** in a position exterior to the inserted flexible type fingers and in contact therewith. Accordingly, not only is dimensional reliability assured, but also appropriate resilience is imparted to the fingers for rapidly returning them to the initial position following hammer impact. Rapid return avoids excessive dwell of the hammer on the paper which would tend to make the printed letters blur.

It will be appreciated that modifications may be made in both the structure disclosed in order to produce type carrier belts having varying characteristics. An obvious modification would be positioning of the continuous filament strands **19** internally of the spring fingers rather than externally. A further modification would reside in the positioning of the strands so that elastic material is interposed between them and fingers **20**.

The embodiment disclosed and discussed hereinabove may be modified by those skilled in the art. It is contemplated in the appended claims to include all such modifications which come within the spirit and scope of the teachings herein.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A unit for use as a type carrier in impact printing apparatus, comprising an elastic belt, a plurality of slots extending through said belt transversely of said longitudinal axis of said belt and spaced at precise predetermined locations, individual type carrying fingers supported in respective ones of said slots, said fingers having a portion extending out of said slots and transversely of said longitudinal axis of said belt, and dimensionally stable means placed in juxtaposition with the portion of said type fingers supported in said slots for maintaining the peripheral dimensional stabilty of said belt along the longitudinal axis thereof.

2. An arrangement as defined in claim **1**, wherein said dimensionally stable means encircles said belt and is embedded therein.

3. An arrangement as defined in claim **2**, wherein said dimensionally stable means is positioned adjacent to the outer peripheral wall of each of said slots.

4. An arrangement as defined in claim **2**, wherein said dimensionally stable means comprises a plurality of windings of filamentary material.

5. An arrangement according to claim **1** wherein said type carrying fingers each comprise a substantially flat elongated member, the major axes of which reside in a common plane, said member being resilient in a direction substantially orthogonal to said common plane and bearing a type-face on a flat surface at one end thereof.

6. A type carrier for use with impact printing apparatus, comprising an elastic belt, a plurality of separate flat type carrying fingers each extending through said belt in the direction of its width, the major axes of said fingers residing in a common plane, said fingers being resilient in a direction substantially orthogonal to said plane, and dimensionally stable means placed in juxtaposition with the portion of said type fingers within said belt for reinforcing said belt along the longitudinal axis thereof.

7. A type carrier according to claim **6** wherein said fingers have a means to precisely locate the type relative to the belt.

8. A type carrier according to claim **6**, wherein said dimensionally stable means encircles said belt and is embedded therein.

9. A type carrier according to claim 8, wherein said dimensionally stable means comprises a plurality of windings of filamentary material.

10. A type carrier according to claim 6, wherein said fingers are removable.

11. A type carrier according to claim 10, wherein each of said type carrying fingers have a first pair of shoulders extending orthogonally from said major axis of said finger and abutting one edge surface of said belt for maintaining the position of each finger on said belt along the longitudinal axis thereof.

12. A type carrier according to claim 11, wherein said each of said type carrying fingers include a second pair of shoulders extending orthogonally from the major axis of said finger, said second pair of shoulders being spaced from the first pair of shoulders by an amount equal to the width of the belt and being positioned in abutting relationship with the other edge surface of the belt for maintaining the position of each finger on said belt along the longitudinal axis thereof.

13. A type carrier according to claim 12, wherein said shoulders extend in the width direction of said fingers, and said fingers are positioned with their width direction parallel to the longitudinal axis of said belt.

14. A type carrier, comprising a belt formed of elastic material and having predetermined dimensions, said belt having a plurality of spaced apart slots formed therein in the direction of belt width, a plurality of elongated flexible fingers bearing type at one end thereof being supported in respective ones of said slots, a cable of flexible, but linearly stable filaments encircling said belt along the direction of its longitudinal axis a plurality of times, said filaments being located substantially on the neutral axis of said belt substantially to limit stresses in the belt due to the cable upon flexure of the belt in moving along a curved path.

15. A type carrier according to claim 14, wherein said cable is wound in successive turns extending along the width of the belt.

16. A type carrier for impact printing along the length of a print line comprising an endless belt formed of an elastomer and adapted for rotation about at least two spaced apart pulleys, said belt having a plurality of uniformly spaced apart slots formed therein in the direction of belt width, a plurality of elongated flexible fingers bearing type at one end thereof and formed of a material highly resistant to taking a set, said fingers being supported in respective ones of said slots and being located substantially on the neutral axis of said belt to minimize stresses in the slot walls due to flexure of the belt in going around said pulleys, said fingers having their one ends extending beyond said belt, said fingers dimensioned to flex resiliently at their one ends in a direction perpendicular to the plane of said belt, means for providing dimensional stability to said belt and fingers comprising a reinforcing cable formed of a plurality of continuous filaments, said cable being embedded within said belt and encircling the belt along its direction of rotation a plurality of times to a height substantially corresponding to the belt width, said filaments being made of relatively high modulus elasticity material to substantially limit stretching of the belt in the direction of rotation but being of fine dimension to permit flexing of the belt in going around the pulleys, said filaments being located substantially on said neutral axis of said belt to limit stresses in the belt due to the reinforcing cable upon flexure of the belt in going around said pulleys.

17. An arrangement according to claim 16 wherein means for utilizing said non-type bearing ends of said fingers protrude outside said belt and means for utilizing said non-type bearing ends to sense the instantaneous type position of the type during belt rotation around said pulley.

18. An arrangement according to claim 16 comprising means for aligning the type along a desired line, said means comprising shoulder means located on said fingers for restraining the fingers within their respective slots and preventing movement of the type along the longitudinal axis of the slot.

19. A type carrier for impact printing along the length of a print line comprising an endless belt formed of an elastomer and adapted for rotation about at least two spaced apart pulleys, said belt having a plurality of spaced apart slots formed therein in the direction of belt width, a plurality of elongated flexible fingers bearing type at one end, said fingers being supported in respective ones of said slots and being located substantially on the neutral axis of said belt to minimize stresses in the slot walls due to flexure of the belt in going around said pulleys, said fingers having at least their one ends extending beyond said belt, said fingers dimensioned to flex resiliently in a direction perpendicular to the plane of said belt, means for providing dimensional stability to said belt and fingers comprising a reinforcing thread, said thread being embedded within said belt and encircling the belt along its direction of rotation a plurality of times in the width direction of said belt, said thread being located substantially on said neutral axis of said belt to limit stresses in the belt due to the thread upon flexure of the belt in going around said pulleys.

20. An arrangement according to claim 16 wherein means for utilizing said non-type bearing ends of said fingers protrude outside said belt and means for utilizing said non-type bearing ends to sense the instantaneous position of the type during belt rotation around said pulley.

21. An arrangement according to claim 16 comprising means for aligning the type along a desired line, said means comprising shoulder means located on said fingers for restraining the fingers within their respective slots and preventing movement of the type along the longitudinal axis of the slot.

22. An arrangement according to claim 21 wherein said belt carries a ridge along its length adapted to mesh with a corresponding groove in said pulleys to maintain belt alignment.

23. A type carrier for impact printing along the length of a print line comprising an endless belt formed of an elastomer and adapted for rotation, said belt having a plurality of spaced apart slots formed therein in the direction of belt width, a plurality of elongated flexible fingers bearing type at one end thereof, said fingers being supported in respective ones of said slots and being located substantially on the neutral axis of said belt to minimize stresses in the slot walls due to flexure of the belt in going around said pulleys, said fingers having at least their one ends extending beyond said belt, said fingers dimensioned to flex resiliently at their one ends in a direction perpendicular to the plane of said belt, means for providing dimensional stability to said belt and fingers comprising a reinforcing thread, said thread being embedded within said belt and encircling the belt along its direction of rotation a plurality of times in the direction of belt width, said thread being made of relatively high modulus elasticity material in a manner to substantially limit stretching of the belt in the direction of rotation while permitting flexing of the belt in going around the pulleys, thread being located substantially on said neutral axis of said belt substantially to limit stresses in the belt due to the thread upon flexure of the belt in going around said pulleys.

24. An arrangement according to claim 5 wherein said member has a first pair of shoulders extending orthogonally from said major axis and abutting one edge surface of said belt for fixing the finger with respect to one edge surface of said belt and a second pair of shoulders spaced from said first pair of shoulders by substantially the width of said belt and extending orthogonally from said major axis and abutting the other edge surface of said belt for facilitating the insertion and removal of said type finger.

25. An arrangement for impact printing along the length

of a line comprising an endless belt formed of an elastomer material and adapted for rotation about at least two spaced apart pulleys, said belt having a plurality of spaced apart slots formed through the belt in the direction of belt width, a plurality of separate, elongated flexible fingers bearing type at one end thereof, said fingers being inserted in respective ones of said slots and extending through the belt with their one ends extending substantially beyond said belt, said fingers formed of spring material and dimensioned to flex resiliently at their one ends in a direction perpendicular to the plane of said belt during impact for printing while being relatively inflexible in a direction in the plane of said belt, said fingers each having a first pair of shoulders extending therefrom in opposing directions along the one edge of the belt and abutting said edge for maintaining the position of each finger on said belt along the longitudinal axis thereof and a second pair of shoulders extending therefrom in opposing directions along the other edge of said belt for maintaining the position of each finger on said belt along the longitudinal axis thereof, said shoulders being dimensioned with respect to the dimensioning of said slots to facilitate forceful insertion or removal of each finger by stretching the elastomer material in the vicinity of the slot while permitting the walls of the slot to firmly grip the type finger in the region between the first and second pairs of shoulders after the finger has been inserted in the slots with said shoulders abutting the edges of said belt.

26. A type element according to claim **24**, wherein said shoulders extend from said major axis of said member in the width direction of said member.

27. An arrangement according to claim **25** wherein said fingers are located substantially on the neutral axis of said belt.

28. An arrangement according to claim **27** comprising means for providing dimensional stability to said belt and fingers comprising a reinforcing cable embedded in said belt in juxtaposition with the portion of said fingers in said slots.

References Cited

UNITED STATES PATENTS

2,267,661	12/1941	Meyers	101—111
2,936,704	5/1960	Hense	101—93
3,012,499	12/1961	Amada	101—93
3,041,964	7/1962	Simpson et al.	101—111
3,041,965	7/1967	Sasaki	101—111
3,142,249	7/1964	Sasaki	101—111
3,216,348	11/1965	Oldenburg et al.	101—93
3,379,125	4/1968	Antonucci	101—93
3,416,442	12/1960	Brown et al.	101—93
798,460	8/1905	Scotford	101—111
2,762,297	9/1956	Baer	101—111
3,418,929	12/1968	Nelson	101—111

WILLIAM B. PENN, Primary Examiner

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,605,613 Dated September 20, 1971

Inventor(s) Seymour M. DePuy and Donald G. Hebert

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 51, cancel "Earl" and insert -- Earle --; line 58, cancel "hase" and insert -- has --. Column 2, line 63, cancel "retractts" and insert -- retracts --. Column 4, lines 69 and 70, cancel "moment" and insert -- movement --. Column 5, line 13, cancel "relatve" and insert -- relative --. Column 6, line 6, cancel "projecing" and insert -- projecting --. Column 7, line 17, cancel "abutting" and insert -- butting --.

Signed and sealed this 15th day of August 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

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