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DePuy et al.

[11] **3,766,852**

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[54] **REBOUND MOTION CONTROLLING APPARATUS**

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[21] Appl. No.: **252,987**

[52] **U.S. Cl.** ..... **101/93 C,** 101/111

[51] **Int. Cl.** **B41j 1/20**

[58] **Field of Search** ..... 101/111, 93 C, 382 MV

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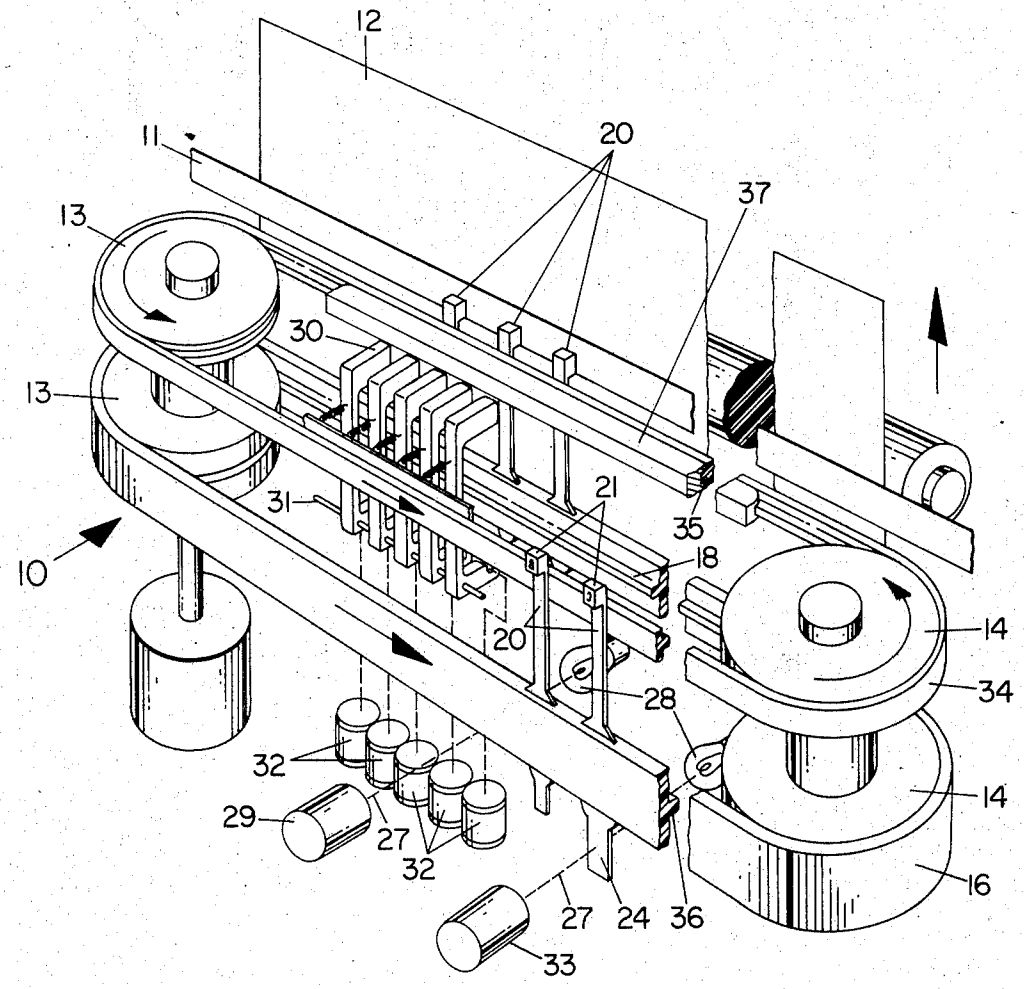
[57] **ABSTRACT**

Use of a moving rebound belt arrangement with various features to control rebound motion of type bearing fingers carried by a moving belt in a printer apparatus.

18 Claims, 7 Drawing Figures



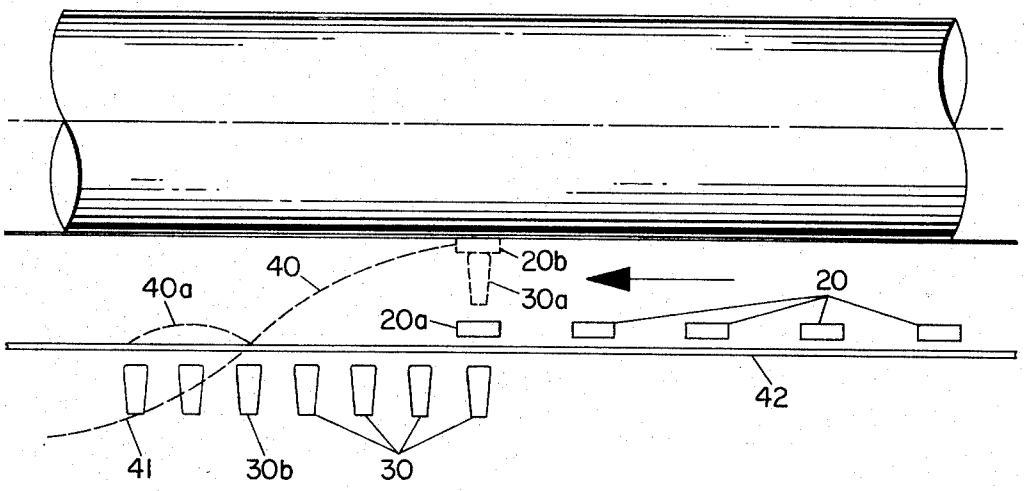
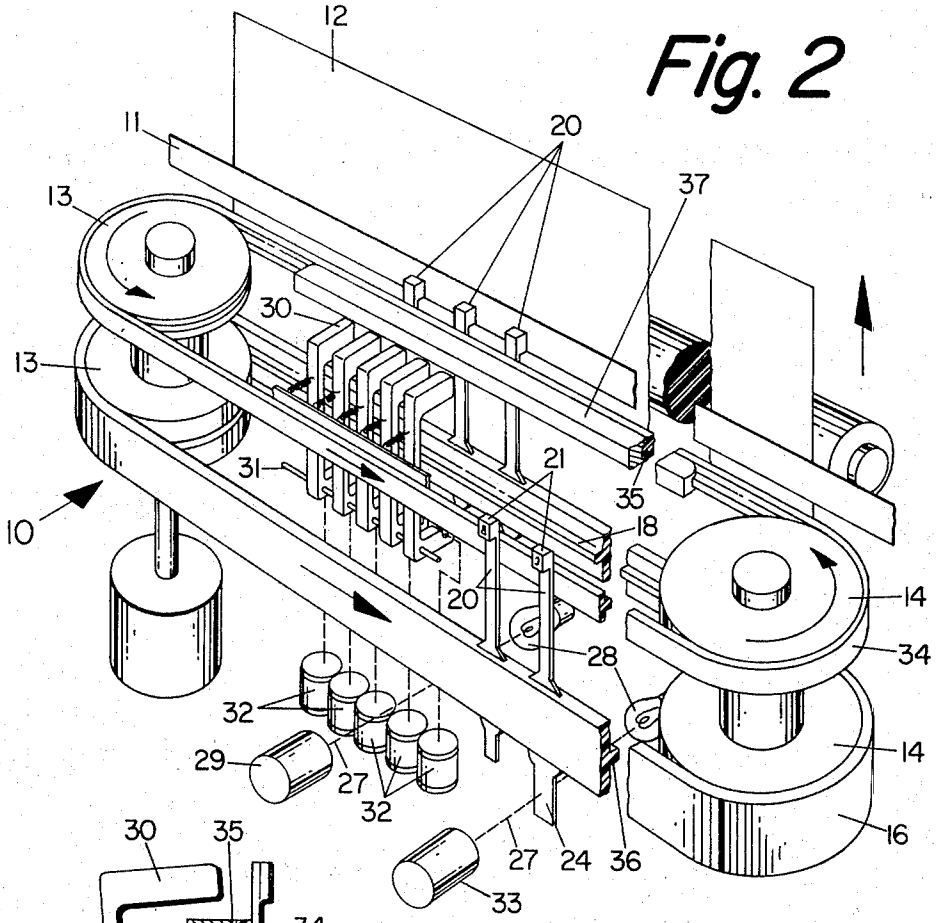


Fig. 1

Fig. 2



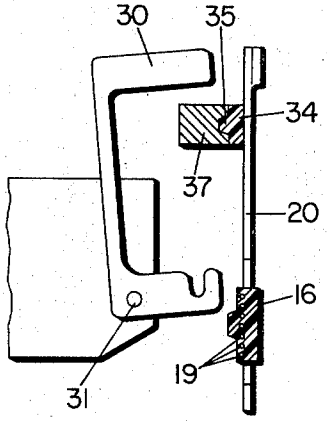


Fig. 3a

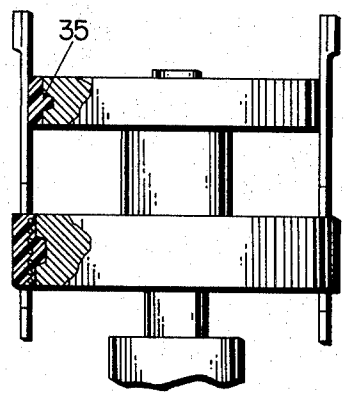


Fig. 3b

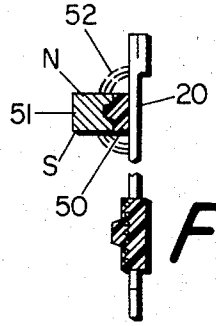


Fig. 4a

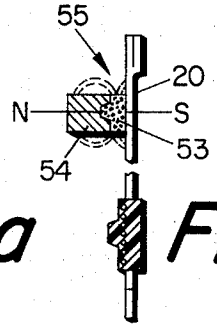


Fig. 4b

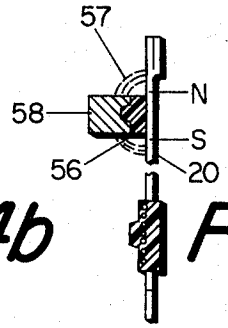


Fig. 4c

REBOUND MOTION CONTROLLING APPARATUS

This invention relates to printer apparatus, and particularly to such apparatus in which printing impressions are formed by impacting resilient type bearing fingers against a record medium under the control of hammers.

In general, an "on the fly" printer comprises a plurality of individual type bearing elements or fingers mounted on a carrier which causes the fingers to traverse a line of movement corresponding to a line of type on a record medium. The fingers are selectively driven against the record medium, such as paper, with an inked ribbon interposed between fingers and paper to enable impact printing of the particular type carried by the driven finger. In such a printer, the type characters are struck when they are in motion across a line of type on the record medium. The energy for impacting is delivered by an inertial hammer mechanism wherein the hammer face engages the type fingers and drives them into the record medium.

It has been recognized that such printers offer many advantages but do require careful design and adjustment to insure optimum operation. Because the type carrying members or fingers are resilient, as may also be the printing surface, care must be taken to insure that the type fingers when driven into the record medium rebound properly and do not undesirably strike subsequent hammers as they move across a line of type. The rebound striking of hammers may damage the fingers or impart further undesirable movement to the fingers to result in undesirable printing. In prior arrangements, one solution for limiting the motion of the fingers and dampening further motion involved the use of a rebound bar which was stationary or fixed with respect to the fingers and which extended along the full length of a line of type along which the hammers were aligned. This rebound bar, as will be described in further detail, contributed to a reduction in the interference between fingers and hammers when properly installed and adjusted. Proper adjustment has involved maintaining a relatively small clearance between fingers and rebound bar. However, objectionable noise and finger wear resulted from use of fingers having misaligned fingers which rubbed on the rebound bar. One solution to avoid this noise and wear was to increase the clearance between the rebound bar and the fingers but this, in turn, reduced the effectiveness of the bar and permitted finger-hammer interference to occur. Another method of dampening finger motion is to attach a continuous dampening material across the fingers at a point intermediate between the point at which the fingers are supported by the belt and the point at which fingers are struck to cause printing. This method of dampening has disadvantages. Additional loading, by way of the attached damping medium, is introduced when the fingers are struck and thereby absorbing energy before printing. Also, a force is transmitted from the struck finger to adjacent fingers which generates undesirable motions and resonances.

Accordingly, an object of this invention is to provide improved on-the-fly printing.

Another object of the present invention is to provide an improved rebound bar for on-the-fly printers.

Another object of this invention is to provide an improved arrangement for controlling the rebound motion of type fingers carried by a carrier.

Another object of the invention is to provide an arrangement for reducing the necessity to precisely locate or position type fingers with respect to the hammers.

A further object of the invention is to reduce objectionable finger noise and wear resulting from rubbing of the type fingers on a rebound bar.

A further object is to use magnetic forces to improve on- the-fly printing.

In accordance with one embodiment of this invention, a type carrier for use with impact printing apparatus comprises an elastic belt with a plurality of separate, type carrying fingers each extending from the belt in the direction of its width. As the belt moves, the fingers are caused to traverse a line of movement across a record medium. The fingers are resilient in the direction of a record medium. A plurality of hammers are located at respective column positions associated with the record medium. Means are provided for causing selected ones of the hammers to strike desired type fingers while the belt and fingers are in motion relative to said hammers to cause said type fingers to impact against the record medium. To prevent the fingers from striking the hammers upon rebound from said record medium, there is provided a second belt of flexible, finger oscillation damping material adapted to move at substantially the same speed and in substantially the same direction as said first moving belt. Said second moving belt is located such as to contact the type fingers near the vicinity of where said hammers impact against the type fingers in order to control the rebound motion of the fingers and dampen finger oscillation.

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 in which:

FIG. **1** is a schematic representation intended to illustrate some of the problems associated with resilient type finger impacting;

FIG. **2** is an illustrative sketch of a belt printer employing the present invention;

FIGS. **3***a* and **3***b* are cross-sectional views of a moving rebound bar in accordance with the present invention; and

FIGS. **4***a*, **4***b* and **4***c* are detail drawings of further embodiments of improvements in a rebound bar and type fingers.

FIG. **1** is a schematic representation intended to illustrate the flight path of type fingers which are struck by hammers for impact against a record medium and the rebound path of such type fingers under the circumstances of (1) there being provided no rebound bar for damping finger oscillation, and (2) there being provided a stationary rebound bar for such purpose. It is intended that this representation and the related discussion will provide the background for explaining the present invention. Referring to FIG. **1**, there is shown schematically a plurality of type fingers **20** carried by a carrier not shown and aligned for movement in the direction of the arrow. A plurality of hammers **30** are provided which when energized drive a desired type finger, such as **20***a*, to impact an inked ribbon against a record medium bearing against the platen. For purposes of simplicity, the ribbon and paper are not shown. **30***a* and **20***b* show the position of the hammer and type finger following one such impact resulting in printing. The hammers are fixedly positioned with re-

spect to a line of type on the record medium and are driven transversely to the belt motion. The hammers retract in a straight line path corresponding to the impact path. The type fingers, on the other hand, being carried by the moving belt would normally follow a trajectory as illustrated in dotted line by **40** and **41** and essentially execute a damped, oscillatory path. This is undesirable since it would lead to collision with subsequent hammers. To overcome this, the prior art teaches the introduction of a stationary rebound bar **42.** In one case, this was made of a smooth, hardened steel. As a consequence of the introduction of this stationary rebound bar, the rebound flight path of the impacted finger was modified and followed the path **40, 40***a*. This resulted in a reduction in the rebound excursion of the impacted finger as well as the duration of the oscillations. However, even with this arrangement of a stationary rebound bar, certain difficulties are still encountered. For example, with the fingers moving relatively to a fixed rebound bar, undesirable scraping of fingers may occur which ultimately can lead to excessive wear and breakage. In addition, undesirable levels of noise may be generated due to the rubbing of moving fingers on a stationary bar. To help reduce the undesirable noise, the spacing of the fingers from the rebound bar can be carefully adjusted. However, in spacing the fingers with respect to the rebound bar to reduce noise, it is necessary to space for the worst condition, namely where some of the fingers are not in a straight alignment. This, of course, reduces the effectiveness of the rebound bar. The present invention teaches the use of a movable rebound bar with varying characteristics for eliminating or minimizing most of the problems previously encountered with the stationary rebound bar arrangement.

Referring to FIG. **2,** there are shown the principal components of an impact printing apparatus. 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 record medium **12** is such that it traverses a line of movement corresponding to a line of print across a record medium such as paper. Interposed between type carrier **10** and the record medium **12** is an inked ribbon **11.** It will be understood that any suitable materials may be used for record medium **12** and inked ribbon **11.**

Type carrier **10** carries a plurality of flexible finger members **20** which are secured to the belt **16** 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 record 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 the particular characters may be changed by changing the fingers **20.** The type may take the form of numerals, letters, marks or other symbols in accordance with the desires of particular users.

A row of hammers **30** is disposed across the entire usable width of the record medium **12,** a separate hammer being provided for each column position at which a character may be printed on the record 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 record medium. The hammer is designed to strike a finger **20** and drive it into ribbon **11** and the surface of record medium **12.** The fingers are formed of material highly resistant to taking a set. A plurality of electomagnets **32** are shown and the dotted lines illustrate the mechanical coupling to the hammers **30** for actuating them. It will be understood that the hammers pivot about an axis **31** and spring means (not shown) are provided for returning them to their rest position.

As the type carrier **10** moves at a continuous velocity across the face of the record medium, hammers **30** are selectively actuated to impress the various characters at desired locations on the record medium. With each hammer impact, the flexible fingers are driven in a direction transverse to the movement of the belt and caused to impact the ribbon and record medium. The fingers must return in time to permit the possible subsequent impacting by a succeeding hammer. The dynamic characteristics required to satisfactorily permit this functioning place stringent requirements upon the design of the type carrier belt.

It may be helpful as background to describe in some detail at this point the characteristic properties of a preferred belt arrangement. U.S. Pat. No. 3,605,613, issued Sept. 20, 1971 to Seymour M. DePuy and Donald G. Hebert, discloses an elastic belt carrier for carrying type fingers across a line of print on a record medium such as paper. In such an arrangement, it is important that each character carrying member or type finger have sufficient resilience to permit it to rebound upon impact with the record medium and at the same time be appropriately dampened so that it can be promptly positioned for impact printing in desired succeeding columns.

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 record medium and then retracts. 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 record 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 in subsequent column positions. It can be well appreciated that an elastic belt of the type described must possess the characteristics of dimensional stability along its periphery as a prime requirement. In the subject patent, one approach disclosed provides such dimensional stability by way of a plurality of windings of filamentary material encircling the belt along the direction of its longitudinal axis a plurality of times. The filaments are located substantially on the neutral axis of the belt in order substantially to limit stresses in the belt due to the windings when the belt flexes in moving along a curved path defined, for example, by driving pulleys. In a particular embodiment, the belt was made of urethane with 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 and 100 strands per inch of belt width. This belt carrier design possesses characteristics of dimensional stability and, in addition, exhibits flexiblity 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. Also, there is sufficient flexiblity in the type or character carrying member along the longitudinal axis of the belt to permit the type face to rest momentarily on the record medium following each impact.

Another aspect of the apparatus shown in FIG. 2 should be noted before proceeding to a description 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 lower 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 relative to the ecord medium. As a result of these indications and information determining which characters are to be printed in respective locations on the record medium, the appropriate hammers are actuated at appropriate times. Another sensor **33** in like manner senses a characteristic such as the broadened bottom position of finger **24** to indicate the start of a font or a set of type. The sensors **29** and **33** are thus used to substantially define the instantaneous location of desired type fingers with respect to the record medium. For further details of the functioning of such a printer, reference may be made to U.S. application Ser. No. 739,501 filed June 4, 1968 by Earle B. McDowell and Clifford M. Jones and assigned to the common assignee.

In the arrangement described in Pat. No. 3,605,613, the belt was manufactured using polyurethane as an elastic material for the body **16** of the carrier belt. This enables the belt to be manufactured by casting techniques. Thus, the belt is cast having the desired peripheral dimensions and including an inner projection portion **18** for engagement with the pulley means **13** and **14** that will be subsequently used to drive the belt as it functions on an impact record printer.

In general, a belt used for the particular type of printing indicated calls for high dimensional stability and accuracy. Because the character carrying member is moving, it must flex in order to permit the type face to rest for a short time on the surface of the record medium. This flexure is in a direction transverse to the direction of belt movement. The polyurethane material serves this purpose adequately. However, it is also necessary that the belt be dimensionally stable in the direction of its movement. To accomplish this, the aforesaid Pat. No. 3,605,613 teaches the use of reinforcing cables or threads **19** (see FIG. **3***a*) preferably formed of filaments embedded within elastic belt **16.** These filaments maintain the required dimensional integrity of the belt along its longitudinal axis. In one emodiment described in the aforesaid patent, continous filaments of steel or plastic having a high modulus of elasticity to substantially limit stretching of the belt in the direction of rotation were wound with a density of 40 to 100 strands per inch of belt width. The filaments were 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 pulley 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. **2,** 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.

In the belt printing arrangements heretofore employed, a problem has arisen particularly at higher speeds. The individual type fingers are caused to be displaced from a preset position to impact against the record medium when driven by a hammer. Upon rebounding from the record medium, the type fingers strike the hammers which are fixedly positoned at the respective column positions along the line of print. This rebound striking of the hammers damages the fingers and may impart further movement to the fingers to cause undesirable printing. As previously mentioned, the problem of rebound striking was met by use of a stationary rebound bar of nonresilient material such as steel. This bar limited motion of the fingers in the direction of the hammer movement and dampened further motion of the fingers. However, while the stationary rebound bar reduced interference between fingers and hammers when properly installed and adjusted, proper adjustment required an extremely small clearance between fingers and rebound bar. Besides the problem of adjustment, objectionable noise and finger wear resulted from use of finger belts having misaligned fingers which rubbed on the rebound bar. To avoid this noise and wear, the clearance between the rebound bar and fingers could be increased but only at the expense of reducing the effectiveness of the bar for damping finger movement.

To eliminate the problem of noise and finger wear, applicants discovered that by making the rebound bar a moving element rather than a stationary element and providing it with certain characteristics, a substantial improvement in noise reduction and finger wear could be achieved.

FIG. **3***a* illustrates in a cross-sectional showing certain characteristics of the hammer, type fingers, rebound bar, finger belt and stationary backstop bar. In this illustration, type finger **20** is shown resting against the rebound belt **34** which carries the tongue **35** that engages the groove of the stationary backstop bar **37.** The belt and associated backstop are positioned to contact the type finger just below the vicinity where the hammer **30,** pivoting about **31,** can impact against the type finger. This figure also illustrates the dimensional stabilizing filaments **19** incorporated in the type finger belt **16.**

In its simplest form, the moving rebound bar consists of a backstop for the fingers which is adapted to move at substantially the speed of the fingers and having a low coefficient of restitution and being closely aligned to intercept finger movement upon rebound from the record medium and dampen finger oscillation. Since

the rebound bar moves at substantially the speed of the fingers, its alignment with respect to the fingers is not as critical and as a practical matter can be in contact with the fingers offering no restraint to the fingers in the direction of printing. A preferred embodiment of a finger rebound bar is shown at **34** in FIG. **2.** The movable rebound belt may be in the form of an O ring, a flat elastic or woven belt of a section to best accommodate the space available and present a nonresilient stop for the fingers. In the arrangement shown in FIG. **2,** the belt **34** is shown to encircle the two pulleys **13** and **14** and to consist of a material such as urethane used in the lower belt **16.** This arrangement permits belt **34** to rotate in unison with the type finger belt **16.** Belt **34** is provided with a guiding tongue **35** similar to the guiding tongue **36** of the type finger belt. These tongues are adapted to engage in grooves cut into pulleys **13** and **14.** While FIG. **2** shows the use of an upper and lower pulley for driving the rebound bar and the type finger belt respectively, obviously other pulley arrangements could be provided to insure that the rebound belt moves at subtantially the speed of the type fingers to traverse a line of movement across the record medium. Inasmuch as the longitudinal of the type fingers is not affected by the rebound belt, it is not necessary to maintain the dimensional stability of the rebound belt along its longitudinal axis as was the case of the type finger belt **16.** Actually, if efforts are made to make belt **34** dimensionally stable in its longitudinal direction, then more care would be needed in dimensioning the belt to make certain that it does not interfere with the alignment of the finger belt and the pulleys **13** and **14.** In a further preferred embodiment, the rebound belt was designed to contact the fingers near the vicinity of where the hammers impact or apply the driving force against said type fingers in order to control the rebound motion of the fingers and dampen finger oscillation. In addition, a desirable alignment of fingers was attained by having the fingers slightly biased toward the belt so that the finger alignment substantially assumes the lines of the rebound belt.

As a further improvement and particularly in the case where numerous fingers are simultaneously impacted and caused to rebound from the record medium, further damping can be achieved by the use of a stationary backstop bar **37** which extends in front of the row of hammers along a line of type and contacts the moving rebound belt in sliding engagement. FIG. **3***a* illustrates one embodiment of such a stationary backstop bar at **37.** This may be formed of a rigid material such as aluminum or steel and surface treated to permit slippage with low friction by the rebound belt moving across its surface. In a particular embodiment the type finger was formed of 0.010 inch thickness spring steel, the finger belt of 0.080 inch thickness urethane, the rebound belt of 0.040 inch thickness urethane and the backstop bar of 0.200 inch thickness aluminum. As shown, the stationary backstop bar is provided with a groove to engage the tongue **35** of the rebound belt **34.** The stationary backstop bar is dimensioned to permit the striking portion of each hammer to pass around the backstop bar and drive the finger into intimate contact with the record medium for printing. FIG. **3***b* is a cross-sectional view across the pulleys showing the relationship between the upper or rebound belt pulley **13,** the rebound belt **34** and associated tongue and groove alignment design, and the lower or type finger belt pulley **13,** the type finger belt **16,** type fingers **20** and associated tongue and groove alignment design.

In certain applications, it may be desirable to maintain relatively strict alignment of the type fingers along the line of type to be produced on a record medium. This can be accomplished by biasing the fingers mechanically to rest or bear against the rebound belt. This can be accomplished, for example, by offsetting the vertical axis of the finger belt sufficiently with respect to the rebound belt (i.e., by positioning the axis of the finger belt **16** to the left as shown in FIG. **3***a*) to cause the finger **20** to bear on rebound belt **34.** Rather than relying on mechanical bias to maintain the type fingers against the rebound belt, a magnetic force could be employed to provide this finger loading against the rebound belt without transmitting undue load to the finger belt and belt guides. FIG. **4***a* illustrateS one such embodiment in which the stationary backstop bar is formed of magnetic material, such as steel, here represented by number **51** and indicated by the north and south pole markings N and S. In this embodiment, the rebound belt was formed of nonmagnetic material such as urethane and the type finger **20** formed of magnetic material such as spring steel. The magnetic influence is represented by the magnetic lines of force **52.** Thus, the stationary backstop bar tracks the metallic type finger and biases it into contact with the rebound belt **50** thereby maintaining a desired alignment of type fingers along a line of type.

FIG. **4***b* illustrates a further embodiment in which the rebound belt is made of magnetic material such as urethane with a magnetic material impregnant. In this embodiment, the stationary backstop bar may be either magnetic or nonmagnetic material. With the polarity of the rebound belt as indicated by the N and S markings, the type finger of magnetic material is drawn against the rebound belt. The magnetic field is determined to be strong enough to provide the desired degree of biasing for alignment purposes without introducing any undesirable drag due to magnetic attraction.

FIG. **4***c* illustrates a still further embodiment in which the magnetic material of the type finger is magnetized at least in the region where it contacts the rebound belt and shown by the N and S poles. Again, the rebound belt **56** may be of urethane material and the lines of force from the type finger **57** engage the stationary backstop bar of magnetic material to provide the degree of biasing of the finger against the rebound belt.

It will be appreciated that modifications may be made in the various structures disclosed in order to produce or to carry out the present invention. Of course, modifications of some of the specific steps cited in describing embodiments of the invention will occur to those skilled in the art. All such modifications which come within the spirit and teachings of this disclosure are intended to be covered by the following claims.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. An arrangement for printing on a record medium comprising a first endless belt supporting a plurality of type bearing fingers spaced along its length, means for causing said belt and type fingers to traverse a line of movement across said record medium, said fingers being formed of material which renders the fingers resilient in a direction perpendicular to the record medium, hammer means positioned along said line of movement for driving selected moving type fingers to

impact on said record medium in a direction transverse to said line of movement, means for controlling the rebound motion of said driven type fingers following such impact comprising a separate, second endless belt, detached from said fingers and located adjacent said fingers to intercept said fingers following rebound, and means for moving said first and said second belts to traverse a line of movement across said record medium substantially with the same velocity.

2. An arrangement according to claim **1** wherein each of said type bearing fingers bears its type near one end remote from said second belt, means for causing said hammers to impart a driving force near the vicinity of said type, and means for locating said second belt adjacent said type fingers near the vicinity of where said driving force is imparted to said type fingers.

3. An arrangement according to claim **2** wherein said belts are made of urethane, means for driving said belts by a common pulley arrangement, and means for preventing said second belt from interfering with the movement of said first belt, comprising means for dimensionally stabilizing said first belt along its longitudinal axis to be more stable than said second belt.

4. An arrangement according to claim **2** comprising means for biasing said type fingers toward said second belt to maintain said type fingers in substantial alignment said alignment being determined substantially by the alignment of said second belt.

5. An arrangement according to claim **4** wherein said biasing means comprises means for providing a magentic force for biasing said type fingers toward said second belt.

6. An arrangment according to claim **2** comprising means for providing damping of finger rebound, said means comprising a nonresilient backstop bar fixedly mounted across said line of movement of said second belt and contacting said moving second belt in sliding engagement.

7. An arrangement according to claim **6** further comprising means for biasing said type fingers toward said second belt, said type fingers being made of magnetic spring steel, and means for providing a magnetic force for causing said type fingers to be biased toward said second belt.

8. An arrangement according to claim **7** wherein said backstop bar is made of magnetic material and said magnetic force is established between said type fingers and said backstop bar.

9. An arrangement according to claim **7** wherein said second belt comprises magnetic material and said magnetic force is established between said type fingers and said second belt.

10. An arrangement according to claim **8** wherein said backstop is magnetized.

11. An arrangement according to claim **8** wherein said type fingers are magnetized in the vicinity of where they pass by the second belt.

12. In combination, a belt carrying a plurality of elongated type bearing fingers mounted thereon, means for moving said belt relative to a record medium to cause said fingers to traverse a line of movement across said record medium, hammer means for causing selected ones of said type fingers during movement to ballistically impact against said record medium along said line of movement, said fingers being made of resilient material so as to rebound from said record medium upon impact, means to control the rebound motion of said fingers comprising a second belt separate from said first belt and fingers, means for locating said second belt parallel to said first belt and in a position adjacent said type fingers to intercept said type fingers and dampen finger oscillation upon rebound of said fingers from said record medium and before the rebounding fingers reach the vicinity of said hammer means, and means to minimize wear and noise due to contact between fingers and said second belt comprising means for moving said second belt at substantially the same linear speed as said first-mentioned belt.

13. A type carrier for impact printing on a record medium, comprising an elastic belt, a plurality of flat type carrying fingers extending from said belt in the direction of its width, means for moving said belt to cause said fingers to traverse a line of movement across said record medium, said fingers being flexible and resilient in the direction of said record medium, a plurality of hammers located at respective print column positions associated with the record medium, means for causing selected ones of said hammers to strike desired ones of said type fingers while said belt and fingers are in motion to cause said type fingers to impact against said record medium, means to prevent said fingers from striking said hammers upon rebound from said record medium comprising a second belt, detached from said fingers and first-mentioned belt, of flexible, damping material, means for moving said second belt at substantially the speed and in substantially the same plane as said first-mentioned moving belt, means for locating said second belt adjacent said fingers to contact said type fingers near the vicinity of where said hammers impact against said type fingers in order to control the rebound motion of said fingers and dampen finger oscillation.

14. A type carrier for impact printing on a record medium, comprising a urethane belt, a plurality of flat type carrying fingers extending from said belt in the direction of its width, means for moving said belt to cause said fingers to traverse a line of movement across said record medium, said fingers being made of spring steel dimensioned to be flexible and resilient in the direction of said record medium, a plurality of hammers located at repective print column positions associated with the record medium, means for causing selected ones of said hammers to strike desired ones of said type fingers while said belt and fingers are in motion to cause said type fingers to impact against said record medium, means to control the rebound motion of said fingers and dampen finger oscillation comprising a second belt, detached from said fingers and first-mentioned belt, of urethane material, means for moving said second belt at substantially the speed and in substantially the same plane as said first-mentioned moving belt, means for locating said second belt in a position adjacent said type fingers to contact said type fingers near the vicinity of where said hammers impact against said type fingers, and a nonresilient backstop bar mounted across said line of movement of said second belt and contacting said moving second belt in sliding engagement.

15. In combination, a belt carrying a plurality of fingers mounted thereon, each of said fingers carrying a respective type face at its end remote from the belt location, means for moving said belt relative to a record medium to cause said fingers to traverse a line of movement across said record medium, means for striking se-

lected ones of said type fingers in the vicinity of said type location on said fingers during movment to cause the associated type to be driven toward and impact against said record medium, said fingers being made of resilient material so as to rebound from said record medium upon impact contacts, means to control the rebound motion of said fingers to prevent undesirable collision with subsequent hammers and to dampen finger oscillation comprising a second belt, detached from said fingers and said first-mentioned belt, means for moving said second belt at substantially the same velocity as said first-mentioned belt, and means for locating said second belt in a position adjacent said type fingers to contact said type fingers in the vicinity of said type location on said fingers along the rebound path from said record medium and before the rebounding fingers reach the vicinity of said means for striking.

16. In combination, a type carrier for impact printing on a record medium comprising a first, endless, elastic belt, elongated type-carrying fingers supported by said first belt at precise predetermined locations and extending transversely of the longitudinal axis of said first belt, means for moving said first belt to cause said fingers to traverse a line of movement across a record medium, said fingers having their elongated portions extending substantially in a common plane along said line of movement and being flexible in a direction substantially orthogonal to said plane, means for striking desired ones of said fingers while said first belt and fingers are moving to cause said type fingers to be driven in one direction orthogonal to said plane for impact against said record medium, to effect printing on said medium, means for controlling the rebound motion of said fingers upon impact with said record medium comprising a second, endless belt detached from said first belt and said fingers and positioned adjacent to said type fingers, and means for moving said first and second belt at the same velocity.

17. In combination, a type carrier for impact printing on a planar, record medium comprising a first, endless, elastic belt, elongated type-carrying fingers supported by said first belt at precise predetermined locations, means for moving said first belt to cause said fingers to traverse a line of movement across said medium, said fingers having their elongated portions extending substantially in a common plane along said line of movement and being flexible in a direction substantially orthogonal to said medium, means for driving desired fingers to impact said record medium to effect printing while said belt and fingers are moving, means for damping the oscillation of said fingers following such impact and rebound from said record medium comprising a second, endless belt detached from said fingers and first belt and positioned to intercept said fingers during their rebound motion, means for normally maintaining said fingers substantially in alignment while awaiting being driven comprising said second belt and means for biasing said fingers to substantially contact said belt, and means for minimizing wear and noise due to such contact comprising means for moving said second belt at substantially the same velocity as said first belt.

18. In combination, a type carrier for impact printing on a record medium comprising a first, endless, elastic belt, elongated type-carrying fingers supported by said first belt at precise predetermined locations, means for moving said first belt to cause said fingers to traverse a line of movement across said medium, said fingers having their elongated portions extending from said belt and being flexible in a direction to impact said medium upon being struck, means for striking desired type fingers to cause such fingers to impact said medium and rebound therefrom while said belt and fingers are moving, a second, endless belt detached from said fingers and positioned adjacent said fingers to intercept the rebounding fingers, and means for moving said first and second belts at the same velocity.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,766,852 Dated October 23, 1973

Inventor(s) Seymour M. DePuy et al

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 50	cancel "dampening" and insert -- damping --
	line 51	cancel "dampening" and insert -- damping --
	line 55	cancel "dampening" and insert -- damping --
	line 62	cancel "on the fly" and insert -- "on-the-fly" --
	line 64	cancel "on the fly" and insert -- "on-the-fly" --
Column 2,	line 9	cancel "on the fly" and insert -- "on-the-fly" --
Column 3,	lines 16 & 17	cancel "osciallations" and insert -- oscillations --
Column 5,	line 28	cancel "ecord" and insert -- record --
	line 39	after "U.S." insert -- continuation --
		cancel "Ser. No. 739,501 filed June 4, 1968" and insert -- Ser. No. 312,722, filed December 6, 1972 --
Column 7,	line 24	after "longitudinal" insert -- alignment
Column 8,	line 17	cancel "illustrateS" and insert -- illustrates --
Claim 5,	lines 30 & 31	cancel "magentic" and insert -- magnetic

Signed and sealed this 16th day of July 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

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