

[54] **PRINTING HEAD FOR HIGH SPEED DOT MATRIX PRINTER**

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[58] Field of Search 101/93; 197/1

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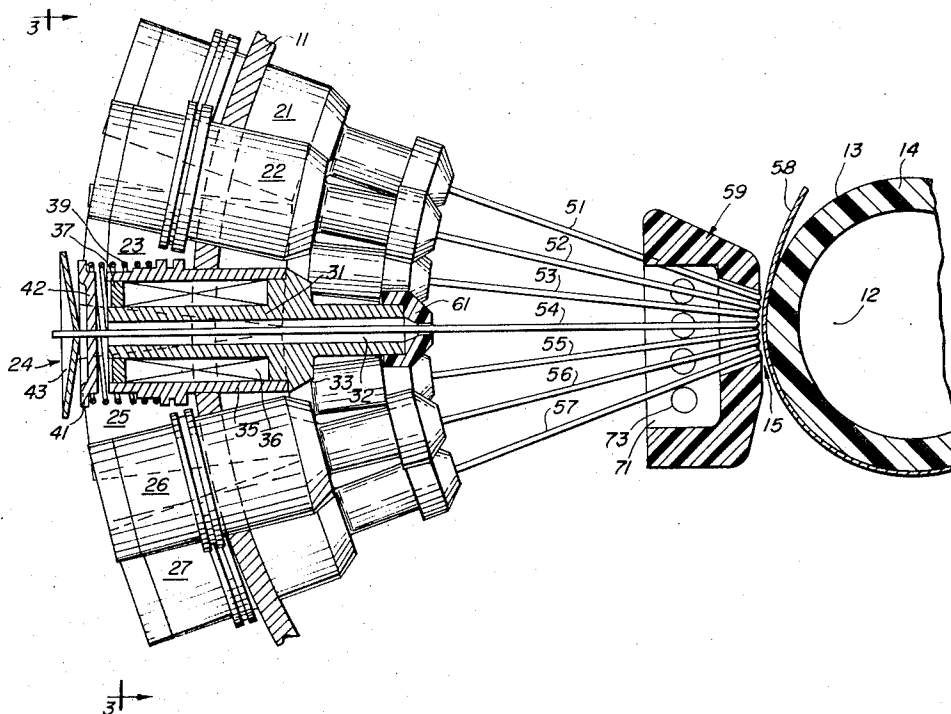
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[57] **ABSTRACT**

A printing head for a high speed dot matrix printer, comprising a plurality of cylindrical electromagnets mounted in an arcuate array with their axes converging on a series of linearly aligned points immediately adjacent an arcuate printing surface. Each electromagnet has a spring-supported armature spaced from its outer end and a needle-like printing rod affixed to the armature and extending through the magnet coil, in spaced coaxial relation thereto, toward the printing surface. A guide bearing engages each rod near the printing surface, but most of the rod length is free of surface contact.

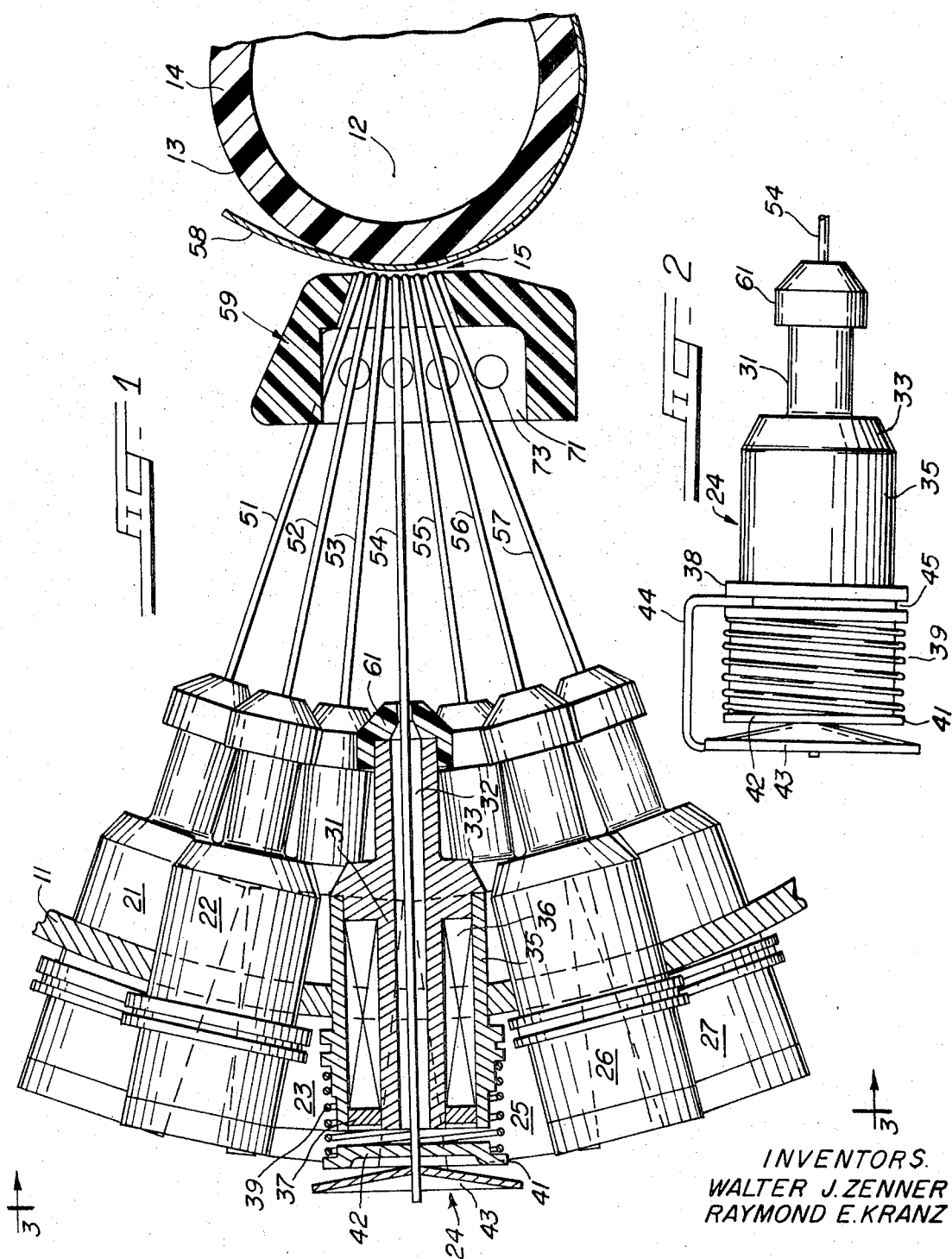
9 Claims, 10 Drawing Figures

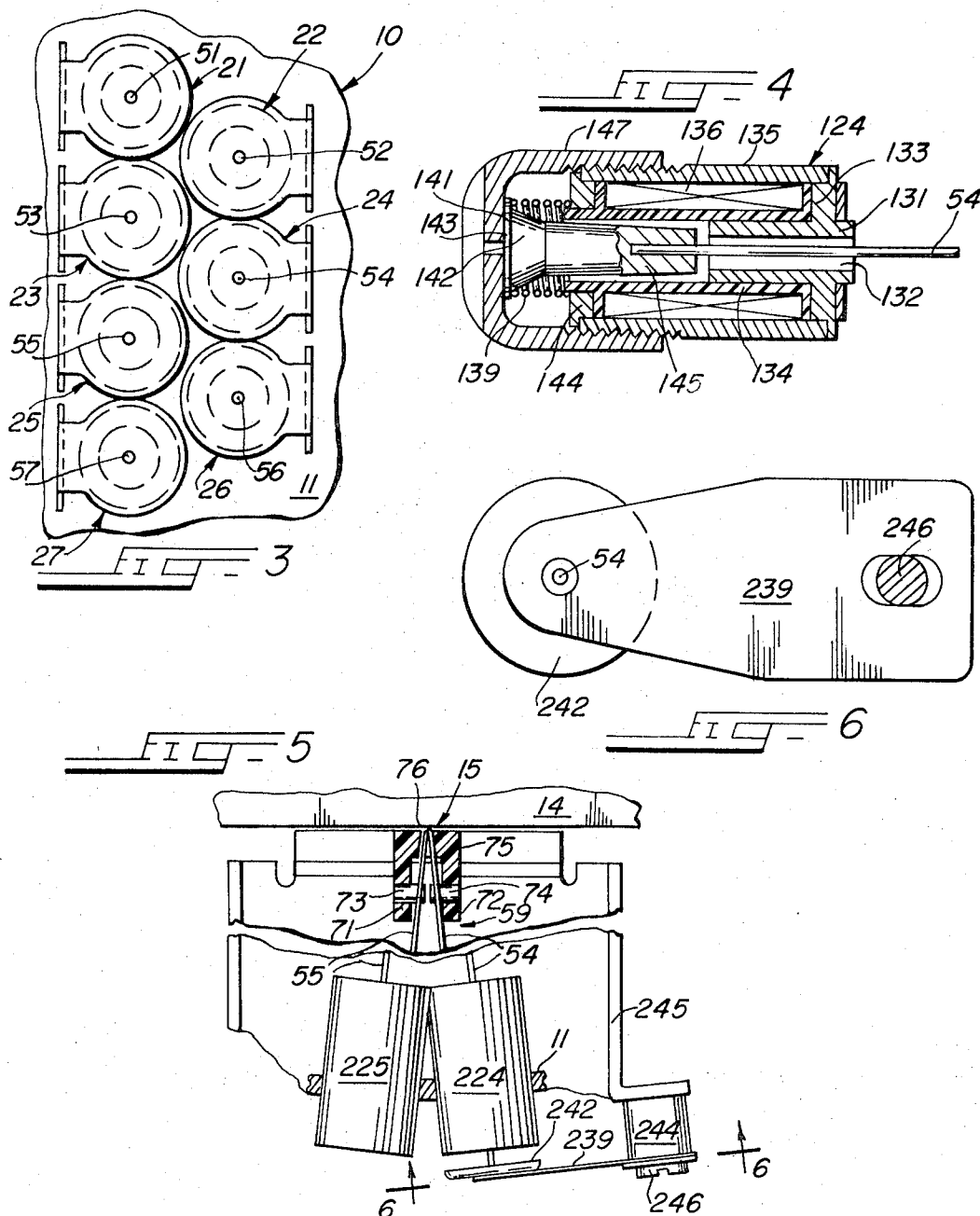


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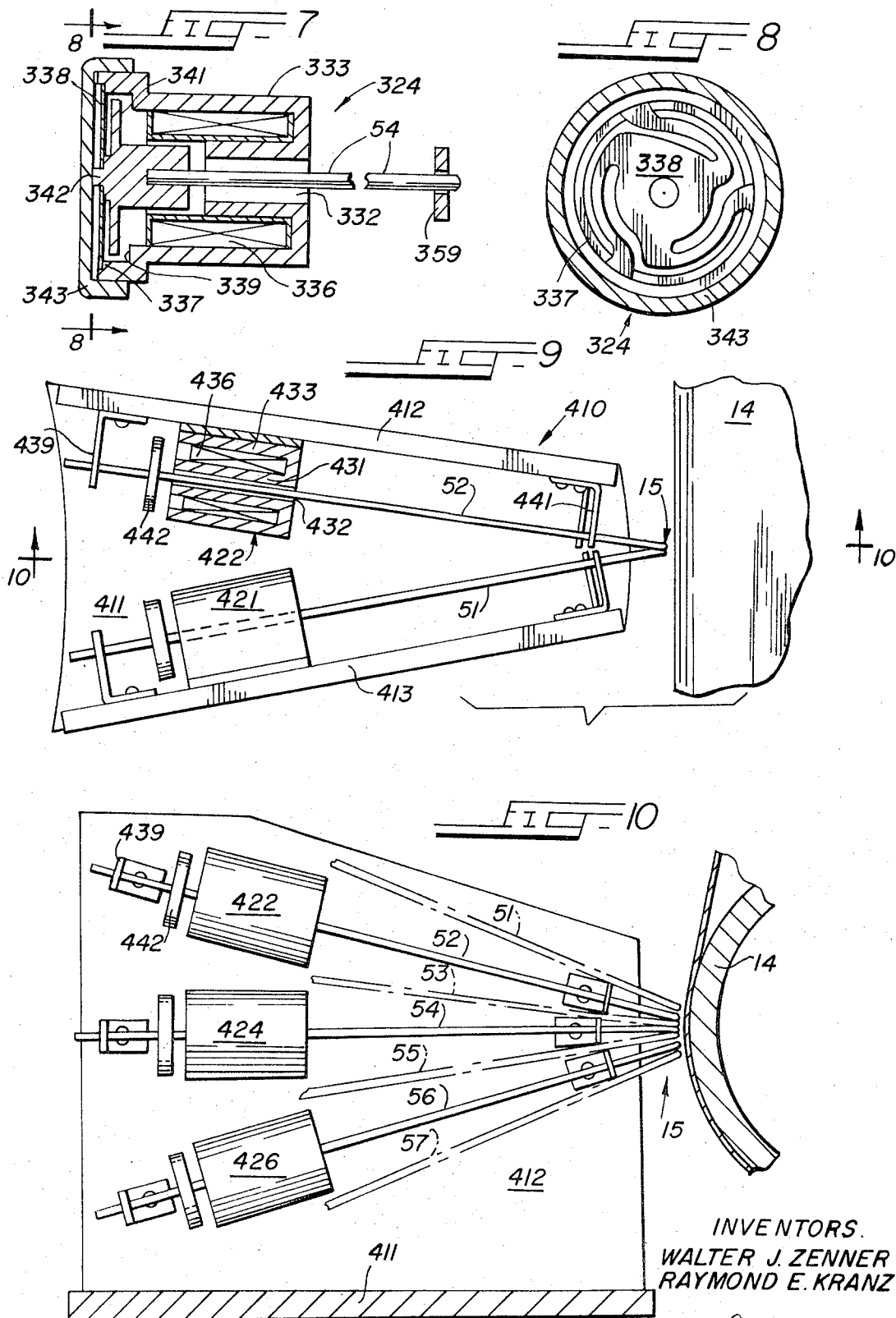
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PRINTING HEAD FOR HIGH SPEED DOT MATRIX PRINTER

CROSS REFERENCE TO RELATED APPLICATION

The printing head described herein is particularly useful in the high speed printer disclosed in the copending application of Walter J. Zenner and Raymond E. Kranz, Ser. No. 71,051, filed Sept. 10, 1970, now U.S. Pat. No. 3,670,861.

BACKGROUND OF THE INVENTION

In a dot matrix printer, the printing operation is performed by a plurality of elongated printing rods or wires that are normally maintained in alignment with a printing surface and spaced a very short distance from that surface. To print a given character, a selected group of printing rods is driven into contact with the paper; the character imprint may be accomplished in a single operation if a large two-dimensional group of printing wires is used or it may be accomplished in several steps if a single row of printing rods is used. In either type of dot matrix printer, the printing rods are actuated many times in printing even a single page of material, either once per character or several times per character.

Dot matrix printers have been used for many years, but usually only in a relatively protected environment. In those printers employing elongated print wires, it is customary to enclose the wire in a sheath which may tend to collect moisture and to freeze under low temperature conditions. Whether employing long wires or short rods as the printing elements, dot matrix printers tend to clog and to exhibit operational difficulties if used in dusty or dirty areas, in applications where the printer is subject to sub-freezing temperatures, or in other adverse environments. This is particularly true because, for the most part, the constructions employed have tended to collect dirt and other foreign matter around the printing rods or wires, leading to substantial maintenance difficulties.

Another problem of dot matrix printers pertains to the extremely rapid action of the printing rods required to achieve high printing rates, particularly in those printers that utilize only a single row of printing rods so that some of the printing rods must be actuated several times to reproduce even a single character. When long printing wires are used, there is likely to be substantial friction and considerable mechanical inertia, both tending to limit the maximum printing speed. This is also true of printing heads that use short printing rods, as is virtually necessary when the printing head is mounted on a movable carriage, if the electromagnets for the printing rods are mounted directly on the rods, as has been done in some prior art printers. The effort required to drive the individual printing elements is also increased in any construction in which a substantial length of the printing rod is encased in a sheath, or supported in elongated bearings, due to the friction between the printing rod and the members that it contacts.

SUMMARY OF THE INVENTION

It is a principal object of the present invention, therefore, to provide a new and improved construction for a printing head for a high speed dot matrix printer, of the

kind in which the printing head is mounted upon a movable carriage that traverses a printing surface, that can maintain effective and continuous operation with minimal maintenance under a wide variety of different and frequently adverse environmental conditions, including dust, dirt, and sub-freezing temperatures.

A more specific object of the invention is to provide a new and improved construction for a high speed dot matrix printing head in which the movable printing elements and the other members connected therewith are of minimum mass and have a minimum mechanical inertia, facilitating high speed printing operation.

Another specific object of the invention is to provide a new and improved high speed dot matrix printing head in which friction losses in operation of the printing elements are minimized by mounting each printing element in what amounts to a substantially frictionless suspension

A further object of the invention is to provide a new and improved printing head for a high speed dot matrix printer, particularly the kind that utilizes only a single row of printing rods or similar printing elements, that is compact, light in weight, and inexpensive to manufacture, yet consistent and long-lived in its operation.

Accordingly, the invention is directed to a printing head for a high speed dot matrix printer which comprises a frame and a plurality of electromagnets that are mounted on the frame in an arcuate array, each electromagnet including a coil and an armature and having a central aperture, with the projected axes of the apertures converging and extending through a print location in a predetermined pattern, usually a single vertical line. The printing head further comprises a corresponding plurality of elongated printing rods, each rod extending in coaxial spaced relation through the aperture of its electromagnet to a point immediately adjacent the aforesaid print location. The outer end of each printing rod is affixed to the armature of its associated electromagnet so that energization of the electromagnet drives the armature and the rod axially toward the print location. Independent resilient suspension means are provided for each printing rod, maintaining the rod and its associated armature in essentially coaxial relation with the electromagnet aperture. Guide bearing means engage only a limited portion of each of the printing rods, near the print location, to maintain the rods in alignment with the aforementioned pattern; each rod is substantially free of surface contact between its associated electromagnet armature and the guide bearing means.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation view, partly in cross section, illustrating a dot matrix printing head constructed in accordance with one embodiment of the present invention;

FIG. 2 is a detail elevation view of one electromagnet in the printing head;

FIG. 3 is an end elevation view taken approximately as indicated by line 3—3 in FIG. 1;

FIG. 4 is a sectional elevation view illustrating a modified construction for the electromagnet and printing rod mount of the invention;

FIG. 5 is a plan view, partly in cross section, of a further embodiment of the invention;

FIG. 6 is a detail view taken approximately along line 6—6 in FIG. 5;

FIGS. 7 and 8 are detail views of another embodiment of the electromagnet and printing rod mount;

FIG. 9 is a plan view, partly in cross section, of another embodiment of the invention; and

FIG. 10 is a sectional elevation view, taken along line 10—10 in FIG. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIGS. 1, 2 and 3 illustrate a printing head 10 for a high speed dot matrix printer constructed in accordance with one embodiment of the present invention and particularly suitable for use in a printer of the kind described in the aforementioned co-pending application of Walter J. Zenner and Raymond E. Kranz, Ser. No. 71,051, in which the printing head includes only enough printing rods for a single vertical line of dots and is mounted upon a carriage that is moved across a printing surface to print a line of characters. Printing head 10 includes a support member or frame 11 of arcuate configuration that is preferably a part of the carriage of the printer. The center of curvature of the arcuate frame 11 is a point 12 located a short distance within the external printing surface 13 of a cylindrical platen 14. Thus, a series of radial lines drawn from point 12 to the arcuate support member 11 will pass through a printing location 15, on the surface 13 of platen 14, in a linear pattern of dots.

Printing head 10 further comprises a plurality of electromagnets mounted in an arcuate array upon support member 11. In the illustrated construction, there are seven individual electromagnets 21 through 27. As shown in FIG. 3, the electromagnets 21—27 are arranged in two close-packed rows, the four odd-numbered electromagnets being in one row and the three even-numbered electromagnets being in the adjacent row. Electromagnet 24, which is located at the center of the array of electromagnets, is shown in cross sectional detail in FIG. 1.

Electromagnet 24, as shown in FIGS. 1 and 2, comprises a cylindrical core member 31, preferably formed of a high-permeability steel or other material having suitable magnetic properties. Core 31 has an elongated central aperture 32. A flange 33 is formed around the medial portion of the magnet core member 31 and a magnetic sleeve 35 is mounted on flange 33. An electrical coil 36 is wound on core 31, between the outer end of the core and the sleeve 35. The outer end of the electromagnet assembly is closed by a non-magnetic washer 37.

The outer end of sleeve 35 comprises a seat for the inner end of a coil spring 39; spring 39 abuts against a shoulder 38 formed integrally with sleeve 35. The outer end of spring 39 engages a flange 41 on a disc-shaped magnetic armature 42. Normally, spring 39 maintains armature 42 displaced from sleeve 35 and core 31, in engagement with a non-magnetic stop member 43. As best shown in FIG. 2, stop member 43 is of U-shaped configuration and includes a mounting arm 44 that extends back along the electromagnet 24 and is mounted in a slot 45 in the shoulder 38 on sleeve 35. Thus, spring 39 provides a resilient suspension means for armature 42.

Printing head 10 further comprises a plurality of elongated printing rods 51 through 57, one for each of the electromagnets 21—27. As shown in FIG. 1, printing rod 54 extends coaxially through the central aperture 32 in the core 31 of electromagnet 24. The outer end of printing rod 54, the end farthest from print location 15, is affixed to armature 42. Thus, spring 39 affords a resilient suspension for rod 54, as well as armature 42, maintaining the rod and the armature in essentially coaxial relation with the central aperture 32 of the electromagnet 24. The inner end of rod 54 extends almost to contact with platen surface 13 at print location 15. The inner end of the print rod just clears a sheet of paper 58 extending around the surface of the platen. The mounting and alignment of the remaining printing rods 51—57 is the same as described and illustrated for printing rod 54.

Printing head 10 is provided with guide bearing means engaging only a limited portion of each of the printing rods 51—57 near the print location 15. In the illustrated construction, this guide bearing means comprises a molded guide bearing member 59 that engages the inner end of each of the printing rods 51—57 and maintains the printing rods in a linear array at the printing location 15. Preferably, the guide bearing member 59 is a molded member of nylon or other plastic material having substantial inherent self-lubricating properties.

The full length of printing rod 54, intermediate armature 42 and bearing member 59, is left free of any substantial contact with other structural elements of printing head 10. That is, the printing rod should be substantially free of surface contact for most of its length. However, it may be desirable to add an additional guide at the center of the printing rod to avoid undue bending of the rod during operation. To this end, a loose-fitting guide member 61 may be mounted on the end of the electromagnet core 31 to afford a limited support for the center portion of rod 54. Guide member 61 should provide a loose fit with rod 54 to minimize frictional engagement between these two elements of the printing head, so that member 61 can perform a guiding function without substantial interference with longitudinal movement of rod 54.

In FIGS. 1—3, electromagnet 24 and print rod 54 are illustrated in the positions that they occupy when the electromagnet is de-energized. On energization of coil 36, the magnetic field of the coil, coupled to armature 42 through the magnetic shell comprising core 31 and sleeve 35, is pulled toward print location 15 against the bias afforded by spring 39. Since printing rod 54 is affixed to armature 42, the printing rod is driven in an axial direction into impact with paper 58 at print location 15, producing a dot impression upon the paper. A visual impression may be created upon the paper by use of a ribbon or accompanying carbon paper; preferably, an impact-sensitive reproducing paper is employed so that no ribbon or carbon is necessary.

Coil 36 is energized for only a short interval and is then de-energized, whereupon spring 39 drives armature 42 back to its original position. The printing rod travel is very short (e.g., one thirty-second inch). This operation is repeated for every column of every character that requires a dot at the central location covered by printing rod 54. The operation is the same

for each of the other electromagnets 21-27 and their associated printing rods 51-57. Printing head 10 is moved rapidly longitudinally of platen 14 to reproduce a complete line of characters, the actuation of the printing rods 51-57 proceeding at a high rate of speed.

Printing head 10 is relatively immune to clogging when used in a dusty or dirty environment. There are no elongated areas of close fit between any of the printing rods 51-57 and other parts of the printing head, so that it is quite difficult for dirt or dust to collect at any point that would jam the mechanism. The only moving parts in the printing head are the relatively light-weight armatures and printing rods, such as the printing rod 54 and its armature 42. The low inertia of the moving parts (limited to the printing rods and the armatures) makes high speed operation practical and efficient and also reduces the signal excitation level required for effective printing. There are no bearing or sleeves for the printing elements that would require lubrication, further reducing the possibility of clogging due to the collection of dirt or dust in the mechanism. Furthermore, the open construction employed makes the collection of moisture in the mechanism at any vital spot unlikely, so that the printing head does not freeze up when used in a low temperature environment.

In each operation of each of the printing rods, the return movement of the printing rod is arrested when its armature engages the associated stop member such as the stop member 43 for armature 42. Stop member 43 may be constructed with some resiliency to help absorb the energy of the armature and the printing rod as they return to the normal de-energized condition.

FIG. 4 illustrates an alternative construction that may be used for the electromagnets in printing head 10. The electromagnet 124 shown in cross section in FIG. 4 comprises a hollow core 131 having a central aperture 132 through which a printing rod 54 extends in coaxial spaced relation. The outer rim of a flange 133 on core member 131 carries one end of a sleeve 135 formed of high permeability magnetic material. A coil 136, wound upon a bobbin 134, is mounted within sleeve 135, one end of the bobbin 134 being affixed to the inner portion of magnetic core 131.

The armature 142 for electromagnet 124 is substantially different in construction from that described above in connection with FIG. 1. Armature 142 has a conical outer portion 141 terminating in a flange 143 that provides a seat for one end of a coil spring 139. The other end of spring 139 is seated around the outer end of bobbin 134 against a washer 144. The conical end 141 of armature 142 tapers inwardly to a smaller section 145 that extends partly into the electromagnet, within coil 136. The print rod 54 is fitted into an axial opening in the inner portion 145 of armature 142. A cup-shaped non-magnetic combination stop member and cover 147 is threaded onto sleeve 135.

In FIG. 4, electromagnet 124 is illustrated with the parts in the positions occupied when coil 136 is de-energized. Upon energization of coil 136, the magnetic field of the coil draws armature 142 inwardly. This drives printing rod 54 through a short distance in an axial direction so that the printing rod strikes the paper and makes a dot impression, as described above. When coil 136 is de-energized, spring 139 drives armature 142 outwardly against stop member 147, restoring the

electromagnet to its original operating condition and again pulling print rod 54 a short distance away from the print location. In addition to providing a stop for armature 142, the cup-shaped member 147 substantially encloses the outer end of the electromagnet to protect it against dirt, moisture, and the like.

FIGS. 5 and 6 illustrate another modification of the armature mounting for the present invention; FIG. 5 also affords a more detailed illustration of the guide bearing means 59 for the print rods 51-57. Only two electromagnets 224 and 225 are shown in FIG. 5, being positioned in the array in the same positions as electromagnets 24 and 25 (FIGS. 1 and 3). As shown in FIG. 5, the guide bearing member 59 is formed with two spaced walls 71 and 72 between which the printing rods such as printing rods 54 and 55 extend. The one wall 72 has a series of nylon posts 74 mounted therein to provide for vertical spacing of the even-numbered printing rods. Similarly, wall 71 has a series of nylon or other self-lubricating resin posts 73 mounted therein which engage the odd-numbered printing rods and maintain them in vertical spaced alignment. All of the printing rods extend forwardly through an additional wall 75 of nylon or like material, immediately adjacent printing location 15. The block 75 has a V-shaped opening 76 to maintain horizontal alignment of the printing rods, all of the printing rods projecting through the V-shaped opening 76.

In the construction illustrated in FIGS. 5 and 6, the armature 242 for the electromagnet 224 is mounted upon a leaf spring 239. The leaf spring 239 has one end supported upon a spacer 244 that is in turn mounted upon a frame member 245 by suitable means such as a bolt 246. The leaf spring 239 performs the same basic function as the coil springs in the previously described embodiments, but does not require a stop member to limit the outward travel of the electromagnet armature. On the other hand, the leaf spring construction introduces a slight disadvantage in that the bending of the spring tends to introduce a slight bending of the associated printing rod 54, which may ultimately result in some minor deformation of the printing rod. In all other respects, the construction and operation of the embodiment illustrated in FIGS. 5 and 6 is essentially similar to that of FIGS. 1-4.

FIG. 7 illustrates a modified form of electromagnet, printing rod, and armature suspension means that may be utilized in either of the printing heads illustrated in FIGS. 1 and 5. The electromagnet 324, shown in cross section in FIG. 7, comprises a hollow core 331 having a central aperture 332 through which the printing rod 54 extends in coaxial spaced relation. Core 331 is of re-entrant construction, affording an outer magnetic sleeve 333 that extends parallel to the inner portion of the core. A coil 336 wound on a bobbin 334 is mounted within sleeve 333 around the central core 331.

The outer end of sleeve 333 is of enlarged circumference and is formed with a shallow internal shoulder 337. A three-legged flat convoluted spring 338 is mounted on shoulder 337. The central portion of spring 338 is affixed to an armature 342 for electromagnet 324. Armature 342 includes a peripherally extending flange 341 aligned with and engageable with an internal shoulder 339 in sleeve 333. Armature 342 is affixed to the outer end of printing rod 54.

Spring 338 comprises an independent resilient suspension means for maintaining both armature 342 and printing rod 54 in coaxial alignment with the central aperture 332 for coil 336, out of contact with the other elements of the electromagnet. The inner end of printing rod 54 is engaged by a guide bearing means, generally indicated at 359, that engages only a very limited portion of the printing rod. Guide bearing means 359, which may correspond in construction to the guide bearing means 59 described above, serves to maintain printing rod 54 and the other printing rods in the printing head in alignment in the desired pattern at the print location.

A cap 343 may be mounted upon shell 333 in encompassing relation to shoulder 337. The cap 343 thus extends across the rear of electromagnet 324, protecting spring 338 and the other working parts of electromagnet 324 from damage from external causes. Cap 343 also serves as a backstop to limit return movement of rod 54 when a printing operation has been completed and coil 336 is de-energized. As in the previously described embodiments, energization of coil 336 drives rod 54 to the right to create a print impression by impact. When the coil is de-energized, spring 338 pulls the armature 342 and rod 54 back to the left to the final position against backstop 343.

Spring 338 offers some space-saving advantages in comparison with a conventional helical spring such as the springs 39 and 139 of FIGS. 1 and 4. Furthermore, spring 338 is more effective in maintaining the desired position of the armature and rod against any tendency toward lateral deflection; spring 338 is quite stiff in a direction parallel to the plane of the spring and affords a high resistance to lateral movement, substantially higher than a helical spring, while remaining quite compliant for axial movement.

FIGS. 9 and 10 illustrate a printing head 410 constructed in accordance with yet another embodiment of the present invention. Printing head 410 comprises a frame including a bottom wall 411 and two vertically extending side walls 412 and 413. A plurality of electromagnets are mounted in an arcuate array upon the vertical walls 412 and 413 of this frame. Thus, there are three electromagnets 422, 424 and 426 mounted upon the one vertical side wall 412, these electromagnets serving as driving motors for three printing rods 52, 54 and 56, respectively. On the other vertical wall 413, there are four electromagnets, as exemplified by electromagnet 421. These additional electromagnets are utilized as drive motors for the remaining printing rods 51, 53, 55 and 57 shown in phantom outline in FIG. 10. As before, the printing rods converge in a linear pattern at a print location 15 on the surface of a roller platen 14.

The construction for the individual electromagnets, in print head 410, may be generally similar to those used in the previously described embodiments. As shown in FIG. 9, electromagnet 422 comprises a central core 431 formed integrally with an outer magnetic sleeve 433. Core 431 has a central axial aperture 432 through which print rod 52 extends in aligned spaced relationship. An electromagnetic coil 436 is disposed between the central core 431 and the outer magnetic shell 433. The armature 442 for electromagnet 422 is mounted upon print rod 52 and is normally maintained

in spaced relation to the end of the magnetic structure for electromagnet 422.

It is the resilient suspension means for printing rods 51-57 that presents the principal difference in printing head 410, as compared with the previously described embodiments. An elongated leaf spring 439 affixed to frame member 412 supports the outer end of print rod 52 and provides the principal support for armature 442. Thus, spring 439 affords an independent resilient suspension means that maintains printing rod 52 and armature 442 in coaxial alignment with the central aperture 432 of electromagnet 422 while allowing free axial movement, within a limited range. Spring 439 normally maintains armature 442 spaced from the magnetic structure of the electromagnet.

The guide bearing for printing rod 52, on the other hand, comprises an additional elongated leaf spring 441 that is mounted upon the vertical frame member 412. Spring 441, like spring 439, affords an independent resilient suspension for the printing rod. A series of similar spring mounts for all of the printing rods in printing heads 410 provide essentially frictionless supports for the printing rods. With the illustrated dual spring suspension for each printing rod, there is virtually no wear, no friction, no sticking, and no drag on any of the printing rods. Even the limited friction of guide bearing 59, described more fully above, is eliminated in the construction shown in FIGS. 9 and 10.

In all of the various embodiments of the invention described above, virtually the entire length of each of the printing rods, from the printing location to the armature, is free of frictional contact with any other part of the printing head. There are no sheaths for the printing rods to collect dirt and clog. The constructions employed are not susceptible to the collection of moisture, which can freeze and prevent effective operation if the printer is used in low temperature environments. The only moving parts in the printing head comprise the printing rods and the lightweight armatures to which they are secured, resulting in a construction having low operating inertia suitable for high speed operations. Relatively low signal levels can be utilized because of the low inertia of the printing rods and armatures, and the essentially frictionless suspensions for the members. The entire structure is quite small and compact and hence well suited to use in a small high speed printer in which the printing head is mounted upon a movable carriage.

We claim:

1. A printing head for a high speed dot matrix printer comprising:

a frame;

a plurality of electromagnets, mounted in an arcuate array, each electromagnet including an fixed magnetic structure having a central axial aperture and a coil mounted within the fixed magnetic structure in symmetrical coaxial alignment with its central aperture, the projected axes of said central apertures of said electromagnets converging toward and extending through a print location in a predetermined pattern;

a corresponding plurality of elongated, stiff, linear printing rods, each extending coaxially through the central aperture of an associated electromagnet, to a point immediately adjacent to said print location;

a corresponding plurality of magnetic armatures, one for each electromagnet, each armature being affixed to the outer end of the printing rod for its electromagnet in coaxial alignment with said printing rod to afford a print rod assembly for the associated electromagnet, said print rod assembly being the only structure located in said central aperture, energization of the electromagnet coil driving the armature toward abutting engagement with the fixed magnetic structure;

fixed inner end guide means, engaging only a limited inner end portion of each of said printing rods, for maintaining the inner end of each printing rod in co-linear alignment with the axis of the central aperture in its associated electromagnet and in alignment with said predetermined pattern;

and a corresponding plurality of individual, independent suspension springs, each affixed to the outer end of the fixed magnetic structure of one electromagnet and to the outer end of the print rod assembly for that electromagnet;

one of said suspension springs and said inner end guide means constituting the sole support for the entire print rod assembly for each electromagnet, maintaining both said armature and said print rod in coaxial linear alignment with the central aperture of the fixed magnetic structure and totally free of engagement with said central aperture at all times and limiting the print rod assembly and the fixed magnetic structure to abutting engagement of the armature and the fixed magnetic structure whenever the coil is energized, whereby friction losses in operation are limited to frictional engagement of the printing rods with the inner end guide means and internal friction in the suspension springs.

2. A printing head for a high speed dot matrix printer, according to claim 1, in which said independent resilient suspension means for each armature and printing rod comprises a flat leaf spring extending transversely to said rod and supporting said rod near the outer end of the rod.

3. A printing head for a high speed dot matrix printer, according to claim 2, in which said inner end guide means comprises a corresponding plurality of flat cantilever leaf springs, one for each armature and rod, each supporting its rod at a point near said print location.

4. A printing head for a high speed dot matrix printer according to claim 2 in which each said leaf spring is a plural-legged convoluted flat spring concentrically mounted relative to its associated printing rod.

5. A printing head for a high speed dot matrix printer, according to claim 1, in which said electromagnet includes a central core and an encompassing concentric sleeve, both of high-permeability magnetic material, and in which said armature is of disc-like configuration, spanning said core and said sleeve when said electromagnet is energized.

6. A printing head for a high speed dot matrix printer, according to claim 1, and further comprising a corresponding plurality of loose-fitting central guide

members, each located at the central portion of a respective one of said print rods, and each extending for only a minor fractional portion of the length of a print rod, for preventing excessive bending of the print rods.

7. A printing head for a high speed dot matrix printer, according to claim 1, in which said inner end guide means comprises two separate guide structures, engaging said print rods at closely spaced points, for maintaining said print rods in vertical and horizontal alignment respectively.

8. A printing head for a high speed dot matrix printer comprising:

a frame;

a plurality of electromagnets, mounted on said frame in an arcuate array, each electromagnet including a fixed magnetic structure having a central axial aperture and a coil mounted within the fixed magnetic structure in symmetrical coaxial alignment with its central aperture, the projected axes of said central apertures of said electromagnets converging toward and extending through a print location in a predetermined pattern;

a corresponding plurality of elongated, stiff, linear printing rods, each extending coaxially through the central aperture of an associated electromagnet, to a point immediately adjacent to said print location;

a corresponding plurality of magnetic armatures, one for each electromagnet, each armature being affixed to the outer end of the printing rod for its electromagnet in coaxial alignment with said printing rod to afford a print rod assembly for the associated electromagnet, said print rod assembly being the only structure located in said central aperture, energization of the electromagnet coil driving the armature toward abutting engagement with the fixed magnetic structure;

and independent resilient suspension and guide means, engaging each print rod only at limited portions thereof adjacent the ends of the rod, comprising a cantilever leaf spring supporting the print rod near said print location and an additional spring supporting said rod near its outer end,

said suspension and guide means constituting the sole support for the entire print rod assembly for each electromagnet, maintaining both said armature and said print rod in coaxial linear alignment with the central aperture of the fixed magnetic structure and totally free of engagement with said central aperture at all times and limiting the print rod assembly and the fixed magnetic structure to abutting engagement of the armature and the fixed magnetic structure whenever the coil is energized, whereby friction losses in operation are limited to internal friction in the suspension and guide means.

9. A printing head for a high speed dot matrix printer, according to claim 8, in which each said additional spring is a plural-legged convoluted flat spring concentrically mounted relative to its associated printing rod.

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