United States Patent [19]

Howard

[11] **3,833,105**

[45] **Sept. 3, 1974**

[54] **PRINTER HEAD ASSEMBLY**

[75] Inventor: **Robert Howard,** Roslyn, N.Y.

[73] Assignee: **Centronics Data Computer Corp.,** Hudson, N.H.

[22] Filed: **Sept. 10, 1971**

[21] Appl. No.: **179,457**

Related U.S. Application Data

[63] Continuation of Ser. No. 37,815, May 15, 1970, abandoned.

[52] **U.S. Cl.** ..... **197/1 R**

[51] **Int. Cl.** **B41j 3/10,** B41j 1/18

[58] **Field of Search** 197/1

[56] **References Cited**

UNITED STATES PATENTS

2,129,065	9/1938	Loop	197/1 R
2,632,386	3/1953	Hyland	197/1 R X
3,108,673	10/1963	Green	197/1 R
3,333,667	8/1967	Nordin	197/1 R
3,467,232	9/1969	Paige	197/1 R
3,584,575	6/1971	Distl	197/1 R X
3,603,442	9/1971	Ward	197/1 R

Primary Examiner—Edgar S. Burr

Attorney, Agent, or Firm—Ostrolenk, Faber, Garb & Soffen; Louis Weinstein

[57] **ABSTRACT**

A printer head assembly for use in high speed printers of the dot-matrix type. The assembly is comprised of a one-piece die cast member having a bevelled rear wall which forms a truncated pyramidal shape for mounting the driving solenoids. The print wires extend diagonally inwardly together with a centrally mounted solenoid, which print wire extends along the longitudinal axis of the printer head assembly housing whereby the print wires are ultimately aligned along the front surface thereof so as to lie along an imaginary straight line in very closely spaced fashion. Guide means are provided for imparting the appropriate curvature to the print wires in the region where they extend from the front to the rear surfaces of the housing. A jewel bearing provided along the front surface serves as a low-friction mounting of the reciprocating print wires and to prevent abrasive wear of the print wires when in the retracted position. The solenoid construction is of such a design as to be extremely lightweight and capable of high speed operation so as to cooperate with the printer head assembly to provide a compact, lightweight design adapted to be moved at high rates of speed across a paper document.

8 Claims, 7 Drawing Figures

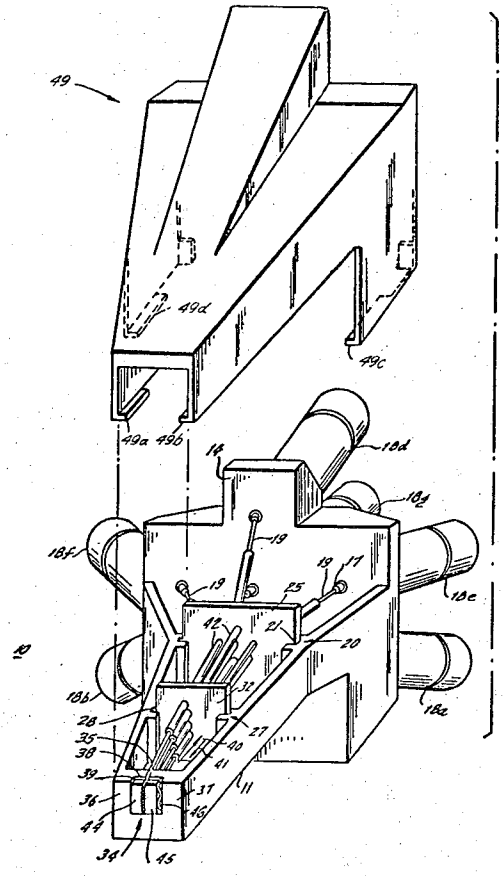

FIG. 1a.

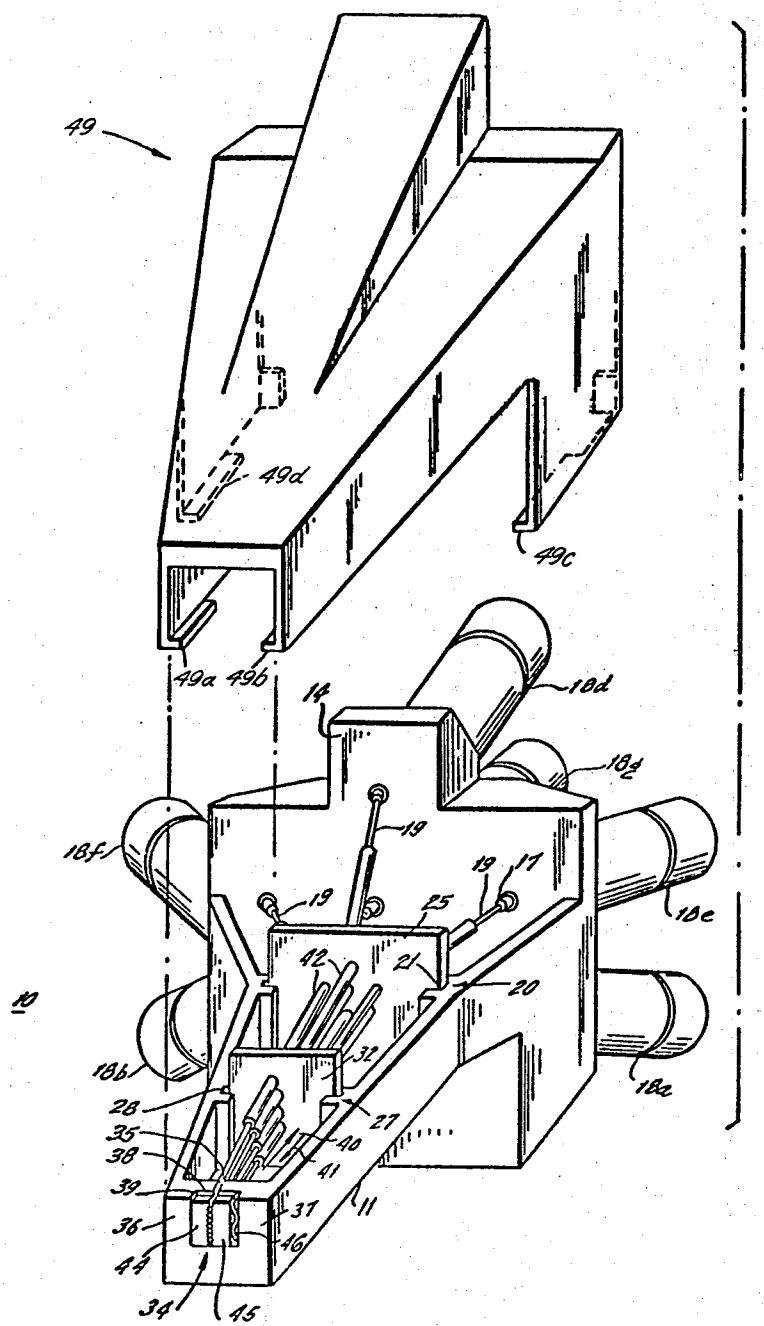
49
49d
49c
49a
49b
14
18d
18g
19
18f
19
17
25
18e
42
21
20
10
32
18b
18a
28
27
35
40
38
41
39
37
11
36
46
44
34
45

FIG. 1b

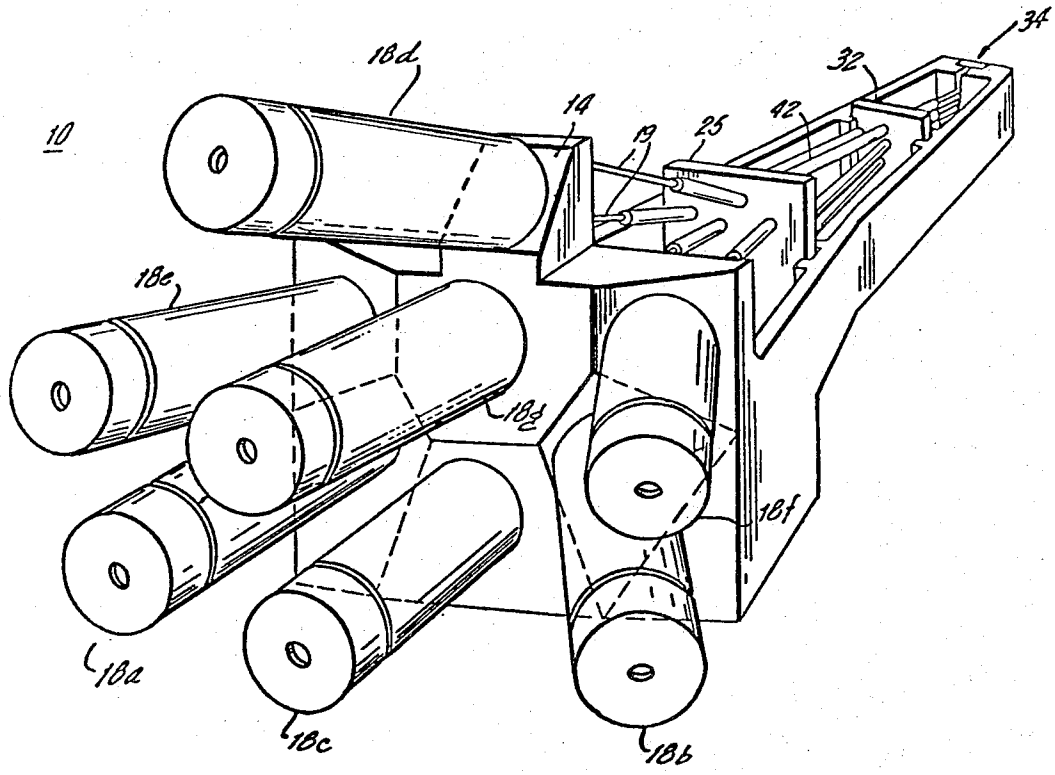
34
32
18d
14
19
25
42
10
18e
18g
18f
18a
18c
18b

FIG. 2

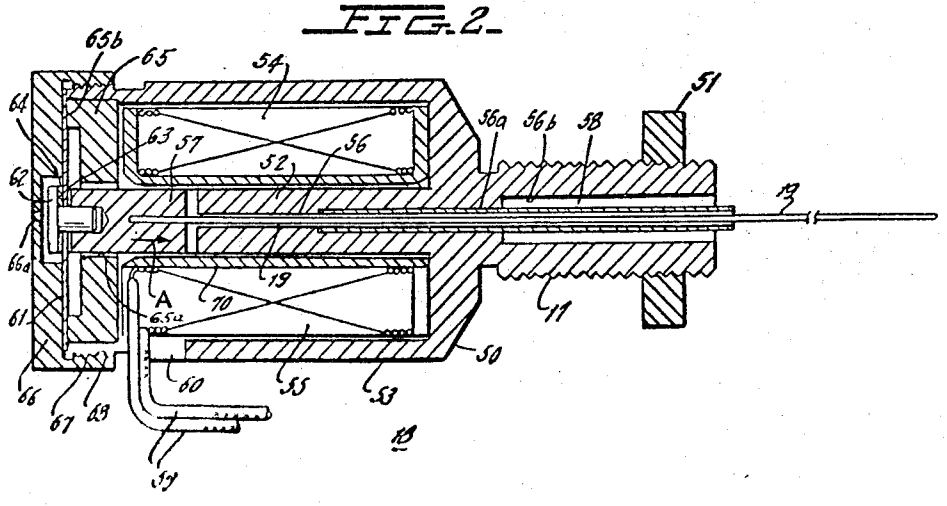
65b
65
54
64
63
57
56
52
56a
56b
58
51
62
19
66a
A
6.5u
70
61
11
50
66
67
69
60
55
53
18
57

FIG. 1c

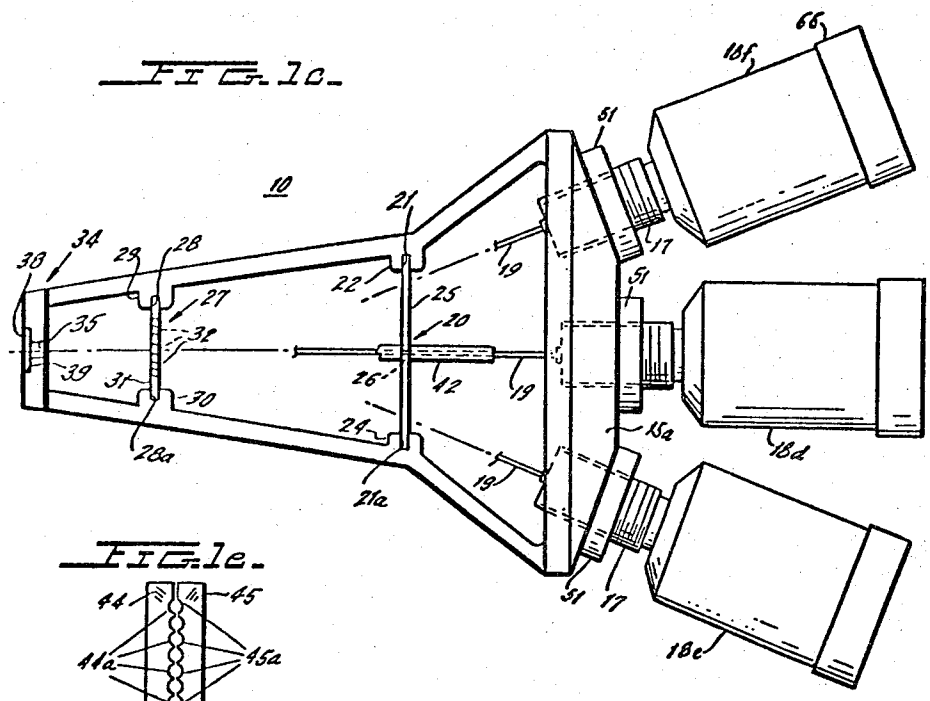

FIG. 1e

FIG. 1f

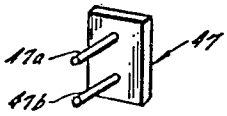

FIG. 1d

PRINTER HEAD ASSEMBLY

This is a continuation of application Ser. No. 37,815, filed May 15, 1970 now abandoned.

The present invention relates to printers and more particularly to a novel printer head assembly and driving means therefor for use with high speed printers of the dot-matrix type.

Wire matrix printers are well known in the prior art. One of the earliest types of wire matrix printers is comprised of a plurality of wires arranged in matrix fashion for making impact through a ribbon to a paper document whereby the wires are selectively energized to form characters, numerals or other symbols. The earliest type of wire matrix printers were capable of printing either words or entire characters. The next development in the art consisted of wire matrix printers having a plurality of wires arranged in an M-row by N-column fashion. A typical arrangement for such wire matrix printers is to provide a total of 35 wires arranged in seven rows and five columns to print any character, number, or symbol. In operation, selected ones of the print wires are driven against the paper document to form the desired character or symbol. The print wires are then shifted one position to the right to print the next character whereby shifting occurs in an intermittent fashion. Since 35 separate mechanisms must be provided for each of the 35 print wires forming the 5 × 7 matrix, the amount of mass which must be moved to perform such printing is quite appreciable. This thereby resulted in the development of wire matrix type printers in which only seven print wires are employed. The print wires are typically arranged in a vertical line and are selectively driven against the paper document to form one of the five columns of the character. The carriage assembly which moves the print wire assembly is then shifted one position to the right to print the next column. This operation continues until all five columns have been printed to ultimately form the character or other symbol.

The present invention is characterized by providing a high speed impact printer of the dot matrix type in which the printer head assembly is constantly moved across the paper document at speeds not heretofore capable of being achieved in present day systems.

The present invention is comprised of a printer head assembly having solenoid driven print wires. The entire printer head assembly, including the solenoid drivers, is moved across the paper document at a constant rate of speed. The arrangement of the printer head assembly is such as to provide a light weight compact structure so as to minimize the mass which is moved across the paper document, enabling the structure to move at relatively high speed.

The printer head assembly is comprised of a one-piece die cast housing having a rear wall which is bevelled to form a truncated pyramidal shape. The light weight high speed solenoid drivers are mounted through tapped apertures provided in each of the rear surfaces so that the solenoid drivers are clustered together in a rather compact fashion. Solenoid drivers are each mechanically coupled to an associated print wire. The print wires are all arranged to converge together at the front end of the housing where they are aligned along an imaginary straight line and arranged in very closed spaced fashion. A jewel bearing mounted upon the front face of the housing effectively provides a low friction guiding means for the forward ends of the print wire as well as eliminating any frictional engagement between the forward ends of the print wires and the paper document which may otherwise occur even when the print wires are in the retracted position, due to the close spacing between the front face of the housing and the paper document.

The closely clustered arrangement of the individual solenoid drivers and the housing assembly provides an extremely compact light weight printer head assembly which is capable of being employed in high speed printers of the dot-matrix type and is adapted to operate at speeds not heretofore obtainable by conventional dot-matrix printers.

It is therefore one object of the present invention to provide a novel printer head assembly for use in impact printers of the dot-matrix type wherein the printer head assembly is designed to occupy a minimum of space and which is of extremely light weight so as to provide an assembly which is capable of operating at high speeds and of moving across a paper document at high speeds during the printing operation.

Another object of the present invention is to provide a novel solenoid driver assembly for use with impact printers of the dot-matrix type, which solenoid driver assemblies are of simplified design and rugged construction to permit high speed operation thereof.

These as well as other objects of the present invention will become apparent when reading the accompanying description and drawing in which:

FIGS. **1***a* and **1***b* are perspective views showing a printer head assembly designed in accordance with the principles of the present invention.

FIGS. **1***c* and **1***d* are top and side elevational views respectively of the printer head assembly of FIGS. **1***a* and **1***b*.

FIG. **1***e* is a front view of the printer head assembly showing the jewel bearings provided along the front face thereof in greater detail.

FIG. **1***f* is a perspective view showing the jewel bearing alignment tool which may be employed in the assembly of printer heads.

FIG. **2** is a sectional view of one of the solenoid drivers as shown in FIGS. **1***a*–**1***d* whereby the internal structure of the solenoid is shown in detail.

FIGS. **1***a*–**1***c* show the printer head assembly **10** which is comprised of a one-piece die cast core member **11** having a base portion **12** for mounting member **11** upon a movable carriage assembly (not shown).

The rear end of member **11** is provided with an upwardly projecting wall **14** having a plurality of tapped openings **15** (note also FIG. **1***a*). The rearwardly directed surface of wall **14** has a truncated pyramidal configuration. The openings **15** provided on the rear surface **15***a* are aligned so as to be substantially perpendicular to their associated mounting surfaces. Opening **15'**, positioned in the truncated portion, is aligned relative to rear surface **15***a* in a substantially similar fashion so that the central axes for all openings except for opening **15'** will intersect at a remote point, which point will lie on an imaginary line which is coincident with the central axis of opening **15'**. The purpose for this alignment will be subsequently described.

Each of the openings is tapped to threadedly engage the threaded collar **17** of a solenoid assembly **18**. FIG. **2** shows a cross-sectional view of one solenoid assembly **18** removed from the assembly **10** in order to show the internal structure in detail. The remaining solenoid as-

semblies are similarly provided with threaded collars for threadedly engaging an associated one of the tapped apertures **15.** Each solenoid has a slender solenoid wire **19** projecting outwardly through an opening provided at the forward end of each tapped collar **17,** which print wires extend from the forward end of each solenoid assembly to the forward or left-hand end of member **11** in a manner to be more fully described.

Die cast member **11** is further provided with a first mounting portion **20** having a first groove **21** provided in a first upright portion **22** and a groove **21a** provided in a second upright portion **24.** The grooves **21** and **21a** are adapted to receive a flat plate **25** provided with a plurality of openings **26,** each receiving an associated one of the solenoid wires **19.**

A second supporting section **27** die cast as an integral part of member **11** and positioned in front of section **20** is comprised of a first groove **28** extending from a first upright portion **29** and a second groove **28*a*** provided in a second upright portion **30.** These grooves are adapted to receive a flat plate **31** provided with a plurality of openings **32,** each receiving an associate one of the solenoid wires **19.**

A final upright portion **34** is die cast as an integral portion of member **11** and is provided with a centrally located opening **35,** which opening widens at ledge **38** to form a wider opening **39.**

In operation, the solenoid wires **19** may be selectively moved in the directions shown by arrows **40** and **41** (FIG. **1d**) so as to selectively impact against a paper tape (not shown) positioned in close proximity to the front end of the printer head assembly. In order that the constant and rapid movement of the print wires be subjected to a minimum amount of abrasive wear, a plurality of tube guides **42** are provided. Each of the tube guides **42** is comprised of a hollow, elongated sleeve formed of a metallic material which is force-fitted through an associated opening **26** in disc **25** and which receives a print wire through its central opening so as to prevent any abrasive wear between the solenoid wires and the disc **25.** The interior surfaces of each of the sleeves is lubricated preferably with a dry lubricant such as disulphide to reduce wearing due to frictional engagement to permit the solenoid wires to experience reciprocal movement within the stationary sleeves without experiencing any noticeable wear.

In order to prevent abrasive wear of the solenoid wires **19** by the plate **31,** tube guides **42** are each of a length sufficient to extend from plate **25** to plate **31.** The forward ends of sleeves **42** are force-fitted into associated openings **32** of the plate **31** and are further cemented with a suitable epoxy (not shown) to permit the solenoid wires to experience reciprocal movement within the stationary guides **42** and openings in plate **31** without experiencing any noticeable wear.

A pair of jewel bearings **44** are force-fitted into the enlarged opening **39** provided in upright section **34.** The jewel bearings **44** and **45** are shown in detail in FIGS. **1*a*** and **1*e*** and are comprised of solid rectangular shaped members preferably formed of sapphire. The adjacent vertically aligned sides of the jewel bearings are provided with a plurality of semicircular-shaped grooves **44*a*** and **45*a***, respectively, such that each groove in jewel bearing **44** is aligned with an associated groove **45*a*** in jewel bearing **45** to form a plurality of substantially circular shaped openings for receiving and guiding an associated one of the solenoid wires **19.**

Jewel bearing **44** is positioned against the left-hand wall of opening **39,** and is preferably secured thereto by a suitable epoxy. Jewel bearing **45** is positioned immediately adjacent jewel bearing **44** and is firmly urged toward jewel bearing **44** by means of a spring **46** positioned between the right-hand vertical side of jewel bearing **45** and the right-hand vertical wall of opening **39.** Resilient spring member **46** preferably has a corrugated or serpentine configuration.

In order to provide for precision alignment of the jewel bearings **44** and **45,** a jewel bearing alignment tool **47,** as shown in FIG. **1*f***, may be employed. The aligning tool is positioned in front of upright section **34** so that its projecting pins **47*a*** and **47*b*** are inserted into the topmost and bottommost circular shaped openings, respectively, which are formed by the semi-circular shaped grooves **44*a*** and **45*a***, respectively, provided in the jewel bearings **44** and **45.** With the jewel bearing alignment tool in this position, the bearings may be accurately aligned. Upon completion of their alignment, a suitable epoxy is applied to the region on both sides of spring member **46** so as to firmly cement the jewel bearing **45** into position. Once the epoxy sets, the jewel bearing alignment tool may be removed.

The printer head assembly design greatly simplifies the final assembly of the head which may be performed in the following manner:

The jewel bearings are aligned and cemented into place in the manner described hereinabove. The tube guides are force-fitted into associated openings within the plates **25** and **32,** respectively. The plates are then positioned into their associated grooves **21–21*a*** and **28–28*a***, respectively. The plates **25** and **32** are preferably cemented into place. The forward free ends of the solenoid wires **19** are first inserted through openings **15** (and **15'**) in rear wall **14,** through rear guides **26,** through rear guides **33** and bearings **44** and **45,** and the threaded collars of solenoids **18** are screwed tightly into threaded engagement with tapped openings **15.** Threaded nuts **51** are provided to align the forward ends of print wires **19** and to lock the solenoids **18** (and **18'**) into place, once adjusted.

The jewel bearings **44** and **45,** which are preferably formed of a material such as, for example, sapphire, are likewise characterized by having a low coefficient of friction so as to cause no significant wear of either the jewel bearings or the solenoid wires as a result of reciprocal movement of the solenoid wires relative to the jewel bearings. The front faces of the jewel bearings also serve as a means for reducing abrasive wear between the forward ends of print wires **19** and the paper document (not shown) when the printer head assembly moves relative to the paper document. Such wear (in the absence of the jewel bearings) is due to the relative close spacing between the forward ends of the print wires (when retracted) and the paper document.

As an alternative assembly the members **44** and **45** may be replaced by a single jewel bearing member (not shown) having centrally located openings for receiving the forward ends of print wires **19.**

The rear surface **14*a*** of rear wall **14** is a truncated pyramidal shaped surface such that the solenoid members **18,** when secured thereto, are all diagonally aligned relative to an imaginary vertical plane, except for the center solenoid member **18*g*** which is aligned substantially perpendicular to an imaginary vertical plane. The solenoids **18*a***, **18*b***, **18*e*** and **18*f*** are aligned at an angle of

approximately 20° relative to an imaginary vertical plane; solenoids **18***a* and **18***b* are aligned at an angle of approximately 30° relative to an imaginary horizontal plane; while solenoids **18***c*, **18***d*, **18***e* and **18***f* are aligned at an angle of approximately 20° relative to an imaginary horizontal plane; and solenoid **18***d* is aligned at an angle of approximately 20° relative to the imaginary horizontal plane. This alignment facilitates and simplifies the degree of bending the printer wires experience in converging toward a more or less bundled position in the region between upright support sections **25, 27** and **34** so as to guide the solenoid wires toward the jewel bearing members **44** and **45** with a minimum amount of bending or bowing thereof. For example, the wires of the topmost solenoid **18***d*, the bottom-most center solenoid **18***c* and center solenoid **18***g* all remain aligned substantially within an imaginary common vertically aligned plane and, therefore, undergo no bending in a direction transverse to said plane. The remaining wires undergo rather limited bending in the aforesaid transverse direction. This arrangement significantly reduces the space (i.e., volume) which the head assembly occupies, to thereby greatly simplify the complementary design of the printer apparatus using the printer head assembly.

The printer head components, when fully assembled in the manner described hereinabove, may be completely sealed by means of a plastic cover assembly **49** which is formed of a plastic material of sufficient resiliency so as to permit the pair of inwardly directed flanges **49***a* and **49***b* provided at the forward end of the cover to move slightly apart when snapping the cover assembly into position until the flanges clear the undersurface of base **12,** at which time the flanges **49***a* and **49***b* snap into position so as to embrace the marginal edges of the undersurface and thereby firmly retain the cover assembly **49** upon the die cast member **11.** A similar pair of flanges **49***c* and **49***d* are provided at the rearward end of the cover assembly **49** for embracing the undersurface of base portion **12** of die cast member **11** in the immediate region of rear wall **14.** The cover assembly **49** may be simply and readily removed from member **11** by pulling the pairs of flanges **49***a*–**49***b* and **53**–**54** slightly apart until they clear the undersurface of die cast member **11,** at which time the cover may then be lifted up and away from member **11** to provide access to the interior of the printer head assembly.

FIG. **2** shows a detailed sectional view of one of the print wire solenoids **18** which is comprised of a one-piece shell member **50** whose right-hand portion is substantially cylindrical in shape and is threaded at **17.** A fastening nut **51** threadedly engages threaded collar **17** for the purpose of tightening or locking the solenoid to the upright wall **14** once the solenoid is mounted in the desired position. The left-hand portion of shell **50** is also cylindrical in shape and has a cylindrical wall **53** to form a hollow annular shaped interior region **54** which houses the solenoid coil **55.** The central core portion **52** has a centrally located opening **56** for slidably receiving print wire **19** which is secured to the left-hand end of cylindrical shaped armature member **57** and which passes through opening **56** to a wider opening **56a** and a still wider opening **56***b* provided in shell **50.** A tubular shaped wire guide **58** surrounds a portion of print wire **19,** as shown. A suitable dry powdered lubricant is provided between the interior surface of wire guide **58** and print wire **19** and between the opening **56** and print wire **19** to minimize wear during reciprocating movement of the print wire. The solenoid coil **55** is provided with a pair of connecting leads **59** for coupling the print solenoid to driving circuitry. The connecting leads **59** extend through an opening **60** provided near the left-hand end of shell **50.**

The armature member **57** which is formed of a permanent magnet material is secured to a circular shaped disc **61,** formed of a springy or resilient metallic material, by means of rivet **62.** A thin mylar wafer **63** is positioned between armature **57** and the left-hand surface of spring **61** and a second mylar wafer **64** is positioned between the right-hand surface of spring **61** and the head of rivet **62,** to reduce vibration.

A relatively thick disc shaped member **65** having a central opening **65a** is positioned within shell **50** and has a continuous annular shaped projecting flange portion **65b** engaging the left-hand surface of spring **61.** The armature assembly, including spring **61** and armature **57,** as well as disc **65,** is rigidly secured within shell **50** by means of a cap **66** having a tapped interior surface **67** which threadedly engages the threaded portion **68** of shell **50.**

In operation, with the coil assembly **55** deenergized, spring means **61** assumes its flat shape, as shown in FIG. **2.** Upon energization of coil assembly **55,** the magnetic field generated by coil **55** urges armature **57** in a direction shown by arrow A against the biasing force imposed upon the armature by spring **61** thereby moving print wire. When the coil assembly **55** is deenergized, armature **57** is caused to return to the position shown in FIG. **2** under the influence of the biasing spring **61.** The print solenoid is adjusted so as to cause the print wire to move approximately 0.45 to 0.56 millimeters toward the right when the coil assembly is energized, thereby causing the extreme left-hand end of the print wire to extend by the above-mentioned distance in order to impact a ribbon (not shown) and thereby print a dot upon a paper document supported by a platen (not shown).

The coil assembly is wound upon a cylindrical shaped bobbin **70** which is then inserted into the hollow annular portion **54** of shell **50.**

The tubular shaped wire guide **58** has its left-hand portion secured to the interior opening **56***a* by means of a suitable epoxy. An epoxy is also preferably applied between the threaded portion **68** of shell **50** and the tapped portion **67** of cap **66** in order to firmly join the shell **53** and cap **66** after appropriate adjustment (i.e., tightening) of cap **66** upon the shell. A small opening **66***a* is provided at the center of cap **66** to adjust the amount of travel which the armature **57** may experience and to thereby control the amount of travel experienced by each print wire **19.** The print wire solenoid assemblies, as well as the printer head assembly of FIGS. **1***a*–**1***e* are formed of lightweight metals and the assembly is of such a compact design as to enable the assembly to move at a high rate of speed across the printer apparatus to provide extremely high speed printing operations. For example, in one preferred embodiment, the printer head assembly is capable of moving at a speed which is sufficient to permit the printing of more than 165 characters per second. The solenoids are capable of being energized at a rate of the order of 1,000 times per second under the control of energizing pulses of 0.4 millisecond pulse width. A detailed description of one such printer system which employs the

printer head assembly described herein to great advantage is set forth in copending application, Ser. No. 37,815, filed May 15, 1970, and assigned to the assignee of the present invention.

It can be seen from the foregoing description that the present invention provides a novel and simplified printer head assembly in which a single die cast member is provided for mounting the printer solenoid, guiding the solenoid wires and providing a jewel bearing mounting which accurately aligns the solenoid printer wires in a precise vertical arrangement so as to greatly facilitate assembly of the printer head apparatus and provide for significantly reduced wear of the components.

Although this invention has been described with respect to its preferred embodiments, it should be understood that many variations and modifications will now be obvious to those skilled in the art and it is preferred, therefore, that the scope of the invention be limited not by the specific disclosure herein, but only by the appended claims.

The embodiments of the invention is which an exclusive privilege or property is claimed are defined as follows:

1. A printer head assembly for use in printers of the dot-matrix type comprising:

a housing having front and rear vertical walls and side walls joining said front and rear walls;

the width of said front wall being smaller than the width of said rear wall whereby said side walls form a configuration which tapers from rear to front;

said rear wall having a plurality of apertures;

a plurality of wire driving means each having a forward end mounted in an associated one of said apertures;

said front wall having a central opening;

a jewel bearing being mounted in said opening and having a plurality of small apertures arranged to lie along an imaginary straight line;

a plurality of thin elongated print wires each having their rearward ends coupled to an associated one of said wire driving means;

each of said print wires extending through the interior of said housing and having their forward ends positioned within one of said small apertures;

the exterior surface of said rear wall having a central surface portion and a plurality of bevelled surface portions surrounding said central surface portion;

said central surface portion being substantially perpendicular to the longitudinal axis of said housing;

said bevelled surface portions being aligned transverse to said housing longitudinal axis;

each of said apertures in said rear wall being provided in one of said rear wall surface portions such that said surface portions determine the alignment of said driving means whereby all of said driving means mounted within openings in said bevelled surface portions are aligned transverse to said housing longitudinal axis and the driving means mounted within the opening provided in the central surface is substantially in alignment with the housing longitudinal axis;

each of said driving means being comprised of means for driving its associated print wire in a forward direction during a printing operation and for driving its associated print wire in a rearward direction upon completion of a print operation.

2. The assembly of claim **1** further comprising a support plate mounted within said housing intermediate said front and rear walls and having a plurality of openings;

rigid elongated wire guides each being mounted within an associated opening in said plate for receiving and guiding the intermediate portion of an associated print wire extending between said front and rear walls to limit the amount of bending experienced by said print wires during operation thereof.

3. The assembly of claim **1** further comprising a pair of support plates mounted in spaced parallel fashion within said housing intermediate said front and rear walls each having a plurality of openings;

rigid elongated wire guides each being mounted within a pair of associated openings in said plate for receiving and guiding the intermediate portion of an associated print wire extending between said front and rear walls to limit the amount of bending experienced by said print wires during operation thereof.

4. The assembly of claim **1** wherein said jewel bearing is comprised of a pair of bearing members each having a plurality of semicircular shaped grooves along one of its edges;

said pair of bearing members being arranged side-by-side in said front wall opening with the edges containing said semicircular grooves abutting one another to co-operatively form said small apertures.

5. The assembly of claim **4** wherein the opening in said front wall receiving said jewel bearing members is wider than the total width of said members;

resilient spring means being positioned between one side of said opening and one of said bearing members for urging said members into engagement with one another to facilitate initial alignment of said bearing members.

6. The assembly of claim **5** wherein at least one of said bearing members is joined to said front wall by an epoxy.

7. The assembly of claim **1** further comprising snap-on cover means for sealing the top of said housing;

said cover being formed of a resilient material and having a top surface and downwardly depending side walls positioned upon said housing side walls;

said cover side walls having inwardly directed flanges along their free ends for embracing the marginal portion of the base of said housing.

8. A printer head assembly for use in printers of the dot-matrix type comprising:

a housing having front and rear vertical walls and side walls joining said front and rear walls;

the width of said front wall being smaller than the width of said rear wall whereby said side walls form a configuration which tapers from rear to front;

said rear wall having a plurality of apertures;

a plurality of wire driving means each having a forward end mounted in an associated one of said apertures;

said front wall having a central opening;

a jewel bearing being mounted in said opening and having a plurality of small apertures arranged to lie along an imaginary straight line;

a plurality of thin elongated print wires each having their rearward ends coupled to an associated one of said wire driving means;

each of said print wires extending through the interior of said housing and having their forward ends positioned within one of said small apertures;

the exterior surface of said rear wall having a central surface portion and a plurality of bevelled surface portions surrounding said central surface portion;

said central surface portion being substantially perpendicular to the longitudinal axis of said housing;

said bevelled surface portions being aligned transverse to said housing longitudinal axis;

each of said apertures in said rear wall being provided in one of said rear wall surface portions such that said surface portions determine the alignment of said driving means whereby all of said driving means mounted within openings in said bevelled surface portions are aligned transverse to said housing longitudinal axis and the driving means mounted within the opening provided in the central surface is substantially in alignment with the housing longitudinal axis;

each of said driving means being comprised of means for driving its associated print wire in a forward direction during a printing operation and for driving its associated print wire in a rearward direction upon completion of a print operation;

each of said driving means being comprised of:

a housing having a central opening extending from the front to the rear of said housing;

a hollow annular shaped opening surrounding a rearward portion of said central opening;

an annular shaped coil assembly being positioned within said annular shaped opening and surrounding the rearward portion of said central opening;

a cylindrical shaped armature being positioned for reciprocating movement within the rearward portion of said central opening so that at least a portion of said armature is surrounded by said coil assembly;

the rearward portion of each of said print wires extending into the central opening of an associated one of said driving means;

the forward end of each armature being joined to the rear end of an associated one of said print wires;

a circular shaped biasing member being secured to the rearward end of said armature;

a circular shaped end cap threadedly engaging the marginal exterior surface of said housing adjacent the rear end thereof;

said biasing member being positioned between the interior surface of said end cap and the edge of said housing forming the outer wall of said annular shaped opening;

the rear end of the hollow cylindrical section of said housing which separates said central opening from said annular shaped opening being a spaced distance from the adjacent end of said armature to enable said biasing member to experience flexing when said coil assembly is energized to move said armature in the forward direction;

said biasing member normally urging said armature in the rearward direction when said coil assembly is deenergized.

* * * * *