Feb. 7, 1967 R. D. NELSON 3,302,562

MEANS TO PREVENT EXCESSIVE FRICTIONAL LOADING IN A WIRE PRINTER

Filed June 29, 1964 2 Sheets-Sheet 1

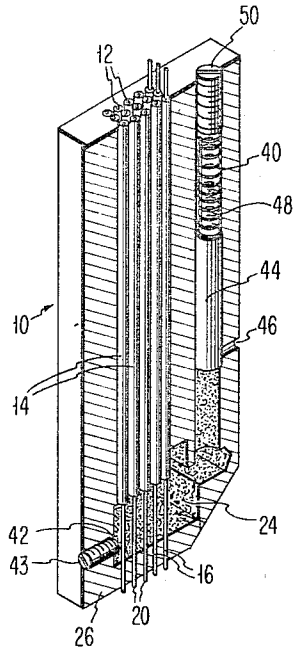


FIG. 1

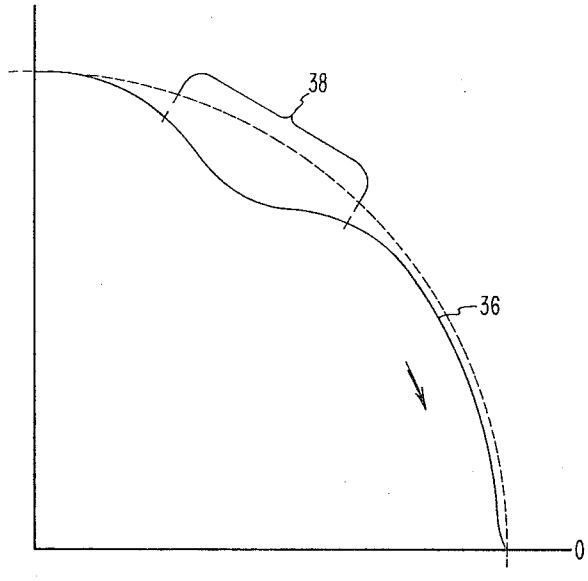


FIG. 2

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MEANS TO PREVENT EXCESSIVE FRICTIONAL LOADING IN A WIRE PRINTER

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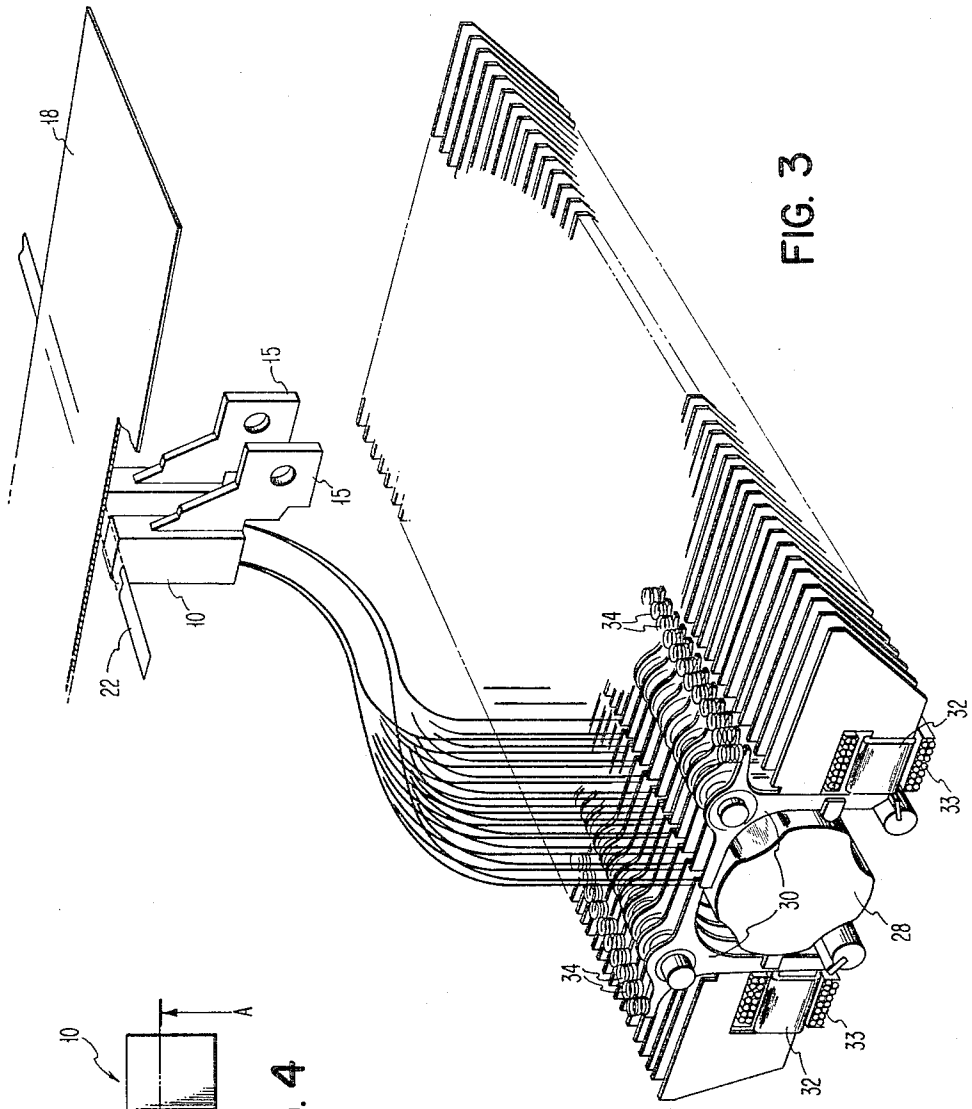


FIG. 3

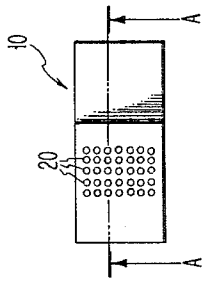


FIG. 4

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3,302,562

MEANS TO PREVENT EXCESSIVE FRICTIONAL LOADING IN A WIRE PRINTER

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11 Claims. (Cl. 101—103)

This invention relates to wire printers and, more particularly, to print head assemblies.

A problem has long existed in wire printers of increased frictional loading of the mechanism over a period of operation due to ink from the ribbon working its way into the space between the print wire and its guide tube. The sliding motion of the wire causes the ink to work its way from the print end of the print wires throughout the entire length of the wire and the tube to the setup mechanism. The resultant high friction causes excessive wear of the actuating device and the other parts of the system and also appreciably increases the operative force required to operate the printer. As the speed of operation of wire printers has increased, the excessive wire friction caused by the ink has become an even greater problem since it is more difficult to drive the wires at the rate required. It is therefore the principal object of this invention to provide a printing apparatus which prevents ink and other foreign matter from entering the working area of the print mechanism.

It is another object of this invention to provide a printing apparatus which is adapted to use in a high speed printer and which is reliable in operation.

It is a further object of the invention to provide a print head assembly that is usable in high speed printers which utilize springs to provide the force to actuate the print mechanism.

Briefly, according to the invention, a print mechanism is provided comprising a plurality of selectively axially displaceable character forming elements, wherein a portion of the character forming elements passes through an enclosure and wherein a fluent material is disposed within the enclosure and is subjected to pressure to provide a seal around each character forming element so that ink, card dust, and other foreign matter is blocked from moving from the character forming ends of the character forming elements to the printer operating mechanism.

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

FIG. 1 is a perspective view, partly in section along lines A—A of FIG. 4, of a print head assembly embodying the invention;

FIG. 2 is a 90-degree segment of the control cam of the wire printer of FIG. 3;

FIG. 3 is a perspective view of a wire printer utilizing a plurality of the print head assemblies shown in FIG. 1;

FIG. 4 is an end view of the print head assembly.

In accordance with the invention, the print mechanism comprises a print head **10** comprising a housing having hollow portions **12** through which the print guide tubes **14** are inserted and fixed into position in the proper alignment. Character forming wires **16** are mounted within the guide tubes **14** so that by selective axial displacement of the print wires **16** a character is formed, and the selected character is recorded on record member **18** by driving the character forming ends **20** of the print wires against an inked ribbon **22**, record card **18**, and a relatively fixed platen member (not shown). The wire print head **10** is provided with a reservoir or cavity **24** through which print wires **16** pass from the ends of guide tubes

14 to the print wire guide matrix **26** formed in the print head face. A fluent material is injected into the cavity and subjected to pressure so that the fluent material closely surrounds the portion of the print wires extending through the cavity.

The fluent material consists of a mixture of three components, a flow restricting material, a filler material, and a bonding material. The particle size of the flow restricting material must be small enough to permit entry between the wires in the matrix, but large enough to prevent entry of the mixture between print wires **16** and their guide tubes **14**. Also, the material must be chemically inert and have a low coefficient of friction. A nylon powder has been found suitable for the flow restricting material of the mixture. The filler powder must be of very small particle size to seal off the pores in the flow restricting powder and thereby prevent ink from flowing through the material. The filler powder also must be chemically inert and have a low coefficient of friction. Polyethylene powder has been found suitable for the filler material. A chemically inert bonding material must be used to seal the small pores of the mixture of the filler powder and the flow restricting powder and to improve the flow characteristics of the mixture. A silicone grease, such as that manufactured under the trade name of Dow Corning No. 3, has been found suitable. The proportions of the three components of the fluent material can be determined experimentally for a particular application, and equal volume of each of the three components has been found to be one suitable mixture.

The fluent material is pressurized to insure that the material closely surrounds each of print wires **16**, and the small reservoir provides a sufficient quantity of the fluent material to compensate for leakage, wear and thermal expansion. In the embodiment shown, the fluent material is injected into the cavity through a loading opening **40**, and a bleed hole **42** is provided to aid in the removal of excess material. When the cavity is first loaded, the material is added until an excess is extruded at bleed hole opening **42**. Bleed hole opening **42** is then closed as by the application of a tight fitting screw **43**, and the fluent material is then pressurized by applying a force to a tight fitting pressure piston **44** which is inserted within loading opening **40**. A second bleed hole **46** is provided to remove excess fluent material, and the material is maintained under pressure by a pressure spring **48** held in position by a suitable means such as a set screw **50** applied in loading opening **40**. A balance in the pressure used may be determined experimentally from the opposing consideration of complete stoppage of ink flow by a high pressure and the increased frictional forces on the print wires by the high pressure of the fluent material. In practice, a pressure of approximately 45 pounds per square inch has been found suitable since this pressure completely stops the flow of ink from reaching guide tubes **14** and produces a frictional drag on each wire of approximately ten grams force, which is not objectionable in the embodiment shown. If the friction force is too high, the print wires may fail to operate dynamically at full speed.

In a specific printer mechanism, the print wires have an outside diameter of .008 inch, and these wires operate in a guide tube having a .010 inch inside diameter. The wires are set on .015 inch centers so that a nominal .007 inch gap is present between wire surfaces as they pass through enclosure **24**. For this mechanism a flow restricting material consisting of a nylon powder having a particle size of .002 to .007 inch is suitable. The filler powder consists of polyethylene powder having a particle size of 500 microns, and the bonding material consists of a silicone grease. The components of the fluent material are combined in equal volume.

A diagrammatic view of a wire printer embodying the invention is shown in FIG. 3. A platen member (not shown) backs up a suitable recording material, such as a ribbon **22**, disposed opposite the record member and the platen member. The character forming ends **20** of a plurality of print wires **16** are positioned on the other side of the ribbon. The print wires **16** are slideably supported in guide tubes **14** which converge at the print ends of the wires to form a print head **10**. The print heads **10** are movably mounted by bracket **15** so that each printhead is operator adjustable to provide printing of a line in any location on record card **18**. The other ends of the guide tubes and wires fan out, and the wires **16** are attached to a wire setting mechanism. The wire setting mechanism comprises a cam **28** which controls the movement of bell cranks **30** which comprise armatures for magnetic holding means **33**. When the armatures **30** are released by magnetic bucking coils **32**, the motive force for driving the print wires to the operative position is supplied by a resilient means, such as coil springs **34**. The contour of the cam is provided with a wire setup portion **36** and a printing portion **38**. The print data is provided by suitable electronic control circuitry (not shown), and the operation is timed so that at the zero point in FIG. 2 the release of the character forming elements comprising the selected character is initiated. This operation is performed by electronically selecting individual bucking coils **32** to buck out the flux generated by the hold coil **33** so that the bell crank is released to wire setup portion **36** of the cam. The print cam controls the character setup, regulates the impact of the wires, and restores the armatures to the hold magnet after printing. The released armatures have stabilized by the start of the print zone **38** of the cam, and the bell cranks are driven by the force of the springs **34** so that the print ends of the character forming elements are moved to the print position to impress the selected character upon the record member.

Thus, it can be seen that there is provided a print head assembly to solve the problem of excessive friction caused by ink and other foreign material being moved into the operating mechanism of a wire printer. The print head assembly possesses small size, low inertia, and high mobility, so that it is suitable for solving this problem in not only the wire printer shown in the drawings but also in wire printers of the type shown in U.S. Patents 2,580,788, 2,785,627 and 2,802,414.

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

What is claimed is:

1. A wire printing mechanism, comprising:
an enclosure;
a plurality of selectively movable character forming elements having first character forming portions and having second portions thereof passing through said enclosure;
a fluent material disposed in said enclosure surrounding said second portions of said character forming elements; and
pressure forming means to pressurize said fluent material in said enclosure to block the passage of foreign material from said character forming portions beyond said second portions of said character forming elements.

2. In a recording device:
a plurality of character forming elements selectively actuable for moving the character forming ends into and out of engagement with a record medium;
a fluent material;
means for positioning said fluent material to surround a portion of said character forming elements; and
means for applying pressure to said fluent material so

that the movement of foreign material along the character forming elements from said character forming ends is limited thereby.

3. A printing transducer, comprising:
a plurality of character forming elements mounted within guide means, each of said character forming elements having character forming ends extending from said guide means;
a housing having a cavity filled with a fluent material;
means for mounting the character forming elements within said housing so that a portion of each of the character forming elements extending from said guide means passes through said fluent material; and
pressure forming means to apply pressure to said fluent material to prevent foreign material from moving along said character forming elements to said guide means.

4. A printing transducer, comprising:
a plurality of character forming elements mounted within guide means, each of said character forming elements having character forming ends extending from said guide means;
a housing having a cavity filled with a fluent material, said fluent material comprising a mixture of plastic powders and a bonding material;
means for mounting the character forming elements within said housing so that a portion of each of the character forming elements extending from said guide means passes through said fluent material; and
pressure forming means to apply pressure to said fluent material to prevent foreign material from moving along said character forming elements to said guide means.

5. A printing transducer, comprising:
a plurality of character forming elements mounted within guide means, each of said character forming elements having character forming ends extending from said guide means;
a housing having a cavity filled with a fluent material said fluent material comprising a flow restricting material, a filler material, and a bonding material;
means for mounting the character forming elements within said housing so that a portion of each of the character forming elements extending from said guide means passes through said fluent material; and
pressure forming means to apply pressure to said fluent material to prevent foreign material from moving along said character forming elements to said guide means.

6. A wire printing mechanism, comprising:
an enclosure;
a plurality of selectively movable character forming elements having first character forming portions and having second portions thereof passing through said enclosure;
a fluent material disposed in said enclosure surrounding said second portions of said character forming elements, said fluent material comprising a mixture of plastic powders and a bonding material; and
pressure forming means to pressurize said fluent material in said enclosure to block the passage of foreign material from said character forming portions beyond said second portions of said character forming elements.

7. A wire printing mechanism, comprising:
an enclosure;
a plurality of selectively movable character forming elements having first character forming portions and having second portions thereof passing through said enclosure;
a fluent material disposed in said enclosure surrounding said second portions of said character forming elements, said fluent material comprising a flow restricting material, a filler material, and a bonding material; and

pressure forming means to pressurize said fluent material in said enclosure to block the passage of foreign material from said character forming portions beyond said second portions of said character forming elements.

8. A wire printing mechanism, comprising:

an enclosure;

a plurality of selectively movable character forming elements having first character forming portions and having second portions thereof passing through said enclosure;

a fluent material disposed in said enclosure surrounding said second portions of said character forming elements, said fluent material comprising a mixture of plastic powders and a bonding material;

pressure forming means to pressurize said fluent material in said enclosure to block the passage of foreign material from said character forming portions beyond said second portions of said character forming elements; and

resilient means to drive selected ones of said character forming elements to a record marking position.

9. A wire printing mechanism, comprising:

an enclosure;

a plurality of selectively movable character forming elements having first character forming portions and having second portions thereof passing through said enclosure surrounding said second portions of said character forming elements;

a fluent material disposed in said enclosure, said fluent material comprising a flow restricting material, a filler material, and a bonding material;

pressure forming means to pressurize said fluent material in said enclosure to block the passage of foreign material from said character forming portions beyond said second portions of said character forming elements; and

resilient means to drive selected ones of said character forming elements to a record marking position.

10. A wire printing mechanism, comprising:

a housing having a central enclosure and a plurality of openings thereto;

a plurality of selectively movable character forming elements mounted in said openings, said character forming elements having first character forming portions extending beyond said enclosure and having second portions thereof passing through said enclosure;

a fluent material comprising a mixture of plastic powders and a bonding material;

means for loading said fluent material into said enclosure surrounding said second portions of said character forming elements;

pressure forming means to pressurize said fluent material in said enclosure to block the passage of foreign material from said character forming portions beyond said second portions of said character forming elements; and

resilient means to drive selected ones of said character forming elements to a record marking position.

11. A wire printing mechanism, comprising:

a housing having a central enclosure and a plurality of openings thereto;

a plurality of selectively movable character forming elements mounted in said openings, said character forming elements having first character forming portions extending beyond said enclosure and having second portions thereof passing through said enclosure;

a fluent material comprising a mixture of nylon powder, polyethylene powder and silicone grease;

means for loading said fluent material into said enclosure surrounding said second portions of said character forming elements;

pressure forming means to pressurize said fluent material in said enclosure to block the passage of foreign material from said character forming portions beyond said second portions of said character forming elements; and

resilient means to drive selected ones of said character forming elements to a record marking position.

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WILLIAM B. PENN, *Primary Examiner.*