June 9, 1959 F. J. FURMAN ET AL 2,889,770

WIRE PRINTER

Filed Dec. 30, 1954

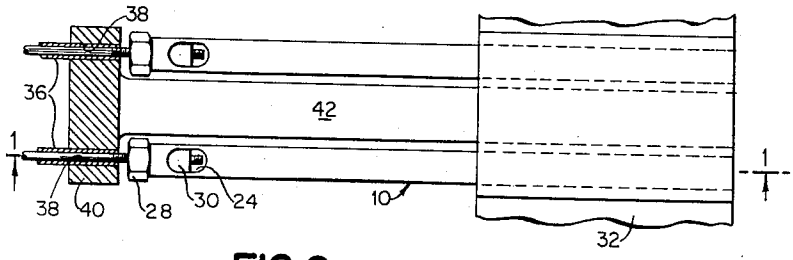

FIG. 2

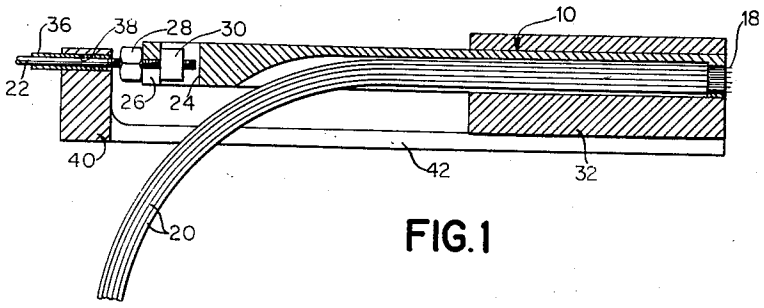

FIG. 1

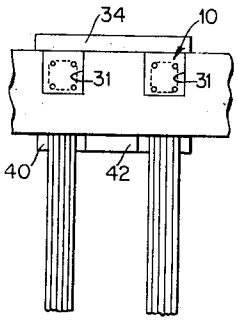

FIG. 3

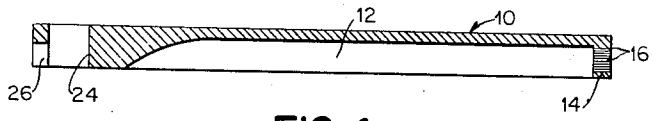

FIG. 4

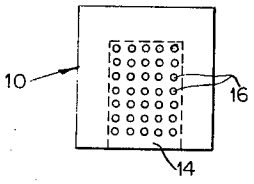

FIG. 6

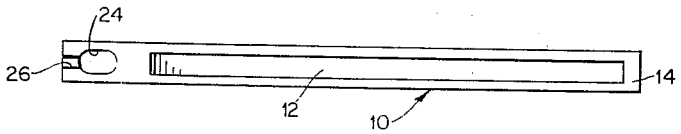

FIG. 5

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WIRE PRINTER

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Application December 30, 1954, Serial No. 478,649

5 Claims. (Cl. 101—93)

This invention relates to wire printers and more particularly to print head assemblies wherein the print ends of a plurality of print wires, through their guide tubes, are gathered together into a character printing cluster and moved toward and away from recording material so as to undergo printing impact in what is often called "front" printing. (See, for example, the United States patent application Ser. No. 384,697 of Reynold B. Johnson, filed October 7, 1953, now U. S. Patent No. 2,785,627.

In previously constructed print head assemblies for wire printers, the print heads have been formed with a cavity designed to more or less exactly receive the closely dimensioned ends of the guide tubes for the respective print wires, usually thirty-five in number and arranged in a pattern of seven columns and five rows. The closely dimensioned size of the cavity enabled the tubes to be clamped in the print head to define a fixed pattern and be movable therewith.

In a print head assembly constructed as above described, it will be apparent that each tube and, hence, its corresponding print wire took its position from the adjacent tube. Any variation in the outside diameter of a tube would result in a row and/or column of tubes which were misaligned with the rest, and this misalignment would in turn be reflected in misalignment of the corresponding print wires. This misalignment would be over and above that which might obtain as a result of play permitted by a variation in the internal diameter of a tube, which, while not affecting the location of the other tubes and print wires, might allow the instant print wire to print out of alignment with the remainder of the print wires. In addition to the possible misalignment of some print wires with the remainder thereof, if the outside diameter of the tubes was smaller than the normal size, the associated print wires in the corresponding rows and columns would be spread over a smaller distance, with the result that characters of reduced size would be printed. It can be seen that it is comparatively difficult and time-consuming, if not impossible, to provide print head assemblies of the conventional construction wherein the print wires are uniformly spaced and whereby characters of perfect size and alignment might be obtained.

Wire printing has become increasingly important because of its ready adaptability to high speed operations. In many applications, for example, business papers, it is desirable to have printed characters of high quality. Such quality is to a considerable extent dependent on the proper alignment of the component dots of the characters, particularly in their vertical and horizontal bars as in the letters "E" and "T."

Progress has also been made in mechanisms for sensing printed characters, and according to at least one scheme, the presence or absence of a particular character is determined by sensing for the presence or absence of marks at just a few points in the total character pattern; the code being such that no other character would be comprised of markings at similar points. It can be seen that characters formed of a pattern of dots particularly lend

themselves to character sensing. On the other hand, it can also be appreciated that each component dot of a character must appear in its proper place; if it should be out of alignment, its presence might not be detected and a different character may be read.

Accordingly, it is the principal object of this invention to provide an easily constructed print head assembly having substantialy uniformly spaced print wires capable of producing characters of substantially perfect size and component dot alignment.

Another object of the invention is to provide a print head assembly that is adapted to high speed printers and reliable in operation.

Other objects of the invention will be pointed out in the following description and claims and illustrated in the accompanying drawings, which disclose, by way of examples, the principle of the invention and the best mode which has been contemplated of applying that principle.

In the drawings:

Fig. 1 is a longitudinal vertical section through an embodiment of the invention.

Fig. 2 is a plan view of the embodiment shown in Fig. 1.

Fig. 3 is a right-hand end view of the embodiment shown in Fig. 1.

Fig. 4 is a disassembled view of the print head shown in Fig. 1.

Fig. 5 is a bottom view of the print head shown in Fig. 4.

Fig. 6 is an enlarged end view of the print head shown in Fig. 4.

In accordance with the invention, the print head, generally indicated by the numeral **10**, is formed of molded nylon or like material and with a cavity **12** (Figs. 4 and 5) on its underside. The front end of the print head is formed with a vertical wall or plate **14** which serves to limit the front end of the cavity. In this front wall there are formed a plurality of apertures **16** (Fig. 6) through which print wires **18** are slidably accommodated, and it is a feature of this invention that, by accurately locating the apertures **16** in the wall **14**, the print wires **18** may be held in substantially perfect aligned relationship and perfect spread.

According to a preferred scheme, the apertures **16** are drilled in the wall **14** by means of a pantograph machine. Normally, the character pattern is selected from a group of thirty-five wires arranged in five columns of seven wires each, and accordingly, a template is prepared having thirty-five holes drilled on center distances a number of times, for example, ten, the center distances which are to obtain between the various print wires. After a template has been prepared, as set forth, it is inserted in the pantograph machine which, in turn, drills the apertures in the front wall **14** at one-tenth the distances between the holes in the template. It will be evident that this reduction cuts the original tolerances by one-tenth and enables the print wires to be located with a minimum of variation on center distances so that characters of uniform size and perfect alignment of the component dots are readily obtained. The formation of the head of nylon or like material facilitates the accurate location and drilling of the relatively frictionless and wear resistant apertures therein.

Once the apertures have been drilled in the print head front wall, they are used to locate the respective print wires **18** in the print head, and whereas formerly the guide tubes **20** were used to locate the print wires in the print head, the print wires are now used to locate the corresponding guide tubes therein. In carrying out this construction, the print wires are inserted in successive columns of the apertures **16** drilled in the front wall **14**, preferably beginning at one side of the print

head and working thereacross in order. After each column of print wires has been inserted into the corresponding apertures, the corresponding guide tubes **20** for the wires are mounted thereon.

Conveniently, the tubes for each column of print wires are soldered together as an aligned unit before they are placed on the corresponding print wires. Since it is desirable to have the ends of the respective tubes adjacent the inner surface of the print head front wall **14** so as to prevent buckling in a wire extending between the end of the tube and its front wall aperture, the tubes are all joined together so that their common ends terminate along a common line. However, since the ends of the tubes are to be located by the print wires extending through the front wall apertures, it is necessary to solder the tubes together at points slightly removed from their aligned ends.

After the print wires have been inserted into a column of apertures **16**, they are inserted one by one into the corresponding tubes **20**, and thereafter the tube unit is slidably moved upon the wires until their common ends abut against the print head front wall. This operation is repeated for each of the other columns of apertures in the print head front wall until all of the tube units have been assembled into the print head.

In this condition, while the tubes are not secured to the print head for movement therewith nor to the tubes of the adjacent units, they are all accurately located in the print head so that their channels are aligned with the apertures in the front wall. A single unitary structure is formed of these components by using a cement, such as those made by Du Pont, Minnesota Mining Co., or CD–300, as a bonding material. Thereafter, when the print head is made to undergo a printing stroke, it carries with it the guide tubes **16** so that any print wires which have been differentially preset to project from the face of the wall **14** are made to undergo printing impact with a recording material.

It will be evident then that, in addition to providing a print head assembly capable of printing characters of substantially uniform size and perfect aligment, there has been provided an assembly which is exceedingly simple and easy of construction. Only a few parts are required, and these do not require close tolerances save for one element, and in these the standard can be readily obtained. The guide tubes may be of smaller external diameter than formerly employed, with the result that the external diameter is no longer critical. The cavity **12** in the print head also does not have to be closely dimensioned as before. Moreover, the use of the cement eliminates the need for extra material as was formerly required to secure the tubes in place and to the print head. It will be obvious that there has also been provided a print head assembly of relatively light weight.

The lightweight yet rugged construction of the print head assembly is particularly adapted to high-speed printers. The low mass enables of rapid acceleration so that high impact velocities may be quickly obtained. This results in a reduction of the possibility of breakage in the drive wire for the print head assembly and, in fact, enables drive wires of lighter construction than heretofore employed, thus further reducing the mass which must be operated and materially reducing the energy expenditures as well as the noise of high-speed printers.

Moreover, the use of a lightweight material for the print head, such as nylon, in a lightweight print head assembly makes feasible the lengthening of the print head so that it extends behind the exit for the print wire guide tubes. This enables the drive wire **22** (Figs. 1 and 2) for a print head to be attached to the print head generally in line with the center of mass thereof, thereby reducing the possibility of a couple being formed between the print head **10** and the means which slidably accommodates its movement. Not only does this result in smoother operation of the print head assembly, but there also obtains a more uniform character impression as well as a further reduction in the possibility for breakage of the assembly drive wire.

This extended print head feature finds particular use in the wire printer mechanism disclosed in the U.S. Patent application of Furman, Moneagle, and Simpson, filed on even date and bearing Serial No. 478,650. In this patent application the guide tubes and print wires therein are shown as being formed with a second curve which materially reduces the mass which is shifted when the print head assembly undergoes a printing stroke. As constructed, the instant print head enables a portion of the second curve to be accommodated within the print head **10**, thereby facilitating attachment of the drive wire **22** to the print head in line with its center of mass. Viewing Fig. 1, it may be seen that the print head **10** is of such length that the guide curved tubes **20** pass out of the cavity **12** and lie beneath the rear end of it. The shape of the rear end of the cavity conforms generally to the curves in the tubes. The cavity terminates short of the rear end of the print head which is formed with a vertical opening **24**. A slot **26** connects the lower end of the opening **24** with the rear end of the print head.

Connection of the print head to the drive wire is made through the opening **24** and slot **26**. The end of the drive wire **22** is threaded, and on this thread are screwed two nuts **28** and **30**. The nuts are left spaced from each other so that the drive wire portion therebetween may be received in the slot **26** in the rear end of the print head while the nut **30** is received in the hole **24**. Thereafter, the nuts **28** and **30** are screwed toward each other to lock the print head to the drive wire.

In Figs. 2 and 3 a pair of print heads is shown. Each print head **10** may be mounted in a corresponding groove **31** formed in the upper side of a transversely extending bar **32** and as being confined in this groove for endwise movement only by a plate **34** removably fixed to the top of the bar **32**. The properties of nylon and steel are such that relatively little friction occurs between these relatively moving parts, thus minimizing wear and tear as well as lubrication problems. More importantly, it produces no material load on the drive wires **22** for the respective print head assemblies, thereby further enhancing high-speed operation of the printer.

The drive wires **22** for a pair of print heads **10** are mounted in corresponding tubes **36** which confine them against buckling when a thrust is imparted to them to move the print head through a printing stroke. The forward ends of the pair of tubes are secured, as by soldering, in slots **38**, formed in the upper surface of a block **40**. The block is carried on the rear end of a bracket **42** fixed at its forward end to the underside of the bar **32** so as to lie between the tubes **20** for the respective print heads.

While there have been shown and described and pointed out the fundamental novel features of the invention as applied to a preferred embodiment, it will be understood that various omissions and substitutions and changes in the form and details of the device illustrated and in its operation may be made by those skilled in the art, without departing from the spirit of the invention. It is the intention, therefore, to be limited only as indicated by the scope of the following claims.

What is claimed is:

1. In a print head assembly for high-speed wire printers having print wires mounted in curved, flexible guide tubes movable at their one ends to carry projecting print wires into engagement with print receiving material on a platen, a movable print head having at one end a plate formed with a plurality of apertures respectively accommodating said print wires and mounted so that the plate faces the platen, means fixing the one ends of the guide tubes in said print head so that the openings thereof are aligned with the apertures for the corresponding print wires which extend therein, and actuating means for moving the print head toward and away from the platen to cause projecting

print wires to undergo a print stroke through the action of the print head carrying the one ends of the guide tubes which in turn carry the print wires.

2. In a print head assembly for high-speed wire printers having print wires mounted in curved, flexible guide tubes movable at their one ends to carry projecting print wires into engagement with print receiving material on a platen, a movable print head having at one end a plate formed with a plurality of apertures respectively accommodating said print wires and mounted so that the plate faces the platen, means fixing the one ends of the guide tubes in the print head so that the ends thereof are disposed adjacent said plate and the openings thereof aligned with the apertures for the corresponding print wires which extend therein, and actuating means for moving the print head toward and away from the platen to cause projecting print wires to undergo a print stroke through the action of the print head carrying the one ends of the guide tubes which in turn carry the print wires.

3. In a print head assembly for high-speed wire printers having print wires mounted in curved, flexible guide tubes movable at their one ends to carry projecting print wires into engagement with print receiving material on a platen, a movable print head formed at one end with apertures spaced on center distances equal to the desired center distances between the component dots of a character pattern and respectively mounting the printing ends of said print wires, means fixing the one ends of the guide tubes in said head so that the openings thereof are disposed in line with the apertures for the corresponding print wires, and actuating means for moving the print head toward and away from the platen to cause projecting print wires to undergo a print stroke through the action of the print head carrying the one ends of the guide tubes which in turn carry the print wires.

4. In a print head assembly for high-speed wire printers having print wires mounted in curved, flexible guide tubes movable at their one ends to carry projecting print wires into engagement with print receiving material on a platen, a movable print head formed at one end with apertures arranged in columns and rows on center distances equal to the desired center distances between the component dots of a character pattern and respectively accommodating the printing ends of said print wires, means fixing the one ends of the guide tubes in said head so that the openings thereof are disposed in line with the apertures for the corresponding print wires which extend therein, and actuating means for moving the print head toward and away from the platen to cause projecting print wires to undergo a print stroke through the action of the print head carrying the one ends of the guide tubes which in turn carry the print wires.

5. In a print head assembly for high-speed wire printers having print wires mounted in curved, flexible guide tubes movable at their one ends to carry projecting print wires into engagement with print receiving material on a platen, a movable print head having an end wall formed with a plurality of apertures respectively accommodating the printing ends of said print wires, a bonding agent securing the one ends of the guide tubes to each other and said print head and so that their openings are aligned with the apertures for the corresponding print wires which extend therein, and actuating means for moving the print head toward and away from the platen to cause projecting print wires to undergo a print stroke through the action of the print head carrying the one ends of the guide tubes which in turn carry the print wires.

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