

[54] **PRINTING HEADS FOR PRINTING MACHINES**  
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[63] Continuation of Ser. No. 169,759, Aug. 6, 1970, abandoned.

**Foreign Application Priority Data**

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[51] **Int. Cl.**..... **B44j 1/34**  
[58] **Field of Search**..... **197/1 R; 101/93 C**

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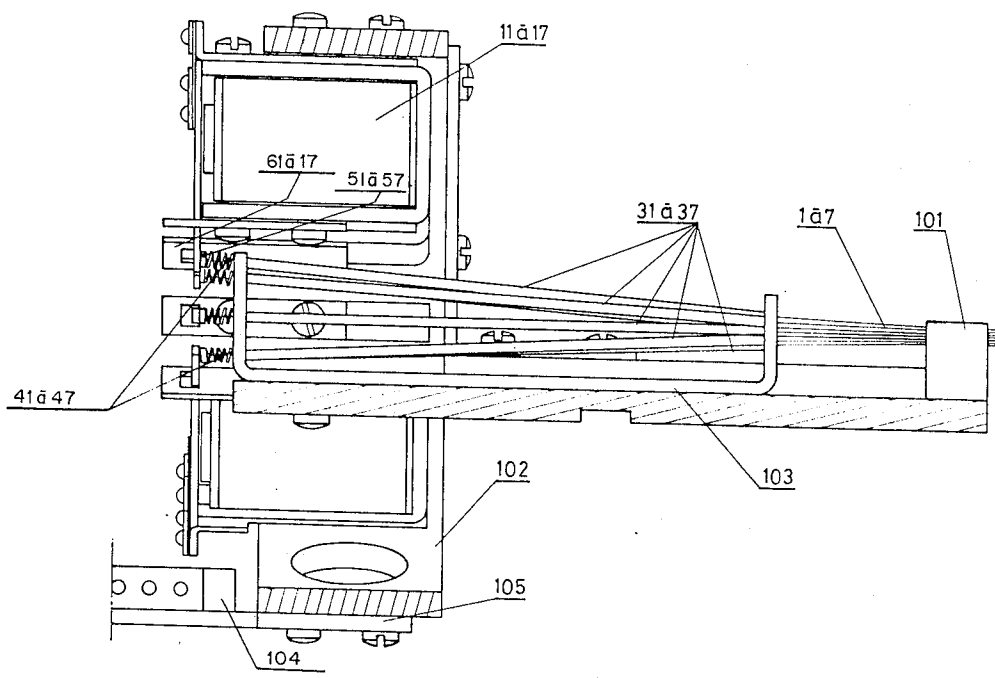
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**ABSTRACT**

A printing head device including movable elongate marker elements projectable against an anvil during striking of a selected character is disclosed. The device includes generally flat cross-section electromagnets disposed radially within a common section of a cylindrical body and each electromagnet has a movable low inertia armature for actuation of the marker elements. This arrangement improves the operating conditions of the printing head.

**1 Claim, 2 Drawing Figures**



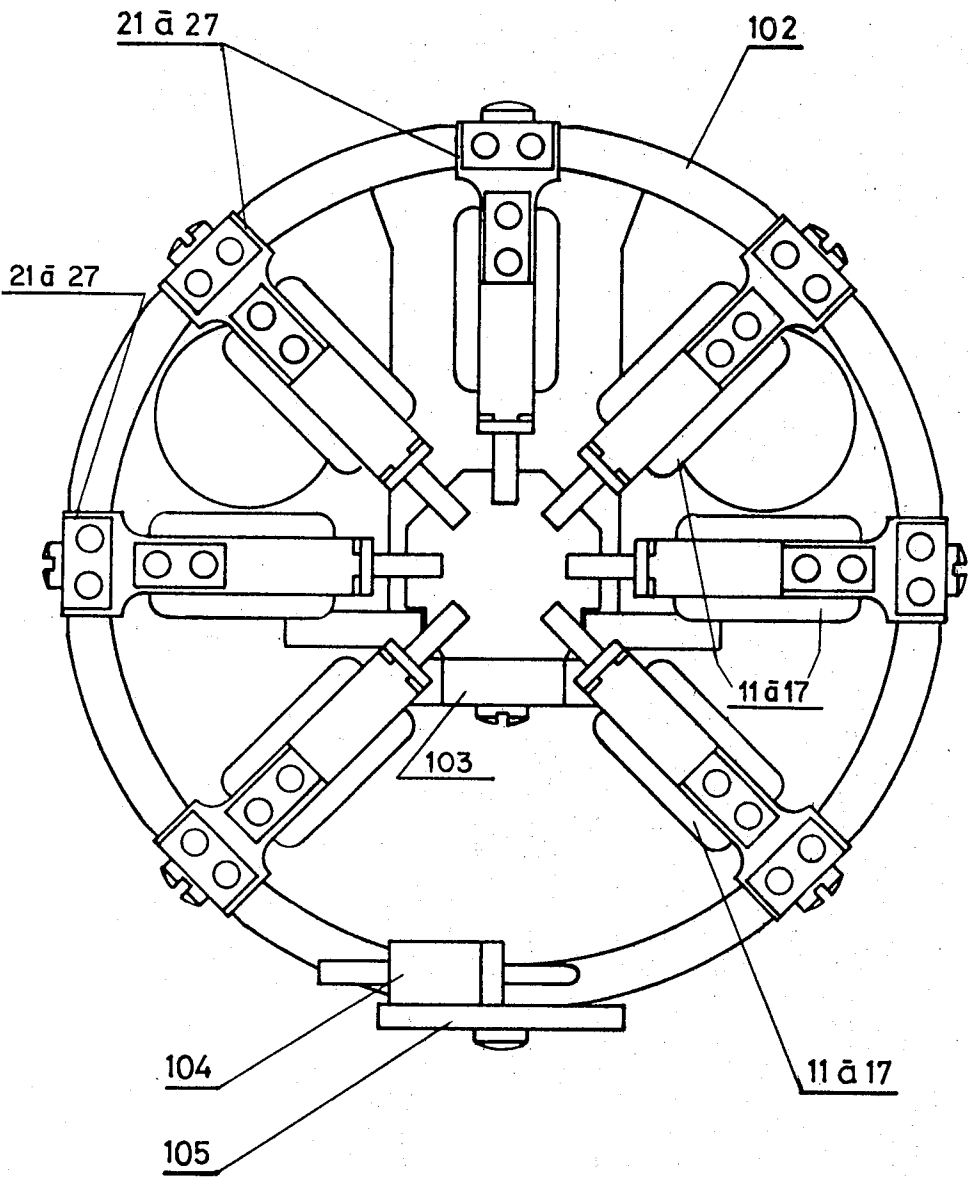
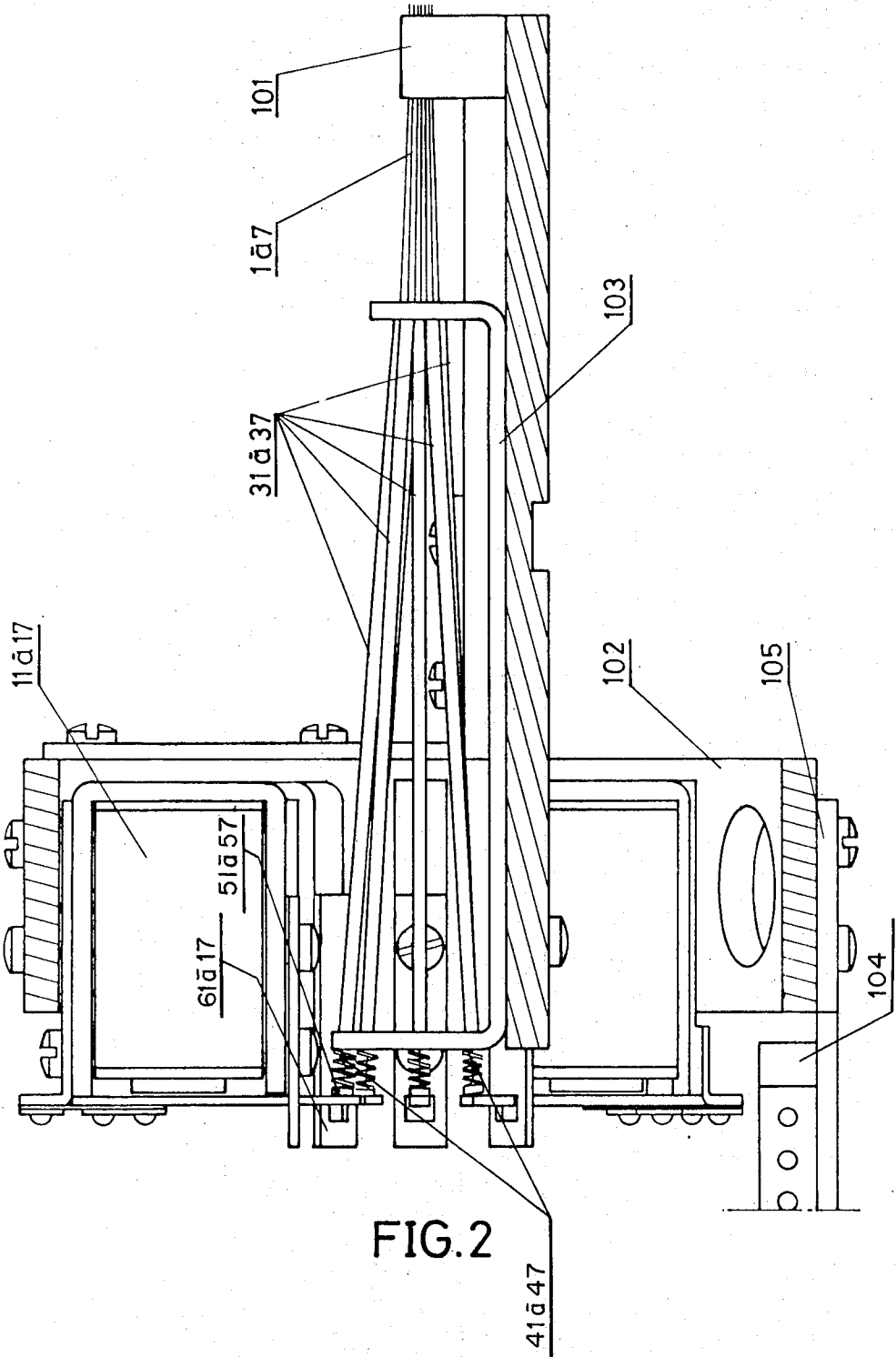


FIG.1



## PRINTING HEADS FOR PRINTING MACHINES

This is a continuation of application No. 169,759 filed Aug. 6, 1970, now abandoned.

The present invention relates to printing heads used in printing machines to produce, with clarity, messages received from a central unit of a computer, each character of the message being struck in turn, and built up from an array or mosaic of dots.

In known devices of this type, the printing of the dots of a particular character on paper is obtained by propelling selected elongate marker elements comprising metal needles or wires towards an anvil arranged behind the paper, so that the ends of these wires strike the paper at the position to be occupied by that character. The particular wires which are propelled are selected in accordance with the shape of the character to be printed. The printing of the character can be effected, either in one operation by simultaneously propelling all of the selected wires required to print the complete character, or by horizontally scanning the different vertical planes or columns of dots belonging to the frame used. In the first case, the number of wires to be provided, and the number of electromagnets which control the wires, is equal to the total number of dots of the frame, which renders the mechanical structure delicate, and gives rise to a large consumption of energy which may cause heating detrimental to the printing head. In the second case, the number of wires, and electromagnets, is limited to the number of dots in the array which occupies the same vertical plane or column which gives rise to less complex mechanical structure, and to a decrease in the power consumption, but requires auxiliary devices to ensure sequential scanning of the different vertical columns of the same character at a constant speed of movement.

Nevertheless, the large dimensions of the control electromagnets relative to the size of the character to be printed necessitate the distribution of the former, either in fan formation on a common helix, or in files, the latter case possessing the advantage of reducing the spacing between the bobbins of the extreme or outer most electromagnets, which causes considerable curvature of the wires. As a result, considerable friction occurs between the wires and their end and intermediate guides, and there is also a risk of breaking the wires during striking of the character.

The device according to the invention enables these drawbacks to be avoided, and the operating conditions of the printing head to be improved.

According to the invention, the control of the elongate marker elements or wires is effected by a corresponding number of electromagnets, each having a movable low inertia armature, and radially arranged within a common section of a cylindrical member, this arrangement being made possible by the use of flat bobbins. The reduction in inertia due to the use of a movable armature has the advantage, compared with systems using electromagnets having plunger cores, of increasing the maximum possible frequency of movement of the wires, which leads to an increase in the striking or printing rate of the characters. The arrangement of the control electromagnets in a common section of a surrounding cylindrical member enables, moreover, minimum bulk to be obtained, and enables the wires to operate under substantially identical conditions with an extremely small degrees of curvature, the

actuation of the wire being effected in the central region of the cylindrical member at the same level as their end guide.

In one embodiment of the invention, the guiding of the wires is ensured over their entire length by elastic or flexible sheaths within which they are freely slidable, without any intermediate guide. This arrangement has many advantages. On the one hand, the deformations which, in the devices usually used, affect the wire during striking of the character, are now absorbed by the flexible sheath surrounding the wire, thus avoiding buckling of the ends of the wires and the risks of breaking of the wire which result such deformation. On the other hand, the wear of the wire is not localized at the sole position of the intermediate guide but spread over the entire length of the wire within the sheath.

An adjustable return device may be associated with each wire, to accelerate the return of the wire to its rest position following de-energisation of the control electromagnet, which enables the return time to be decreased and the rate of strike to be further increased.

In order that the invention may be more readily understood, reference will now be made to the accompanying drawings which show, by way of example, one preferred embodiment of the device according to the invention, and in which:

FIG. 1 is a partial end view of the printing head showing the radial arrangement of the control electromagnets within the cylindrical body of the head; and

FIG. 2 is a side view, partially sectioned, of the head shown in FIG. 1.

As shown, the device is intended to effect printing of the characters according to a rectangular frame size of  $7 \times 9$ , two consecutive dots belonging to a same horizontal, moreover, not being able to be struck.

Seven steel marker needles or wires 1 to 7, the ends of which pass through an equal number of vertically aligned holes in an end guide 101, are controlled, via their opposite ends, by energising control electromagnets 11 to 17 which are fixed radially, by means of detachable supports 21 to 27, to a cylindrical body 102 of the head. The end guide 101 may be displaced with respect to an anvil (not shown), thus enabling adjustment to be effected. The guide 101 is made from a hard material having a high coefficient of friction, such as ruby.

As will be readily apparent from FIG. 2, the bobbin of each electromagnet is generally flat in cross-section, having its major axis disposed radially, and its minor axis normal to its major axis. The electromagnets may therefore be positioned more closely together, or on a smaller pitch-circle diameter, than corresponding electromagnets having circular cross-section bobbins.

Each electromagnet actuates its associated wire via a radially disposed armature in the form of a thin, low mass blade which is resiliently mounted from its electromagnet at its radially outer end, and, at its radially inner end, abuts the opposite end of its associated wire.

The elastic or flexible sheaths 31 to 37 within which the wires 1 to 7 slide each comprise a Bowden cable made from a very fine steel wire wound into a helix having contiguous convolutions. The sheaths are welded, or otherwise secured, by their opposite ends to curved parts of a rigid support 103. This arrangement has the advantage of enabling, once and for all, lubrica-

tion of the system to be ensured and enables the wear to be spread over the entire length, the oil used being initially distributed over the entire external surface of the sheath and remaining in the gaps between consecutive convolutions. The assembly of the elastic sheaths and their rigid support **103** form a detachable unit which may easily be dismantled and reassembled.

A device is associated with each wire which ensures its return to its rest position as soon as the electric pulse applied to the corresponding control electromagnet is suppressed or terminated. Each of the devices comprises a return spring **41** which is compressed between the rigid support **103** and a nipple **51** attached to the end of the controlled wire. An adjustable rest stop **61** to **67** enables the travel of the wire to be adjusted.

A link bar **104**, secured to the cylindrical body **102** by an intermediate clip **105**, completes the printing head according to this embodiment of the invention.

The device specifically described may be used in all cases where it is desired to achieve printing, on the one hand, with continuous, long duration operation without significant deterioration in the print-out quality, and on the other hand, with the possibility of simultaneously obtaining a plurality of perfectly legible copies, for example **5** or **6** copies, whilst still benefiting from appreciable ease of adjustment and maintenance. Series printing can therefore be achieved which may strike **50** characters per second or more, which form a less burdensome solution for peripheral editing of any data processing system.

It will be understood that various modifications may be made without departing from the scope of the present invention as defined in the appended claims. For example, the electromagnet bobbins may be of flat-

tened rectangular cross-section as shown, or oval, elliptical, or of other flattened form.

What we claim is:

1. A printing head device including slidable elongate marker needle elements projectable against an anvil during striking a straight line of dots of a selected character, the device including a body having a longitudinal axis of symmetry, a plurality of electromagnets each having a frame mounted within said body and radially projecting towards said axis of symmetry, said frame including a blade-like armature extending radially towards said axis of symmetry and having a movable radially inner end, the inner ends of said armatures being centrally disposed in a circular array about the axis of symmetry of the said body; the needle elements directly cooperating at a first end with the respective inner ends of the armatures, and having at a second end, terminal portions parallel to said axis of symmetry, a supporting member secured to the said body, said supporting member including a rigid guide member for guiding said terminal portions in a common plane in which the adjacent terminal portions are adjoining each other; said supporting member further including first and second spaced further guide members for guiding and supporting the needle elements at first and second points intermediate between the first and second ends thereof; and lubricated exposed Bowden cable sheaths, each having first and second ends respectively secured to said first and second further guide members, said Bowden cable sheaths respectively surrounding the respective needle elements between said first and second points.

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