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[73] Assignee **Cambridge Industrial Instruments Limited**
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[33] **Great Britain**
[31] **37,959/68**

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[50] Field of Search **346/140**

[56] **References Cited**

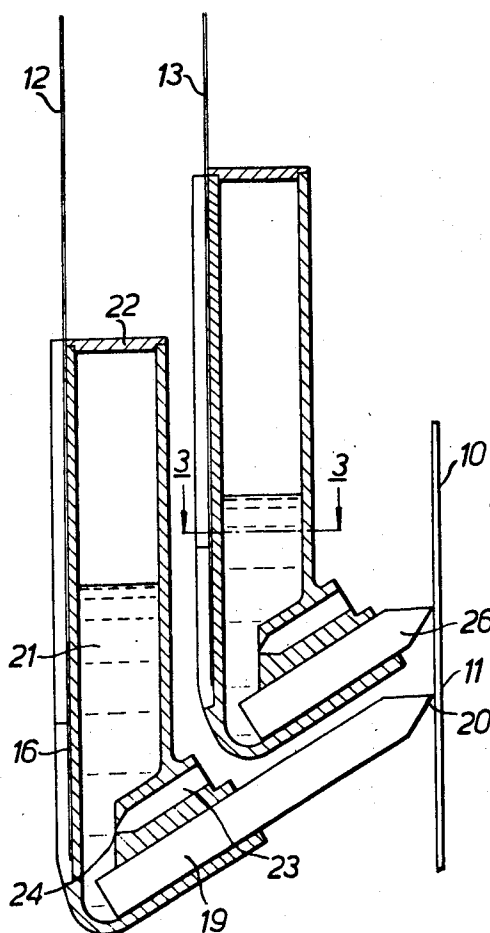
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[54] **RECORDING PEN**
5 Claims, 10 Drawing Figs.

[52] U.S. Cl. **346/140**

ABSTRACT: A fiber-tip pen for use in recording apparatus, having a vertical reservoir closed at its upper end, a fiber rod inclined upwardly from the lower end of the reservoir, and an air inlet aperture provided above and adjacent the fiber rod.



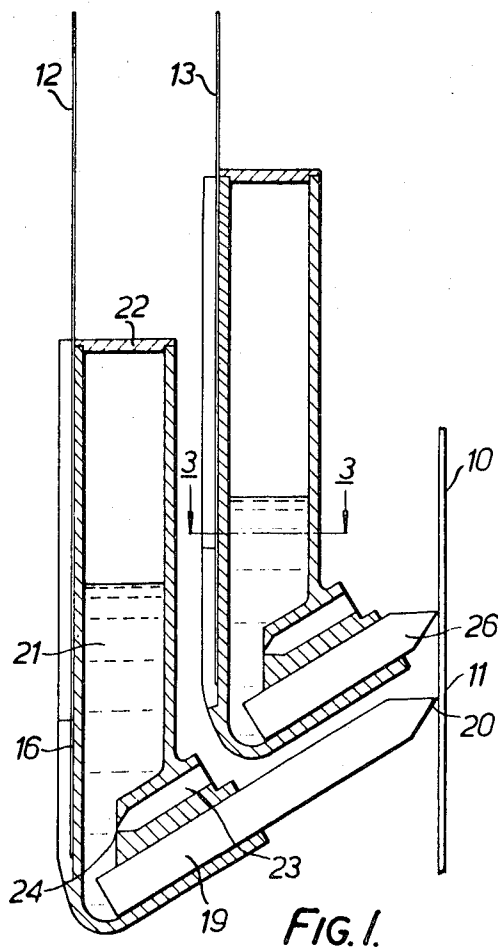


FIG. 1.

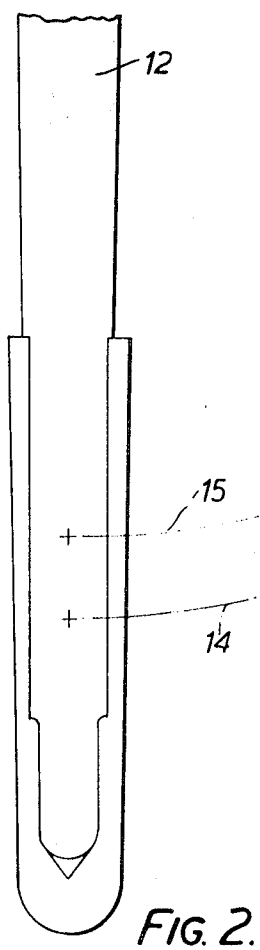


FIG. 2.

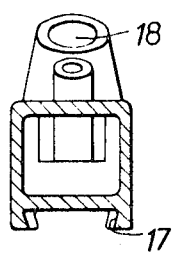


FIG. 3.

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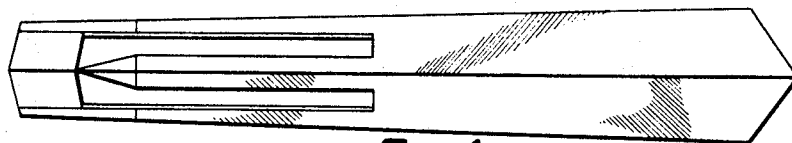


FIG. 4.

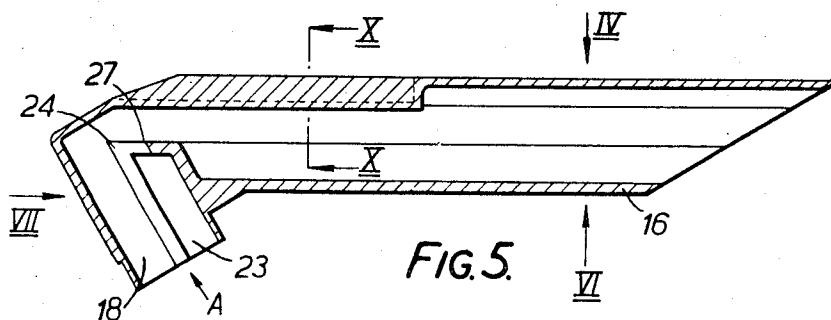


FIG. 5.

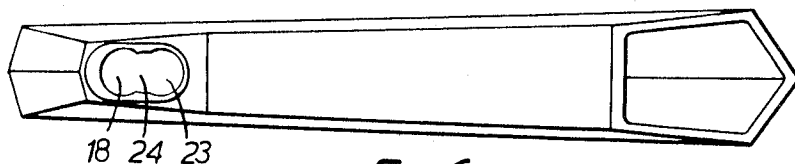


FIG. 6.

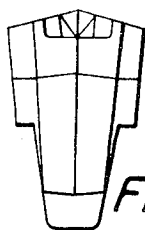


FIG. 7.

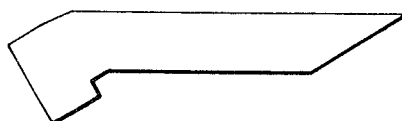


FIG. 8.

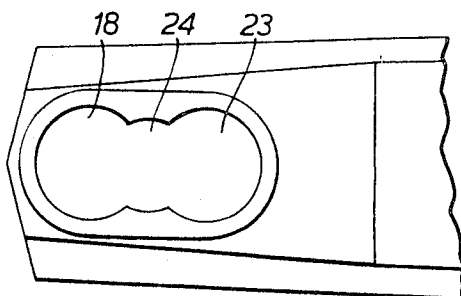


FIG. 9.

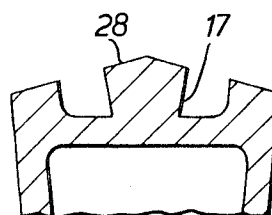


FIG. 10.

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RECORDING PEN

This invention relates to chart recorders and is more particularly concerned with inking pens for use with such recorders.

Inking pens for this use should meet certain requirements. The pen should be capable of producing a fine line and should not require substantial pressure to be applied to the surface of the chart, since this pressure must be obtained from the pen of the recorder. The pen should hold sufficient ink to last for a substantial period of time without attention, whether used or not, and so the ink should neither blot nor run nor should it readily dry on the pen. Replacement of the pen when necessary should be carried out easily and it should be possible to replace the pen in a predetermined position, as otherwise the accuracy of the recording may be affected.

The present invention is concerned with a design of pen for a chart recorder which is improved in various respects over the pens at present in use.

According to the invention there is provided a pen for the use with recording apparatus comprising:

- a. a tubular element for mounting in a generally vertical position,
- b. an element connected to said tubular element and having an aperture connected to the lower end of the cavity in said tubular element and inclined upwardly away from said tubular element,
- c. a fiber rod contained in the aperture in said element, the remote end of said rod being shaped to a point,
- d. a further aperture in said element for the admission of air to said tubular element above and adjacent the aperture containing said fiber rod.

Features and advantages of the invention will appear from the following description of embodiments thereof, given by way of example, in conjunction with the accompanying drawings, in which:

FIG. 1 is a partly diagrammatic cross-sectional view through a twin-pen chart recorder according to the invention;

FIG. 2 is a front elevational view of the arrangement shown in FIG. 1;

FIG. 3 is a cross-sectional view of the reservoir unit of FIG. 1, with the pen fiber removed, and taken on the line 3—3 of FIG. 1;

FIG. 4 is a front elevational view of a pen in accordance with another embodiment of the invention, and analogous to FIG. 2;

FIG. 5 is a partly diagrammatic cross-sectional view through the pen shown in FIG. 4, and analogous to FIG. 1;

FIG. 6 is a rear elevational view of the pen shown in FIGS. 5 and 6;

FIG. 7 is an underside view of the pen shown in FIG. 4 to 6;

FIG. 8 is a silhouette of the pen shown in FIGS. 4 to 7 and corresponding to FIG. 5;

FIG. 9 is a view in the direction of the arrow A in FIG. 5; and

FIG. 10 is a cross section view on the line XX in FIG. 5.

In the examples of the invention described herein the recorder is assumed to be of the chart type using a paper disc chart 10 which can be clamped against a support plate 11 and rotated, about an axis not shown, at a predetermined speed. Recording marks are drawn on the paper chart by means of pens carried by two recording arms 12 and 13, carried on suitable pivots, also not shown, so that the recorded variable is recorded as the position of the pen varies along an arc such as 14. To enable a second variable to be recorded on the same chart, the second pen is used and since the two pens cannot occupy the same radial position along the length of the arms, the second pen follows an arc such as 15.

The two pen arms 12 and 13 are made in the conventional manner of thin light material, conveniently metal, and the pen mechanisms are attached, preferably frictionally to the ends of the arms. The two pens are generally similar in construction and therefore one only will be described in detail. Thus, the pen assembly attached to arm 12 consists of a small plastic

container 16, preferably of rectangular cross section as indicated in FIG. 3, the front face of the container being formed with a tapering wedge-shaped groove at 17, by means of which it can be held frictionally on the end of arm 12.

At the lower end of the container 16 there is formed an opening 18, forming a receptacle for a fiber rod 19, shaped to a conical tip at 20. The tip 20 forms the writing point of the pen and in use engages the paper chart 10. The rod 19 is composed of closely compacted fibers of material which can, for example, be of nylon and are suitably bonded together to form a coherent but porous rod.

The container 16 is filled with a suitable ink, as at 21 and the top of the container, when so filled, is closed by a cap 22. The cap provides an airtight closure for the container. Above the hole 18, the container is formed with a second, air-bleed opening 23, terminating at its inner end in a small hole 24.

In use, the pen is used with the arm 12 in the vertical position, as shown in FIG. 1 and the ink 21 will feed by gravity to the lower part of the pen assembly, and by the capillary action of the fibers forming the rod 19 will be supplied to the tip 20 in known manner. A pen of this type has the advantage that the writing tip 20 may be made fine, so that only a narrow line will be drawn on chart 10 and in addition, provided that the fiber is adequately maintained with ink, only a light contact pressure is required.

However, the use of a fiber pen for a chart recorder would not normally be satisfactory; one reason for this is that the relatively large exposed area of the fiber there is a considerable ink loss, which may impair the writing by the pen and which leads also to early exhaustion of the ink supply. A second reason for the unsuitability of a fiber pen for this service is that if the reservoir formed by the container 16 is adequate, there will be an appreciable head of ink above the fiber rod 19, leading to flooding of the rod with ink.

With the arrangement described, these difficulties are obviated in two ways: firstly, there is used for the ink 21 a liquid which has a low vapor pressure so that the loss by evaporation from the fiber 19 is minimized. By suitable choice of ink, and by maintaining ink at the lower part of the fiber rod 19 it can be arranged that the rod remains appropriately moist with ink and does not dry out in use. Secondly, means are provided for limiting the head of ink which will exist at the inner end of the fiber rod 19. As shown, it will be seen that with the closure 22 forming an airtight seal at the upper end of the container ink will flow, as described above, into the lower part of the container but as soon as the hole 24 becomes obstructed by ink, no further ink will flow from the reservoir, until the ink below the level of the hole 24 is used up sufficiently to expose the hole again, when further ink will be released from the upper part of the reservoir. It will be seen that the tip 20 of the fiber rod is above the level of the hole 24, so that there is no tendency for the ink to flood the writing end of the fiber rod.

A device such as that described has been found to give much longer satisfactory service than is possible by corresponding devices of which we are aware. It is also of advantage that with the fiber pen, a legible mark will continue to be made by the pen after the normal exhaustion of the ink supply.

The second pen arm 13 is provided with an assembly which is similar to that described except that the fiber rod 26 used with this pen is shorter, so that the two pens can be mounted, as shown in FIG. 1, to write on the common chart 10.

The pen illustrated in FIGS. 4 to 10 is a modification of that shown in FIGS. 1 to 3, and is intended to be inserted in a tube closed at the remote end (not shown) so that its body and said tube constitute a reservoir and are then mounted on an arm equivalent to 12 or 13 (FIG. 1). Parts which are similar to those appearing in the above-described embodiment of the invention are given the same reference numerals. This embodiment differs from the other embodiment principally in that instead of there being provided an air-bleed opening 23 separate from the opening 18 for the fiber rod 19, the air-bleed opening is an enlargement of the opening for the fiber rod. This may

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best be seen in FIG. 9 where the opening 18 for the fiber rod is shown to be circular in cross section. This is enlarged by a further somewhat smaller diameter tubular opening 24 which intersects opening 18. A further tubular opening 23 of the same diameter as opening 18 intersects opening 24. The opening 24 penetrates to the reservoir whereas opening 23 terminates at the wall of the reservoir 27 without penetrating into it. The three openings 18, 24, 23 are of diameters respectively 2.0, 1.5, and 2.0 mm. and their centers are separated by distances of 1.0 mm. respectively.

The body of the pen is a symmetrical pentagon in cross section as may be seen in FIG. 6 and a pair of grooves are provided along the top to form a wedge-shaped portion 28 for attachment to the arm supporting the pen.

In use a fiber rod is inserted in the tubular hole 18 and as stated the device as shown in the FIGS. 4 to 10 is inserted into a tube containing ink and closed at the remote end. It is mounted with the axis of the reservoir vertical. Its operation is exactly the same as that of the device shown in FIGS. 1 to 3.

A suitable ink for the pen is that available commercially as a nondrying recording ink, which is slow to evaporate, has nonspreading qualities and is color fast.

The pen assemblies are simple to manufacture and can be molded in plastic material, so that they can be expendable after use. Means may be provided, consisting of detent means between the pen assembly and the arm, to ensure that the pen tip such as 20 assumes the direct radial position on the arm such as 12.

Although the embodiments described above are specifically intended for use in disc recorders it will be obvious that the invention may equally be utilized for use with strip-chart recorders or other types of recording apparatus.

What is claimed is:

1. A pen for use with recording apparatus comprising a body member including a tubular element defining an elongated enclosed inner cavity adapted for mounting in a generally vertical position, the upper end of said tubular element being closed to form an ink-retaining reservoir, and a

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stylus-receiving section formed at the lower end of said tubular element and having an open-ended inner chamber which opens at an inner end into said enclosed inner cavity, said stylus-receiving section being inclined upwardly away from the lower end of said tubular element, an enclosed open-ended air channel for the admission of air to said tubular element having an inner end which opens into said enclosed inner cavity at a point above but adjacent to the inner end of said stylus-receiving section inner chamber, said air channel being inclined upwardly away from said tubular element, and an elongated stylus received in the inner chamber of said stylus-receiving section and extending outwardly therefrom; away from said tubular element to a remote end positioned at a point above the point at which said air channel opens into said enclosed inner cavity, said stylus being formed from a fiber element adapted to conduct ink to the remote end thereof from said enclosed inner cavity, the remote end of said fiber element being shaped to a point.

2. A pen according to claim 1 wherein said air channel is formed in said stylus-receiving section above the open-ended inner chamber thereof, said air channel being formed to provide a restricted opening into the enclosed inner cavity of said tubular element.

3. A pen according to claim 2 wherein said air channel constitutes an enlargement of the stylus-receiving open-ended inner chamber in said stylus-receiving section, said air channel extending above said stylus.

4. The pen according to claim 2 wherein the lower end of the enclosed inner cavity in said tubular element is smaller in cross section in the area adjacent the inner ends of said air channel and stylus-receiving section and said stylus extends completely through said stylus-receiving section and into said enclosed inner cavity.

5. The pen according to claim 4 wherein pen-mounting means are formed on said tubular element, said mounting means including a longitudinally extending wedge-shaped channel formed in the outer surface of said tubular element.

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