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DE-A- 3 637 875
DE-A- 3 811 762
US-A- 4 854 762
US-A- 4 943 817

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Description

BACKGROUND OF THE INVENTION

1. *Field of the Invention*: The present invention relates generally to pens and adapters for use in graphic plotters, and particularly to a plotter pen assembly construction having the ability to mount against more than one surface of an adapter, for wide applicability to various plotting machines.

2. *Brief Description of the Prior Art*: Plotter pens for use in graphic plotters are well-known. For example, the assignee of the present invention has designed and offered for sale various plotter pens to fit particular geometrical relationships required for the plotter models of different manufacturers.

A plotter pen assembly that is adapted for a friction fit directly within a Calcomp® plotter, is illustrated by GUNDERSON, ET AL., (U.S.-A-4,540,993). The pen body essentially comprises a nib portion in combination with an ink reservoir portion, with a barrel and a guide ridge or stop shoulder that is friction fit within a pen holder arm of the plotter to accurately locate the pen with respect to a drawing surface. The wide popularity of graphic plotters has suggested the advantage of a plotter pen assembly which, through different surrounding adapters, might fit in a wide variety of graphic plotting devices. The plotter-pen assembly should be without regard to the specific pen assembly geometry required by a given pen holder, or whether the nib element is configured as a liquid ink tubular stylus; a fiber tip; a roller ball; or a ballpoint.

One prior art DPP® plotter pen assembly sold by Koh-I-Noor Rapidograph, Inc., of Bloomsbury, New Jersey, assignee of the present invention; is the Model 64C style pen assembly, which is also illustrated in FIG. 1. The Model 64C is a two piece assembly specifically designed for use with an adapter to fit certain Calcomp® model plotters, and without an adapter to fit other Calcomp® model plotters. The present invention involves defining certain important dimensions within a plotter pen assembly, so that associated adapter rings will permit use of the same pen assembly in a wide variety of plotter devices. The prior art generally has required very specifically shaped plotter pens for each plotter model made by a particular manufacturer, so that no wide use for a single plotter pen assembly has been possible. The prior art generally recognizes use of an adapter assembly for mounting a plotter pen assembly against a first seating shoulder. However, the present invention uniquely permits a single liquid ink nib assembly and a single ink cartridge assembly, for example, to cooperate as a single plotter pen assembly, that has alternative contact means, with a set of different adapters. The present invention also permits either single piece, or multiple piece plotter pen assemblies and either active or refillable plotter pen assemblies to be configured for use with the same set of adapters. The adapters, in turn, each have a particular configuration for a friction (or other) mounting within the plotting head of a particular plotting machine.

It is, therefore, a first object of the present invention to provide a novel two-piece plotter pen assembly (by combining a novel ink cartridge assembly with a conventional nib assembly) that will permit a large number of alternative mounting options, through adapters, for the drawing heads of various plotting machine manufacturers.

A second object of the present invention is to provide a novel single-piece, two-piece or multiple-piece plotter pen assembly that will permit a large number of alternative pen types and mounting options, through a common set of adapters, for the drawing heads of various plotting machine manufacturers.

It is a third object of the present invention to provide both preferred and secondary seating dimensions upon a plotter pen assembly, so that an adapter may accurately be seated against either a hard plastic surface of a nib assembly, or against a shoulder defined either as part of a softer plastic ink cartridge assembly, or as part of a unitary pen body that is of either soft or hard plastic.

It is a fourth object of the present invention to provide a plotter pen assembly which securely mounts with respect to a large number of adapters, whether or not the seating contact is against a hard plastic shoulder of a nib assembly, or against a soft plastic shoulder of a separate ink cartridge assembly or a unitary pen body.

These and other objects of the present invention will be understood further with respect to the following description of the invention, wherein preferred and other embodiments are shown and described.

SUMMARY OF THE INVENTION

The foregoing objectives are met by defining various types of plotter pen assemblies, wherein certain dimensions of the combination are surprisingly advantageous. A tight tolerance situation exists with respect to certain dimensions, so that the plotter pen assembly becomes capable of mounting within various adapters, which in turn can be used in various graphics plotter machine drawing heads. A preferred embodiment consists of two piece assembly, wherein a liquid ink nib assembly of hard plastic holds a tubular stylus for liquid ink,

and a separate soft plastic, non-refillable ink cartridge is joined thereto.

The nib assembly portion, in various embodiments of the present invention may be itself conventional. Nib assemblies of such structure have been used in the prior art. A nib assembly essentially comprises a hard plastic cylindrical element wherein a nib element fits within a transition cylindrical section, and a mounting cylindrical section. The nib element may be a tubular stylus for liquid ink that is made from metal, plastic, tungsten carbide or ceramic or the nib element may be a ball point, a roller ball, a fiber tip, or of other known types. The mounting cylindrical section conventionally may include a rearward surface configuration that is particularly shaped to be press fit, within the open end at the front of a surrounding, soft plastic ink cartridge assembly. This nib assembly of a preferred embodiment has certain dimensions and certain tolerances, as known in the prior art. Hence, a first seating shoulder defined between the transition circular section and the mounting circular section, is spaced axially (with respect to the leading edge of the nib element) without regard to either the dimensions of a separate ink cartridge assembly, or any other form of writing fluid reservoir that feeds forwardly, to the nib-element.

The second seating shoulder is defined axially rearwardly of the first seating shoulder In a preferred embodiment, the second shoulder is formed as part of a soft plastic ink cartridge assembly, and is not part of a hand plastic nib assembly. However, because that ink cartridge assembly is press fit from the rear onto the back of the nib assembly, to an exact axial mounting position, the second seating shoulder becomes accurately spaced axially, with, respect to the leading edge of the nib element. In other embodiments, the second seating shoulder also is accurately spaced axially with respect to the leading edge of a nib element. The second seating shoulder is very particularly designed to cooperate with adapter structure, so as to perform a secure mounting with those adapters that cannot seat against the first, or preferred, seating shoulder, in all embodiments.

Accordingly, more than one plotter pen assembly embodiment can be used with the same set of various adapters, wherein each adapter has an external structure to mount with the drawing head of various graphics plotting machines. The interior structure of any adapter, according to the present invention, may be configured to securely engage either the first seating shoulder or the second seating shoulder. While seating against the first seating shoulder is considered preferred, the present invention uniquely defines both first and second seating shoulders that alternatively may be used. Further, in either alternative there is a secure and accurate location of the leading edge of the plotter pen nib element with respect to a reference drawing surface, when the plotter pen assembly is used according to its intended purpose, in a graphics plotting machine.

In the preferred embodiment, a nib assembly for a metal tubular stylus has a prior art construction, wherein a first seating shoulder is located .394 inches or 10 mm, axially spaced from the leading edge of a tubular nib. This first shoulder is defined by an annulus and an adjacent chamfered surface, on the lower edge of a mounting cylindrical surface thereof, that has a diameter of approximately 0.245 inches, or 6.22 mm. The transition cylindrical section below the first shoulder conventionally has a diameter of .155 inches or 3.94 mm.

As noted hereinbefore, a nib assembly with such dimensions *per se* is a prior art geometry. For example, the 64C style DPP® pen assembly sold by Koh-I-Noor Rapidograph, Inc., has such dimensions. Further, the 64C pen assembly can be used with an adapter, that seats against the first shoulder, to define a combination that fits the Calcomp® 102x, 104x, series of graphics plotter machines. However, the preferred embodiment of the present pen assembly combines such a conventional, hard plastic nib assembly with a novel soft plastic ink cartridge assembly, so as define also a second seating dimension, that also is controlled with a defined tolerance dimension above the leading edge of the nib element.

The second seating dimension preferably is axially spaced 2.358 inches or 59.89 mm a from the leading edge of a nib element such as a metal tubular liquid ink stylus, when a two-piece pen assembly is defined. The second seating shoulder is a transverse annular surface defined between a maximum ink cartridge diameter of 0.450 inches, or 11.43 mm, and the maximum diameter of an immediately adjacent external thread of the ink cartridge assembly. Prior art specifications for direct mount ink cartridge assemblies such as the DPP® Model 64C, have required coarse external mounting threads and narrow shoulders. Such specifications are considered incapable of performing the function of a secure second seating shoulder, when used with an adapter. For example, within the 64C, the annular transverse seating surface located between the rear portion of a coarse thread and the ink cartridge maximum diameter was too narrow and too easily deformable and would not resist bending moments around the pen assembly axis.

The present invention provides a wider annular second seating shoulder and a shallower thread configuration that together cooperate to permit a secure mounting of a pen assembly in various adapters of a second type. By employing a shallow external thread upon a minimized ink cartridge

shaft diameter, or equivalent pen assembly body structure, a larger annular second seating shoulder is available for contact with a hard plastic transverse annulus of various adapter rings. Accordingly, where a second seating contact is required with a plotter pen assembly according to the preferred embodiment, the transverse annulus of soft plastic on the ink cartridge subassembly is sufficiently large, so that it will not deform against a complementary, hard plastic transverse surface of the surrounding adapter.

In the preferred embodiment, the second shoulders is spaced axially from the tubular nib leading edge at a reference dimension of 2.358 inches, or 59.89 nun, instead of only 2.08 inches, or 52.8 mm, as in the Model 64C. This longer dimension has been found to permit the greatest number of possible plotter adapter fits, where a second mounting location is needed. Further, the ink cartridge mounting shaft outer diameter is slightly smaller at a maximum reference dimension of .352 inches, or 8.94 mm, instead of a maximum reference dimension of 0.36 inches or 9.1 mm, in the Model 64C. The ink cartridge maximum diameter also is smaller, at a reference dimension of 0.45 inches or 11.43 mm, instead of a dimension of a dimension of .54 inches, or 13.7 mm in the Model 64C. These relationships permit the pen assembly to fit a greater number of adapters and, therefore, a greater number of plotting machines. The outer diameter maximum of an ink cartridge mounting shaft in the preferred embodiment also is configured for a certain diametrical clearance fit, preferably 0.005 inches, within an axial guideway of any associated adapters. This clearance will preclude axial bending movements, and consequent ink leakage.

Further features and advantages of the present invention can be further understood by reference to the following detailed description of preferred and other embodiments, wherein reference is made to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation view of a prior art form of pen assembly;

FIG. 2 is a side elevation view of a preferred embodiment of two pieces and non-refillable, plotter pen assembly according to the present invention;

FIG. 3 is a side elevation view, in vertical cross-section, showing the ink cartridge assembly portion of FIG. 2;

FIG. 4 is a side elevation view, of the pen assembly of FIG. 2 when mounted in a first type of adapter, shown in partial section, with a first seating contact;

FIG. 5 is a side elevation view of the pen assembly of FIG. 2 when mounted in a second type of adapter, shown in partial section, with a second seating contact;

FIG. 6 is a side elevation view of a second embodiment plotter pen assembly of one piece, wherein a roller ball nib element is illustrated;

FIG. 7 is a side elevation view of a third embodiment plotter pen assembly, of several pieces, wherein a refillable liquid ink tubular nib element is illustrated;

FIG. 8 is a side elevation view, in vertical section, of a plotter pen body element according to the assembly of FIG. 7; and

FIG. 9 is a side elevation view, in vertical section, of a plotter pen refillable ink cartridge according to the assembly of FIG: 7.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 is a side elevational view of a prior art form of pen assembly, and in particular the Model 64C style, plotter pen assembly noted hereinbefore. This non-refillable plotter pen assembly comprises essentially two major subassemblies. First, a hard plastic nib subassembly comprises a mounting cylindrical section, 2, a transition cylindrical section, 4, and a nib element, 6, wherein a first seating shoulder annulus, 8, is surrounded by a chamfered surface between the transition cylindrical section and the mounting cylindrical section. Second, a soft plastic ink cartridge subassembly, comprising a mounting shaft section, 12, to accept the nib assembly by a press fit, an ink cartridge maximum diameter in a reservoir section, 16, and a means to mount the ink cartridge into a plotter head. Coarse threads, 14, are the mounting means illustrated at FIG. 1. For the particular 64C style plotter pen assembly in the prior art, the mounting thread specification is 7/16-20UNF. The ink cartridge assembly further comprises a button, 20, which doses an open end after filling. Between the maximum cylindrical section, which may be knurled, as shown, and the ink cartridge mounting shaft diameter, 12, is shown a transverse shoulder, 18.

The Model 64C style plotter pen assembly shown is used with an adapter, in order to fit within the 102x, 104x series of Calcomp® plotters. The Model 64C style pen assembly also may mount directly. Internal threads on the arm of a plotter head in the Calcomp® 96x, 97x, family of graphical plotters may engage directly with the external mounting threads, 14. However, in that application there is significant plotter structure to engage a large area of the coarse, soil plastic threads, 14, so as to supply adequate rigidity. The adapter typi-

cally used with the plotter pen assembly of FIG. 1 will produce an external configuration equivalent to that for a unitary pen, as illustrated in GUNDERSON, ET AL. (U.S.-A-4,540,993).

FIG. 2 is a side elevational view of a preferred plotter pen assembly of two-piece construction, according to the present invention. Since the nib assembly is fully equivalent to that illustrated as a subassembly in FIG. 1, the same numerals have been used to identify the same parts. The non-refillable ink cartridge assembly according to the preferred embodiment comprises a mounting shaft, 22, and a maximum diameter section which also may be knurled, to define a reservoir, 26. Between the reservoir or maximum diameter and the ink cartridge mounting shaft is a fine threaded mounting means, 24. In the preferred embodiment, the thread is 0.393 x 36 TPI, which is uniquely suited to the present application because it is shallow, with a small difference between the major and minor diameters of the thread. A second mounting shoulder, 28, is defined by an annulus between the outer diameter of the fine thread, 24, and the outer diameter of the ink cartridge reservoir section, 26. The ink cartridge reservoir is also shown to have an open end dosed by a button, 30, but may be dosed by any equivalent means. While a non-refillable reservoir thereby is implied, a refillable reservoir also may be employed.

Accordingly, the preferred assembly of FIG. 2 has a hard plastic nib assembly as shown in the prior art design of FIG. 1, but with a soft plastic ink cartridge assembly, 22, that is significantly elongated, and with different geometrical relationships. A first axial distance, A, is identified. In the preferred embodiment, A is set at 10 mm or 0.394 inches. A second axial distance, B, preferably is 59.89 mm or 2.358 inches. Both of these dimensions are referenced with respect to the leading edge of a nib element, that is shown to be a liquid ink tubular stylus, 6. Such a preferred embodiment now will be illustrated as to function, with respect to two alternate forms of adapters.

The preferred ink cartridge, 22, is molded from a soft plastic, such as polypropylene, and a preferred ink volume is between 2.0 cc and 3.0 cc. The nib assembly, as in the prior art, may be color coded as to the point size, and is comprised of a hard plastic, or metal. Therefore, the first dimension A defines a first seating contact with a first type of adapter that is between a first shoulder annulus, 8, and a hard plastic mating surface on an adapter. The second dimension B defines a second seating contact that is between a second seating annulus, 28, and a hard plastic or metal mating surface of a second type of adapter. The fine thread, 24, and the dimensions between the ink cartridge mounting shaft, 22, and the ink cartridge maximum diameter, 26, also are particularly chosen to help define a rigid, second mounting against the second shoulder, 28. The ink cartridge mounting shaft outer diameter preferably is 0.352 inches, as a maximum, or 8.94 mm, as shown by reference C. The ink cartridge maximum outer diameter, reference E, is preferably 0.45 inches, or 11.43 mm in the vicinity of the shoulder, 28. The relative difference between diameters C and E is important and a maximum value to outer shaft diameter, C, also is an important fit constraint. The maximum diameters, C and E, with a 0.393 x 36 TPI thread, will create a larger annulus for the second seating shoulder, 28, than is created by the geometry of FIG. 1 at the shoulder, 18.

FIG. 3 illustrates, in vertical cross-section, the basic interior structure of a novel ink cartridge portion of the combination shown in the preferred embodiment of FIG. 2. The ink cartridge shown in FIG. 3 is of unitary soft plastic construction, preferably polypropylene and is of the non-refillable type. An axial stop, 32, is spaced 0.875 inches (± .003) inside the ink cartridge forward end. The forward end also has a tapered inner diameter, 34, that is adapted to tightly engage over the rear end of the mounting cylindrical section, 2, of the nib assembly, as in the prior art. External threads are formed by molding at 24, and a wall section, 26, in the vicinity of the major diameter is relatively thick, to act as a rigidifying element for the second seating shoulder, 28. An open rear end, 36, conventionally is dosed by a button or other form, of closure, 30, as shown in FIG. 2.

FIG. 4 illustrates the preferred plotter pen assembly of FIG. 2 in combination with an adapter of the first type, wherein the axial mounting is between complementary surfaces on an adapter body, and the first seating shoulder annulus, 8. The adapter body, 40, is shown in partial cross-section to comprise an axial, reflective-surface cylinder section, 42, and is intended for use with a Calcomp® 102x, 104x type of graphics plotter. The adapter of FIG. 4 also has an external configuration equivalent to the pen body, shown in the patent to GUNDERSON, discussed hereinbefore The adapter internal threads, 44, are significantly longer than the mating external threads, 24, of the plotter pen assembly. A needed guide ridge, 46, is generated on the outside of the adapter body. Axial mounting is accomplished by contact between an axial stop, 48, against the first seating shoulder annulus, 8. A further contact also may be made against the immediately adjacent chamfered surface, 10. The axial stop, 48, preferably is defined by an inner surface of a transverse wall, at the leading edge of the adapter, 58. The rear end of the adapter, 50, is shown spaced axially ahead of the second seating shoulder, 28, so as not to interfere with the first

seating. Further, there is an axial guideway, 52, within the adapter which is defined to leave approximately 0.13 mm (0.005 inches) of diametrical clearance, around the outer diameter of an ink cartridge mounting shaft diameter, 22. It has been determined that an ink cartridge diameter of this type can swell approximately 0.05 mm (0.002 inches) upon assembly, and that a diametrical clearance of 0.13 mm (0.005 inches) will act as a secure, yet non-binding, interface between the adapter and the outside of the cartridge mounting shaft portion. The reflective-surface cylindrical portion, 42, also preferably has a heavy wall thickness, 54, in the vicinity of the threads, 44, to guarantee rigidity as the adapter is screwed tightly upon the soft plastic external threads, 24.

A second type of adapter for the pen assembly of FIG. 2 is shown in FIG. 5, wherein the adapter, 60, again is shown in partial cross-section. Adapter bodies of the second type are needed for applications where the first seating shoulder is not available. For example, the adapter shown in FIG. 5 is useful with an Hitachi 675 model graphics plotter wherein the adapter leading edge, 78, is spaced approximately 1.457 inches above the leading edge of the tubular nib, 6. The adapter of FIG. 5 has an inner cylindrical section, 62, an internal thread, 64, a guide ridge, 66, and an outer cylindrical section, 68, particularly configured for a mounting within an Hitachi 675 plotter head pen holder, for example.

Internal threads, 64, and a rear end of the adapter, 70, are configured in second type adapters for a tight abutment against the second seating annular shoulder, 28, of the pen assembly. In FIG. 5, a conventional cap, 80, is shod sealing the leading edge of the tubular nib. Hence, FIG. 5 also illustrates the combination of plotter pen assembly, adapter assembly and cap, as would be combined just before mounting in a graphics plotter head. While the rear end of a second type adapter. 70, tightly abuts against the second annular seating shoulder, 28, of the plotter pen assembly, further axial bending movement rigidity is supplied by an axial guideway, 72, that is located within a relatively thick wall section, 74 of the adapter. The Hitachi 675 adapter illustrated in FIG. 5 also has a thin wall section, 76, but that section does not affect the rigidity which comes from a tight engagement at the second seating shoulder, 28, and an axial guideway engagement between the outer diameter of the ink cartridge mounting shaft, 22, and the inner diameter of the adapter axial guideway, 72. As in FIG. 4, the preferred diametrical dearance between the axial guideway and the outer diameter of the ink cartridge mounting shaft, 22, is on the order of 0.13 mm (0.005 inches), and may be as large as 0.25 mm (0.010 inches), in order to accommodate a radial distension, or swelling, of the cartridge upon an axial mounting into the adapter.

Figure 6 is a side elevation view of a second plotter pen assembly embodiment, of one-piece construction according to the present invention. The illustrated nib element is of the roller ball type, and the entire nib assembly is mounted as part of a single piece of support structure. Hence, this is a one-piece pen type of plotter pen assembly, where the ink reservoir, the plotter pen body assembly and the nib assembly are assembled as a single or unitary device. In such pens, the nib element typically is a fiber tip, a ball point or a roller ball, as illustrated. Such plotter pen assemblies typically are nonrefillable.

The one piece assembly shown as a second embodiment in FIG. 6 comprises a central body shaft portion, 82 and a maximum diameter upper body potion, 96 which may be knurled, as illustrated. The body essentially defines a reservoir. Between the upper body portion, 96, which has a maximum diameter and the central body shaft portion, 82, there is a fine-threaded mounting means 94. In the preferred embodiment, the thread of this mounting means is 0.393 x 36 TPI, which is both uniquely suited to the present application and identical to the mounting means shown for the preferred embodiment of FIG. 2. A second mounting shoulder, 98 is defined by an annulus between the outer diameter of the fine thread, 94 and the outer diameter of the upper body portion, 96. The body upper end is shown dosed by a button, 100, but any equivalent means for closing the body to define a dosed reservoir may be used. FIG. 6 therefore illustrates a non-refillable device which essentially is of one piece, in that no assembly is required between different materials, such as soft plastic and hard plastic, as in FIG. 2. While the second embodiment in FIG. 6 preferably is of hard plastic, the body may be made of soft plastic, even though there is no need to seal between elements which comprise the unitary plotter pen assembly.

As in FIG. 2, the second embodiment of FIG. 6 has a first axial distance A. As in the preferred embodiment, A is set at 0.394 inches or, 10 mm. A second axial distance, B, preferably is 2.358 inches or 59.89 mm. Both of the dimensions are referenced with respect to the leading edge of a nib element that is shown as a roller ball stylus, 92. This second embodiment plotter pen assembly will function with respect to the two alternate forms of adapters shown for the preferred embodiment, at FIGS. 3 and 4, in a fashion identical to the interconnections available from the preferred embodiment plotter pen assembly. Therefore, each of the adapter types illustrated in FIGS. 3 and 4 can be used with either the preferred embodiment liquid ink plotter pen assembly of FIG. 2,or with the roller ball plotter pen assembly, of FIG. 6.

In FIG. 6, the first dimension, A, will define a first seating with a first adapter type between a first shoulder annulus, 90, and a hard plastic mating surface on that adapter. The front of the one piece plotter pen assembly illustrated in FIG. 6 comprises a mounting cylindrical section, 86, a transition cylindrical section, 84 and a nib element, 92 so that a first seating shoulder annulus, 88 will he surrounded by a, chamfered surface between a transition cylindrical section and the mounting cylindrical section. The central body shaft portion, 82 is separated from the mounting cylindrical section, 86, by a transition section, which is illustrated in FIG. 6 to be inclined. The on-piece construction illustrated in FIG. 6, therefore, defines dimensional relationships at A, B, C, D and E that are equivalent to those for a two-piece construction, as in FIG. 2.

The second dimension, B, defines a second seating between the second seating annulus, 98, and a hard plastic mating surface of the second type of adapter. The fine thread, 94, the dimensions between the body central portion, 82 and the maximum diameter body section, 96, particularly are chosen to help define a rigid second mounting against the second shoulder, 98. The central body shaft diameter, C, preferably is 0.352 inches at maximum, or 8.94 mm. The upper body portion maximum outer diameter, E, preferably is 0.45 inches or 11.43 mm in the vicinity of the shoulder, 98. These two maximum diameters, and the 0.393 x 36 TPI thread define a larger annulus for the second seating shoulder, 98, than could be created by the geometry of the prior art shoulder, 18, as shown in FIG. 1.

A third plotter pen assembly embodiment of the invention is illustrated in FIGS. 7 through 9. The third embodiment comprises several pieces, and is illustrated to be refillable with liquid ink for a tubular stylus type of nib element.

FIG. 7 is a side elevation view of a third embodiment of a plotter pen assembly with three major pieces. A nib, or plotter point, assembly, 101 is mounted, at its rear end, within the front end of a compatible refillable plotter pen body, 102. A refillable ink cartridge, 120, has a front end that communicates ink to the plotter point assembly via a press-fit interconnection around a mount that is inside of the plotter pen body, 102.

FIG. 8 shows, in vertical section, that the plotter pen body, 102 is a tubular, hollow element, having an oblong view window, 128 at a mid-axial location. The plotter pen body forward end, 122, accepts the rear end, 124, of a plotter point assembly, 101, that is shown as a conventional screw mount type point. To facilitate a tight mounting, a hexagonal nut-like surface, 107, is provided so that a wrench can he applied.

The nib or plotter point assembly, 101, shown in FIG. 7 has a short mounting cylindrical section, 103, a transition cylindrical section, 104 and a nib element, 106. As in FIG. 2, a first seating shoulder annulus, 108, is defined and that shoulder is surrounded by a chamfered surface, 110 between a transition cylindrical section and a mounting cylindrical section. The plotter point assembly, 101, is shown to have first and second axial dimensions A, B, that are identical to those in the first and second embodiments. An exact axial mounting means is provided between a rear end of the plotter point assembly, 122, and an interior surface, 102, at the front of the refillable plotter pen body, 102. The hexagonal surface, 107, is provided upon the plotter point assembly between the adapter mounting cylindrical section, 103, and the pen body mounting mounting section, 124. As shown in FIGS. 7 and 8, the refillable plotter pen body, 102, has an oblong view window, 128, to facilitate gauging of the amount of ink within the reservoir. The view window is located rearwardly of an internal mount between the pen body and a reservoir. A remarkable, refillable ink cartridge, 120, defines that reservoir, and is further illustrated in FIG. 9.

As shown in FIG. 8, the plotter pen body, 102 has a forward end, 122, that defines an inner diameter of 7.5 mm (0.295 inches). The body central portion dimension, C', preferably is 8.8 mm (0.348 inches), or slightly less than the C dimension, shown in FIGS. 2 and 6. FIG. 8 further illustrates the internal cylindrical mounting element, 130, which preferably has a 5.5 mm (.218 inch) diameter, so as to be press-fit within the front end of the refillable ink cartridge, 120, illustrated in FIG. 9. Thus, the oblong view window, 128, permits ink to be gauged in the vicinity of the interconnection of the plotter pen body, 102, and the refillable ink cartridge, 120.

The plotter pen body, 102, has a maximum diameter portion, 116, with a maximum dimension E of 0.45 inches, or 11.9 mm, that is consistent with the dimension E shown in FIGS. 2 and 6. The fine thread, 114, is 0.393 x 36 TPI. The second mounting shoulder, 118, is defined by an annulus between the outer diameter of the fine thread 114 and the outer diameter of the maximum diameter section, 116, of the plotter pen body, 102, as in FIGS 2 and 6. The refillable ink cartridge, 120, has a similar maximum diameter, to facilitate insertion of the assembly into various types of adapters.

Hence, with respect to the preferred embodiment of Fig. 2, and the embodiments of FIGS. 6 and 7, the dimensions A, B and D are identical among all three embodiments. Dimensions C and E are clearance dimensions, and not considered as critical for functioning with adapters.

A refillable ink cartridge for use in the assembly of FIG. 7 further is illustrated in FIG. 9. While the refillable plotter pen body, 102, preferably is made of a hard plastic, the refillable ink cartridge 120, preferably is made of a soft plastic, such as natural nucleated polypropylene.

FIG. 9 is side elevation view, in vertical section, and illustrates a refillable ink cartridge, 120. The maximum diameter rear portion, 132 has a diameter of approximately 11.4 mm (0.45 inches), so as to be substantially coextensive with the maximum diameter portion, 116, of the plotter pen body, 102, into which it is inserted from the rear. The leading edge of the ink cartridge has an internal diameter of about 5.5 mm (0.216 inches), to define a tight and leak-proof press-fit over the cylindrical mounting element, 130, shown in FIG. 8. A button, 126, doses the upper end of the ink cartridge in a conventional fashion. As shown in Fig. 9, the cartridge rear portion, 132, preferably is knurled to facilitate turning and pushing the cartridge leading edge, 124, over the male member, 130 to create the assembly of FIG. 7. The refillable ink cartridge, 120, can be removed rearwardly out of the assembly of FIG. 7, without destroying a previous mounting of the assembly into an adapter of the first type, as shown in FIG. 4, or of the second type, as shown in FIG. 5.

Claims

1. A plotter pen assembly consisting of a nib assembly and an ink cartridge assembly, wherein the nib assembly comprises a mounting cylindrical section (2; 86; 103), a transition cylindrical section (4; 84; 104), a nib element (6; 92; 106) and a first seating shoulder annulus (8; 88; 108) between the mounting cylindrical section (2; 86; 103) and the transition cylindrical section (4; 84; 104), and wherein the ink cartridge assembly comprises an ink cartridge mounting shaft (22; 82; 102) and an ink cartridge section (26; 96; 106) with a maximum diameter (E), and a threaded section (24; 94; 114) located on the outer diameter of the cartridge mounting shaft (22; 82; 102) proximate to the cartridge maximum diameter (E), and wherein a first dimension (A) measured axially between a leading edge of said nib element (6; 92; 106) and said first seating shoulder annulus (8; 88; 108) is 10.00 mm, **characterized in that** a second dimension (B) measured axially between the leading edge of said nib element (6; 92; 106) and a second seating shoulder (28; 98; 118) defined between said threaded section (24; 94; 114) and said ink cartridge section (26; 96; 106) with a maximum diameter (E) is between 59.89 mm and 60 mm, wherein either of said shoulders is capable of a seating contact with a surrounding adapter (40; 60) for accurate axial positioning of said pen assembly within a plotter head.

2. A plotter pen assembly according to claim 1, **characterized in that** said nib body portion is comprised of hard plastic material.

3. A plotter pen assembly according to claim 2, **characterized in that** said ink cartridge assembly is comprised of soft plastic material.

4. A plotter pen assembly according to claim 3, **characterized in that** said ink cartridge mounting shaft (22) is press fit over a rear surface of said nib assembly.

5. A plotter pen assembly according to claim 2, **characterized in that** said ink cartridge assembly is comprised of a hard plastic material.

6. A plotter pen assembly according to one of claims 1 to 5, **characterized in that** the outer diameter of said ink cartridge mounting shaft (22; 82; 102) is between 8.94 mm and 9.00 mm and said cartridge maximum diameter (E) is between 11.43 mm and 11.5 mm.

7. A plotter pen assembly according to one of claims 1 to 6, **characterized in that** said ink cartridge section (26; 96; 106) with a maximum diameter (E) is knurled, that said threaded section (24; 94; 114) has a dimension of 0.393 x 36 TPI and that said threaded section (24; 94; 114) is immediately adjacent to said second seating shoulder (28; 98; 118).

8. A plotter pen assembly according to one of claims 1 to 7, **characterized in that** an adapter (40) of a first type is made of hard plastic and is adapted to come in axial engagement only against said first seating shoulder (8; 88; 108) and that an adapter (60) of a second type is made of hard plastic or metal and is adapted to come to an axial engagement only against said second seating shoulder (28; 98; 118), wherein each of said adapters (40; 60) has an internal thread (44; 64) that engages said threaded section (24; 94; 114) on the cartridge mounting shaft (22; 82; 102).

9. A plotter pen assembly according to claim 8, **characterized in that** said adapter (40) of the first type comprises an axial guideway (52) with in inner diameter slightly greater than the maximum outer diameter of said ink cartridge mounting shaft (22; 82; 102) and that said

adapter (60) of the second type comprises an axial guideway (72) with an inner diameter slightly greater than the maximum outer diameter of said ink cartridge mounting shaft (22; 82; 102).

Patentansprüche

1. Plotterstiftanordnung bestehend aus einer Spitzenanordnung und einer Tintenpatronenanordnung, wobei die Spitzenanordnung einen Befestigungszylinderabschnitt (2; 86; 103), einen Übergangszylinderabschnitt (4; 84; 104), ein Spitzenelement (6; 92; 106) und eine erste Sitzringschulter (8; 88; 108) zwischen dem Befestigungszylinderabschnitt (2; 86; 103) und dem Übergangszylinderabschnitt (4; 84; 104) aufweist, und wobei die Tintenpatronenanordnung einen Tintenpatronenbefestigungsschaft (22; 82; 102) und einen Tintenpatronenabschnitt (26; 96; 106) mit einem maximalen Durchmesser (E) sowie einen Gewindeabschnitt (24; 94; 114) auf dem äußeren Durchmesser des Patronenbefestigungsschaftes (22; 82; 102) nahe dem maximalen Patronendurchmesser (E) aufweist und wobei eine erste Abmessung (A) axial gemessen zwischen einer vorderen Kante des Spitzenelementes (6; 92; 106) und der ersten Sitzringschulter (8; 88; 108) 10,00 mm betragt, dadurch gekennzeichnet, daß eine zweite Abmessung (B) gemessen axial zwischen der Vorderkante des Spitzenelementes (6; 92) 106) und einer zweiten Sitzschulter (28; 98; 118), die zwischen dem Gewindeabschnitt (24; 94; 114) und dem Tintenpatronenabschnitt (26; 96; 106) mit einem maximalen Durchmesser (E) gebildet ist, zwischen 59,89 mm und 60 mm beträgt, wobei jede der Schultern in der Lage ist, in Sitzeingriff mit einem umgebenden Adapter (40; 60) zu kommen, um die Stiftanordnung genau axial innerhalb eines Plotterkopfes zu positionieren.

2. Plotterstiftanordnung nach Anspruch 1, dadurch gekennzeichnet, daß der Spitzenkörperbereich aus einem harten Kunststoffmaterial besteht.

3. Plotterstiftanordnung nach Anspruch 2, dadurch gekennzeichnet, daß die Tintenpatronenanordnung aus einem weichem Kunststoffmaterial besteht.

4. Plotterstiftanordnung nach Anspruch 3, dadurch gekennzeichnet, daß der Tintenpatronenbefestigungsschaft (22) im Pressitz auf einer hinteren Fläche der Spitzenanordnung sitzt.

5. Plotterstiftanordnung nach Anspruch 2, dadurch gekennzeichnet, daß die Tintenpatronenanordnung aus einem harten Kunststoffmaterial besteht.

6. Plotterstiftanordnung nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß der äußere Durchmesser des Tintenpatronenbefestigungsschaftes (22; 82; 102) zwischen 8,94 mm und 9,0 mm und der maximale Patronendurchmesser (E) zwischen 11,43 mm und 11,5 mm liegt.

7. Plotterstiftanordnung nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß der einen maximalen Durchmesser (E) aufweisende Tintenpatronenabschnitt (26; 96; 106) gerändelt ist, daß der Gewindeabschnitt (24; 94; 114) eine Abmessung von 0,393 x 36 TPI hat und daß sich der Gewindeabschnitt (24; 94; 114) unmittelbar benachbart zur zweiten Sitzschulter (28; 98; 108) befindet.

8. Plotterstiftanordnung nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß ein Adapter (40) eines ersten Typs aus harten Kunststoff hergestellt und geeignet ist, in axialen Eingriff mit nur der ersten Sitzschulter (8; 88; 108) zu kommen, und daß ein Adapter (60) eines zweiten Typs aus hartem Kunststoff oder Metall hergestellt und geeignet ist, in axialen Eingriff mit nur der zweiten Sitzschulter (28; 98; 108) zu kommen, wobei jeder der Adapter (40; 60) ein Innengewinde (44; 64) hat, das in Eingriff mit dem Gewindeabschnitt (24; 94; 114) auf dem Patronenbefestigungsschaft (22; 82; 102) kommt.

9. Plotterstiftanordnung nach Anspruch 8, dadurch gekennzeichnet, daß der Adapter (40) des ersten Typs eine axiale Führung (52) mit einem inneren Durchmesser geringfügig größer als der maximale äußere Durchmesser des Tintenpatronenbefestigungsschaftes (22; 82; 102) aufweist und daß der Adapter (6) des zweiten Typs eine axiale Führung (72) mit einem inneren Durchmesser geringfügig größer als der maximale äußere Durchmesser des Tintenpatronenbefestigungsschaftes (22; 82; 102) aufweist.

Revendications

1. Appareil à tracer constitué d'un ensemble de pointe et d'un ensemble de cartouche à encre, dans lequel l'ensemble de pointe comporte une zone cylindrique de montage (2 ; 86 ; 103), une zone cylindrique de transition (4 ; 84

; 104), un élément de pointe (6 ; 92 ; 106) et un premier épaulement annulaire d'appui (8 ; 88 ; 108) entre la zone cylindrique de montage (2 ; 86 ; 103) et la zone cylindrique de transition (4 ; 84 ; 104), et dans lequel l'ensemble de cartouche à encre comporte une tige de montage de cartouche à encre (22 ; 82 ; 102) et une zone de cartouche à encre (26 ; 96 ; 106) avec un diamètre maximum (E), et une zone filetée (24 ; 94 ; 114) située sur le diamètre extérieur de la tige de montage de cartouche (22 ; 82 ; 102) à proximité du diamètre maximum de cartouche (E), et dans lequel une première dimension (A) mesurée axialement entre le bout avant de l'élément de pointe (6 ; 92 ; 106) et le premier épaulement annulaire d'appui (8 ; 88 ; 108) est égal à 10,00 mm, caractérisé en ce qu'une seconde dimension (B) mesurée axialement entre le bout avant de l'élément de pointe (6 ; 92 ; 106) et un second épaulement d'appui (28 ; 98 ; 118) défini entre la zone filetée (24 ; 94 ; 114) et la zone de cartouche à encre (26 ; 96 106) à diamètre maximum (E), se situe entre 59,89 mm et 60 mm, et en ce que l'un des deux épaulements est apte à un contact d'appui avec un adaptateur périphérique (40 ; 60) pour un positionnement axial précis de l'appareil à tracer dans une tête de traçage.

2. Appareil à tracer selon la revendication 1, caractérisé en ce que la zone du corps de la pointe est constituée d'un matériau plastique dur.

3. Appareil à tracer selon la revendication 2, caractérisé en ce que l'ensemble de cartouche à encre est constitué d'un matériau plastique tendre.

4. Appareil à tracer selon la revendication 3, caractérisé en ce que la tige de montage pour cartouche à encre (22) est assemblée à la presse sur une surface arrière de l'ensemble de pointe.

5. Appareil à tracer selon la revendication 2, caractérisé en ce que l'ensemble cartouche à encre est constitué d'un matériau plastique dur.

6. Appareil à tracer selon l'une des revendications 1 à 5, caractérisé en ce que le diamètre extérieur de la tige de montage de cartouche à encre (22 ; 82 ; 102) se situe entre 8,94 mm et 9,00 mm et en ce que le diamètre maximum de cartouche (E) se situe entre 11,43 mm et 11,5 mm.

7. Appareil à tracer selon l'une des revendications 1 à 6, caractérisé en ce que la zone de cartouche à encre (26 ; 96 ; 106) avec un diamètre maximum (E) est moletée, en ce que la zone filetée (24 ; 94 ; 114) a une dimension de 0,396 x 36 TPI, et en ce que cette section filetée (24 ; 94 ; 114) est immédiatement voisine du second épaulement d'appui (28 ; 98 ; 118).

8. Appareil à tracer selon l'une des revendications 1 à 7, caractérisé en ce qu'un adaptateur (40) d'un premier type est constitué d'un plastique dur et conçu pour venir en contact axial uniquement contre le premier épaulement d'appui (8 ; 88 ; 108) et en ce qu'un adaptateur (60) d'un second type est constitué d'un plastique dur ou d'un métal et est conçu pour venir en appui axial uniquement contre le second épaulement d'appui (28 ; 98 ; 118), chacun des adaptateurs (40 ; 60) ayant un filetage interne (44 ; 64) qui se visse avec la zone filetée (24 ; 94 ; 114) sur la tige de montage de cartouche (22 ; 82 ; 102).

9. Appareil à tracer selon la revendication 8, caractérisé en ce que l'adaptateur (40) du premier type comporte un chemin de glissement axial (52) avec un diamètre intérieur légèrement plus grand que le diamètre extérieur maximum de la tige de montage de cartouche à encre (22 ; 82 ; 102), et en ce que l'adaptateur (60) du second type comporte un chemin de glissement axial (72) avec un diamètre intérieur légèrement plus grand que le diamètre extérieur maximum de la tige de montage de cartouche à encre (22 ; 82 ; 102).

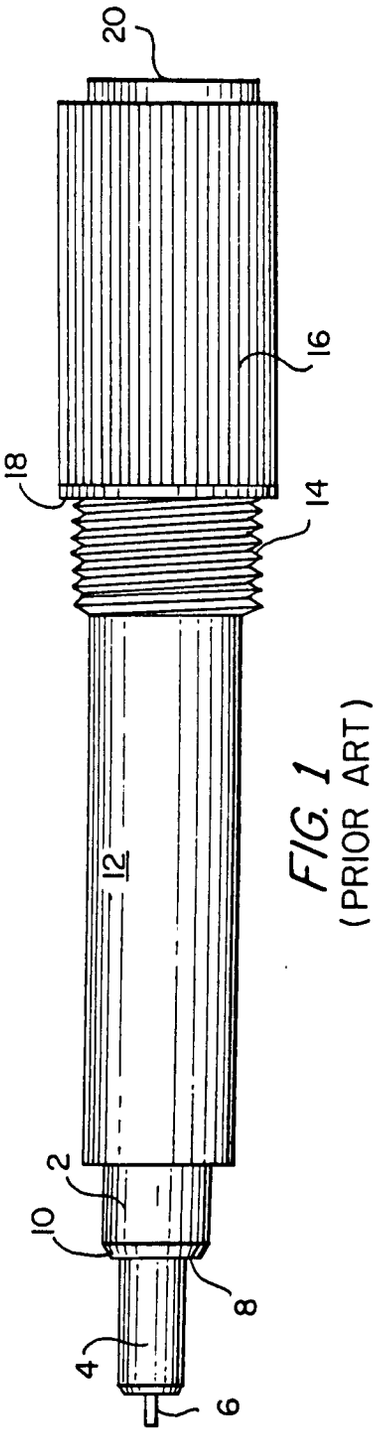


FIG. 1
(PRIOR ART)

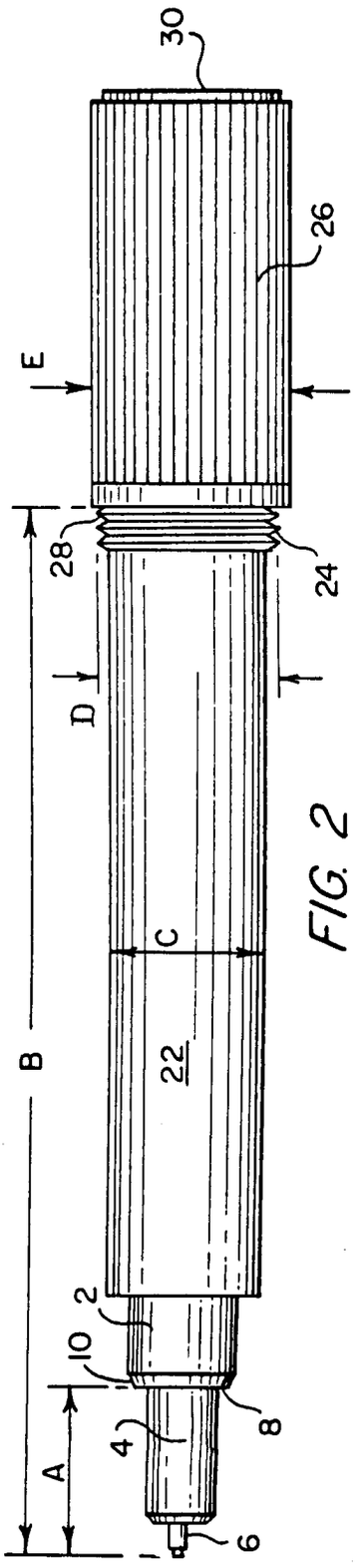


FIG. 2

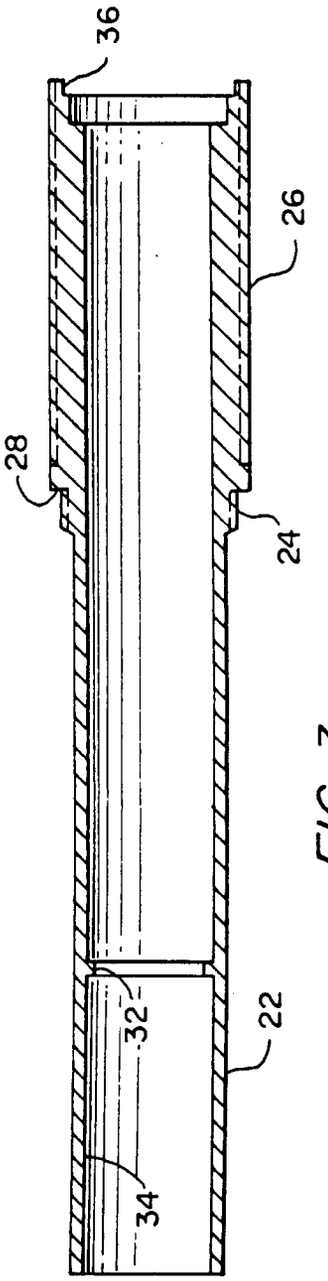
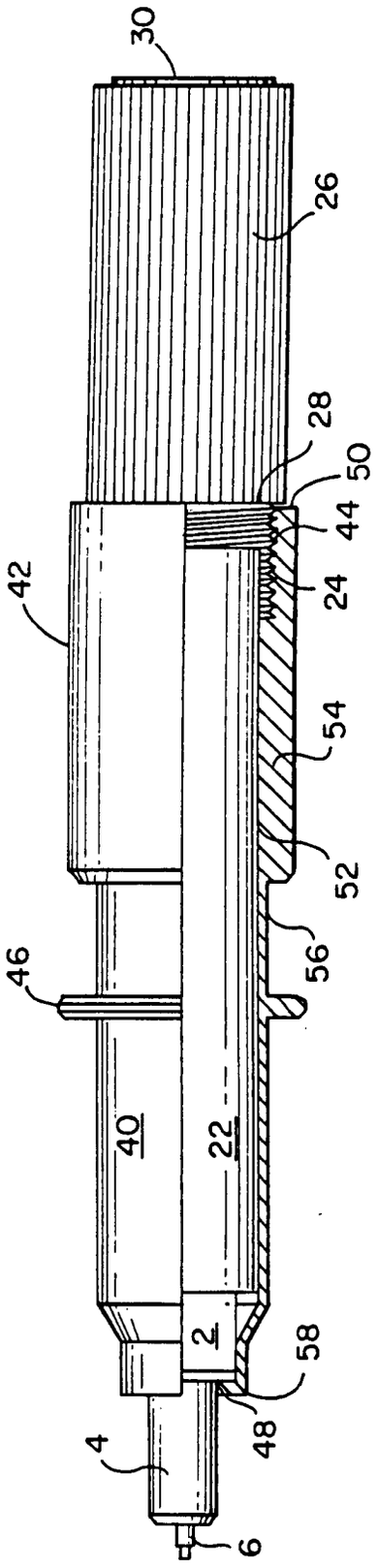


FIG. 3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24
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52
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40
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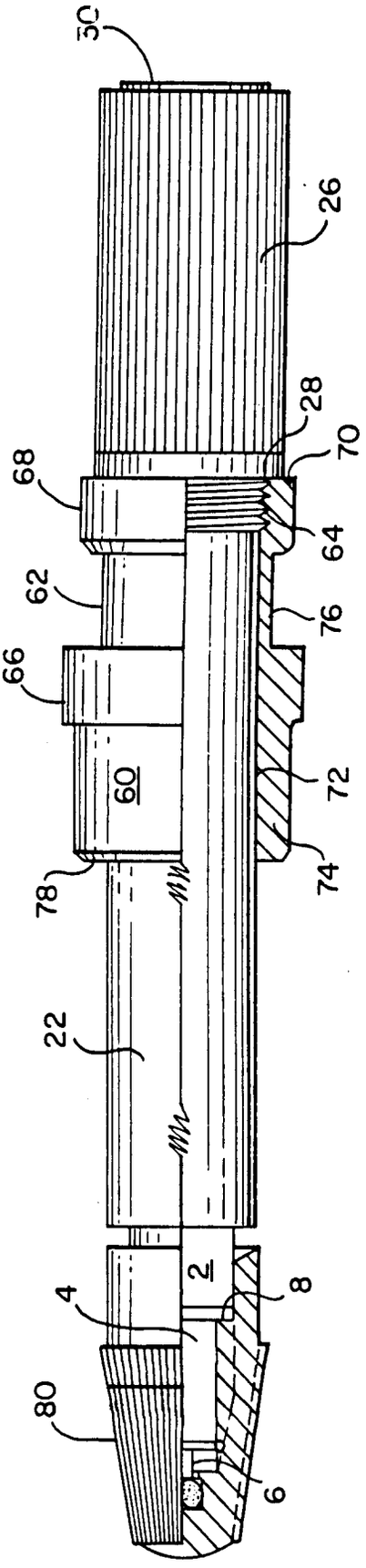
6

FIG. 4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60
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74
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22
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80
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FIG. 5

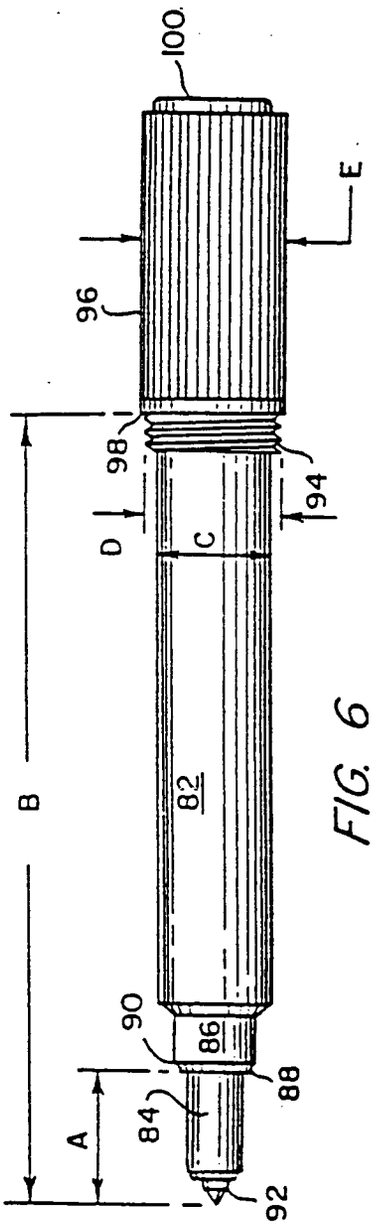

FIG. 6

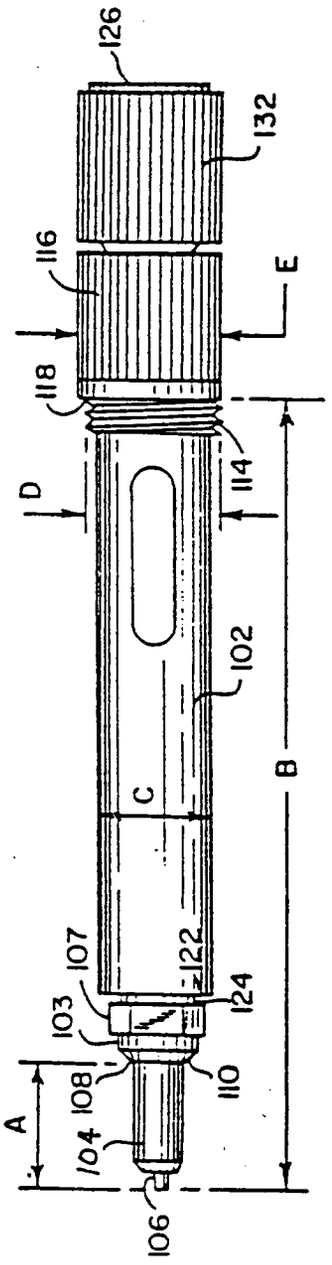

FIG. 7

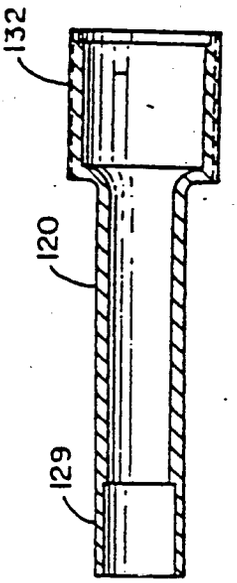

FIG. 9

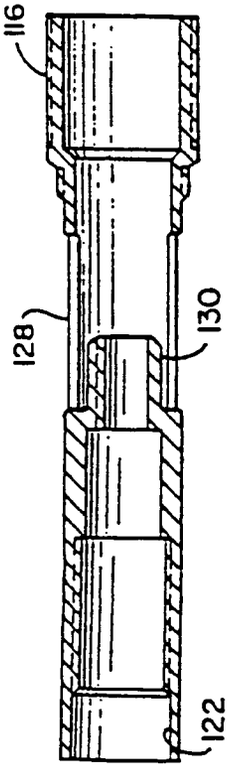

FIG. 8