United States Patent

Tullos et al.

[15] **3,644,933**

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[54] RESERVOIR-TYPE INKING PEN SYSTEM

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[51] **Int. Cl.** **G01d 15/16**

[58] **Field of Search** .....346/140; 401/198, 199; 248/318, 313, 204; 211/120; 24/257 RC, 81 CC

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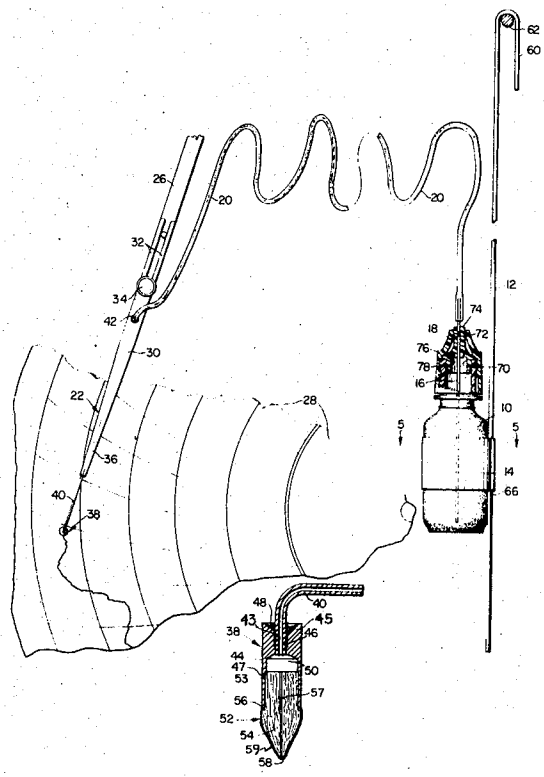
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[57] **ABSTRACT**

An inking pen system with an ink container reservoir being a small resilient plastic bottle held by an encircling metal slide clip which, with the container, entraps a wire rod or bar serving as a reservoir mounting unit. A capillary metal stinger passing down through the container top projects to near the container bottom. A clear plastic capillary tube connects to the stinger and leads to the pen assembly. The pen has a capillary metal tube secured to a small metal sleeve which holds a fiber pen tip and provides a secondary ink reservoir. The pen unit metal tube is secured to a thin spring leaf metal pen arm which can be fastened to an operating arm of, for example, a chart recorder. All metal parts are stainless steel.

21 Claims, 5 Drawing Figures



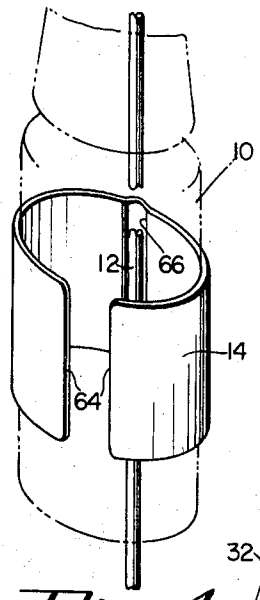


Fig. 4

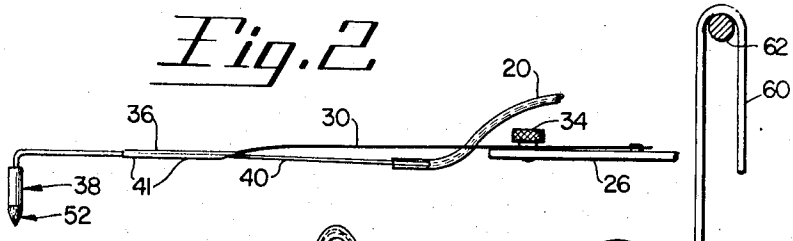


Fig. 2

Fig. 1

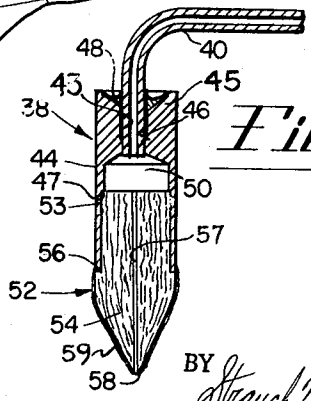


Fig. 3

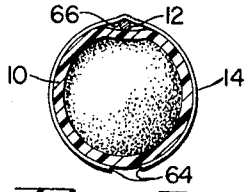


Fig. 5

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RESERVOIR-TYPE INKING PEN SYSTEM

BACKGROUND OF THE INVENTION

This invention relates to an inking system including an ink reservoir feeding a pen, the system being adaptable to many uses in drawing lines. It has particular utility as an inking device used with recording charts.

The prior art has proposed many systems for inking lines on recording charts but none have utilized the specific assembly of ink reservoir with stainless steel metal fittings including the unique container slide clip and capillary stinger tube which draws ink from the container, a small plastic capillary tube passing the ink to a special penhead, accurately made to hold a fiber penpoint and provide a small chamber communicating with the fiber point and serving as a secondary ink reservoir at the penhead. The prior art has not taught any system with the dependable flow action, inexpensive dependable height adjustment of the ink container and convenient removal and replacement of the penpoint.

Some prior art examples of ink feed systems can be seen in U.S. Pat. Nos. 2,176,777; 2,800,385; and 2,800,418.

SUMMARY OF THE INVENTION

Accordingly, a primary object of the present invention resides in the provision of a novel reservoir-type inking system in which ink container, capillary tubing and penhead are coordinated to provide dependable operation over extended time periods. In such a system, a further object resides in providing an inexpensive height adjustment device enabling simple, quick and easy changes in reservoir height relative to the penhead.

Another object resides in providing a pen with a stainless steel supply tube whose passage is of extremely small, capillary size securely sealed and bonded to a stainless steel sleeve serving as a penhead which carries a fiber penpoint and with the assembled penpoint providing a small chamber serving as a secondary reservoir.

Still another object resides in the provision of a pen as set forth in the preceding object secured on a stainless steel leaf spring penholder and connected to a very small diameter capillary plastic tubing which in turn in fed from an ink container reservoir.

Further novel features and other objects of this invention will become apparent from the following detailed description, discussion and the appended claims taken in conjunction with the drawings.

BRIEF DESCRIPTION

A preferred structure and embodiment is disclosed in the accompanying drawings in which:

FIG. 1 is a partial broken-away front elevation view of a recording instrument incorporating the ink container reservoir, its support, capillary supply tubing, a pen arm and penhead in accord with the present invention;

FIG. 2 is a side view of the pen assembly showing the leaf spring arm with the attached penhead;

FIG. 3 is a greatly enlarged cross section detail view illustrating the various components of the penhead;

FIG. 4 is an enlarged perspective view illustrating the plastic ink container in phantom lines as it would be secured to a support bar by the slide clip; and

FIG. 5 is a cross section taken on lines 5—5 of FIG. 1 illustrating details of the cooperative assembly of the plastic ink container, its slide clip, and vertical support rod.

This is a reservoir-type inking pen system which while capable of many uses, was developed initially for use with recording charts.

Basically, the system consists of an ink container **10** secured to a support rod **12** by a sliding metal clip **14**, the units working in conjunction to maintain the ink container **10** in a vertical disposition. An extremely small diameter capillary stinger tube **16**, made from stainless steel, is inserted through a stopper **18** in the top of container **10** projecting down to a

position just above the bottom of the container. A length of plastic capillary tubing **20**, suitable for the installation as desired, extends from the upper end of stinger **16** to a recording pen assembly **22**.

The plastic tubing **20** must be light and extremely flexible and requires a very small capillary passage. As a result of actual practice, it has been found that the length of the plastic tubing **20** between stinger **16** and the pen assembly **22** is not critical. Two and one-half feet has been found to be convenient, but the length can be shorter or longer and does not affect acceptable and dependable operation of the system. One type of commercially available satisfactory tubing is one which is made of "Tygon" plastic, the tubing being approximately 0.059 inch in outside diameter and having an inside diameter of approximately 0.028 inch although precise dimensions are not critical. The plastic tubing slips in a telescopic manner tightly over the end of stinger **16** and has its other end also slipped in a telescopic manner tightly over the penhead feed tubing which is also made of stainless steel of a similar size to stinger **16**.

Viewing both of FIGS. **1** and **2**, the illustrations show only a few portions of a circular chart recorder, e.g., the recorder pen operating arm **26** and a portion of a circular chart **28** which is normally rotated by a timed drive and enables a timed recording in conjunction with movement of the recorder arm **26**.

The pen assembly **22** includes as part of an effective pen arm, a thin stainless steel spring leaf arm **30**, the rear end of which is bifurcated at **32** to provide a means for securing the pen assembly **22** to the recorder operating arm **26**. As shown, the bifurcated end **32** can slip under a small thumbscrew **34** which can be tightened to hold the pen assembly on the operating arm. The end **36** of the spring leaf closest to the penhead is tapered and slightly bent to form a small inverted trough form.

The pen assembly includes pen head **38** and an ink supply tube **40**, the latter being an extremely small (0.0355 inch OD × 0.023 inch ID) stainless steel capillary tube, but here again precise dimensions are not critical. The tube **40** at the penhead end is bent at right angles. At its midpoint **41** the tube **40** is secured, e.g., by being silver soldered, to the underside of the tapered end **36** of the spring leaf arm **30**, terminating just short of a small aperture **42** through the spring leaf. The plastic capillary tubing **20** from the reservoir leads from the top side of the spring leaf pen arm **30** through aperture **42** and adjacent thereto is tightly telescoped over the end of the pen feed tube **40**.

Turning to FIG. **3**, the bent end **46** of the pen tube **40** extends approximately 0.10 inch into a coaxial through passage **43** in the upper end wall **45** of a stainless steel cartridgelike sleeve **44**, which has approximately 0.10 inch outer diameter and a lower thin wall portion. The upper end passage **43** is drilled and dimensioned so the tube end **46** fits tight at its lower end but has clearance from the upper portion of passage **43** to provide space for soldering. The bent end **46** of tube **40** terminates and opens into the interior of the penhead sleeve **44**, being coaxially secured to the upper end of sleeve **44** by cohesive bonding, for example, silver solder **48**. FIG. **3** illustrates that the open end of the bent portion **46** of ink feed tube **40** together with the lower surface of end wall **45** forms a small domed space **50** at the upper end of the remaining space within the thin lower wall of sleeve **44**. Inserted up into the lower end of sleeve **44** is a stiff porous fiber pen tip **52**. The upper half **53** of pen tip **52** is cylindrical, has a snug fit within the cylindrical sleeve **44**, and extends up to an internal sleeve shoulder **47** which limits insertion of the pen tip to a position spaced away from the lower surface of the end wall **45**. The upper surface of the porous tip thus serves as the lower wall of the small chamber **50**. Chamber **50** constitutes a portion of a secondary reservoir system which inherently incorporates the body portion of the porous tip. The lower part **54** of the porous fiber tip can be shouldered as at **56** to provide an alternative or supplementing structure limiting the insertion position of the tip within the sleeve **44**.

A hole 57 of minute diameter (0.009 inch) extends down through the porous tip to an opening at the writing point 58. The lower end of tip 52 is tapered to a desired shape of drawing point 58. In some applications it is desirable that the tapered lower exterior end of tip 52 be coated with a non-porous material 59 such as epoxy, which will also serve to hold the tip in the sleeve in case of a loose fit. Various suitable porous fiber materials can be used as the pen tip and the described installation enables the pen tip to be removed and replaced or washed to flush old ink from the porous fibers. Several suitable porous fiber materials which have been found acceptable for use as a pen tip in this system are bamboo and pressed nylon fibers.

Returning to FIG. 1, it will be seen that the reservoir container 10 is fastened on a vertical wire rod 12 which has its upper end bent in a reverse hook shape 60. The wire rod is made of stainless steel and forms a very simple reservoir support which can be hooked over many available structural parts of a recorder such as a member 62 or any nearby structure. A wire rod has been illustrated and is in fact being used and while it is one of the most convenient and most economical hanger or support means to use, it is to be understood that it could be a square or flat bar. Whichever is used, it can still be utilized in assembly with the sliding clip 14 and plastic container 10 to form a simple economical arrangement by which the ink container can be easily raised or lowered to different levels along the hanger rod 12.

FIG. 4 clearly shows the clip 14 as a split sleevelike piece of thin stainless steel shaped in circular form with a spaced-apart split 64 near the front portion of the slide clip. The circular form of the clip 14 is slightly smaller than the diameter of ink container 10 and has inherent springiness. The rear midportion of clip 14 includes a vertical V-shaped deformation 66 which serves to receive and locate the hanger rod 12 on the inside of clip 14. This arrangement is assembled by placing the clip over rod 12 so the V-shaped deformation 66 receives the rod, and then vertically forcing the small resilient plastic ink container 10 down into the clip 14. The clip 14 being of slightly smaller diameter than the container 10 springs slightly and presses the plastic container against the front surface portion of rod 12 forcing the rod into the V-shaped groove 66. This coordinated assembly holds the container and the clip 14 by friction at a desired position on the rod 12 and it can very readily be slipped up or down along the rod to vary the height of the ink container relative to the height of the penhead 38.

Returning again to FIG. 1, it will be seen that the upper portion of container 10 is shown in section. Such plastic containers are commercially available and are similar to flexible plastic medicine bottles of the type used to dispense medicinal fluids, drop by drop. To this end, the top of the small container 10 includes the plastic stopper 18 with a small central passageway 72 extending up through a short nipple end 74. As an added safety precaution, the stopper can be secured by means of a screw threaded cap 76 which is spaced around the nipple portion and is apertured at the top to enable access to the stopper nipple 74. The aforedescribed stinger tube 16 is press fit down through the central passage 72 of stopper 18 resulting in a secure assembly. The stinger 16 extends down to approximately one-eighth of an inch from the bottom of container 10 to provide access to essentially the entire amount of ink. Stopper 18 is modified by adding a bleed passage 78 enabling pressure equalization of the ink fluid inside of container 10 as ink is removed through the capillary tubing.

The aforedescribed reservoir system and inking pen combination has been suitably and acceptably utilized with the bottle varied in height from approximately 2 feet below the penhead to positions above the pen head. While it is desirable that the reservoir container height be approximately the same level as the penhead, desirable flow conditions have existed with the container lying on a table 2 feet below the pen head. The flow rate and hence the depth of color applied by the pen can be very conveniently controlled and modified by slight changes in the height of container 10. As an example of the highly dependable nature of this system, pens and reservoirs have been operated continuously for 24 hours drawing one annular chart line per minute. That amounts to 1,440 lines within the 24-hour period, and was accomplished without the ink running or blotting on any of the lines drawn.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by Letters Patent is:

1. A reservoir inking pen system comprising: an ink container; a container support device including means enabling vertical sliding adjustment of said ink container; a capillary ink feed tube means extending from adjacent the bottom of said container and up through the top portion thereof; an ink pen assembly including an ink penhead having a metal capillary tube projecting from one end and connected in capillary fluid communication with the other end of said tube means; at least an intermediate portion of said tube means between said container and said pen assembly being lightweight and extremely flexible; said ink pen assembly having a deflectable arm and means securing said metal capillary tube to said deflectable arm; said ink penhead comprising a vertical compartment having a fiber penpoint inserted up into the bottom thereof and a secondary ink reservoir chamber having a larger cross-sectional area than a cross section drawn through said metal capillary tube, located between the top of said fiber portion and in communication with said metal capillary tube.

2. A system as defined in claim 1, wherein said ink container has an apertured stopper in its upper end, said tube means includes metal stinger tube inserted into said container through the aperture of said stopper, said stopper further includes a pressure-equalizing bleed passage into said container.

3. A system as defined in claim 1, wherein said support device includes a sliding sleeve clip and a vertical elongate support member; said clip embracing and frictionally holding said elongate support member and said container in contacting adjacent relationship enabling selective adjustment of said clip and container along said support member against the friction bias.

4. In the system as claimed in claim 3, said ink container constituting a small resilient plastic bottle; said sleeve clip constituting a sleevelike split metal clip embracing on its inner side said elongate support member and surrounding said plastic bottle and creating a bias force on said bottle pressing and slightly deforming said bottle in a frictionally bearing relationship against said elongate support member thereby frictionally biasing said elongate support member against the inner surface of said sleeve clip.

5. A system as defined in claim 4, wherein said elongate support member is a stainless steel wire rod having a reverse bend hook arrangement adjacent its top end and said encircling spring clip has vertical groove means provided on its inner side for partially receiving said elongate support member.

6. A system as defined in claim 1, wherein said ink pen assembly comprises pen arm means; said penhead is located at the end of said arm means and comprises a stainless steel thin-walled cylinder sleeve the upper end of which has inserted coaxially therein a portion of said pen arm means extending less than half of the distance of said sleeve length, cohesive bonding means seal and secure said arm end portion to said sleeve, a capillary passage means comprises at least a part of the terminal end of said end portion of said pen arm and is in capillary fluid communication with the interior of said penhead and enables attachment of a flexible capillary tubing, said fiber penpoint having a substantially cylindrical upper end spigoted into the lower open end of said sleeve and terminating in spaced relationship to the secured end of said pen arm, the lower end of said fiber penpoint being contoured to an ink drawing point.

7. A system as defined in claim 6, wherein said pen arm comprises a stainless steel capillary tube having an end portion bent transverse to the main extent of said capillary tube and forming the portion which is secured within the upper end of said stainless steel sleeve of said penhead, and a very thin stainless steel leaf spring having a terminal end adapted for attachment to an operator lever and the other end of said spring leaf having securing means securing rigidly a midportion of said stainless steel capillary tubing to said spring leaf.

8. For use as an inking pen system ink reservoir adjustable support device, a sliding sleevelike spring clip and a vertical elongate support member over which said clip is placed, said clip encircling and resiliently biasing an ink container within the clip and against said support member with a frictional force sufficient to hold the container and said clip at selected positions on said support member.

9. A reservoir support device as defined in claim 8, wherein said elongate support member is a stainless steel wire rod having a reverse bend hook arrangement adjacent its top end and said encircling spring clip has vertical groove means provided on its inner side for partially receiving said elongate support member.

10. A reservoir support device as defined in claim 8, including the ink container and said ink container is a resilient plastic bottle.

11. An inking pen comprising: pen arm means and a penhead secured at the end of said arm means, said pen head comprising a thin-walled metal sleeve, the upper end of which has inserted centrally therein a portion of said pen arm means, cohesive bonding means sealing and securing said arm end portion to said sleeve, a capillary passage means comprising at least the terminal end portion of said pen arm and having means in capillary fluid communication from the exterior to the interior of said penhead, and a porous fiber pen tip having a shaped upper end in conformity with the cross section of said sleeve and spigoted into the lower open end of said sleeve terminating in spaced relationship to the secured end of said pen arm to provide a chamber within said sleeve, the lower end of said porous fiber tip being contoured to an inking point.

12. A pen as defined in claim 11, wherein said sleeve is made from stainless steel said pen arm comprises a stainless steel capillary tube including the portion which is secured within the upper end of said sleeve, and a very thin stainless steel leaf spring having a terminal end adapted for attachment to an operator lever and means on its other end securing a midportion of said stainless steel capillary tube rigidly thereto.

13. A pen as defined in claim 11, wherein shoulder means between said sleeve and said porous tip define the limit of insertion of said tip into said sleeve.

14. A pen as defined in claim 11, wherein the porous tip, excepting for a minute portion of its lower end point, has a nonporous cover material.

15. A pen as defined in claim 11, wherein said porous tip has a hole therein from its point to its other end providing a through passage for ink and said hole is smaller in cross section dimension than the capillary passage cross section.

16. A pen as defined in claim 15, wherein the portion of said porous tip exterior of said sleeve is covered with a nonporous material and said tip passage opens through said nonporous material.

17. A recording inking pen in which the recording end of the penhead includes a small diameter sleeve portion, comprising a porous pen tip having a shaped upper end portion in conformity with the interior cross section of the sleeve portion of the penhead, constructed to have a snug friction fit when spigotted into the lower penhead sleeve portion, a pen tip lower portion adapted to protrude from the lower open end of the sleeve portion and contoured to an inking point, and means defining a hole extending from said inking point to the other end of the pen tip, said hole having a cross section size providing a minute capillary through passage for ink, said hole cross section size being greater than the diameter of the minute capillary passages inherent in the structure of said porous pen tip.

18. A porous pen tip as defined in claim 17 wherein said upper portion has a smaller cross section than that portion of the lower contoured portion immediately adjacent said upper portion thereby defining a stepped shoulder located intermediate the two portions of said tip, said stepped shoulder constituting an abutment portion adapted to cooperate with the bottom periphery of the penhead sleeve portion to limit the insertion position of said porous tip into said penhead sleeve portion.

19. A porous pen tip as defined in claim 17, wherein at least the lower portion of the porous tip which is adapted to extend from the sleeve, excepting for a minute portion of its lowermost contoured point, has a nonporous cover material.

20. A reservoir inking pen system comprising: an ink container; a container support device including means enabling vertical sliding adjustment of said ink container; a capillary ink feed tube means extending from adjacent the bottom of said container and up through the top portion thereof; an ink pen assembly including an ink penhead having a metal capillary tube projecting from one end and connected in capillary fluid communication with the other end of said tube means; at least an intermediate portion of said tube means between said container and said pen assembly being lightweight and extremely flexible; said ink pen assembly having a deflectible arm and means securing said metal capillary tube to said deflectible arm; said ink penhead comprising a vertical compartment having a fiber penpoint inserted up into the bottom thereof and the upper portion of said vertical compartment providing fluid communication from the top of said fiber portion to the passage in said metal capillary tube, said vertical compartment having a larger cross-sectional area than a cross section drawn through said metal capillary tube.

21. A system as defined in claim 20, wherein said support device includes a sliding clip and a vertical elongate support member; said clip embracing and frictionally maintained on both said elongate support member and said container, enabling selective adjustment of said clip and container along said support member against the friction bias.

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