Dec. 1, 1970 TAKASHI AOKI ET AL 3,544,229

MARKING PEN

Filed Dec. 2, 1968

FIG. 1

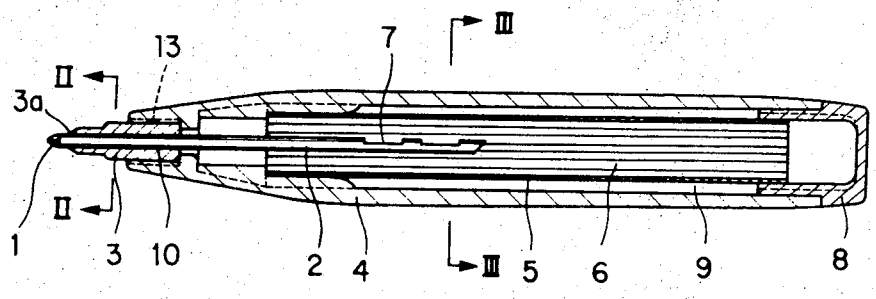


FIG. 2

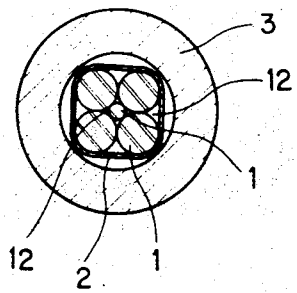


FIG. 3

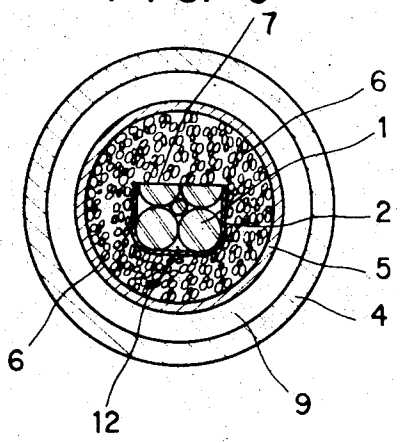


FIG. 4

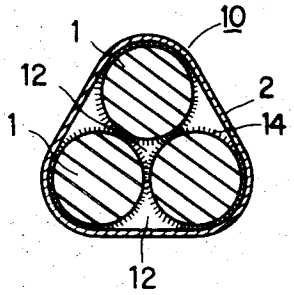
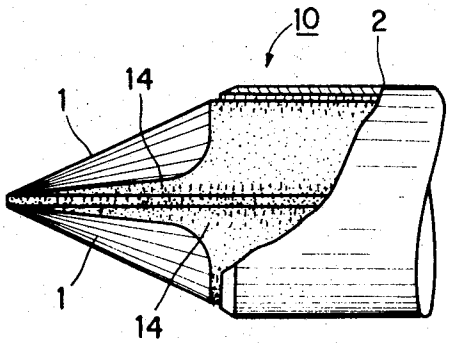


FIG. 5



United States Patent Office 3,544,229 Patented Dec. 1, 1970

3,544,229

MARKING PEN

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Filed Dec. 2, 1968, Ser. No. 780,378
Claims priority, application Japan, Dec. 19, 1967, 42/135,939
Int. Cl. B43k 8/00
U.S. Cl. 401—199 10 Claims

ABSTRACT OF THE DISCLOSURE

The present invention relates to a marking pen or the like characterized by the fact that it comprises a bundle of stick-like mono-filaments used for the conduction of ink and as a point.

SUMMARY OF THE INVENTION

The present invention relates to a marking pen or the like. Conventional marking pens use stiff felt as writing points and to conduct ink to such points, but they have the drawbacks that the felt used to conduct the ink has very small capillary passages and its tip is liable to wear and to be deformed when used over a long period of time. Furthermore, it is impossible to form a fine point on the felt, and therefore impossible to write fine lines with it.

The primary object of this invention is to provide a marking pen which includes an ink-conducting member formed by bundling a plurality of stick-like mono-filaments together by means of a synthetic resin film or tube which contracts when heated to form the ink-conducting member, and sharpening the tip of said ink-conducting member. The tip of the ink-conducting member extends outside of the pen holder, while its rear end is located in an ink-reservoir within said holder.

In the pen according to the present invention, the capillary passages in the ink-conducting member are larger than those in a conventional marking pen using a felt nib, and the writing point, which consists of stick-like mono-filaments, can be much finer than a conventional felt writing point, and is very wear-resistant.

Another object of this invention is to use very fine stick-like mono-filaments for ink conduction. In this invention, a synthetic resin film or tube which contracts when heated is employed to fasten stick-like mono-filaments into a bundle. A single mono-filament may be fine and weak, but a plurality of them can be bound together into a strong bundle.

Still another object of this invention is to provide a marking pen in which the gravity-induced flow of ink due to the enlarged capillary passages in the ink conducting member can be prevented. Prevention of this gravity-induced flow is accomplished by applying an agent to the surface of the stick-like mono-filament which retards the flow of ink.

A further object of this invention is to provide a marking pen in which the rear end of the ink-conducting member is inserted into the lower end of an ink-reservoir, which reservoir is loosely filled with a number of parallel threads.

Other features and further objects of this invention will be more clearly understood upon reading the following description of several embodiments of this invention, with reference to the accompanying drawing, in which:

FIG. 1 is an axial sectional view of a first embodiment of this invention;

FIG. 2 is an enlarged transverse section taken along the line II—II of FIG. 1;

FIG. 3 is an enlarged transverse section taken along the line III—III of FIG. 1;

FIG. 4 is a cross-section taken through the ink-conducting member in another embodiment; and

FIG. 5 is a side view of the tip of the ink-conducting member in the embodiment of FIG. 4 with the synthetic resin film or tube partly removed.

To explain the embodiment illustrated in FIGS. 1–3 the ink-conducting member **10** consists of five sticks **1** covered with a film or tube made of a synthetic resin **2** which contracts when heated. The sticks **1** consist of mono-filaments made of nylon, polyacetal, polycarbonate, etc. and the stick located at the center of the bundle of the sticks is about 0.16 mm. in diameter, while the others are 0.2–0.5 mm. in diameter. These mono-filaments may be deformed, instead of circular, in cross-section. A bundle of fibers bound together with a synthetic resin binding agent into a stick substantially corresponding in diameter may be employed instead of one or more of the mono-filaments.

The film or tube made of a material which contracts when heated can be made of polyvinylidene chloride, polyester, etc.

First, five sticks are bound together by means of a film or tube made of a synthetic resin which contracts when heated, and then heated. Owing to the characteristics of the above mentioned synthetic resin, said sticks are formed into a firm bundle. A binding agent is employed when a synthetic resin film is used.

The tip of the ink-conducting member **10** is sharpened and the middle portion **7** of said member **10** has its synthetic resin coat stripped off, exposing the sticks **1**. As compared with the conventional felt ink-conducting member, the ink-conducting member according to this invention has a very fine tip and the writing point of this tip will remain fine despite prolonged usage.

The ink-conducting member **10** has its writing point projecting out of the hole **3***a* in the part **3** at the open end of the holder **4**, and its rear end extends into the ink reservoir **5** within the holder **4**. There is an axial clearance or space **9** between the holder **4** and the ink reservoir **5** for ventilation. 20–100 pieces of 10–100 denier thread **6** are longitudinally arranged in the ink reservoir **5**. Each of the threads **6** in the ink reservoir is formed by loosely bundling or twisting together 1–15 denier fibers. The plug **8** at the rear end of the holder **4** closes the holder **4**. Reference numeral **12** (FIGS. 2, 3 and 4) indicates the capillary passages formed between the sticks **1**, **1** and their synthetic resin cover **2**, and **13** (FIG. 1) indicates an opening for the admission of air.

As mentioned in the preceding paragraph, the ink reservoir is filled with a loose mass of threads, each of which consists of a plurality of loosely-twisted fibers, whereby a plurality of capillary passages, including fine capillary passages between the fibers loosely bundled into threads and larger capillary passages between the threads themselves, are provided in the ink reservoir. The capillary passages between the threads are larger than the ones in the ink-conducting member.

When the ink reservoir is filled with ink, the ink will be retained by the threads in said reservoir. If the capillary passages in the ink-conducting member are larger than the capillary passages between the threads, the ink will flow back into the reservoir, without being retained in the capillary passages in the ink-conducting member, when the ink-conducting member is tilted.

When, according to this invention, the capillary passages between the threads **6** in the ink reservoir are larger than those in the ink-conducting member a back flow of ink will not occur. The total surface of the capillary passages is increased due to that they are formed between threads

consisting of loosely twisted fibers, which also increases the ink-retaining capacity of the ink reservoir, so that even if the marking pen is shaken, the ink will not escape from it due to the presence of a plurality of capillary passages including fine capillary passages between the fibers and larger capillary passages between the threads themselves in the ink reservoir.

A valuable feature of this invention is as follows: When you hold the marking pen in a tilted position for writing the threads filling the reservoir become saturated at its lower end and not at its upper end, but a smooth feeding of ink through the ink-conducting member to the writing point can nevertheless be ensured, because the uncovered portion **7** of the ink-conducting member is always in contact with the ink in the saturated lower end of the ink reservoir.

EXAMPLE OF EMBODIMENT I

Five nylon mono-filaments, the one located at the center thereof being 0.162 mm. in diameter and the others being 0.42 mm. in diameter, are bundled together. A polyester film which contracts when heated is wound about them from end to end. The resulting assembly is then heated to 95° C. to shrink the film. The assembly is then coated with a urethane resin to a total outer diameter of 1.1 mm. and the coating hardened.

The ink-conducting member produced in this manner is cut to a length of 65 mm. One end of it is sharpened to a cone, which is to serve as the writing point. The synthetic resin coating covering the nylon mono-filaments is stripped away over a 35 mm. length, beginning 25 mm. from the writing point, thus exposing the nylon mono-filaments.

Next, eighty 250 denier threads composed of 3 denier polyacrylonitrile fibers, each 5 cm. long, are bundled together and covered on the outside with a film of vinylidene chloride, thus forming an ink-reservoir 6 mm. in diameter and 70 mm. in length.

About 45 mm. of the rear end of said ink-conducting member is inserted into the ink reservoir, and the threads of said reservoir are impregnated with 1.8 cc. of ink.

When this pen is used continuously for writing at a rate of 3.5 meters/min., 75% of the ink contained will be consumed giving 700 meters of writing. The width of a stroke is 0.3 mm. at first, and 0.45 mm. at the end. Thus, this pen is found suitable for fine writing.

The embodiment shown in FIGS. 4 and 5 is a pen having improved capillary passages of better ink-holding power in the ink-conducting member **10**, due to the fact that an agent which retards the back flow of ink due to gravity-induction is applied to the surface of the sticks in the ink-conducting member. Each stick **1** is a mono-filament or a bundle of fibers cemented together with synthetic resin. This stick is coated with fiber powder or synthetic resin grains **14** by means carried in a binding agent, or is scratched to render it rough. A plurality of such sticks are coated, as in the preceding embodiment, with a synthetic resin film or tube which contracts when heated.

EXAMPLE OF EMBODIMENT II

A 400-denier bundle of nylon fibers is cemented together with urethane resin. An epoxy resin bonding material is applied to its surface and 5-denier polyester fiber segments 0.5 mm. long or powders are applied thereto. Three of the bundles of fibers are assembled together and coated with a film of vinylidene chloride which contracts when heated, and the assembly is shrunk at 95° C. Then urethane resin is spread on the surface to complete the ink-conducting member. The tip of this ink-conducting member is conically sharpened and its rear end is connected to an ink reservoir holding 1.5 cc. of ink. The resulting pen can be used for continuous writing at a rate of 3.5 meters/min. and 600 meters of writing can be done with a total consumption of 75% of the contained ink.

What is claimed is:

1. In a marking pen or the like comprising a holder, an ink reservoir and an ink-conducting member, the improved ink-conducting member which comprises a bundle comprising a plurality of sticks each comprising at least one textile filament, said bundle being encircled by a covering of synthetic resin heat shrunk thereon to bind said sticks together, said sticks having an average diameter of at least 0.16 mm., one end of said ink-conducting member being pointed and protruding out of said holder, and the other end of said ink-conducting member being located within said ink reservoir.

2. The ink-conducting member claimed in claim **1**, wherein said sticks are mono-filaments.

3. The ink-conducting member claimed in claim **1**, wherein said sticks are bundles of fibers cemented together with synthetic resin.

4. The ink-conducting member claimed in claim **1**, wherein said sticks have fiber powders secured to their surface.

5. The ink-conducting member claimed in claim **1**, wherein the surface of said sticks is roughened.

6. The ink-conducting member claimed in claim **1**, wherein said covering is a synthetic resin tube which contracts when heated.

7. The ink-conducting member claimed in claim **1**, wherein said covering is a synthetic resin film which contracts when heated.

8. A marking pen comprising a holder, an ink-conducting member as claimed in claim **1**, and an ink reservoir containing a plurality of threads each of which is formed by twisting the fibers forming said thread loosely together.

9. A marking pen as claimed in claim **1** in which said sticks have an average diameter of from 0.2 to 0.5 mm.

10. A marking pen as claimed in claim **9** in which said cover extends only part way around a portion of the end of said ink-conducting member within said reservoir.

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