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Courier Press, Leamington Spa, England.

## Description

The present invention is applicable to a variety of writing instruments such as a fountain pen, a fabric-tip pen, a ball-point pen or the like, but is especially most effective when incorporated in writing instruments such as a fabric-tip pen and a water-ink ball-point pen.

The applicant has already filed applications on various writing instruments in which a seal cap or a seal ball is movable into and out of a sealing position in response to a knocking or turning motion for sealing a writing tip or unsealing the same in readiness for writing (as disclosed by Japanese patent application Nos. 102238/1981 and 137779/1981, Japanese Utility model application Nos. 167109/1981, 167110/1981, 52578/1982 and 53014/1982. These prior writing instruments have an air vent hole defined in the vicinity of a tip end portion of a cartridge to seal the writing tip near the tip end portion. This structural limitation prevents such prior arrangements from being incorporated in writing members or ink cartridges generally available on the market or those with small modifications. Therefore, the prior inventions have required ink cartridges to be constructed as a whole with special design.

There is also known a writing instrument from DE—A—2 012 726 comprising a barrel, an inner tube within the barrel and having a sealable opening defined in a distal end thereof, the inner tube being coupled to the barrel, and a writing member disposed in the inner tube and having a writing tip on a distal end thereof. In the known writing instrument the said opening can be sealed by sealing means which when urging the writing member towards the writing position is moved out of the way of the writing member by contact with a shoulder provided on the writing member so that the writing tip does not contact the sealing means. However, said writing instrument cannot be used with a commercially available writing member or ink cartridge.

Therefore, it is an object of the present invention to provide a writing instrument which can be constructed by utilizing a commercially available writing member or ink cartridge with a small modification.

In DE—A—3224816 there is disclosed, with reference to Figs. 18 to 18c of that patent, a ball-point pen of the kind in which there is an ink cartridge having an elongated front end portion that is smaller in diameter than the ink containing part of the cartridge.

The cartridge is rigidly mountable with respect to an outer barrel of the pen.

Between the outer barrel of the pen and the cartridge is a first slidable tube shaped as a push-button at its top end and tapered at its otehr end to a distal orifice. This first slidable tube can be moved to a retracted setting in which the ball point of the cartridge projects through said distal orifice and to an extended setting in which said ball point is housed within said first slidable tube.

A second slidable tube, that is shorter in length than the small diameter part of the cartridge and of an internal diameter such that only said small diameter part can extend therethrough, surrounds said small diameter part.

There are two compression springs. The first spring is within said push-button part of the first slidable tube and serves to bias the first slidable tube to said retracted setting. The second spring surrounds said second slidable tube and serves to bias the second slidable tube away from said distal orifice of the first slidable tube, the second slidable tube having arms at its up-stream end that extend through elongated slits in the first slidable tube to be engaged, when the push button is pressed, by an engagement ring carried by the first slidable tube.

The arrangement is such that in a closed setting of the pen an otherwise loosely housed ball member is trapped between the down-stream end of said second slidable tube and said distal orifice in the conical end of the first slidable tube to seal-off the ball point end of the cartridge. On depressing said push button the first slidable tube moves axially so that its conical end moves away from the down stream end of the second slidable tube. With the pen held horizontally the ball member is now free to drop away from its sealing setting. On releasing pressure on said push-button, the first slidable tube retracts to a setting in which the ball point end of the cartridge projects from the distal end of the first slidable member. By holding the pen vertically and by then pressing and releasing the push button end of the first slidable tube the pen can be brought back to its initial state in which the ball point end of the cartridge is within the second slidable tube and the loosely housed ball member is again trapped between the down stream of the second slidable tube and said distal orifice in the first slidable tube.

In this prior art, every time the push button end of the first slidable tube is pressed the aforesaid slits therein are moved to a setting in which they project beyond the outer barrel of the pen and are thus exposed to dirt and dust.

It is a further object of the invention to avoid this disadvantage.

Several embodiments of the present invention are characterized by the features of the accompanying claims.

In the accompanying drawings:

Figs. 1, 4, 5 and 6 are cross sectional view of a writing instrument according to a first embodiment of the present invention, the views showing steps of operation;

Fig. 2 is a fragmentary exploded perspective view of the writing instrument of the first embodiment;

Fig. 3 is a perspective view of the assembled parts shown in Fig. 2;

Fig. 7 is a cross-sectional view of a second embodiment;

Fig. 8 is a cross-sectional view of a third embodiment;

Fig. 9 is a fragmentary perspective view of a fourth embodiment;

Fig. 10 is a fragmentary perspective view of a fifth embodiment;

Fig. 11 is a fragmentary cross-sectional view of the fifth embodiment;

Figs. 12 and 13 are fragmentary cross-sectional views of a sixth embodiment, showing steps of operation;

Figs. 14, 15, 16 and 17 are fragmentary cross-sectional views of a seventh embodiment, showing steps of operation;

Figs. 18, 19 and 20 are fragmentary cross-sectional views of eighth, ninth and tenth embodiments, respectively;

Figs. 21, 23 and 24 are fragmentary cross-sectional views of an eleventh embodiment, showing steps of operation;

Fig. 22 is a fragmentary perspective view of the eleventh embodiment;

Fig. 25 is a fragmentary cross-sectional view of a twelfth embodiment;

Figs. 26 and 27 are fragmentary perspective views of the twelfth embodiment;

Figs. 28, 29, 30, 31 and 7A are framentary cross-sectional views of thirteenth, fourteenth, fifteenth, sixteenth and seventeenth embodiments;

Fig. 7B is a cross-sectional view of an eighteenth embodiment of the present invention;

Figs. 32, 34, 35 and 36 are cross-sectional views of a nineteenth embodiment;

Fig. 33 is a perspective view of a seal body used in the nineteenth embodiment;

Figs. 37 and 38 show a twentieth embodiment;

Figs. 39 and 40 show a twenty-first embodiment;

Figs. 41 and 42 show a twenty-second embodiment;

Fig. 43 shows a twenty-third embodiment;

Fig. 44 is a fragmentary exploded perspective view of the writing instrument of the first embodiment;

Fig. 45 is a fragmentary perspective view of Fig. 44;

Fig. 46 is a perspective view similar to Fig. 44 but not exploded;

Fig. 47 is a cross-sectional view taken along line XLVIII-XLVIII of Fig. 46;

Fig. 48 is a fragmentary exploded perspective view of a 24th embodiment;

Fig. 49 is a fragmentary cross-sectional view of the 24th embodiment;

Figs. 50, 51, 52 and 53 are cross-sectional views showing a 25th embodiment of the invention;

Fig. 54 shows a 26th embodiment;

Fig. 55 shows a 27th embodiment.

The present invention will now be described with reference to the drawings.

Fig. 1 shows in cross section a writing instrument according to a first embodiment of the present invention. A cylindrical barrel or casing 1 has on a rear end thereof a pair of diametrically opposite legs 2, 2 extending radially inwardly toward an axial center of the barrel 1. The legs 2, 2 have inner ends formed integrally with an outer periphery of a cylinder 3 adjacent to a front end thereof. The cylinder 3 has a rear end including a radially inwardly extending edge which provide a step 4. The cylinder 3 also has a cam wall 5 in an inner peripheral surface thereof, the can wall 5 having axial groove and oblique locking edges at a front end thereof. The barrel 1, the legs 2, 2, and the cylinder 3 are integrally molded, but may be separately molded and then assembled together as by adhesive bonding.

A cylindrical pusher rod 6 is fitted in the cylinder 3 and has a front end of a larger diameter engageable with the step 4 of the cylinder 3 to prevent the pusher rod 6 from being pulled rearwardly out of the cylinder 3. The larger front end of the pusher rod 6 has ridges fitted respectively in the axial grooves in the cam wall 5. The pusher rod 6 has an oblique front surface. The substantial portion of the pusher rod 6 normally projects rearwardly through the rear opening in the cylinder 3. A rotary cam 7 is disposed in a front end portion of the pusher rod 6 and has on an outer periphery thereof ridges fitted respectively in the grooves in the cam wall 5. The rotary cam 7 has an oblique rear surface and a central hole. A rod 8 is positioned in front of the rotary cam 7 and has a rear end portion fitted in the central hole in the rotary cam 7. Thus, the rod 8 and the rotary cam 7 are coupled to each other. A bushing 9 is fitted in the cylinder 8 at a front end portion thereof. The rod 8, the rotary cam 7 and the pusher rod 6 are normally urged toward a rear position under the force of a spring S1 disposed between the bushing 9 and a rear flange of the rod 8.

A separate writing member 10 such as an ink cartridge is housed in the barrel 1. A connector 11 has a front larger-diameter cylindrical portion and a rear smaller-diameter cylindrical portion. The ink cartridge 10 has a rear end portion removably fitted in the front larger-diameter cylindrical portion of the connector 11, and the smaller diameter portion is fixedly fitted over a front end portion of the rod 8. Accordingly, the ink cartridge 10 is positioned in front of and coupled to the rod 8. The ink cartridge 10 has a front air vent hole 12 and a smaller-diameter front end portion 13 having a writing tip 14 on its front end. A packing 15 is attached to a front end surface of the bushing 9 and has an outer peripheral edge dimensioned to be resiliently pressed against an inner peripheral surface of an inner cylindrical tube 16.

The inner cylindrical tube 16 is housed in the barrel 1 and accommodates therein the ink cartridge 10. The inner tube 16 has a rear end detachably fitted over the front end portion of the cylinder 3, and a smaller-diameter front end portion 17 having a distal opening 18. As shown in Fig. 2, the smaller diameter front end portion 17 has a pair of lugs 19, 19 with small apertures 20, 20 formed respectively therein. A substantially disk-shaped sealing body 21 is pivotably attached to the front end portion 17 and has a size large enough to close the opening 18. More specifically, the sealing body 21 has a rounded front surface with a sealing member 22 attached to a rear

surface thereof. The sealing body 21 has a pair of lugs 23, 23 having respective small apertures 24, 24. For assembly, a spring 25 is placed between the lugs 19, 19, and the lugs 19, 19 are sandwiched between the lugs 23, 23, followed by insertion of a pin 26 through the small apertures 20, 20, 24, 24 and a hole in the spring 25. The sealing body 21 is now pivotably mounted on the distal end of the inner tube 16 as shown in Fig. 3. The sealing body 21 is normally urged by a small force of the spring 25 in a direction to open away from the opening 18. The sealing body 21 can be angularly moved in against the force of the spring 23 into abutment against the inner tube 16, thereby closing and sealing the opening 18 in the inner tube 16. A spring of a magnet may be employed to normally bias the sealing body 21 to close and seal the opening 18 in the inner tube 16 as described later.

A cylindrical slidable tube 27 is also housed in the barrel 1 and fitted over the inner tube 16. The slidable tube 27 has a pair of diametrically opposite slits 28, 28 defined in a rear end portion thereof. For assembly, the slidable tube 27 is inserted in a rearward direction between the barrel 1 and the inner tube 16 until the rear end portion of the slidable tube 27 projects rearward through the rear opening of the barrel 1 with the legs 2, 2 disposed respectively in the slits 28, 28. A push cap 29 is then fitted over the rear end portion of the slidable tube 27 with a spring S2 placed between the legs 2, 2 and a bottom of the push cap 29. In the embodiment shown in Fig. 1, a small space is provided between the rear end of the pusher rod 6 and an inner bottom surface of the push cap 29. The spring S2 normally urges the slidable tube 27 in a rearward direction away from the barrel 1. Thereafter, a conical front cap 30 is threaded over a front end of the slidable tube 27. The writing instrument is thus assembled as illustrated in Fig. 1. The conical front cap 30 is tapered with a distal opening 31 defined in a front end thereof and has a conical inner surface 32.

Fig. 1 shows the writing instrument as placed in a sealed condition. More specifically, the slidable tube 27 is retracted under the bias of the spring S2 to enable the conical inner surface 32 in the conical front cap 30 to push the sealing body 21 backward until it closes and seals the opening 18 in the inner tube 16. Where the sealing body 21 is normally biased by the spring or magnet to close the opening 18, the sealing body 21 may not necessarily be pushed backward by the conical inner surface 32. With the packing 15 providing a seal between the rear end portion of the inner tube 16 and the rear end of the ink cartridge 10, the writing tip 14 and the air vent hole 12 of the ink cartridge 10 are sealed from the exterior. At this time, the pusher rod 6 is displaced rearward and the rotary cam 7 is in the rear position on the cam wall 5.

To actuate the writing instrument from the sealed condition into an unsealed condition in readiness for writing, the push cap 29 is pushed to move the slidable tube 27 and hence the front conical cap 30 while compressing the spring S2 after the cap 29 is advanced by a short distance between the rear end of the pusher rod 6 and the bottom surface of the cap 29. As the front conical cap 30 moves forwardly, the sealing body 21 is angularly moved under the resiliency of the spring 25 to uncover the opening 18 in the inner tube 16. At the same time, depression of the push cap 29 causes the pusher rod 6, the rotary cam 7 and the rod 8 to move the ink cartridge 10 in a forward direction through the position shown in Fig. 4 to the position of Fig. 5, in which the small-diameter front end portion 13 of the ink cartridge 10 projects through the opening 18. At this time, the rotary cam 7 is positioned slightly ahead of the front edge of the cam wall 5 with the spring S1 kept under compression. When the push cap 29 is released in the position of Fig. 5, the slidable tube 27 is moved back under the force of the spring S2. At this time, the rotary cam 7 is also moved back as it slightly turns into engagement with the front edge of the cam wall 5, thus preventing the ink cartridge 10 from being moved back. The tip end portion of the ink cartridge 10 now remains projecting through the opening 31 in the conical front piece 30 as illustrated in Fig. 6. The writing instrument is now in the writing portion.

For bringing the writing instrument from the writing position back to the sealed position, the push cap 29 is pushed again in the position of Fig. 6. The push cap 29 is moved forwardly to cause the pusher rod 6 to move the rotary cam 7 slightly forward. When the push cap 29 is released at such time as the rotary cam 7 is slightly shifted off the front edge of the cam wall 5 as shown in Fig. 5, the rotary cam 7 is slightly turned and then moved back along the cam wall 5 under the force of the spring S1. The ink cartridge 10 is also moved back until the rear end thereof abuts against the packing 15 attached to the front end of the bushing 9. At this time, the ink cartridge 10 is bodily stored in the inner tube 16. Simultaneously, the slidable tube 27 returns under the force of the spring S2 and so does the conical front cap 30 with its conical inner surface 32 pushing the sealing body 21 into engagement with the distal end of the inner tube 16, thereby closing and sealing the opening 18. The writing instrument is now in the sealed condition.

A writing instrument according to a second embodiment will be described with reference to Fig. 7. According to the second embodiment shown in Fig. 7 in which the same reference numerals are used to disignate the same components shown in Figs. 1 to 6, the slidable tube 27 and the ink cartridge 10 move forward at the same time in response to the push cap 28 being pushed. With the first embodiment, the rear end of the pusher rod 6 is slightly spaced from the bottom of the push cap 29 in the sealed condition. When the push cap 29 is pushed, the slidable tube 27 is first moved forwardly, and after the push cap 29 hits the rear end of the pusher rod 6, the ink cartridge 10 is moved forwardly. The writing instrument of the second embodiment can operate in sub-

stantially the same manner as that of the writing instrument of the first embodiment. According to the first embodiment, the ink cartridge 10 can be positioned relatively forward of the ink cartridge 10 of the second embodiment by the distance equal to the spacing between the rear end of pusher rod 6 and the bottom of the push cap 29.

Fig. 8 illustrates a writing instrument according to a third embodiment of the invention. The push cap 29 has a central through hole 33. The pusher rod 6, which is longer than the pusher rods according to the first and second embodiments, projects rearward through the hole 33 in the push cap 29 in the sealed condition. In the sealed condition, the tip end of the ink cartridge 10 is spaced from the sealing member 22 by a distance greater than the length of the pusher rod 6 which projects rearward beyond the bottom of the push cap 29. For bringing the writing instrument from the sealed position to the writing position, the pusher rod 6 is pushed to move the ink cartridge 10 at first. After the rear end of the pusher rod 6 lies flush with the rear end of the push cap 29, the pusher rod 6 and the push cap 29 are moved together to advance the ink cartridge 10 and the slidable tube 27 at the same time. The writing instrument of the third embodiment can thus operate in substantially the same manner as those of the writing instruments according to the first and second embodiments.

Fig. 9 illustrates a fourth embodiment of the present invention. A sealing body 21 is integrally molded with the distal end of the inner tube 16 through an integral hinge 34.

According to a fifth embodiment shown in Figs. 10 and 11, a sealing body 21 and a ring 35 are integrally molded of a resilient material through an integral hinge 34, and the ring 35 is fitted over the smaller-diameter portion of the inner tube 16 and attached in position by a retaining ring 36 fitted over the ring 35.

Figs. 12 and 13 show a writing instrument constructed according to a sixth embodiment of the present invention. With the sixth embodiment, a pair of sealing bodies 21 is hinged to the distal end of the inner tube 16 and can swing open away from each other.

According to a seventh embodiment illustrated in Figs. 14 through 17, a spherical sealing body 21 is employed instead of the disk-shaped sealing body 21. The slidable tube 27 is tapered at its distal end and has an opening 37 defined in the tapered end, the tapered end having an inner inclined surface 38. Therefore, no conical front piece 30 is mounted on the slidable tube 27. The sealing body 21 is slightly greater than the opening 37 in the slidable tube 27 and the opening 18 in the inner tube 16. In the sealed condition shown in Fig. 14, the sealing body 21 is clamped between the opening 37 in the slidable tube 27 and the opening 18 in the inner tube 16 to thereby close the opening 18 for sealing the writing tip 14. When it is desired to unseal the writing tip 10, the push cap is pushed while the writing instrument is held substantially horizontally or the tip end thereof is slightly raised. As the slidable tube 27 is advanced, the sealing body 21 drops out of engagement with the slidable tube 27 and the inner tube 16 and is brought off the opening 37 in the slidable tube 27 into the position of Fig. 16. The push cap is then released to keep the writing instrument in the writing position shown in Fig. 16. For sealing the writing tip 14 again, the knock cap is depressed while the writing tip 14 is being directed downwardly. The slidable tube 27 now advances to allow the sealing body 21 to close the opening 37 in the slidable tube 27 as shown in Fig. 17. Thereafter, the push cap is free to bring the writing instrument back into the sealed condition as illustrated in Fig. 14.

An eighth embodiment of the present invention will now be described with reference to Fig. 18. The writing instrument of the eighth embodiment is a small modification of that of the seventh embodiment. A conical front cap 30 threaded over the slidable tube 27 and has a disk-shaped flange 39 secured therein for accommodating a spherical sealing body 21 in the conical front cap 30. This arrangement makes it difficult for the sealing body 21 to drop off when the conical front cap 30 is removed for the replacement of the ink cartridge 10.

Fig. 19 illustrates a writing instrument according to a ninth embodiment of the invention. In the first embodiment, the rear end portion of the ink cartridge 10 is sealed in the vicinity of the rear end thereof. According to the ninth embodiment, a seal ring 40 is retained by an inner peripheral surface of the inner tube 16 to seal a portion of the ink cartridge 10 behind the air vent hole 12. The air vent hole 12 in the ink cartridge 10 may be located anywhere forward of the seal ring 40 in the sealed condition shown in Fig. 19. The seal ring 40 may be mounted on an outer peripheral surface of the ink cartridge 10.

Fig. 20 illustrates a tenth embodiment of the present invention. While in the ninth embodiment the elongated inner tube 16 is employed, an inner tube 16 according to the tenth embodiment is comparatively short. The inner tube 16 has a pair of legs 41, 41 on an outer peripheral surface adjacent to a rear end thereof, the legs 41, 41 projecting outwardly through the slits 28, 28 in the slidable tube 27. The legs 41, 41 have outer ends fitted respectively in front grooves defined in an inner surface of the barrel 1. A seal ring 40 is retained by an inner surface of the inner tube 16 in the vicinity of a rear end thereof. The seal ring 40 may be mounted on an outer periphery of the ink cartridge 10 in contact with an inner periphery of the short inner tube 16.

An eleventh embodiment of the invention will be described with reference to Figs. 21 through 24. As better shown in Fig. 22, a sealing body 21 according to the eleventh embodiment has a round portion 42 projecting rearward and including a recess 43 defined in a rear surface thereof. The sealing body 21 has an outer periphery which can be held in intimate contact with the front edge of the inner tube 16. As

illustrated in Figs. 23 and 24, as the ink cartridge 10 advances, it fits in the recess 43 and lifts the sealing body 21 while the inclined surface of the distal end portion of the ink cartridge 10 is in contact with shoulders of the recess 43. Where no spring is used to normally urge the sealing body 21 in an opening direction, or the seal body 21 is normally urged to close the opening 18 in the inner tube 16, the writing tip 14 is protected from direct contact with the sealing body 21 when the inclined surface of the distal end portion of the ink cartridge 10 pushes the sealing body 21 aside. Therefore, there is no tendency of the sealing body 21 to get smeared with ink from the writing tip 14 or the writing tip 14 to be damaged from contact with the sealing body 21.

Figs. 25 through 27 are illustrative of a twelfth embodiment of the present invention. A sealing body 21 according to the twelfth embodiment hsa a flat and straight recess 43 formed in a rear surface thereof, as better shown in Fig. 26. As illustrated in Fig. 27, the distal end of the inner tube 16 has a projection 44 sized to snugly fit in the recess 43. The operation and advantages of the writing instrument according to the twelfth embodiment can readily be understood from the description of eleventh embodiment and Fig. 25.

A thrirteenth embodiment of the invention will be described with reference to Fig. 28. In the first embodiment, the conical front cap 30 is held against the sealing body 21 which is in contact with the ink cartridge 10 in the writing condition. Thus, the slidable tube 27 is prevented from moving back by the ink cartridge 10 through the sealing body 21. With the thirteenth embodiment, the opening 31 of he conical front cap 30 has an inner edge held against a step 45 on the smaller-diameter portion 13 of the ink cartridge 10, so that the slidable tube 27 is prevented from moving back directly by the ink cartridge 10.

Fig. 29 shows a writing instrument according to a fourteenth embodiment of the present invention. In the second embodiment, the spring S2 for urging the slidable tube 27 rearward can be seen through the slits 28, 28 in the slidable tube 27. According to the fourteenth embodiment, however, the spring S2 is accommodated within the pusher rod 6 and cannot be seen from the exterior.

According to a fifteenth embodiment illustrated in Fig. 30, a pusher rod 6 and a push cap 29 are integrally molded. The cam wall 5 of the cylinder 3 extends to the rear end thereof so that the rotary cam 7 can be inserted into the cylinder 3 from the rear end thereof at the time of assembly.

A sixteenth embodiment of the invention will be described with reference to Fig. 31. A push cap 29 is elongated to the extent that it entirely conceals the slits 28, 28 in the slidable tube 27.

Fig. 7A shows a writing instrument according to a seventeenth embodiment of the present invention. The spring S1 for urging the ink cartridge 10 backward is disposed between a step of the inner tube 16 near its front end and a step of the ink cartridge 10 near its front end. The ink cartridge 10 has in its rear end a recess in which there is fitted an attachment 46 fitted over the front end of the rod 8. Thus, the ink cartridge 10 is removably attached by the attachment 46 to the front end of the rod 8.

Fig. 7B illustrated a writing instrument according to an eighteenth embodiment of the present invention. The slidable tube 27 has long slits 28, 28 extending from the front end thereof so that the slidable tube 27 is inserted into the barrel 1 from the rear end thereof at the time of assembly. A ring 47 is fitted in the front end of the slidable tube 27 to reinforce the latter. The ring 47 may be fitted in the conical front cap 30 to provide reinforcement against radially inward bending of the slidable tube 27.

Although various embodiments of the persent invention have been illustrated, the present invention is not limited to the foregoing embodiments only. For example, the invention is applicable to rotary type writing instruments. While the ink cartridge 10 can be locked in the advanced position or moved back to the retracted position by the cam mechanism disposed between the barrel 1 and the ink cartridge 10, the ink cartridge 10 may similarly be actuated by a screw-driven feed mechanism. In the first and other embodiments, the rear seal is provided by the packing 15. However, bushing 9 may be constructed of a resilient material to provide a desired seal rather than using the packing 15. In the first and other embodiments, furthermore, the seal member 22 is attached to the rear surface of the sealing body 21. However, the sealing body 21 itself may be made of a resilient material so that the seal member 22 may be dispensed with. Instead of employing the seal member 22, a seal ring or the like made of a resilient material may be attached to the distal end of the inner tube 16, or the inner tube 16 itself may be formed of a resilient material. Where the sealing body 21 is spherical in shape, it may be made of a resilient material. Where the distal end of the slidable tube 27 is rendered transparent, it allows visual inspection of movements of the internal mechanism.

With the writing instrument of the invention, as described above, the slidable tube 27 and the ink cartridge 10 should be moved forward to bring the writing instrument from the sealed condition into the writing condition. When the slidable tube 27 is moved forward, the sealing body 21 that has closed the opening 18 in the inner tube 16 is no longer pressed and the ink cartridge 10 is advanced until the writing tip 14 projected out of the opening 18 in the inner tube 16. When the slidable tube 27 is thereafter retracted, the writing tip 14 projects through the distal end of the slidable tube 27, whereupon the writing instrument is in the writing condition. When the ink cartridge 10 is unlocked from the advanced position, the ink cartridge 10 is moved back into the inner tube 16, and the inner surface of the front end of the slidable tube 27 as it returns presses the sealing body 21 into the opening 18 in the inner tube 16, thus closing and sealing the open-

ing 18. Since there is a seal means for providing a seal between the ink cartridge 10 and the inner tube 16 behind the opening 18, the writing tip 14 and the air vent hole 12 are both sealed at the same time. The writing instrument can be brought from the writing condition to the sealed condition or vice versa simply by advancing and retracting the slidable tube 27 and the ink cartridge 10. Therefore, the entire operation is quite simple. The seal in the sealed condition is provided between the position of the opening 18 in the inner tube 16 and the intermediate or rear position of the ink cartridge 10. This makes it possible to utilize commercially available ink cartridges 10 or small modifications thereof. When the ink cartridge 10 runs short of ink, it can simply be replaced with a new one.

The foregoing embodiments have various advantages but has some disadvantages. That is, as clearly shown in Fig. 1 there is always an annular concave step between the front end of the barrel 1 and the rear end of the conical member 30, which would adversely affect the aesthetic designs of the writing instrument and would degrade its writing feeling because the writer's fingers would contact with the annular concave step. The following embodiments remedy this disadvantage and more over provides a floating type writing instrument in which the writing tip may be slightly retracted in a writing state when an excessive writing pressure is applied thereto. The embodiments will now be described in detail.

Fig. 32 is a cross-sectional view of a writing instrument according to a nineteenth embodiment of the present invention. The writing instrument comprises a cylindrical barrel or casing 101 having a pair of axial slits 102, 102 formed in a rear end portion thereof in diametrically opposite relation. A slidable tube 103 is fitted in the barrel 101 for back-and-forth sliding movement therein. The slidable tube 103 also has a pair of axial slits 104, 104 formed in a rear end portion in diametrically opposite relation. A conical front cap 105 is threaded over a front end of the slidable tube 103. The conical front cap 105 is tapered at its front end with an opening 106 defined in a distal end thereof, and has an inner inclined surface 107.

An inner tube 108 is fitted in the conical front cap 105 and the slidable tube for back-and-forth sliding movement therein. The inner tube 108 has a smaller-diameter front end portion 109 including an intermediate step and an opening 110 defined in a distal end thereof. A separate sealing body 111 as shown in Fig. 33 is made of a resilient material such for example as rubber. The sealing body 111 includes a ring-shaped attachment 112 and an L-shaped tongue 113 extending therefrom, the L-shaped tongue 113 having a seal member 114 at a distal end thereof. The seal member 114 has a semispherical upper surface and a flat lower surface. For attachment, the attachment 112 is fitted onto the small-diameter portion 109 of the inner tube 108 and held against the step on the small-diameter portion 109. The attachment 112 may be bonded or simply left fitted over the small-diameter portion 109.

A writing member 115 such as an ink cartridge is fitted in the inner tube 108. The ink cartridge 115 has a front air vent hole 116 and includes a front smaller-diameter portion 117 having a writing tip 118 on a distal end thereof. Some writing instruments, however, do not require such an air vent hole 116. A separate connector 119 is composed of a front larger-diameter cylindrical portion and a rear smaller-diameter cylindrical portion. A rear end portion of the ink cartridge 115 is removably fitted in the front larger-diameter cylindrical portion. The rear smaller-diameter cylindrical portion is fitted over a front end portion of a rod 120. Thus, the rod 120 is connected to the rear end of the ink cartridge 115.

A cylinder 121 is fitted in a rear end of the inner tube 108, and has a rear end including a radially inward edge which provide a step 122. The cylinder 121 has an inner peripheral surface serving as a cam wall 123 having axial grooves and a front inclined locking edge. The cylinder 121 also has a pair of diametrically opposite legs 124, 124 projecting radially outwardly and fitted in the slits 104, 104 in the slidable tube 103 and the slits 102, 102 in the barrel 101.

A bushing 125 is fitted in the rear end of the inner tube 108 and the front end of the cylinder 121, with a seal ring 126 interposed between the bushing 125 and the cylinder 121. Another seal ring 127 is bonded to a front surface of the bushing 125.

A spring S1 is disposed between a step formed on an inner surface of the bushing 125 and a step formed on an outer peripheral surface of the rod 120 near its rear end, and normally biases the rod 120 and the ink cartridge 115 to move in the rearward direction. A rotary cam 128 has a central hole in which there is fitted a smaller-diameter rear end portion of the rod 120. The rotary cam 128 is fitted in the cam surface 123 of the cylinder 121. The rotary cam 128 has on its outer periphery ridges fitted respectively in grooves in the cam wall 123. The rotary cam 128 has a rear inclined surface.

A pusher rod 129 is disposed behind the rotary cam 128. The pusher rod 129 is tubular in shape with a rear end portion of the rotary cam 128 fitted in a front end portion of the pusher rod 129. The front end portion of the pusher rod 129 has a larger front end engageable with the step 122 of the cylinder 121 to prevent the pusher rod 129 from being pulled rearward out of the cylinder 121. The larger front end of the pusher rod 129 has ridges fitted respectively in the grooves in the cam wall 123. The pusher rod 129 has a front inclined surface. The substantial portion of the pusher rod 129 projects rearward out of a rear opening in the cylinder 121.

A bearing ring 130 is fitted over the rear end of the slidable tube 103. A spring S2 is interposed between the legs 124, 124 of the cylinder 121 and

the bearing ring 130, and a spring S3 is interposed between the rear end of the barrel 101 and the bearing ring 130. The bearing ring 130 has a central circular hole which is internally threaded. A cap 131 is fitted over the bearing ring 130 and the rear end portion of the barrel 101. For assembly, an attachment ring 133 of a clip 132 is held against a rear surface of the cap 131, and then an externally threaded central projection of a disk-shaped push member 134 is threaded into the internally threaded hole in the bearing ring 130 through central holes in the attachment ring 133 and the cap 131. The cap 131 and the clip 132 are now attached to the bearing ring 130.

Fig. 32 shows the writing instrument in a sealed condition. Since the slidable tube 103 and the conical front cap 105 are urged to move rearward under the force of the spring S2 acting between the legs 124, 124 and the bearing ring 130, the semispherical upper surface of the seal member 114 of the sealing body 111 with its attachment 112 mounted on the smaller-diameter portion 109 of the inner tube 108 is pressed by the inner inclined surface 107 of the conical front cap 105, thus preventing the conical front cap 105 and the slidable tube 103 from being retracted. The opening 110 in the inner tube 108 is completely sealed by the seal member 114. At this time, the barrel 101 is urged forward under the force from the spring S3 acting between the rear end of the barrel 101 and the bearing ring 130, so that the rear end of the barrel 101 is kept in intimate contact with the front end of the spring S3 which is much weaker than the force of the spring S2. The spring S3 may be dispensed with. In the rear portion of the writing instrument, the seal ring 127 bonded to the front surface of the bushing 125 provides a seal between the latter and the connector 119 attached to the rear end of the ink cartridge 115, and the seal ring 126 provides a seal between the bushing 125 and the cylinder 121. Accordingly, the ink cartridge 115 is completely sealed. In the sealed position, the pusher rod 129 is retracted back, and the rotary cam 128 is also retracted back in the cam wall 123.

To bring the writing instrument from the sealed condition into a writing condition, the barrel 101 is gripped and the push member 134 is pushed. When the push member 134 is pushed, the slidable tube 103 and the conical front cap 105 are slightly moved forward while compressing the springs S2, S3. After the front surface of the push member 134 hits the rear end of the pusher rod 129, the push member 134 causes the pusher rod 129, the rotary cam 128, the rod 120 and the connector 119 to advance the ink cartridge 115. The inner tube 108 is slightly advanced under the force of the spring S2 acting on the legs 124, 124, and then is prevented from moving forward after the legs 124, 124 have reached front edges of the slits 102, 102 in the barrel 101. As the conical front cap 105, the slidable tube 103 and the ink cartridge 115 move further forward, the front end of the inner surface of the conical front cap 105 is spaced from the front end of the inner tube 108. At this time, the sealing body 111 springs forward under its own resiliency to open the opening 110 in the smaller-diameter portion 109 of the inner tube 108 as shown in Fig. 34. As the push member 134 is continuously pushed, the smaller-diameter portion 117 of the ink cartridge 115 projects through the opening 110 in the inner tube 108 as illustrated in Fig. 35. During movement from the position of Fig. 32 to the position of Fig. 35 through the position of Fig. 34, the writing tip 118 of the ink cartridge 115 does not contact the seal member 114. In the position of Fig. 35, the rotary cam 128 is positioned slightly forward of the front edge of the cam wall 123 while keeping the spring S1 under compression. When the push member 134 is released of a push, the conical front cap 105 and the slidable tube 103 are retracted under the bias of the spring S2. The ink cartridge 115 is prevented from moving back when the rotary cam 128 is pushed back by the spring S1 and slightly turned to engage the front edge of the cam wall 123. Therefore, the distal end portion of the ink cartridge 115, including the writing tip 118, remains projecting out of the opening 106 of the conical front cap 105. The writing instrument is now in the writing position as shown in Fig. 36. At this time, the inner surface of the front end portion of the conical front cap 105 is kept in abutment against the front end of the inner tube 108, so that the conical front cap 105 and the slidable tube 103 are prevented from being retracted. There is no gap between the conical front cap 105 and the barrel 101 under the force of the spring S3 as in the condition shown in Fig. 32. The writing instrument is now in readiness for writing operation.

In the writing condition, writing pressure acting on the ink cartridge 115 is borne by the spring S2 through the rod 120, the rotary cam 128, the pusher rod 129, the cylinder 121. Since any excessive writing force imposed on the ink cartridge 115 is taken up by the spring S2, the writing tip 118 is prevented from being damaged due to such an excessive writing force.

To bring the writing instrument from the writing condition back into the sealed condition, the push member 134 is pushed in the position of Fig. 36. The push member 134 is advanced to hit the pusher rod 129 and move the rotary cam 128 slightly forward. When the rotary cam 128 is advanced slightly off the front edge of the cam wall 123 as shown in Fig. 35, the push member 134 is released. Then, the rotary cam 128 is slightly turned and thereafter retracted along the cam wall 123 under the force of the spring S1. The ink cartridge 115 is also retracted until the rear end of the connector 119 abuts against the seal ring 127 in front of the bushing 125. By this time, the ink cartridge 115 is stored in the inner tube 108. The conical front cap 105 and the slidable tube 103 are also retracted under the force of the spring S2. As the conical front cap 105 moves back, the seal member 114 of the sealing body 111 is progressively moved toward the opening 106 in the conical front cap 105 while the semicy-

lindrical upper surface of the seal member 114 is slid along the inner inclined surface 107 of the conical front cap 105, until the seal member 114 is eventually positioned behind the opening 106. Continued retraction of the conical front cap 105 causes the inner surface thereof to press the seal member 114 against the distal end of the inner tube 108, thus closing the opening 110 in the inner tube 108. The writing instrument is now brought back to the sealed condition as shown in Fig. 32.

The rear end of the conical front cap 105 and the front end of the barrel 101 are normally kept in close contact with each other with no gap left therebetween under the force of the spring S3. This is to prevent an unsightly appearance which would otherwise be occassioned by such a gap, and prevent the barrel 1 from wobbling back and forth.

Fig. 37 shows a twentieth embodiment of the invention. In this embodiment, a cylindrical attachment 112 is made of elastic material and is to be press-fitted in the smaller diameter portion of the inner tube 108, so that the attachment 112 may be held on the outer periphery of the inner tube 108 without adhesives.

A twenty-first embodiment of the invention will now be described with reference to Figs. 39 and 40. In this embodiment, a cylindrical member 135 made of elastic material is inserted into the smaller-diameter portion 109 of the inner tube 108 as shown in Fig. 39. The cylindrical member 135 has at its front end a radially outwardly extending flange 136 which is to be positioned at the front end of the smaller-diameter portion 109. With such an arrangement, it is possible to satisfactorily seal the interior of the inner tube 108 even if the seal member 114 of the sealing body 111 is not made of elastic material.

A twenty-second embodiment of the invention will now be described with reference to Figs. 41 and 42 in which the cylindrical member 135 is fitted to around the outer periphery of the inner tube 108 and has at its front end a radially inwardly extending flange 137 which is to be positioned at the front end of the smaller diameter portion 109. With such a construction, substantially the same effect as in the twenty-first embodiment may be obtained.

A twenty-third embodiment of the invention will now be described with reference to Fig. 43. In the nineteenth embodiment, there is a fear that it would be somewhat difficult to insert the legs 124, 124 of the cylinder 121 into the slits 102, 102 of the barrel 101. In the twenty-third embodiment, the slits 102, 102 are formed in a curvilinear shape as shown in Fig. 43, so that in assembling, an additional work in which the barrel 101 and the cylinder 121 are rotated relative to each other is carried out. With such a construction, the barrel 101 may be prevented from being pulled apart from the mechanism.

As shown in Fig. 44, which is a fragmentary exploded view of a part of the first embodiment the smaller-diameter front end portion 202 has a pair of lugs 204, 204 having small apertures 205, 205, respectively. A substantially disk-shaped sealing body 206 is sized to close the opening 203 in the front barrel 201. The sealing body 206 has a curved front surface with one groove 207 defined therein. The sealing body 206 also has a pair of lugs 208, 208 having respective small apertures 209, 209. As better illustrated in Fig. 45, in which the sealing body 206 is seen from the rear side, a seal ring 210 is attached to a rear peripheral edge of the sealing body 206. The seal ring 210 is dimensioned so as to equal in shape to a front edge of the smaller-diameter portion 202 of the front barrel 201. The sealing body 206 has on a rear surface thereof a substantially disk-shaped projection 211 with a central recess 212 formed therein.

A spring 213 in the form of a single wire has a front portion curved in the shape of a C and a rear coil portion. For assembly, the lugs 204, 204 on the smaller-diameter portion 202 are sandwiched between the lugs 208, 208 on the sealing body 206, and the sealing body 206 is held against the front end of the smaller-diameter portion 202. The C-shape front portion of the spring 213 is fitted into the groove 207 in the sealing body 206 while the coil portion of the spring 213 is positioned between the lugs 204, 204. Thereafter, a pin 214 is inserted through the small apertures 205, 205, 209, 209 in the lugs 204, 204, 208, 208 and the coil portion of the spring 213. The sealing body 206 is thus attached to the front barrel 201 as shown in Fig. 46. As shown in Fig. 47, the sealing body 206 is normally urged by the spring 213 toward the smaller-diameter portion 212 so that the seal ring 210 is held against the front edge of the smaller-diameter portion 202, enabling the sealing body 206 to close and seal the opening 203 in the smaller-diameter portion 202.

Another embodiment (24th) of the invention will be described with reference to Figs. 48 and 49. As shown in Fig. 48, a sealing body 206 has a flat rear surface having a straight recess 212. The front end of the front barrel 201 has a projection 238 sized to neatly fit in the recess 212. A spearate leaf spring 239 has a rear arcuate attachment 240. For assembly, as shown in Fig. 49, the leaf spring 239 is bonded to a front surface of the seasling body 206 and the attachment 240 is fitted over the smaller-diameter portion 202 of the front barrel 201. Thereafter, an attachment ring 241 is fitted over the attachment 240 to mount the sealing body 206 so that it closes the opening 203 in the smaller-diameter portion 202. As the sealing body 206 is attached in position, the projection 238 of the smaller-diameter portion 202 is neatly fitted in the recess 212 in the sealing body 206.

Fig. 50 is a cross-sectional view of a writing instrument according to another embodiment (25th) of the present invention. The writing instrument includes a front barrrel 301 having axial grooves defined in a cam wall 302 or an inner periphery of the front barrel 301 in the vicinity of a central portion thereof, the cam wall 302 having a front inclined locking edge.

A slidable tube 303 is fitted in the front barrel 301 and has three axial slits 304, 304, 304 extending from a rear end thereof and angularly spaced at equal intervals. The slidable tube 303 has a tapered front end having a through hole 305 in its distal end.

A seal tube 306 is fitted in a front portion of the slidable tube 303. The seal tube 306 has three legs 307, 307, 307 angularly spaced at equal intervals and extending radially outwardly from a rear end of the seal tube 306. The three legs, 307, 307, 307 project respectively through the slits 304, 304, 304 in the slidable tube 303 radially outwardly of the slidable tube 303. A seal ring 308 is retained in an inner periphery of the seal tube 306 near a rear end thereof. The seal tube 306 includes a smaller-diameter front end portion 309 having an opening 310 in a distal end thereof.

A sealing body 13 spring biased in its opening direction as described before is attached to the seal tube 306 in the vicinity of the distal end thereof.

A rotary cam 319 is fitted over the slidable tube 303 behind the legs 307, 307, 307 of the seal tube 306. The rotary cam 319 has axial ridges projecting on an outer periphery thereof and fitted respectively in the axial grooves in the cam wall 302. The rotary cam 319 has a rear inclined edge. A cam ring 320 is fixedly fitted over the slidable tube 303 rearward of the rotary cam 319. The cam ring 320 has ridges projecting on an outer periphery thereof and fitted respectively in the grooves in the cam wall 302. The cam ring 320 also has a front inclined edge. A spring S1 is disposed between the legs 307, 307, 307 of the seal tube 306 and a ring 321 threaded into a front end of the front barrel 301.

A writing member 322 such as an ink cartridge is stored in the seal tube 306 and the slidable tube 303. The ink cartridge 322 can be inserted from a rear end of the front barrel 301. As the ink cartridge 322 is inserted, the seal ring 308 fitted in the seal tube 306 is held in intimate contact with an outer periphery of the ink cartridge 322 to seal the space between the seal tube 306 and the ink cartridge 322. The ink cartridge 322 has a front air vent hole 323 and a smaller-diameter front end portion 324 with a writing tip 325 on its front end. A recess 326 is formed in a rear end of the ink cartridge 322.

A separate connector 327 has a front cylindrical projection 328 fitted in the recess 326 of the ink cartridge 322. The connector 327 has three angularly equidistant legs 329, 329, 329 projecting on an outer periphery thereof and extending radially outwardly through the slits 304, 304, 304 respectively, in the slidable tube 303.

For assembly, a reinforcement ring 330 is fitted in the rear end of the slidable tube 303 and then a spring S2 is disposed between the connector 327 and a bottom of a push member 331, while at the same time a front end portion of the push member 331 is threaded over a rear end portion of the slidable tube 303. Then, the legs 329, 329, 329 of the connector 327 are held against a rear end surface of the front barrel 301, and a rear barrel 332 is fitted over the push member 331 from behind. A front end portion of the rear barrel 332 is threaded over a rear end portion of the front barrel 301. The legs 329, 329, 329 of the connector 327 are now fixedly clamped between the rear end surface of the front barrel 301 and a step formed on an inner periphery of the rear barrel 332 near the front end thereof. Thus, the rear barrel 332 is coupled to the front barrel 301 at the rear end thereof. The writing instrument is thus assembled as shown in Fig. 50. At this time, the push member 331 is urged by the spring S2 to move backwardly and project rearward through a rear opening 333 in the rear barrel 332.

Fig. 50 shows the writing instrument in a sealed condition. The rotary cam 319 as in an advanced position with the spring S1 under compression and bears the legs 307, 307, 307 of the seal tube 306 to maintain the latter in an advanced position. At this time, the slidable tube 303 is urged backward under the force of the spring S2 to enable an inner surface of the slidable tube 303 at the front end thereof to push the sealing body 313 backwardly. The seal member 314 attached to the sealing body 313 closes and securely seals the opening 310 in the seal tube 306. The seal ring 308 provides a seal between the rear end of the seal tube 306 and the outer periphery of the ink cartridge 322. Accordingly, the air vent hole 323 and the ink cartridge 325 which are positioned forward of the seal ring 308 are sealed.

To bring the writing instrument from the sealed condition to a writing condition, the push member 331 is pushed, whereupon the slidable tube 303 is advanced while compressing the spring S2. As the slidable tube 303 is moved forwardly, the sealing body 313 is released and swings forward under the resiliency of the spring 317, thereby opening the opening 310 in the seal tube 306 as shown in Fig. 51. On advancing movement of the slidable tube 303, the cam ring 320 attached to the slidable tube 303 also advances to push the rotary cam 319. The rotary cam 319 pushes the legs 307, 307, 307 to move the seal tube 306 forward while compressing the spring S1 until the rotary cam 319 is positioned slightly ahead of the front edge of the cam wall 302 as shown in Fig. 52. At this time, the rotary cam 319 is slightly turned along the front inclined edge of the cam ring 320. When the push member 331 is released of a push, the slidable tube 303 is retracted under the bias of the spring S2, and the cam ring S2 is also pushed back along the cam wall 302. The rotary cam 319 is also retracted along the cam wall 302 together with the seal tube 306 by being pushed by the legs 307 under the force of the spring S1, until the tip end of the ink cartridge 322 projects through the hole 305 in the slidable tube 303 as shown in Fig. 53. The writing instrument is now ready for writing operation.

To bring the writing instrument from the writing condition back to the sealed condition, the push member 331 is pushed in the position shown in Fig. 53. When the push member 331 is

pushed, the rotary cam 319 is advanced, and when the rotary cam 319 is positioned slightly ahead of the front edge of the cam wall 302 as shown in Fig. 52, the push member 331 is released of a push. The rotary cam 319 is then slightly turned and then slightly pushed back by the legs 307 under the resilient force of the spring S1. The rotary cam 319 is then engaged by the front locking edge of the cam wall 302, thus preventing the seal tube 306 from being retracted. The slidable tube 303 is also retracted under the force of the spring S2 to thereby enable the front inner surface of the slidable tube 303 to push the sealing body 313 until the latter closes and seals the opening 310 in the seal tube 306. Therefore, the writing instrument is now in the sealed condition as shown in Fig. 50.

Another embodiment (26th) of the invention will now be described with reference to Fig. 54, in which a front barrel 301 and a rear barrel 332 are formed integrally with each other and further a connector 327 is formed integrally with the rear barrel 332 via its three legs. Three associated slits 304, 304, 304 are formed on the front side of a slidable tube 303. A push member 331 is formed integrally with the slidable tube 303. A ring 308 is fitted in a rear and opening of the rear barrel. After a reinforcement ring 330 is fitted in an interior of a tip member 335, the tip member with the reinforcement ring 330 is threadedly engaged with a front end portion of the slidable tube 303. The reinforcement ring 330 serves to reinforce the front portion of the slidable tube 303 having the three slits 304, 304, 304. The other constructions are the same as those shown in Fig. 50 to 53.

Another embodiment (27th) of the invention will now be described with reference to Fig. 55 in which the seal member 313 is composed of openable divided halves each having on the rear side a straight groove 337. Such a seal member 313 is applicable to the foregoing embodiments.

## Claims

1. A writing instrument comprising an outer barrel (1, 101, 301);

a writing member housed in said barrel, said writing member comprising an ink cartridge (10, 115, 325) terminating in a front end portion (13, 117, 324) that is smaller in diameter than the diameter of the ink containing part of the cartridge, said front end portion having a writing tip (14, 118, 325) on a distal end thereof;

a slidable tube (27, 103, 303) housed in the barrel for back- and -forth movement thereof relatively to the barrel and having an opening (31, 106, 305) at a distal end thereof for passage therethrough of said writing tip (14, 118, 325) when said slidable tube is retracted relatively to the barrel (1);

an inner cylindrical tube (16, 108, 306) housed in said barrel between the slidable tube (27, 108, 303) and the writing member, said inner cylindrical tube having at its distal end (17, 109, 309) an opening (18, 110, 310) through which said front end portion (13, 117, 324) of the cartridge can pass on appropriate relative axial movement of said inner cylindrical tube (16, 108, 306) and said writing member, the inner cylindrical tube (16, 108, 306) extending over at least a part of the length of the ink containing part of the cartridge, and

sealing means (21, 114, 206) for sealing the opening (18, 110, 310) at said distal end of the inner cylindrical tube (16, 108, 306) when the front end portion (13, 117, 324) of the writing member is wholly within said inner cylindrical tube.

2. A writing instrument as claimed in Claim 1 having a push cap (29) at its upper end and means associated with the push cap and the writing member and the slidable tube (27) such that when the push cap (29) is depressed the writing member moves forwardly with a time delay with respect to forward movement of the slidable tube (27) (Figs. 1 to 6).

3. A writing instrument as claimed in Claim 1 having a push cap (29) at its upper end and means associated with the push cap and the writing member and the slidable tube (27) such that when the push cap is depressed the writing member and the slidable tube commence to move forward simultaneously (Fig. 7).

4. A writing instrument as claimed in Claim 1 having a push cap (29) at its upper end and means associated with the push cap and the writing member and the slidable tube (27) such that when the push cap is depressed the slidable tube moves forwardly with a time delay with respect to forward movement of the writing member (Fig. 8).

5. A writing member as claimed in Claim 2, the arrangement being such that as a result of said time delay the spacing between the distal ends of the slidable tube (27) and the inner cylindrical tube (16) increases to an extent in which there is sufficient space between said distal ends for the sealing means (21, 114, 206) to move away from (Figs. 1 to 6 and Figs. 14 to 20) the opening (18) at the distal end of the inner cylindrical tube (16).

6. A writing instrument as claimed in any one of Claims 1 to 5 in which when the sealing means (21, 114, 206) seals the opening (18, 110, 310) at the distal end of the inner cylindrical tube (16, 108, 306) it also seals the opening (31, 106, 216) in the distal end of the slidable tube (27, 108, 303).

7. A writing instrument as claimed in any one of Claims 1 to 6 in which a mechanism is interposed between said barrel (1) and said writing member for locking said writing member in an advanced position and subsequently allowing said writing member to move back to a retracted position.

8. A writing instrument as claimed in any one of Claims 1 to 7 in which at the distal end (17, 109, 309) of the inner cylindrical tube (16, 108, 306) there is a sealing body (21, 114, 313) that is swingable about a single point for opening and closing the opening (18, 110, 310) at the distal end of the inner cylindrical tube (16, 108, 306).

9. A writing instrument as claimed in Claim 8 and in which the sealing body(21, 114, 313)

comprises, or is associated with, means (25, 34, 113) serving to bias the sealing body away from the opening (18, 110, 310) at the distal end of the inner cylindrical tube (16, 108, 306).

10. A writing instrument as claimed in any one of Claims 1 to 9 in which the inner cylindrical tube (16, 108) is of such a length that the writing member, in its retracted position, is wholly accommodated therein.

11. A writing instrument as claimed in Claim 10 when appended to any of Claims 2 to 9 in which the inner cylindrical tube (16, 108) is secured to the outer barrel (1, 101).

12. A writing instrument as claimed in Claim 1 and wherein:

the writing member (322, Figs. 58 to 61A) is secured against movement with respect to the outer barrel (301);

the inner cylindrical tube (306) is movable back-and-forth with respect to the barrel;

where the inner cylindrical tube (306) extends over said ink containing part of the cartridge it has legs (307) extending radially outwardly through slits (304) in the slidable tube (303);

there being means acting on said legs (307) and on said slidable tube (303) for first causing the distal end of the slidable tube (303) to move away from the distal end of the inner cylindrical tube (306) to provide room for a sealing member (313) closing the distal end of the inner cylindrical tube (306) to move to a non-sealing setting;

there being means for then causing the slidable tube (303) and the inner cylindrical tube (306) to jointly move to a retracted setting relative to the barrel (301) such that the writing tip (325) of the writing member (322) projects from the distal end of the slidable tube (303).

**Patentansprüche**

1. Schreibgerät, gekennzeichnet durch einen äußeren Mantel (1, 101, 301);

ein im Mantel untergebrachtes Schriebelement, das eine Tintenpatrone (10, 115, 325) umfaßt, die in einem vorderen Endabschnitt (13, 117, 324) endet, dessen Durchmesser kleiner als der Durchmesser des Tintenaufnahmeteils der Patrone ist, und dieser vordere Endabschnitt an seinem distalen Ende eine Schreibspitze (14, 118, 325) aufweist;

ein verschiebbares Rohr (27, 103, 303), das im Mantel relativ zu diesem hin- und herbeweglich ist und an seinem distalen Ende eine Öffnung (31, 106, 305) hat, die den Durchtritt der Scheibspitze (14, 118, 325) gestattet, wenn das verschiebbare Rohr relativ zum Mantel (1) zurückgezogen wird;

ein inneres zylindrisches Rohr (16, 108, 306), das im Mantel zwischen dem verschiebbaren Rohr (27, 108, 303) und dem Schreibelement angeordnet ist und das an seinem distalen Ende (17, 109, 309) eine Öffnung (18, 110, 310) hat, durch welche der vordere Endabschnitt (13, 117, 324) der Patrone bei einer entsprechenden axialen Relativbewegung von innerem zylindrischen Rohr (16, 108, 306) und Schreibelement hindurchtreten kann, wobei sich das innere zylindrische Rohr (16, 108, 306) über mindestens einen Teil der Länge des Tintenaufnahmeteils der Patrone erstreckt, und

eine Verschlußeinrichtung (21, 114, 206) zum Verschließen der Öffnung (18, 110, 310) am distalen Ende des inneren zylindrischen Rohrs (16, 108, 306), wennsich der vordere Endabschnitt (13, 117, 324) des Schreibelements vollständig innerhalb des inneren zylindrischen Rohrs befindet.

2. Schreibgerät nach Anspruch 1, gekennzeichnet durch eine Druckkappe (29) an seinem oberen Ende und eine Einrichtung, die der Druckkappe und dem Schreibelement und dem verschiebbaren Rohr (27) derart zugeordnet ist, daß beim Niederdrücken der Druckkappe (29) sich das Schreibelement mit einer Zeitverzögerung gegenüber der Vorwärtsbewegung des verschiebbaren Rohrs (27) nach vorne bewegt (Fig. 1 bis 6).

3. Schreibgerät nach Anspruch 1, dadurch gekennzeichnet, daß es an seinem oberen Ende eine Druckkappe (29) aufweist und eine Einrichtung, die der Druckkappe und dem Schreibelement und dem verschiebbaren Rohr (27) derart zugeordnet ist, daß beim Niederdrücken der Druckkappe das Schreibelement und das verschiebbare Rohr beginnen, sich gleichzeitig vorwärtszubewegen (Fig. 7).

4. Schreibgerät nach Anspruch 1, gekennzeichnet durch eine Druckkappe (29) an seinem oberen Ende und eine Einrichtung, die der Druckkappe und dem Schreibelement und dem verschiebbaren Rohr (27) derart zugeordnet ist, daß beim Niederdrücken der Druckkappe sich das verschiebbare Rohr mit einer Zeitverzögerung gegenüber der Vorwärtsbewegung des Schreibelements nach vorne bewegt (Fig. 8).

5. Schreibgerät nach Anspruch 2, gekennzeichnet durch eine Anordnung, bei der in Folge der Zeitverzögerung der Abstand zwischen den distalen Enden des verschiebbaren Rohrs (27) und dem inneren zylindrischen Rohr (16) sich in einem Ausmaß erhöht, bei welchem ausreichend Raum zwischen den distalen Enden ist, damit sich die Verschlußeinrichtung (21, 114, 202) von der Öffnung (18) am distalen Ende des inneren zylindrischen Rohrs (16) wegbewegen kann (Fig. 1 bis 6 und Fig. 14 bis 20).

6. Schreibgerät nach einem der Ansprüche 1 bis 5, dadurch gekennzeichnet, daß wenn die Verschlußeinrichtung (21, 114, 206) die Öffnung (18, 110, 310) am diestalen Ende des inneren zylindrischen Rohrs (16, 108, 306) abdichtet, sie ebenfalls die Öffnung (31, 106, 216) im distalen Ende des verschiebbaren Rohrs (27, 108, 303) abdichtet.

7. Schreibgerät nach einem der Ansprüche 1 bis 6, dadurch gekennzeichnet, daß eine Einrichtung zwischen dem Mantel (1) und dem Schreibelement zwischengeschaltet ist, um das Schreibelement in einer vorgeschobenen Position zu verriegeln und es anschließend dem Schreibelement zu gestatten, sich in eine zurückgezogene Position zurückzubewegen.

8. Schreibgerät nach einem der Ansprüche 1 bis 7, dadurch gekennzeichnet, daß am distalen Ende

(17, 109, 309) des inneren zylindrischen Rohrs (16, 108, 306) ein Verschlußelement (21, 114, 313) vorhanden ist, das um einen einzelnen Punkt verschwenkbar ist, um die Öffnung (18, 110, 310) am distalen Ende des inneren zylindrischen Rohrs (16, 108, 306) zu öffnen und zu schließen.

9. Schreibgerät nach Anspruch 8, dadurch gekennzeichnet, daß das Verschlußelement (21, 114, 313) eine Einrichtung (25, 34, 113) umfaßt, oder dieser zugeordnet ist, die dazu dient, das Verschlußelement weg von der Öffnung (18, 110, 310) am distalen Ende des inneren zylindrischen Rohrs (16, 108, 306) zu belasten.

10. Schreibgerät nach einem der Ansprüche 1 bis 9, dadurch gekennzeichnet, daß das innere zylindrische Rohr (16, 108) eine solche Länge hat, daß das Schreibelement in seiner zurückgezogenen Stellung völlig darin aufgenommen wird.

11. Schreibgerät nach Anspruch 10 unter Rückbeziebung auf irgendeinen der Ansprüche 2 bis 9, dadurch gekennzeichnet, daß das innere zylindrische Rohr (16, 108) am äußeren Mantel (1, 101) befestigt ist.

12. Schreibgerät nach Anspruch 1, dadurch gekennzeichnet, daß

das Schreibelement (322, Fig. 50 bis 53) gegen eine Bewegung relativ zum äußeren Mantel (301) gesichert ist;

das innere zylindrische Rohr (306) relativ zum Mantel hin und zurück beweglich ist;

wo das innere zylindrische Rohr (306) sich über den Tintenaufnahmeteil der Patrone erstreckt, es Füße (307) hat, die sich radial nach außen durch Schlitze (304) im verschiebbaren Rohr (303) erstrecken;

eine Einrichtung vorhanden ist, die auf die Füße (307) und auf das verschiebbare Rohr (303) einwirkt, um zuerst das distale Ende des verschiebbaren Rohrs (303) zu veranlassen, sich vom distalen Ende des inneren zylindrischen Rohrs (306) wegzubewegen, um einen Raum für ein Verschlußelement (313), das das distale Ende des inneren zylindrischen Rohrs (306) verschließt, zu schaffen, damit es sich in eine nicht-abdichtende Stellung bewegen kann;

eine Einrichtung vorhanden ist, die anschließend das verschiebbare Rohr (303) und das innere zylindrische Rohr (306) veranlaßt, sich gemeinsam in eine zurückgezogene Stellung relativ zum Mantel (301) zu bewegen, so daß die Schreibspitze (325) des Scheibelements (322) vom distalen Ends des verschiebbaren Rohrs (303) vorsteht.

**Revendications**

1. Instrument d'écriture comprenant un corps externe (1, 101, 301),

un organe d'écriture logé dans le corps, cet organe ayant une cartouche d'encre (10, 115, 325) aboutissant à une partie d'extrémité avant (13, 117, 324) dont le diamètre est inférieur à celui de la partie de la cartouche qui contient l'encre, la partie d'extrémité avant ayant une pointe d'écriture (14, 118, 325) à son extrémité externe,

un tube coulissant (27, 103, 303) logé dans le corps afin qu'il puisse se déplacer alternativement en translation par rapport au corps et ayant une ouverture (31, 106, 305) placée à son extrémité externe et permettant le passage de la pointe d'écriture (14, 118, 325) lorsque le tube coulissant recule par rapport au corps (1),

un tube cylindrique interne (16, 108, 306) logé dans le corps entre le tube coulissant (27, 108, 303) et l'organe d'écriture, le tube cylindrique interne ayant, à son extrémité externe (17, 109, 309), une ouverture (18, 110, 310) par laquelle peut passer la partie d'extrémité avant (13, 117, 324) de la cartouche lors d'un déplacement axial relatif convenable du tube cylindrique interne (16, 108, 306) et de l'organe d'écriture, le tube cylindrique interne (16, 108, 306) étant disposé sur une partie au moins de la longueur de la partie de cartouche contenant l'encre, et

un dispositif de fermeture (21, 114, 206) destiné à fermer l'ouverture (18, 110, 310) de l'extrémité externe du tube cylindrique interne (16, 108, 306) lorsque la partie d'extrémité avant (13, 117, 324) de l'organe d'écriture se trouve totalement dans le tube cylindrique interne.

2. Instrument d'écriture selon la revendication 1, ayant un capuchon (29) de poussée placé à son extrémité supérieure et un dispositif associé à ce capuchon, à l'organe d'écriture et au tube coulissant (27) afin que, lorsque le capuchon (29) est enfoncé, l'organe d'écriture se déplace vers l'avant avec un certain retard par rapport au mouvement d'avance du tube coulissant (27) (figures 1 à 6).

3. Instrument d'écriture selon la revendication 1, ayant un capuchon (29) de poussée à son extrémité supérieure et un dispositif associé au capuchon de poussée, à l'organe d'écriture et au tube coulissant (27) afin que, lorsque le capuchon est enfoncé, l'organe d'écriture et le tube coulissant commencent à se déplacer simultanément vers l'avant (figure 7).

4. Instrument d'écriture selon la revendication 1, ayant un capuchon (29) de poussée placé à son extrémité supérieure et un dispositif associé au capuchon, à l'organe d'écriture et au tube coulissant (27) afin que, lorsque le capuchon est enfoncé, le tube coulissant se déplace vers l'avant avec un certain retard par rapport au mouvement d'avance de l'organe d'écriture (figure 8).

5. Organe d'écriture selon la revendication 2, ayant une disposition telle que, du fait dudit retard, la distance comprise entre les extrémités externes du tube coulissant (27) et du tube cylindrique interne (16) augmente à un point tel qu'il existe un espace suffisant, entre les extrémité externes, pour que le dispositif de fermeture (21, 114, 206) puisse s'écarter (figures 1 à 6 et figures 14 à 20) de l'ouverture (18) de l'extrémité externe du tube cylindrique interne (16).

6. Instrument d'écriture selon l'une quelconque des revendications 1 à 5, dans lequel, lorsque le dispositif de fermeture (21, 114, 206) ferme l'ouverture (18, 110, 310) placée à l'extrémité externe du tube cylindrique interne (16, 108, 306), il ferme

aussi l'ouverture (31, 106, 216) formée à l'extrémité externe du tube coulissant (27, 108, 303).

7. Instrument d'écriture selon l'une quelconque des revendications 1 à 6, dans lequel un mécanisme est disposé entre le corps (1) et l'organe d'écriture afin qu'il bloque l'organe d'écriture en position avancée et permette ensuite à l'organe d'écriture de se déplacer vers l'arrière, vers une position reculée.

8. Instrument d'écriture selon l'une quelconque des revendications 1 à 7, dans lequel, à l'extrémité externe (17, 109, 309) du tube cylindrique interne (16, 108, 306), un élément de fermeture (21, 114, 313) est disposé afin qu'il puisse pivoter autour d'un point unique lorsqu'il ouvre et ferme l'ouverture (18, 110, 310) formée à l'extrémité externe du tube cylindrique interne (16, 108, 306).

9. Instrument d'écriture selon la revendication 8, dans lequel l'élément de fermeture (21, 114, 313) comporte un dispositif (25, 34, 113) destiné à rappeler l'élément de fermeture à distance de l'ouverture (18, 110, 310) formée à l'extrémité externe du tube cylindrique interne (16, 108, 306) ou est associé à un tel dispositif.

10. Instrument d'écriture selon l'une quelconque des revendications 1 à 9, dans lequel le tube cylindrique interne (16, 108) a une longueur telle que l'organe d'écriture, dans sa position reculée, est totalement logé à l'intérieur du tube.

11. Instrument d'écriture selon la revendication 10 lorsqu'elle dépend de l'une des revendications 2 à 9, dans lequel le tube cylindrique interne (16, 108) est fixé au corps externe (1, 101).

12. Instrument d'écriture selon la revendication 1, dans lequel:

l'organe d'écriture (322, figures 58 à 61A) est fixé afin qu'il ne puisse pas se déplacer par rapport au corps externe (301),

le tube cylindrique interne (306) peut se déplacer en translation par rapport au corps,

à l'emplacement où le tube cylindrique interne (306) est placé sur la partie de cartouche qui contient l'encre, ce tube a des branches (307) dépassant radialement vers l'extérieur par des fentes (304) formées dans le tube coulissant (303),

un dispositif agit sur les branches (307) et sur le tube coulissant (303) afin qu'il provoque un déplacement de l'extrémité externe du tube coulissant (303) à distance de l'extrémité externe du tube cylindrique interne (306) et laisse de la place pour un organe de fermeture (313) fermant l'extrémité externe du tube cylindrique interne (306) lorsqu'il se déplace vers une position non fermée, et

un dispositif est destiné à provoquer un déplacement conjoint du tube coulissant (303) et du tube cylindrique interne (306) vers une position reculée par rapport au corps (301) afin que la pointe d'écriture (325) de l'organe d'écriture (322) dépasse de l'extrémité externe du tube coulissant (303).

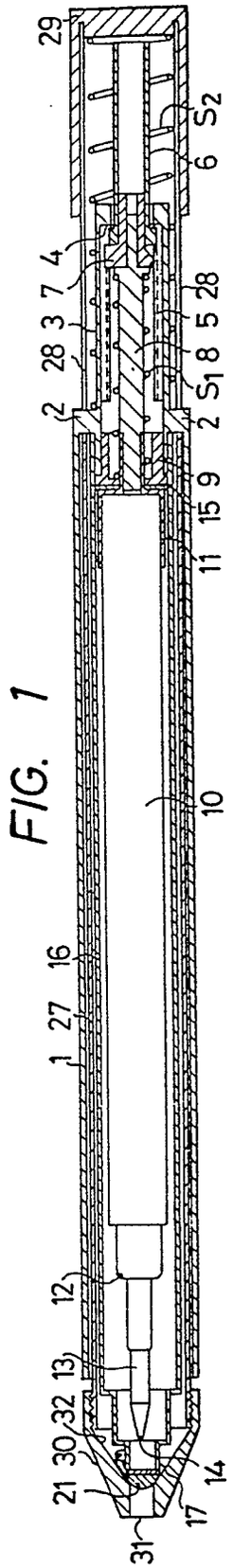



FIG. 1

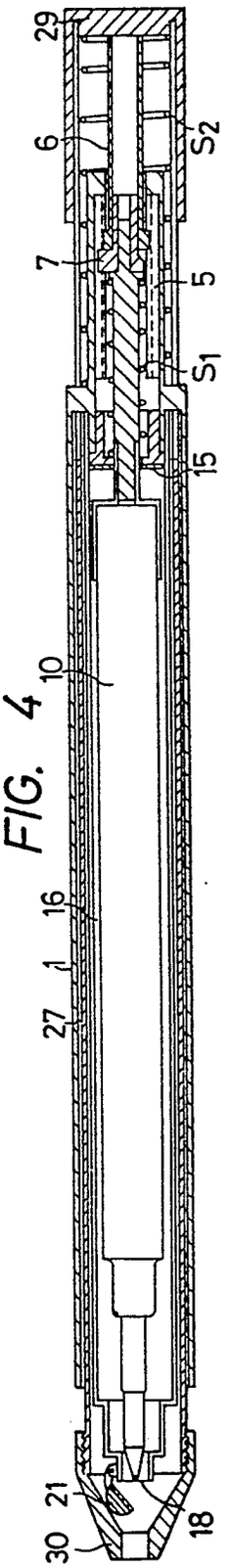



FIG. 4

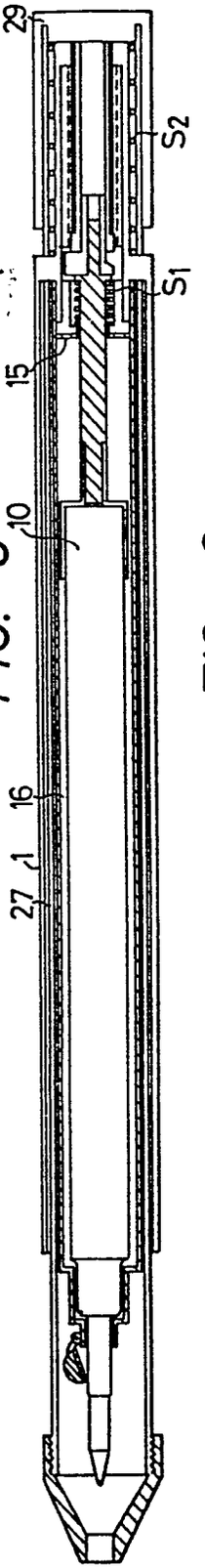



FIG. 5

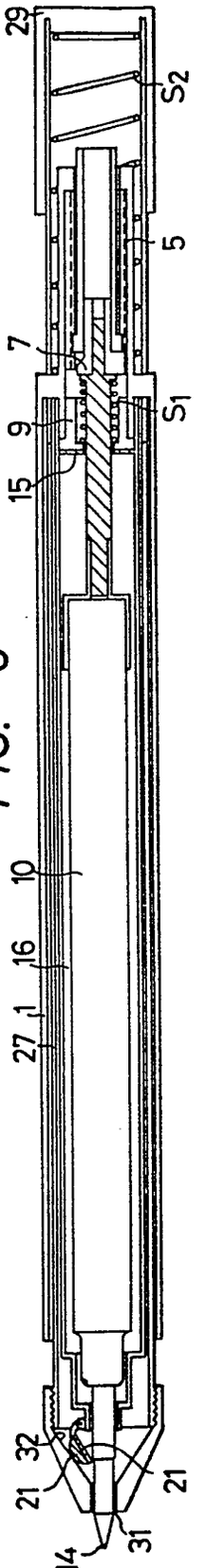



FIG. 6

FIG. 3

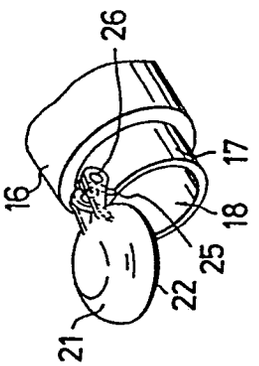



FIG. 2

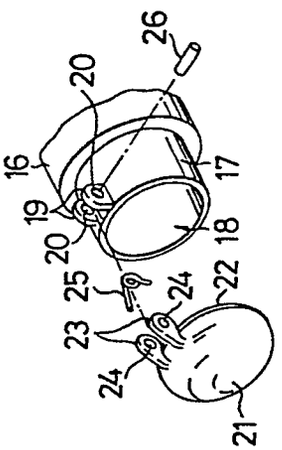



FIG. 8

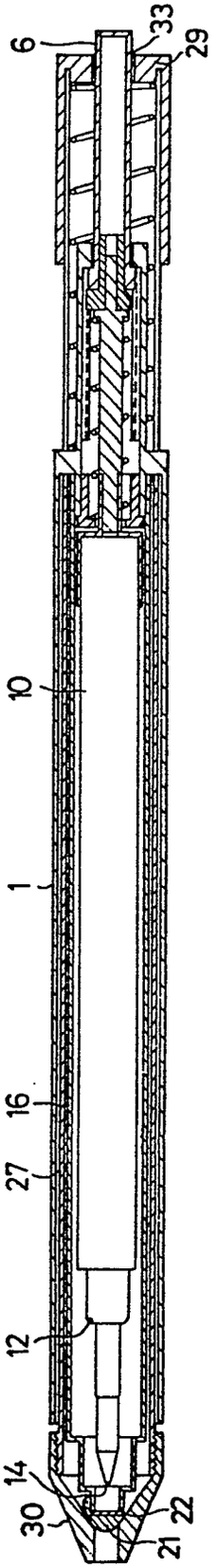



FIG. 11

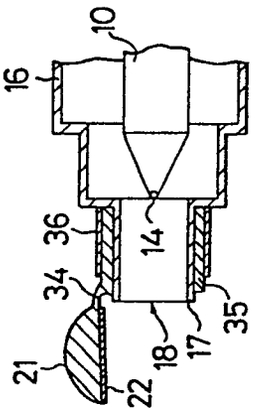



FIG. 10

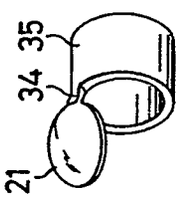
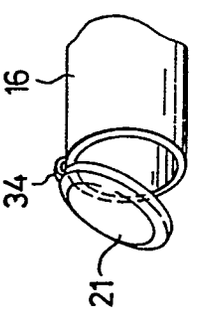



FIG. 9



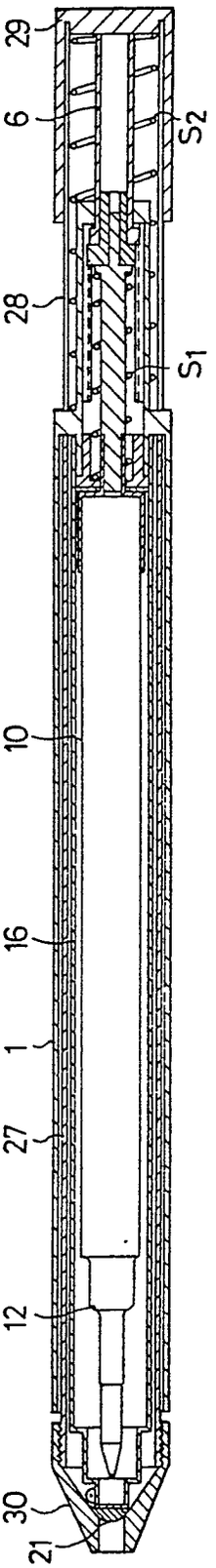



FIG. 7

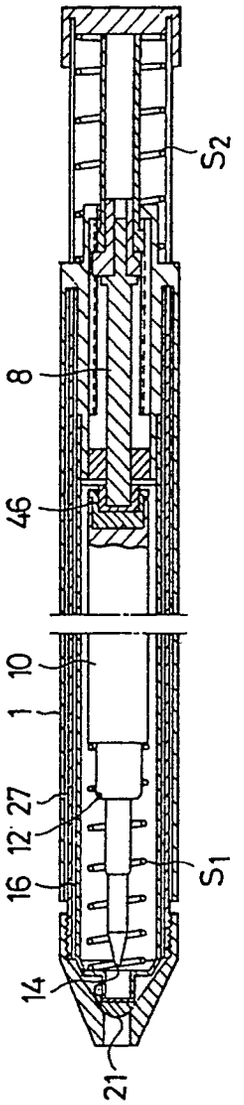



FIG. 7A

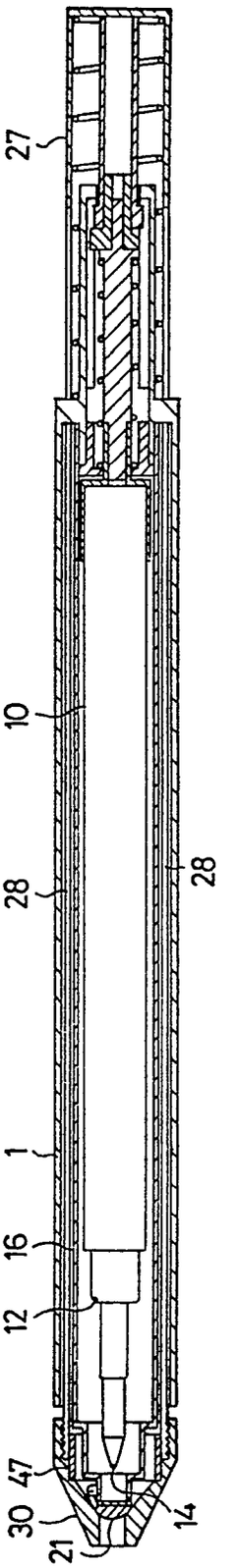



FIG. 7B

FIG. 12

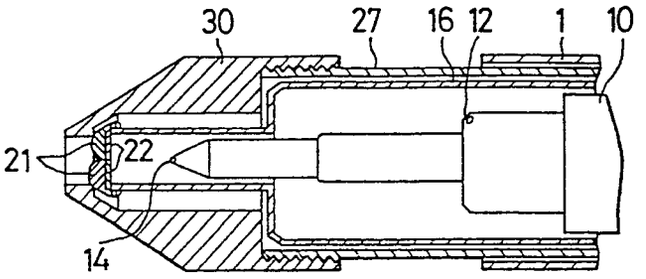



FIG. 13

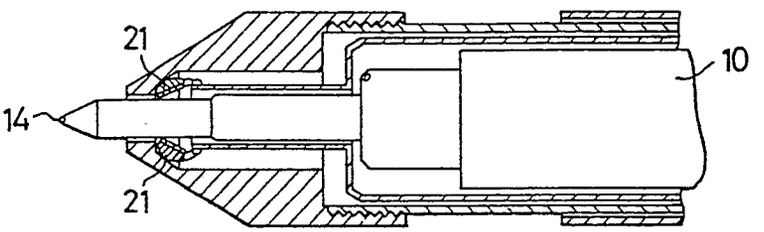



FIG. 14

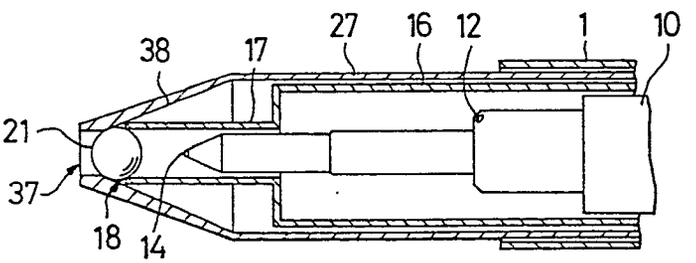



FIG. 15

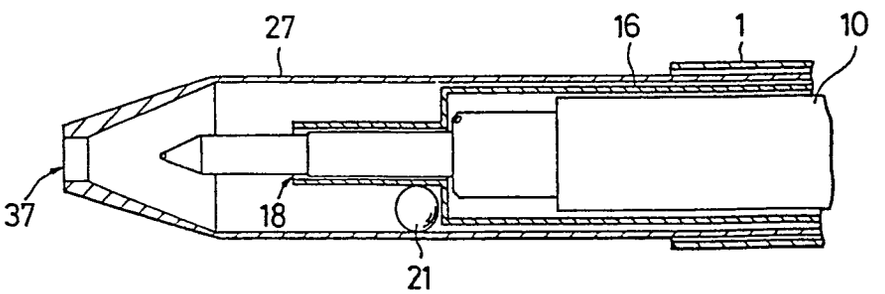


FIG. 16

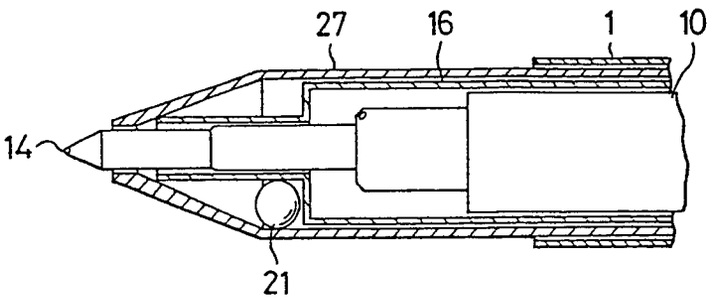



FIG. 17

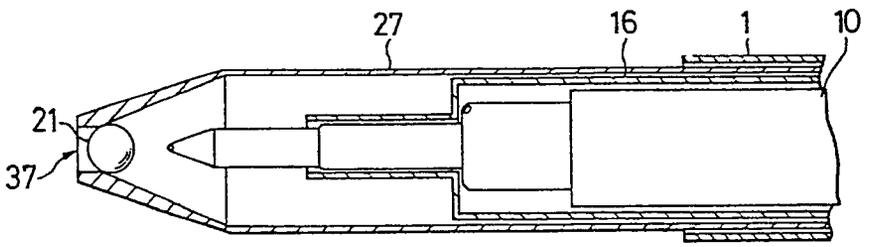



FIG. 18

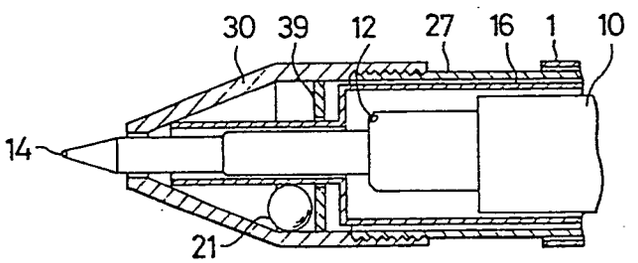



FIG. 19

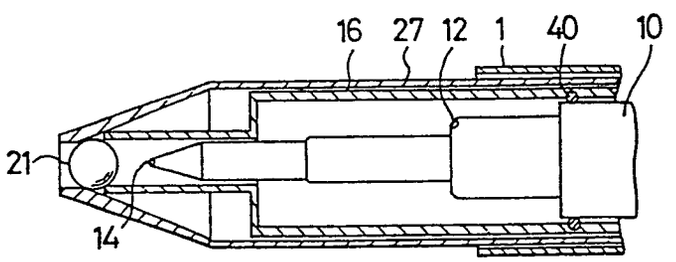


FIG. 20

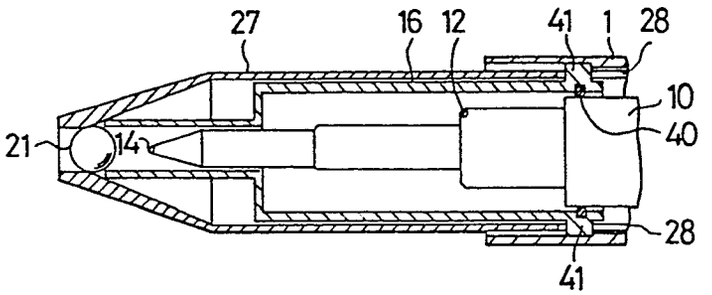



FIG. 21

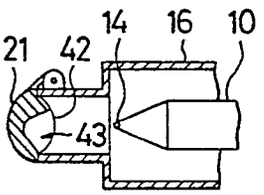



FIG. 22

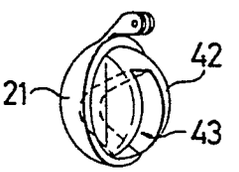



FIG. 23

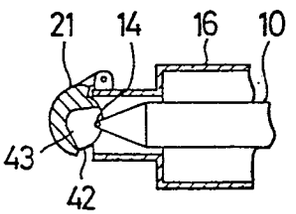



FIG. 25

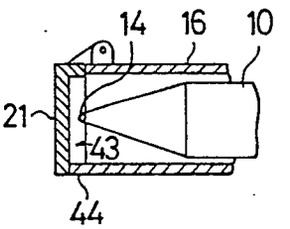



FIG. 24

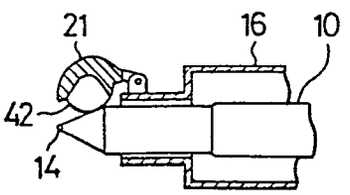



FIG. 26

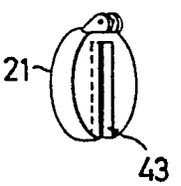



FIG. 27

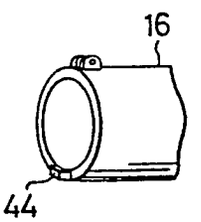


FIG. 28

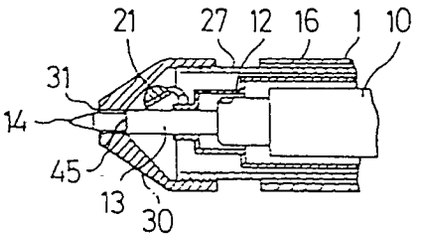



FIG. 29

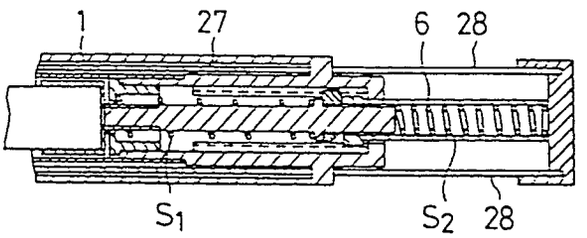



FIG. 30

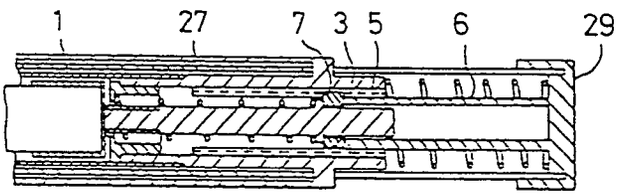
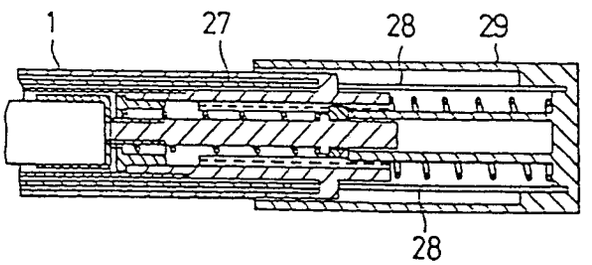



FIG. 31



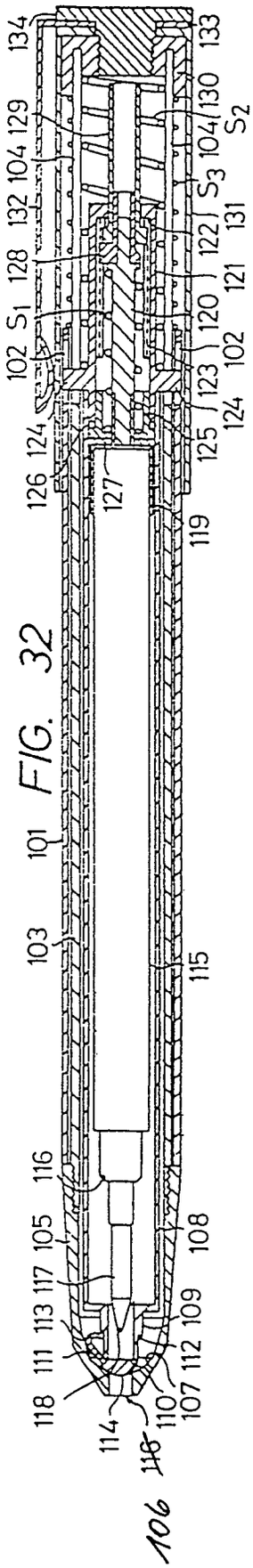


FIG. 32

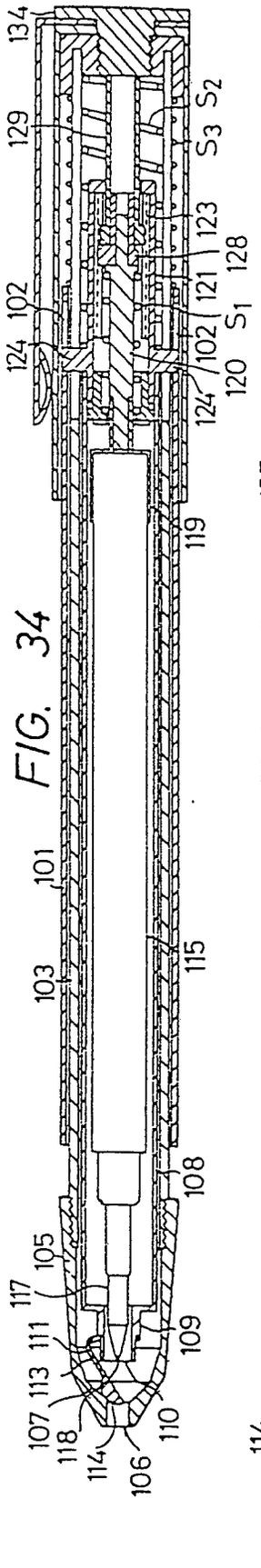


FIG. 34

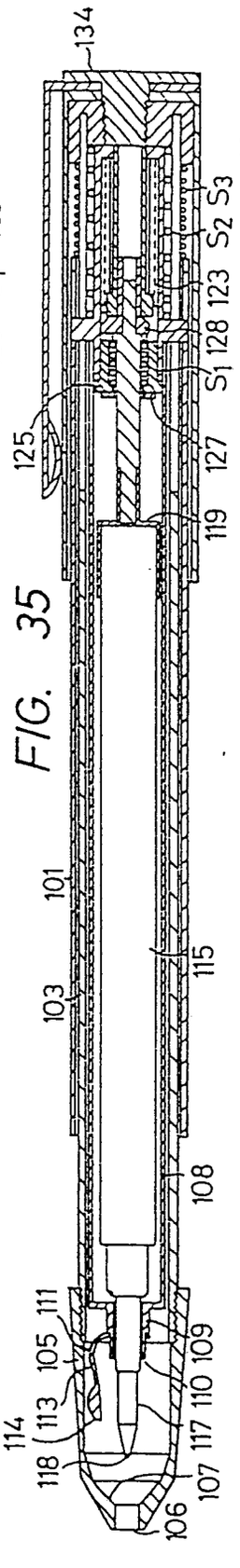


FIG. 35

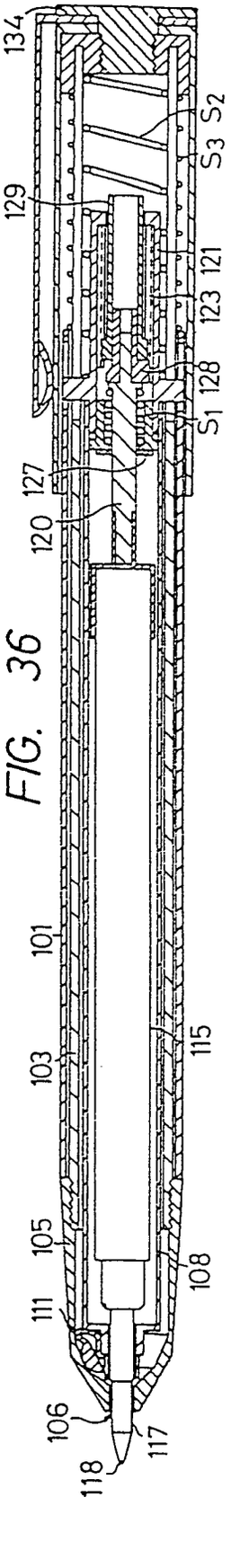


FIG. 36

FIG. 33

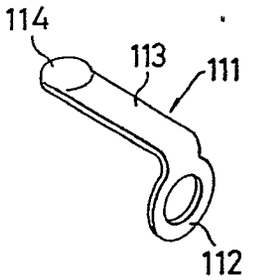



FIG. 37

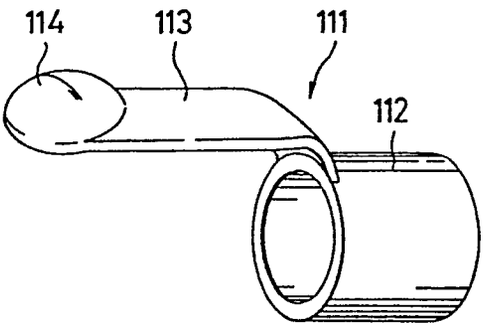



FIG. 38

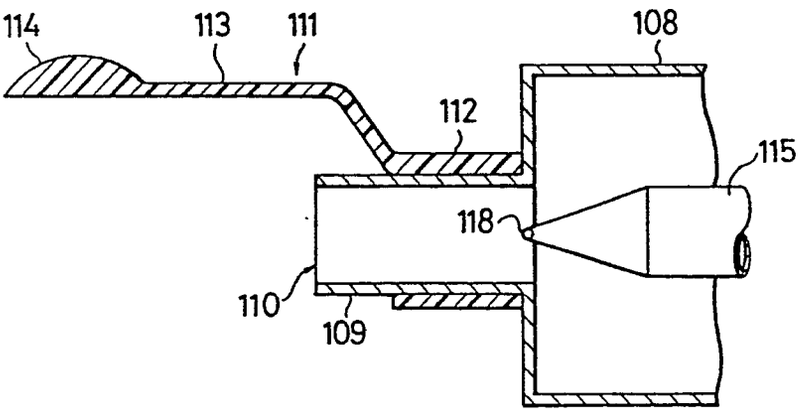



FIG. 39

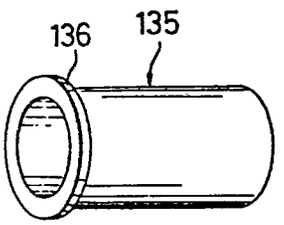



FIG. 40

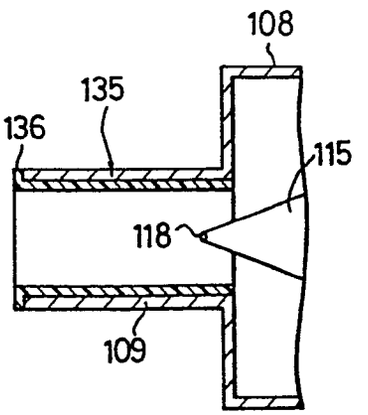


FIG. 41

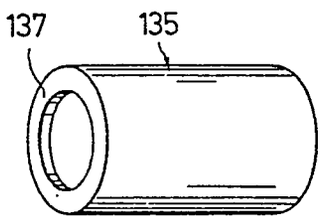



FIG. 42

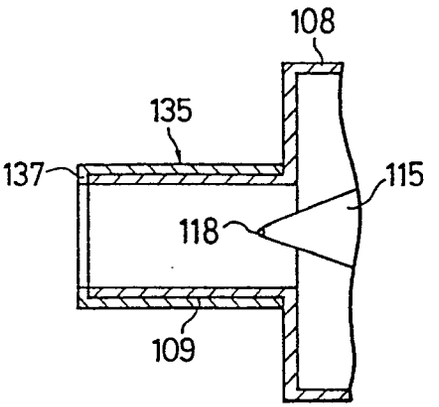



FIG. 43

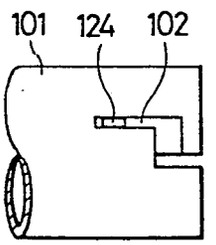


FIG. 44

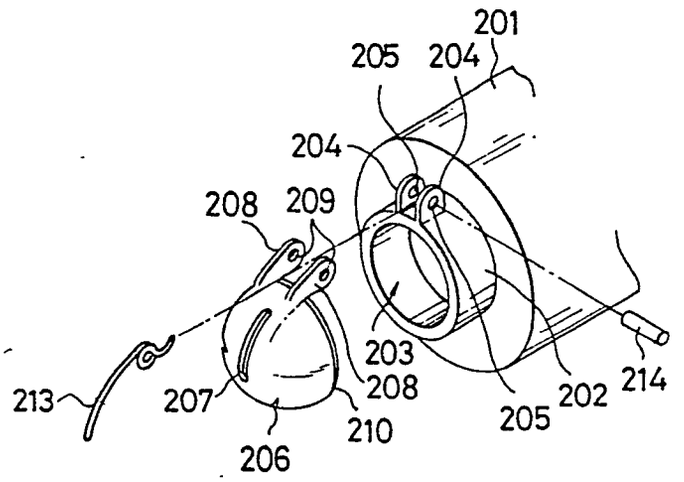



FIG. 45

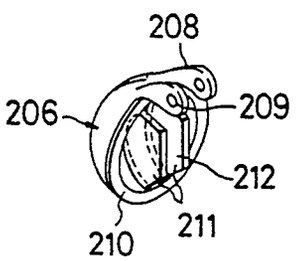



FIG. 46

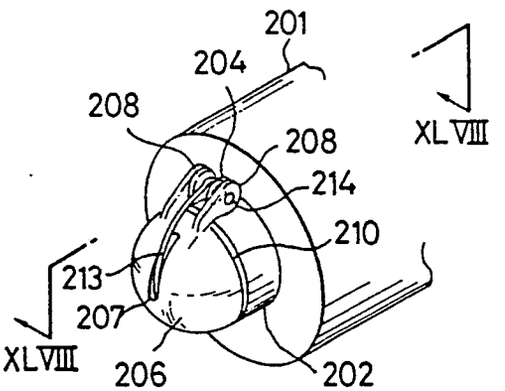



FIG. 47

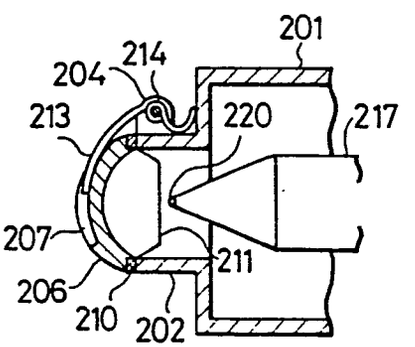


FIG. 49

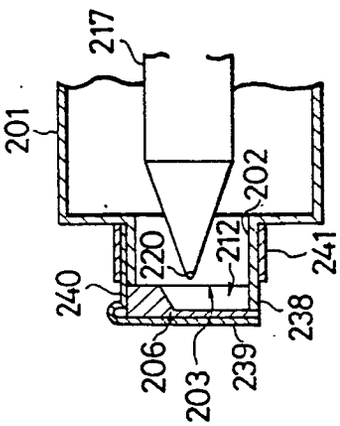



FIG. 48

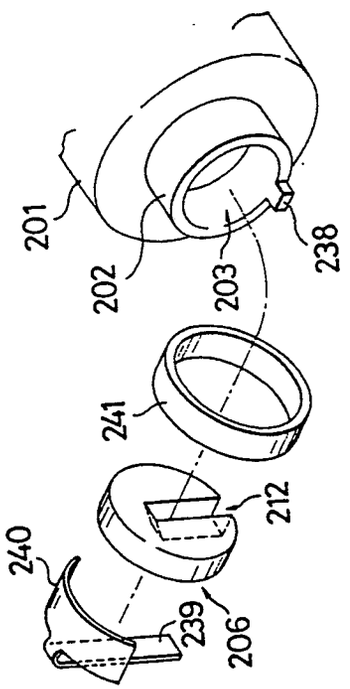



FIG. 54

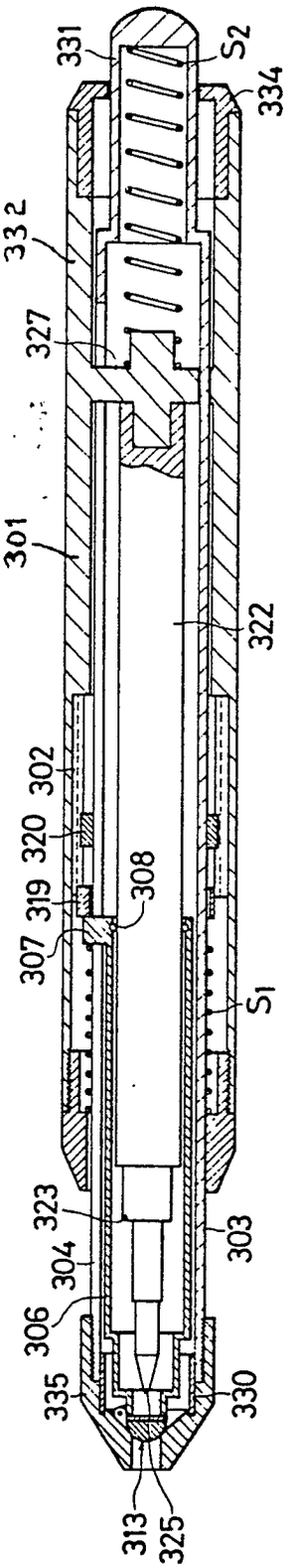
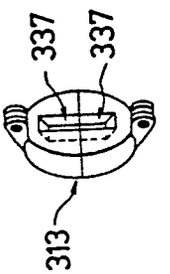
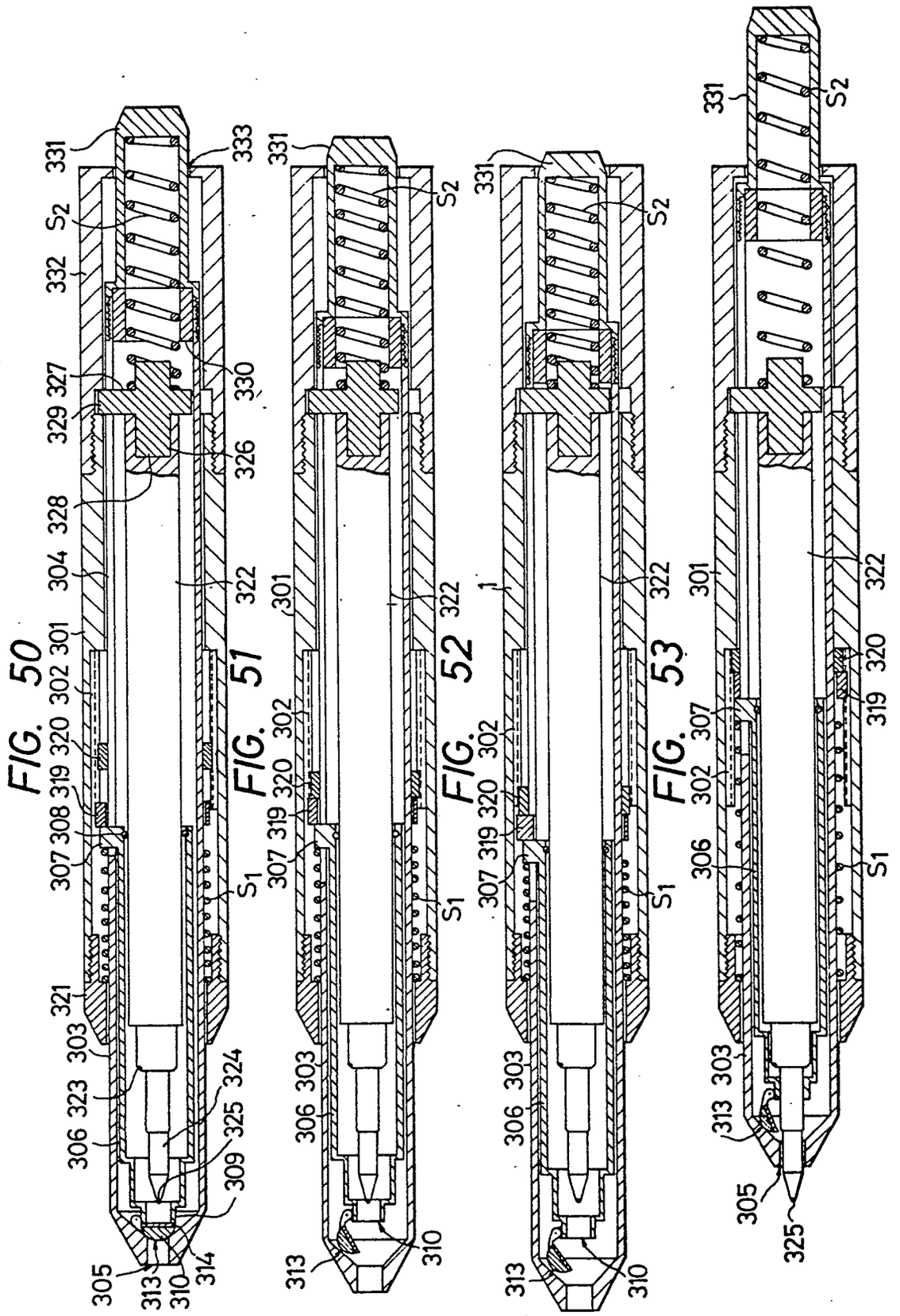



FIG. 55




FIG. 50
FIG. 51
FIG. 52
FIG. 53